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HEARING ON PRESIDENT BIDEN'S FISCAL YEAR 2024 BUDGET REQUEST WITH HEALTH AND HUMAN SERVICES SECRETARY BECERRA

HEARING

BEFORE THE

COMMITTEE ON WAYS AND MEANS HOUSE OF REPRESENTATIVES

ONE HUNDRED EIGHTEENTH CONGRESS

FIRST SESSION

MARCH 28, 2023

Serial No. 118–FC06

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United States House Committee on
Ways & Means
CHAIRMAN JASON SMITH

FOR IMMEDIATE RELEASE
March 21, 2023
No. FC-06

CONTACT: 202-225-3625

Chairman Smith Announces Hearing on President Biden's Fiscal Year 2024 Budget Request with Health and Human Services Secretary Becerra

House Committee on Ways and Means Chairman Jason Smith (MO-08) announced today that the Committee will hold a hearing on the President's Fiscal Year 2024 Budget Request with Health and Human Services Secretary Xavier Becerra. The hearing will take place on **Tuesday, March 28, 2023, at 2:00pm in 1100 Longworth House Office Building**.

Members of the public may view the hearing via live webcast available at https://waysandmeans.house.gov. The webcast will not be available until the hearing starts.

In view of the limited time available to hear the witnesses, oral testimony at this hearing will be from invited witnesses only. However, any individual or organization not scheduled for an oral appearance may submit a written statement for consideration by the Committee and for inclusion in the printed record of the hearing.

DETAILS FOR SUBMISSION OF WRITTEN COMMENTS:

Please Note: Any person(s) and/or organization(s) wishing to submit written comments for the hearing record can do so here: WMSubmission@mail.house.gov.

Please ATTACH your submission as a Microsoft Word document in compliance with the formatting requirements listed below, **by the close of business on Tuesday, April 11, 2023**. For questions, or if you encounter technical problems, please call (202) 225-3625.

FORMATTING REQUIREMENTS:

The Committee relies on electronic submissions for printing the official hearing record. As always, submissions will be included in the record according to the discretion of the Committee. The Committee will not alter the content of your submission but reserves the right to format it

according to guidelines. Any submission provided to the Committee by a witness, any materials submitted for the printed record, and any written comments in response to a request for written comments must conform to the guidelines listed below. Any submission not in compliance with these guidelines will not be printed but will be maintained in the Committee files for review and use by the Committee.

All submissions and supplementary materials must be submitted in a single document via email, provided in Word format and must not exceed a total of 10 pages. Please indicate the title of the hearing as the subject line in your submission. Witnesses and submitters are advised that the Committee relies on electronic submissions for printing the official hearing record.
All submissions must include a list of all clients, persons and/or organizations on whose behalf the witness appears. The name, company, address, telephone, and fax numbers of each witness must be included in the body of the email. Please exclude any personal identifiable information in the attached submission.

Failure to follow the formatting requirements may result in the exclusion of a submission. All submissions for the record are final.

ACCOMMODATIONS:

The Committee seeks to make its facilities accessible to persons with disabilities. If you require accommodations, please call 202-225-3625 or request via email to WMSubmission@mail.house.gov in advance of the event (four business days' notice is requested). Questions regarding accommodation needs in general (including availability of Committee materials in alternative formats) may be directed to the Committee as noted above.

Note: All Committee advisories and news releases are available on the Committee website at http://www.waysandmeans.house.gov/.

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PRESIDENT BIDEN'S FISCAL YEAR 2024 BUDGET REQUEST WITH HEALTH AND HUMAN SERVICES SECRETARY BECERRA

TUESDAY, MARCH 28, 2023

HOUSE OF REPRESENTATIVES,
COMMITTEE ON WAYS AND MEANS,
Washington, DC.

The committee met, pursuant to call, at 2:13 p.m., in Room 1100, Longworth House Office Building, Hon. Jason T. Smith, [chairman of the committee] presiding.

Chairman SMITH. The committee will come to order.

Thank you, Secretary Becerra, for testifying today before the House Ways and Means Committee.

The President's 2024 budget doubles down on harmful policies that will only make access and affordability of care worse, killing new medical innovation, false promises of Medicare solvency with real consequences, and more reckless spending on government subsidies for the wealthy.

The President's new budget expands Democrats' harmful drug price control, which means higher prices for new medicines, according to the nonpartisan Congressional Budget Office.

Regular folks will have less access to care and fewer new drugs, up to 342 fewer, according to one study, with medical researchers already announcing suspending work on treatments for eye disease and certain blood cancers.

On top of fewer and more expensive medicines for seniors, President Biden's budget also cuts Medicare. For example, under current law Medicare faces 500 billion in cuts created solely by Democrats' spending spree. The President's new budget presents no plan to stop them and threatens seniors' hard-earned benefits.

It also proposed significant changes to Medicare Advantage, which may negatively impact the 31 million Americans who rely on the program. These seniors who prefer Medicare Advantage plans need assurance from the Administration that their cost, coverage, and access to care will not be impacted.

Republicans are committed to protecting and strengthening Medicare, which is why last week all of the Republicans on Ways and Means and Energy and Commerce sent you a letter about this issue, and we look forward to your detailed response.

Additionally, this budget continues welfare for the wealthy by proposing another $183 billion in new Obamacare subsidies for wealthy people making as much as $600,000 a year.

These Washington subsidies are a cause of inflation, not a solution. I represent rural, working-class communities where access to health care is a major challenge. Health clinics and hospitals are struggling to keep their doors open to treat patients.

The Biden Administration must prioritize better access to care for rural Americans.

Thanks to the President's policy failures, our economy is still struggling, and his refusal to change direction will only further undermine Medicare and Social Security. In fact, a University of Chicago analysis shows the Presidents' low-growth policies will reduce Medicare and Social Security financing by nearly $900 billion, another direct threat to seniors' health and retirement at the hands of this Administration.

This budget rehashes the same mistakes of more government price controls, false promises to seniors, and billions more in subsidies that drive health care inflation.

House Republicans want to lower cost for working families, improve access to quality care, and protect Medicare. The Biden Administration should work with us to achieve these goals.

Chairman SMITH. I am pleased to recognize the gentleman from Massachusetts, Mr. Neal, for his opening statement.

Mr. NEAL. Thank you, Mr. Chairman.

We want to welcome back to the Committee on Ways and Means the distinguished alum, another success story that comes from the Ways and Means Committee.

It is an honor to have you here, Mr. Secretary. When you testified before us last year, our country was in the midst of an unprecedented economic recovery from the financial impacts of COVID–19.

Today that progress continues, two years of consecutive economic growth, wages rising, and the strongest jobs record of any administration in history. And we have accomplished all of this while our colleagues on the other side have reported the idea that somehow we are in a recession, launching partisan attacks.

We are raising the first generation of Americans that only know life with the Affordable Care Act. What a story this has turned out to be, and now it is baked into the American economy. At life's most vulnerable moments they do not have to fear any longer that their insurance company will cut off their coverage or be denied coverage because of cost or preexisting conditions.

They only know health coverage is free from discrimination for those with preexisting conditions and women.

In the last 13 years, we have given Americans peace of mind, and we are not going back. Democrats have supercharged the ACA over the last decade, lowering health care costs, reducing prescription drug prices for millions with the American Rescue Package and the Inflation Reduction Act.

Republicans, on the other side, have repeatedly attempted to repeal without a replacement opportunity to the ACA.

President Biden's fiscal 2024 budget shares the Ways and Means Committee Democrats' commitment to building on historic progress that the last Congress made. This budget responsibly invests in affordability and accessibility of care, giving Americans more breathing room while reducing the deficit.

Simply put, this budget puts workers and families over the well-connected.

Mr. Secretary, we hope that during this afternoon's opportunity, Republicans might unveil what their budget really looks like. We eagerly await that opportunity.

This is how you build an economy from the middle out and the bottom up, further expanding Medicare's ability to negotiate drug prices, permanently extending premium tax credits, strengthening Medicare, improving its services, building on the American Rescue Plan's investments in childcare, and addressing America's mental health crisis, and closing our coverage gaps for Americans living in States that have not expanded it.

Other Ways and Means priorities included in the President's budget are, investments in elder care and TANF emergency funds. We will protect our most vulnerable citizens. Democrats know that investing in health care and care of giving is an investment in our Nation's children, families, and economy.

Many on the other side have attempted to send this health care system back to the grim days when tens of millions of Americans were without health insurance. That plot to repeal the ACA or the Inflation Reduction Act, while making deep cuts to Medicaid, would devastate millions.

Their plan pulls from the same unsuccessful playbook that they have been pushing for the last 13 years, shifting costs onto patients, sending the health care system into chaos, and taking away protections relating to preexisting conditions.

Our colleagues have made it clear where they stand, and let me tell you it is not with the American family if the companies who will profit hand over hand and fist over fist from lifesaving medications and the top one percent continue to get billions of dollars in tax cuts in exchange for health care coverage.

Ways and Means Democrats have stayed the course, strengthening Americans' health care even as that coverage has been threatened to be taken away by the other side. Countless lives have been saved.

In my opening statement I have used the opportunity to remind all of the success of the ACA, the success of Medicare, the success of Social Security, and just as importantly, a reminder that Medicaid has now become, as we have discussed in the past, a very important part of planning for long-term care for the American family. Fifty-seven cents on every Medicaid dollar now goes to long-term care.

As you know, Mr. Secretary, we are delighted to have you here on the topics on which we agree, I am also going to use my question-and-answer period to talk about what this committee did of historic purpose with the whole idea of surprise billing.

Mr. Brady and I fully were on the same page. We know exactly what we intended with the wording choice, and I hope that based on the conversations we have had and the court decisions that have been rendered that we will be able to travel down that path in the next few hours.

Thank you, Mr. Secretary, for your presence.

And thank you, Mr. Chairman.

Chairman SMITH [continuing]. Thank you, Ranking Member Neal.

Today's sole witness, former Ways and Means colleague and is the Secretary of the Department of Health and Human Services, Xavier Becerra.

The committee has received your written statement, and it will be made part of the formal hearing record.

You have five minutes to deliver your oral remarks. Secretary Becerra, you may begin when you are ready.

STATEMENT OF THE HON. XAVIER BECERRA, SECRETARY OF THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Secretary BECERRA. Mr. Chairman, Chairman Smith, Ranking Member Neal, to all the members, thank you very much for the invitation. Great to be back in the room. I see my chair somewhere around there.

A lot of things have happened in the year since I last spoke to you about budgets. More than 16 million Americans have secured health insurance through the Affordable Care Act marketplaces. That is an all-time high, to emphasize what Congressman Neal had mentioned.

All together more than 300 million Americans now carry insurance to cover their health care. That is another historic high.

The President's new lower cost prescription drug law has capped insulin at $35 per month and made preventative vaccines like flu, COVID, shingles available for free under Medicare.

Moving forward, this new law gives us the right to finally negotiate for lower prescription drug prices for Americans.

To cap it all off, the Biden-Harris Administration has safely and effectively executed the largest adult vaccination program in U.S. history, achieving nearly 700 million shots in arms during the COVID pandemic without charge.

The fiscal year 2024 budget proposes $144 billion in discretionary funding and $1.7 trillion in mandatory funding for HHS. It positions us to tackle the urgent challenges we face, including a growing behavioral health crisis and future public health threats.

It also funds operations and mission critical infrastructure needed to build a healthier America, moving the Nation from an illness care system to a wellness care system.

An illness care system leaves our most vulnerable families behind. A wellness care system invests in providing the full spectrum of health care to all Americans.

Illness care allows the price of prescription drugs to skyrocket. Wellness care starts by prescribing fruits, vegetables, and exercise. It treats food as medicine.

Illness care requires you to get a referral by your family physician to see a specialist for mental health services. Wellness care, well, it lets you get mental health care the minute you walk through the door of your family physician's office.

Illness care forces hardworking Americans to deplete their life savings to get that long-term care that they need, and this is the point that Mr. Neal was stressing. Wellness care will invest nearly as much as it can and as early as possible in long-term care, like

in-home care, so our older adults and Americans with disabilities can thrive at home and in their communities.

Our budget invests in wellness care. We invest more than $30 billion to prepare for the next COVID or public health crisis, including $1 billion to replenish our Nation's strategic national stockpile.

On behavioral health, too many of our loved ones are dying from suicide and overdose. So we increase access to crisis care. We grow the behavioral health workforce and we beef up substance use services.

We are also gearing up to handle more than six million additional contacts from the people who are experiencing a mental health crisis through 988, the three-digit suicide prevention lifeline we stood up last year.

This budget covers two million adults left out of Medicaid by their home State and extends tax credits that make health care more affordable for millions of Americans.

It would also ensure that expanded postpartum Medicaid coverage for a new mom and her baby is here to stay.

The President's budget not only strengthens Medicare for today's seniors but protects and strengthens it for the next generation.

We also take care of our family members in this budget, investing $600 billion in childcare and preschool programs and $150 billion to strengthen Medicaid home and community-based services. This budget funds the Cancer Moonshot and APRA–H and invests in Title 10 family planning programs essential to so many of our families.

It delivers on our commitments made as part of the National Strategy for Hunger, Nutrition, and Health. It opens more community health centers.

And important to me as the former Attorney General, it bolsters our health care fraud and abuse detection and enforcement work.

And of course, the President's budget honors our responsibilities to Indian Country with more than $2 billion in new resources in 2024.

This budget reflects the President's and our values and commitments. It helps begin the move from a Nation focused on illness care to one about wellness care, and most importantly, it ensures health and wellness are within the reach for all Americans.

On behalf of the women and men of HHS, we look forward to working with you and, Mr. Chairman, we thank you for the time.

And I yield back.

[The statement of Secretary Becerra follows:]

TESTIMONY OF SECRETARY XAVIER BECERRA
BEFORE THE HOUSE COMMITTEE ON WAYS AND MEANS
March 28, 2023

Chair Smith, Ranking Member Neal, and Members of the Committee, thank you for the opportunity to discuss the President's Fiscal Year (FY) 2024 budget for the Department of Health and Human Services (HHS). I am pleased to appear before you today, and I look forward to continuing to work with you to serve the American people.

It is my great pleasure to serve as the head of the Department of Health and Human Services – a department full of dedicated civil servants who work tirelessly to meet our mission of enhancing the health and well-being of the American people. We know this goal is also shared by all of you, and we are excited about working with you to fund key initiatives that will enable us to continue to meet that mission.

The FY 2024 budget proposes $144 billion dollars in discretionary funding and $1.7 trillion dollars in mandatory funding to continue the work of the Department and make major investments in several critical areas. Our country faces numerous health care challenges – and HHS is at the center of addressing many of these issues – including the need to transform behavioral healthcare; prepare for future public health threats; support unaccompanied children and refugees; protect the health of all Americans; meet the health needs of Indian Country; expand the health care workforce; expand coverage and access to care, including high-quality early childhood education; improve the health and well-being of children, families, seniors, and people with disabilities; advance science to improve health; end cancer as we know it; and promote effective and efficient management and stewardship.

Transforming Behavioral Healthcare

In response to the current behavioral health crisis, HHS makes substantial investments in services to provide more Americans with access to the care they need when they need it. The 9-8-8 National Suicide Prevention Lifeline operates 24/7 to provide access to trained counselors to people in crisis. In the FY 2024 budget, the Substance Abuse and Mental Health Services Administration (SAMHSA) will dedicate an additional $334 million to the 9-8-8 program to meet an expected volume of 9 million contacts. Investing in the crisis response continuum more broadly is critical to ensuring that the system is responsive at any time and in any place. The budget builds on previous investments to provide $100 million for mobile crisis response to expand partnerships with 9-8-8 local crisis centers, community providers, 9-11 centers, and first responders to promote health-first responses to mental health, suicidal, and substance use crisis events.

One in 4 adults in the United States had a mental illness and 46 million Americans had a substance use disorder in the past year.[1] To address these challenges, the budget continues to invest in the nation's mental health infrastructure and to further integrate behavioral health care into health care, social services, and early childhood systems. The FY 2024 budget proposes to

[1] "Facts about Suicide", Centers for Disease Control and Prevention

increase the Community Mental Health Services Block Grant by $645 million and proposes to increase the Substance Use Prevention, Treatment, and Recovery Services Block Grant by $700 million. The budget converts the Certified Community Behavioral Health Clinics demonstration to a permanent program to further ensure access to comprehensive behavioral health care for all who need it.

Additionally, to help build the behavioral health workforce needed to provide such care and services, the FY 2024 budget expands Medicare coverage of, and payment for, additional behavioral health professional services including those furnished by clinical social workers, peer support workers, and certified addiction counselors.

To develop new approaches to addressing mental health and substance use disorders, the FY 2024 budget includes an additional $200 million for the National Institutes of Health (NIH) to prioritize innovative mental health research and treatment, with the agency allocating a portion of these resources to launch a new precision psychiatric initiative. NIH will also continue to invest over $1.8 billion in research on opioid misuse, addiction, and pain disorders, including the Helping to End Addiction Long-term (HEAL) initiative. HEAL aims to develop innovative treatments for opioid addiction and chronic pain and associated health disparities. The budget also includes proposals to modernize and expand Medicare's mental health benefits and improve behavioral health for the private insurance market, with an emphasis on improving access, promoting equity, and fostering innovation.

Preparing for Future Public Health Threats

On February 11th, HHS renewed the COVID-19 Public Health Emergency (PHE) for what we expect will be the final time. The nation has made tremendous progress: the Administration effectively implemented the largest adult vaccination program in U.S. history, with nearly 270 million Americans receiving at least one shot of the COVID-19 vaccine. Second, we made available to the American public 1.16 billion COVID tests at no cost. And we were able to provide over 23 million therapeutic courses of treatment to Americans. According to the Commonwealth Fund, two years of COVID vaccinations saved over 3 million lives, in addition to preventing more than 18.5 million hospitalizations.

The FY 2024 budget prioritizes preparedness for the next health crisis. The budget includes $20 billion in mandatory funding, available over 5 years, across the Administration for Strategic Preparedness and Response (ASPR), the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), and NIH to support the President's plan to transform the Nation's capabilities to prepare for, and respond rapidly and effectively to, future pandemics and other biological threats. This includes investments in enhancing early detection and warning systems, advancing, and securing safe and effective supplies and medical countermeasures, and strengthening public health systems and core capabilities. For ASPR, the budget includes $1 billion in discretionary funding for the Biomedical Advanced Research and Development Authority (BARDA) to develop innovative medical countermeasures, $995 million for the Strategic National Stockpile, and $400 million to bolster the medical supply chain and create medical countermeasures that address key preparedness gaps. The FY 2024 budget includes $10.5 billion in discretionary funding for the CDC to protect health, safety, and security at home

and abroad. Additional strategic investments, including at the FDA and NIH, are proposed to bolster our national preparedness posture as we ready ourselves for the next public health threat – no matter its origin. These funding proposals are paired with a suite of legislative proposals that would provide HHS with authorities to enable HHS to respond to future threats nimbly and effectively.

Supporting Unaccompanied Children and Refugees

Children presenting at the border without a parent or guardian, and refugees arriving in our nation, must be cared for in a safe and humanitarian manner. At HHS, we will continue to do our part to protect the safety and wellbeing of unaccompanied children by providing them appropriate child-centered care while they are in our custody; placing them in the custody of parents, relatives, and other appropriate sponsors after thorough vetting; and providing post-release services including safety and wellbeing calls. HHS already provides post-release services to more than 40 percent of children released from our care, nearly double the percentage receiving services when the Biden Administration took office, and is on track to provide services to nearly 60 percent of children by the end of this fiscal year, and all children within the next two years.

The FY 2024 budget provides $5.5 billion for unaccompanied children and $1.7 billion for refugees and other new arrivals eligible for benefits. In addition, to address the inherent uncertainties in budgeting for these populations, the budget includes a discretionary contingency fund, which would provide additional resources if either population exceeded certain levels and is estimated to provide $2.8 billion in FY 2024. The fund expands on the unaccompanied children contingency fund that Congress enacted in FY 2023. These services and resources are critical to our country, and I would like to thank Congress for your continued dedicated support.

Protecting the Health of All Americans

The Administration aims to reduce maternal mortality and morbidity, through proposals such as the "Birthing-Friendly" hospital designation, which drives improvements in maternal health outcomes. The budget includes $1.9 billion for the Health Resources and Services Administration (HRSA) Maternal and Child Health programs, an increase of $205 million, directing $276 million toward reducing maternal mortality and morbidity and $185 million to the Healthy Start program to reduce racial disparities in maternal and infant health outcomes. The budget also provides $30 million for NIH to continue the Implementing a Maternal health and PREgnancy Outcomes Vision for Everyone (IMPROVE) initiative to support research focused on interventions for preventable maternal mortality and morbidity and associated risk factors that contribute to health disparities in maternal care. The budget further includes $3 million for NIH's continued research on the effects of COVID-19 on individuals during pregnancy, lactation, and the postpartum period. The budget also requires states to provide 12 months of postpartum coverage through Medicaid and the Children's Health Insurance Program.

HHS is also committed to protecting and strengthening access to reproductive healthcare. The budget provides $512 million to the Title X family planning program to address the increased need for family planning services for approximately 4.5 million individuals, with 90% having

family incomes at or below 250% of the federal poverty level. Title X is the only federal grant program solely dedicated to providing individuals with comprehensive family planning and related preventive health services in communities across the United States.

In 2022, HHS released the Viral Hepatitis National Strategic Plan, which provides a framework to eliminate viral hepatitis as a public health threat in the United States by 2030. The Viral Hepatitis Plan focuses on hepatitis A, hepatitis B, and hepatitis C—the three most common hepatitis viruses that have the most impact on the health of the nation. The Viral Hepatitis National Strategic Plan is the first to aim for elimination of viral hepatitis as a public health threat in the United States. Building on this work, the FY 2024 budget includes $11.3 billion for a new HHS-wide proposal to establish a five-year national program to significantly expand screening, testing, treatment, prevention, and monitoring for hepatitis C infections. This program would increase access to tests and curative medicines and expand public health efforts, with a net cost of $5.1 billion over ten years once accounting for health improvements and reduced health care spending. Continuing this work is vital to protecting and improving the lives of Americans who are impacted by this serious disease.

Health Centers provide healthcare services to underserved populations across the country, including low-income patients, ethnic minorities, rural communities, and persons experiencing homelessness. The budget proposes a pathway to doubling the program's funding with a critical three-year down payment on this goal. The FY 2024 budget provides $7.1 billion for Health Centers, which includes $5.2 billion in proposed mandatory resources, an increase of $1.3 billion above FY 2023 enacted. At this funding level, the Health Center Program will provide care for approximately 33.5 million patients.

The FY 2024 budget also makes critical investments to establish Vaccines for Adults program within CDC, as a complement to the successful Vaccines for Children program. The Vaccines for Adults program will begin expanding access to routine and outbreak response vaccines recommended by the Advisory Committee on Immunization Practices for uninsured adults at no cost.

Meeting the Health Needs of Indian Country

HHS is committed to upholding the United States' responsibility to tribal nations by addressing the historic underfunding of the Indian Health Service (IHS). Building on the historic passage of advance appropriations for the IHS in FY 2023, the FY 2024 budget proposes $8.1 billion in discretionary funding for the IHS Services and Facilities accounts, an increase of $2.2 billion above FY 2023 enacted. This funding will expand access to healthcare services for 2.8 million American Indians and Alaska Natives, address key operational capacity needs, and modernize outdated facilities and information technology systems. The budget also includes $1.6 billion in proposed mandatory funding in FY 2024 for Contract Support Costs, payments for Section 105(*l*) tribal leases, and the Special Diabetes Program for Indians.

Beginning in FY 2025, the budget proposes all IHS resources as mandatory. The budget would automatically grow IHS funding each year to account for inflationary factors, population growth, key programmatic needs, and existing backlogs in both healthcare services and infrastructure

needs. The mandatory funding approach would ensure that the IHS budget grows sufficiently to both address historic underinvestment and expand capacity for increased service provision. It also includes new funding streams to address key gaps, including the lack of dedicated funding for public health infrastructure in Indian Country. HHS firmly believes that mandatory funding is the most appropriate long-term solution to address chronic underinvestment in IHS. The Department will continue consultation with Tribes and working in partnership with Congress to see this important goal realized. While this work is underway, it is critical that Congress continues to provide discretionary advance appropriations to ensure that the critical advancements achieved through enactment of advance appropriations in the FY 2023 Omnibus are not reversed.

Expanding and Retaining the Health Workforce

The health workforce plays a vital role in responding to public health needs. As the demand for healthcare workers increases, HHS remains committed to strengthening, expanding, and retaining the workforce. The FY 2024 budget provides $2.7 billion for HRSA workforce programs, including $947 million in mandatory resources, to expand workforce capacity across the country. The discretionary budget includes $28 million for a new program to support innovative approaches to address health care workforce shortages and strengthen retention efforts. The budget also provides $25 million for a program to support the adoption of workplace wellness in health care facilities including hospitals, rural health clinics, community health centers, and medical professional associations. The budget includes $106 million within CDC to support public health training and fellowship programs to strengthen the existing workforce as well as support a pipeline of personnel ready and able to address public health threats. In addition to these investments, HHS prioritizes the importance of diversifying the health care workforce to better serve all communities and build a more equitable health care system.

Expanding Coverage and Access to Care

It is ever more crucial to promote the health, safety, and dignity of older adults and people with disabilities, particularly as America's older population increases. The FY 2024 budget makes essential investments to strengthen our nation's long-term care system and invests $150 billion over 10 years to improve Medicaid home and community-based services, to ensure that more people who are aging and those with disabilities can receive care in their home or community and to strengthen the home care workforce. President Biden also issued a call to action to improve the quality of America's nursing homes, and HHS continues to take action to ensure that older adult nursing home residents receive the highest quality care. The FY 2024 budget includes multiple provisions to strengthen nursing home oversight, transparency, and enforcement, including $566 million for surveying and inspections. The provisions protect older adult residents by identifying and penalizing nursing homes that commit fraud, endanger patient safety, and/or prescribe unnecessary drugs.

Since the passage and subsequent expansions of the Affordable Care Act, tens of millions of Americans have gained access to quality health insurance through the marketplace. To build on this success, the FY 2024 budget invests in making private insurance even more affordable. This includes new proposals to build on historic progress made in Congress, including a permanent

extension of the enhanced premium tax credits in P.L. 117-169, commonly known as the Inflation Reduction Act. The budget proposes to extend protections from the No Surprises Act to ground ambulances. The FY 2024 budget also provides Medicaid-like coverage to low-income individuals in states that have not expanded Medicaid under the Affordable Care Act, paired with financial incentives to ensure states maintain their existing expansions.

Improving the Well-Being of Children, Families, Seniors, and People with Disabilities

Early childhood programs have a return of up to $9 for every $1 spent due to the positive long-term health, educational, and social impacts on vulnerable children. The budget includes $13 billion for Head Start, an increase of $1.1 billion, to provide comprehensive early learning and development services to roughly 760,156 slots for eligible children and pregnant women. Within this total, $440 million is included for a cost-of-living adjustment for Head Start workers, and $575 million is included to further improve compensation. Collectively, these investments ensure that families have access to high-quality services by retaining and supporting the workforce. In addition, the budget includes a legislative proposal to expand tribal, migrant, and seasonal Head Start eligibility.

The budget likewise invests in child care, critical to both working parents, and particularly to mothers and children. For the discretionary Child Care and Development Block Grant, the budget provides for an investment of $9 billion, an increase of nearly $1 billion over the FY 2023 enacted funding level. In addition, the budget includes a mandatory proposal to invest $400 billion over 10 years in high-quality child care, and $200 billion over 10 years in universal preschool.

The $400 billion in mandatory funding over 10 years for high-quality child care includes funding for states to serve children ages zero to five for families earning up to $200,000. It provides higher federal matching funds for child care providers serving low- and middle-income families and allows those families to pay the lowest co-pays – with a goal of ensuring that the lowest income families pay nothing and that most families pay no more than $10 a day per child, meaning that a median-income family with young children saves about $400 per month while accessing higher-quality care. The Administration's proposal enables states to expand access to affordable, high-quality child care to more than 16 million children. This reflects an expectation that all states will choose to adopt the program but, if some states do not, the Administration is committed to serving low-income children through a federal alternative.

The $200 billion in mandatory funding over 10 years for universal preschool supports free preschool in the setting of a parent's choice – from public schools to child care providers to Head Start – to support healthy child development and ensure that children enter kindergarten ready to succeed. The proposal provides funding through a federal-state partnership to expand high-quality preschool education to all 4-year-old children, with the flexibility for states to expand preschool to 3-year-olds once high-quality preschool is fully available to 4-year-old children. The proposal also includes funding to provide access to preschool to children in underserved communities in states that do not choose to participate in the new preschool program, so that families in every state have access to high-quality preschool.

To further protect and enhance child well-being, the budget also includes $4.9 billion in mandatory funding over 10 years for prevention services and kinship navigator programs, $1.3 billion in mandatory funding over 10 years to give states an incentive to place children with kin, and $1 billion in mandatory funding over 10 years for support for youth who experienced foster care in transitioning to adulthood.

The COVID-19 pandemic revealed that millions of children, families, seniors, and people with disabilities are living with food insecurity. The increased need for nutrition programs has not abated, and the FY 2024 budget supports the Administration's National Strategy on Hunger, Nutrition, and Health by including $137 million across HHS to reduce hunger, food insecurity, and malnutrition. Within the $137 million, the budget includes $12 million at the Administration for Community Living (ACL) for nutrition services for older adults and people with disabilities and $72 million to expand CDC's State Physical Activity and Nutrition program, which implements evidence-based strategies to reduce chronic disease. In addition, the budget proposes to increase funding at NIH for nutrition research. The budget also expands Medicare coverage for nutrition and obesity counseling, and includes a new pilot project on medically tailored meals.

HHS is committed to ensuring that seniors and people with disabilities have the essential resources and services they need. The FY 2024 budget also makes key investments in the Elder Justice Adult Protective Services program. And, to help more older adults and those with disabilities receive care in their home or community. As noted above, the budget also includes a $150 billion mandatory investment over 10 years in improving and strengthening Medicaid home and community-based services and provisions to improve safety and quality in our nation's nursing homes.

The budget extends the solvency of the Medicare Hospital Insurance Trust Fund by at least 25 years without cutting benefits. The budget builds on efforts in the Inflation Reduction Act to lower prescription drug prices. It also invests $8 billion to enhance Medicare benefits, such as preventing diabetes, expanding access to behavioral health services and community health workers, improving the quality and safety of long-term care services, expanding coverage for nutrition and obesity counseling, eliminating hepatitis C, and advancing equity. Additionally, the budget aligns income and asset determination processes for Medicare low-income assistance programs, easing administrative burdens for states and removing enrollment barriers for individuals.

Advancing Science to Improve Health

As President Biden has said, "cancer does not care if you're a Republican or a Democrat," which is why the President and First Lady reignited the Cancer Moonshot one year ago. HHS is committed to leading the public sector in pursuit of cutting the cancer death rate by 50 percent over the next 25 years and supporting families, their caregivers and family members, living with and surviving cancer.

NIH will continue to build on the Cancer Moonshot's momentum by supporting projects that will deliver important insights into preventing, detecting, and treating cancer. The FY 2024 budget

includes $716 million in discretionary resources for dedicated Cancer Moonshot activities at NIH. In addition to the FY 2024 resources, the budget also proposes to reauthorize the 21st Century Cures Act Cancer Moonshot through 2026 and provide $2.9 billion in mandatory funding in 2025 and 2026, $1.45 billion each year. To support the goals of the Cancer Moonshot, the FY 2024 budget includes an additional $183 million for a total of $839 million to support cancer prevention and control programs across CDC, including screening programs, tobacco prevention, Human Papillomavirus (HPV) prevention and analysis of cancer clusters, and laboratory and environmental health activities. An additional investment of $20 million for HRSA is also provided, to expand partnerships between federally funded health centers and NCI-Designated Cancer Centers to facilitate access to lifesaving cancer screenings and early detection services for medically underserved populations. The budget also includes $108 million within IHS to address specialized cancer care needs in tribal communities. The budget also proposes to create a new Cancer Care Quality Reporting Program for all Medicare providers furnishing cancer care services. This unified program would enable the Centers for Medicare & Medicaid Services (CMS) to assess and compare cancer care delivered through multiple provider types, drive improvements in the quality of cancer care, and standardize data collection to identify and address potential inequities in care.

The FY 2024 budget includes several investments for FDA to support food programs including $20 million for the Emerging Chemicals and Toxicology Issues program to streamline regulatory frameworks for food products that may pose chronic risks to human health. Funds support post-market reassessment of previously approved food chemicals and develop approaches to inform and modernize safety assessments using science and risk-based approaches. An additional investment of $5 million is provided for the 21 Forward food supply chain continuity system, which enables the agency to develop accurate models for situational awareness and forecast the impact of a pandemic, product shortages, or other high-risk threats on the food supply chain. Within medical product safety, the budget dedicates a total of $59 million to continue efforts that strengthen public health supply chains and promote the availability of medical devices by proactively monitoring, assessing, and communicating risks and vulnerability.

The budget will prioritize innovative mental health research and treatment and the NIH climate change initiative. NIH will continue to invest funds to address the opioid crisis, end HIV, and advance other research areas, such as improving health disparities and inequities research, as well as continuing the agency's progress towards a universal influenza vaccine. NIH's budget also continues support for the *All of Us* and Brain Research Through Advancing Innovative Neurotechnologies (BRAIN) initiatives, both started with the 21st Century Cures Act.

The budget also invests in high-impact research advances that drive innovation through the Advanced Research Projects Agency for Health (ARPA-H). As an independent research entity, ARPA-H will be able to accelerate health breakthroughs with the potential to transform important areas of health and medicine. The budget provides $2.5 billion for the agency's approach to prevent, detect, and treat cancer and other diseases such as diabetes and dementia. ARPA-H will advance high-potential, high-impact biomedical and health research that cannot be readily accomplished through and other existing research or commercial activity.

In keeping with the Agency for Healthcare Research and Quality's (AHRQ) mission to provide evidence-based research, data, and tools to improve healthcare quality, the FY 2024 budget includes $564 million to support AHRQ's research on quality, health costs, and outcomes to make healthcare safer, more accessible, equitable, and affordable for all Americans. Included are additional resources to further Long COVID care, primary care, and diagnostic safety research.

Promoting Effective and Efficient Management and Stewardship

As federal stewards, it is our duty to ensure that taxpayer dollars are spent appropriately through the delivery of high-quality services, through necessary security, and through strong action to prevent fraud and abuse. To protect against information technology threats, the budget provides an increase of $88 million above FY 2023 enacted for cybersecurity initiatives in the Office of the Chief Information Officer (OCIO). Due to the increasing frequency of cyber-attacks that impede the delivery of healthcare and leak private patient health information, the ASPR and OCIO budgets have been increased to understand, mitigate, and identify Healthcare and Public Health (MPH) Sector cybersecurity risks, as well as, to prevent, detect, respond, and recover from HPH cyber-attacks.

The budget makes robust investments in the Health Care Fraud and Abuse Control funding to provide oversight of CMS health programs, strengthen the HHS Office of Inspector General investigations, and protect beneficiaries against healthcare fraud. Our comprehensive program integrity legislative package and allocation adjustment yields $19.7 billion in net savings over 10 years. The Office of Civil Rights would receive significant additional funding to address a sharp rise in its caseload, from 45,000 cases in 2020 to a projected 80,000 in 2024. Finally, the budget includes much-needed investment in core infrastructure, oversight, and operations, including in the Nonrecurring Expenses Fund, General Departmental Management, CMS Program Management, and ACL.

Conclusion

I want to thank the Committee for inviting me to discuss the President's FY 2024 budget for HHS. The budget represents the continued investment in the health, growth, protection, and vitality of the American people. With adequate funding in these critical areas, we can support the forward mobility of our country and continue to make stride towards a brighter future. Thank you for your dedication and partnership in our shared goal to improve the health, safety, and well-being of our nation.

Chairman SMITH. Thank you, Secretary.

As always, we want to make sure that all members have an opportunity to ask questions of the Secretary. Therefore, without objection, each member will be recognized for three and a half minutes to accommodate the Secretary's time.

We will now proceed to the question-and-answer session, and I will begin.

In the Inflation Reduction Act, Democrats gave your department $3 billion to implement a drug price setting scheme which will undermine innovation into lifesaving drugs and increase the cost of new medication.

I, along with the Ranking Member of the Senate Finance Committee, Senator Crapo, as well as House Energy and Commerce Chair, Cathy McMorris Rogers, have requested detailed information on how your department plans to spend the $3 billion.

That was sent to you more than a month ago, and we only received your response just mere minutes before the hearing began today.

Will you commit to keeping Ways and Means regularly informed by making appropriate HHS officials available to testify before this committee about the drug pricing scheme so that we can have more effective oversight over what I fear will be more government expansion and control?

Secretary BECERRA. Mr. Chairman, we are absolutely committed to making sure that in implementation of this new prescription drug law that allows us to negotiate for better prices and increase competition, that we will absolutely keep this committee informed.

Chairman SMITH. Thank you, Secretary.

The President's budget claims to add 25 years of solvency to the Medicare Program, but it is all just budgetary sleight of hand.

The President's budget does have $650 billion in new taxes on small businesses, but then you use that money to claim both shoring up Medicare's Trust Fund and deficit reduction.

You are putting budget gimmicks over beneficiaries. The last time you claimed savings in Medicare through the Inflation Reduction Act's drug price setting program, you used that $300 billion in savings to pay for green new deal policies, such as green vehicle tax credits.

How can you assure the new revenue will be used for Medicare solvency when your own budget also claims these same tax increases will be used for deficit reduction?

Secretary BECERRA. Mr. Chairman, what I can tell you is that the President is committed to make sure that he not only extends Medicare into the next generation, but he does it by protecting the benefits that curb Medicare beneficiaries' receipt.

And the beauty of this is that because he does it in a way that does not hurt middle income Americans, we can make sure that as you continue to work, you are going to be ready to receive your Medicare ready and fully there to go for you.

And so what I can say to you is that the President is the first President I know, and I sat at that dais for over 20 years, the first President who has actually proposed a real plan to deal with Medicare to keep it strong for the years to come.

Chairman SMITH. So that leads to my next question because he did not address this issue in regards to Medicare.

During the Biden Administration's first two years, we have seen near $2 trillion in unpaid for, reckless Democrat spending, and according to pay-go law, this will result in more than $500 billion in cuts to Medicare over the next decade.

To the detriment of seniors, your budget shows no plan to reverse these cuts. You simply ignore them and try to sweep them under the rug as if they are not happening.

Why do you not account for these looming cuts in your budget?

And what are you going to do to prevent them from taking place?

Secretary BECERRA. Mr. Chairman, we can try to go through the numbers, but what I can tell you is that the President's budget actually reduces the deficit in the years to come, and what it does for Medicare is it preserves those benefits that we have become accustomed to seeing available to our family members, our parents, and our grandparents.

And what I will tell you is this. The President made sure that he proposed a budget that not only would strengthen Medicare for the next generation, but at the same time—and the budget numbers show it—would be able to reduce the deficit long term by substantial numbers into the hundreds of billions, if not trillions.

Chairman SMITH. But the budget does not say anything about the $500 billion in looming cuts from pay-go. Do you have anywhere in the budget that you would show that the President is going to make sure those cuts do not take an effect?

Secretary BECERRA. So I will try to stay in my lane and speak to HHS budget elements and say to you that within Medicare, I can speak to you unequivocally that this budget protects every single benefit that the Medicare laws provide to seniors and those who are disabled.

And it does so by making sure that moving forward into the next generation those very benefits are there for them as well.

Chairman SMITH. Last Tuesday you received a letter from myself and all the Republicans on the Ways and Means Committee and Energy and Commerce Committee asking specific questions about proposed changes your department wants to make to the Medicare Advantage Program.

Your department is claiming a one percent increase in Medicare Advantage payments for 2024. This calculation includes what is called the "risk score trend," basically a metric that is supposed to project insurance plans' coding behavior throughout the year of care for their beneficiaries.

Do you agree that the risk score trend, of which CMS projects to be three percent for 2024, is a forward-looking metric and is not factored into a plan's base payment?

Secretary BECERRA. Mr. Chairman, today, after some 30 years, almost 30 years of managed care within the Medicare system, we have data that helps us be able to project forward, and the projections that we are making are based on data.

And that data is showing us that in many cases that we have been overpaying those insurance companies that are within the Medicare system. We are simply trying to make sure that we keep money in Medicare for Medicare beneficiaries.

And no one, whether it is an insurance company or a provider, should make unreasonable profits at the expense of Medicare beneficiaries.

And so we are just trying to make sure that we now use the data, the evidence that we have, to make sure that we move forward in the Medicare Program, whether it is the fee-for-service program or the managed care program.

Chairman SMITH. It is my understanding that this is a projected metric.

Do you agree that your own agency, CMS, approves Medicare Advantage insurers' bids, excluding this risk score trend?

Secretary BECERRA. Let me ask the question again. Now you are asking me to get into CMS' business. So I want to make sure I am——

Chairman SMITH. Yes. Do you agree that your own agency, CMS, approves Medicare Advantage insurers' bids, excluding this risk score trend?

Secretary BECERRA. So I will try to answer the best I can and certainly ask our Administrator to respond more directly and precisely.

But we make sure that we follow both the statutory prescriptions that we have and all the regulations that are in place for the managed care program within Medicare when it comes to how we put out the reimbursement rates for those insurance companies.

And what we are finding is, of course, that we are overpaying in many cases, and now we are trying to make sure we get some of that money back. It is in the billions.

Chairman SMITH. It is my understanding that CMS excludes this in their evaluations. So excluding this risk score trend, Medicare Advantage insurers will have to set their premiums based on an expected two percent decrease in payments compared with last year, correct?

Secretary BECERRA. We, in our plan, we do not require Medicare Advantage plans to cut any Medicare services that are provided within the confines of the law of Medicare.

Chairman SMITH. So, Mr. Secretary, it is basic math. One minus three is a negative number. We have heard from many concerned groups that this proposal may lead Medicare Advantage insurers to increase premiums or decrease certain benefits, potentially impacting seniors and their access to care.

I urge you to provide a diligent response to our questions that we sent you.

One last thing. HHS, under President Trump, established a hospital price transparency rule that went into effect on January 1st, 2021, requiring hospitals to post publicly the cost of various medical services they provide.

Unfortunately, there are major concerns regarding hospitals' compliance with the rule and whether the data is truly helpful for patients.

What is the Biden Administration doing to ensure hospitals are abiding with not just the letter but the intent of that rule so that patients have greater transparency and insight into the cost of the procedures before they receive care?

Secretary BECERRA. Excellent question, Mr. Chairman. Because we are trying to make sure that we move forward that new law, I think there are still some 30 percent of providers who have not yet complied. We are trying to move quickly.

Part of it we have to recognize that these providers have never had to do that. All of them use different formulas to figure out what their cost structure would be. We are trying to get all of them to become more uniform, but that does not excuse for them not complying with the law.

And so we are trying to be more aggressive in how we get them there. Hopefully it is with a carrot, but we have got the stick as well that you all provided us, and we will definitely try to do that.

I look to you for some guidance as well because we want to make sure that as we get all these providers to be transparent in their pricing, we do it without hurting the little guys who do not have the kind of wherewithal that the big guys do to really get in that stream of things.

And, by the way, on Medicare managed care program, Medicare Advantage, so-called Medicare Advantage, Mr. Chairman, our proposal increases the amount of money that those insurance companies will get from last year. How anyone can claim that there is going to be a cut I do not understand.

The second thing is there is nothing that we are doing that would require any insurance company to cut any benefits to any American on Medicare. If they make those cuts, it is those insurance companies that are doing it, and it is on them, not on the laws or what we have done at CMS.

Chairman SMITH. It is just a huge concern for 31 million Americans, and we are very concerned.

Secretary BECERRA. Because it should be.

Chairman SMITH. Because many of these Americans are worried that they are going to have cuts, and the way that we add it up, it appears that there is going to be a minus 2 percent cut.

Secretary BECERRA. We have these deceptive commercials that are on TV. I think it is unfair.

Chairman SMITH. We need to—yes. Well, this will not be the last we discuss this topic.

Thank you, Secretary.

Secretary BECERRA. Thank you, Chairman.

Chairman SMITH. I recognize the gentleman from Massachusetts, Mr. Neal.

Mr. NEAL. Thank you.

Under President Biden and with your department's leadership, Mr. Secretary, we have seen an increase in the number of Americans with insurance coverage and a reduction in out-of-pocket costs and lowering insurance and drug costs due to both strengthening and the growth of the Affordable Care Act.

Our legislative agenda on the Democratic side, including the Inflation Reduction Act is prevailing. Today more than 40 million Americans owe their health coverage to the Affordable Care Act. That is how important this law is.

Just last week the other side tipped their hand on some of their health care ideas. More of the same, allowing insurers to discriminate against patients with preexisting conditions including diabe-

tes, shifting costs onto patients, and promoting tax accounts that benefit the wealthy.

All of this instead of bolstering a law that is not only widely popular, but also what consumers want and need. That agenda would raise health care costs for families across the country.

On average Americans with coverage through exchanges have saved $800 this year, thanks to the Inflation Reduction Act, and the other side would put those savings on the line, as we noted in this committee just recently.

We still have not seen a Republican budget plan. They want us to get to work in balancing a budget, but they will not show us their plan.

Make no mistake. Their proposals will have a hard time under the magnifying glass in standing up. They simply will punish the sick by making them foot higher bills.

If going after workers is not enough, many of these physicians will go after seniors, and one of the first bills to repeal the life-changing drug pricing provisions of the Inflation Reduction Act, they would remove the power to negotiate drug prices from Medicare, eliminating the cap on out-of-pocket costs and insulin.

Had the insulin cap been in effect in 2020, more than 1.5 million Americans would have saved $500 that year, including free vaccines that will save the average American $70 as beneficiaries.

I think we can agree they will attack family budgets through their plans.

Finally, Mr. Secretary, let me take a note for a moment, by the way, to congratulate North Carolina on expanding Medicaid and the Affordable Care Act, a reminder that every child in Massachusetts has health insurance. Ninety-seven percent of the adults in Massachusetts have health insurance because of the ACA, and it polls regularly in the high 70 percentiles.

Finally, you and I have spoken a number of times, Mr. Secretary, about surprise billing. Mr. Brady and I, the former Ranking Member, we know precisely what we intended with the language and the words that we chose. We have not only prevailed in this committee. We have prevailed on the floor of the House, on the floor of the Senate, and now in subsequent court cases.

I hope that these implementation issues will be consistent with what this committee intended, and much of the confusion and expense has been a result of a department that is not fulfilling the wishes of what the committee intended here on this legislation.

We need a commitment to indicate that we will continue to expeditiously air these issues and do precisely what this committee intended when we marked this legislation up. We saw it on both side as a huge accomplishment.

And if you might in the last 14 seconds, Mr. Secretary?

Secretary BECERRA. Yes, and I know we will talk about this more, but first I have to say thank you to you, Mr. Brady, and many of your colleagues who pushed this because at the end of the day, we still have work to do to make it work right, to your point.

What we can guarantee you is that Americans as consumers of that health care service, as the patients are taken out of the food fight between the provider who gave the care and the insurance company who has to pay it, the most important thing you did was

to make sure that as that fight continues, it is not patients who have to pay the price.

Mr. NEAL. Thank you, Mr. Chairman. I yield back.

Chairman SMITH. I recognize the gentleman from Florida, Mr. Buchanan.

Mr. BUCHANAN. Welcome back, Mr. Secretary. It is great to see you.

Secretary BECERRA. Great to see you.

Mr. BUCHANAN. We did work out a lot of things together. So I appreciate that.

I want to touch base on Alzheimer's drugs. I am in Florida. I have got the fifth oldest district in the country. So CMS decided they will not cover the Alzheimer's drugs.

It just seems like every family is touched by this. To give someone an extra six months to a year even though the drug is maybe not quite where it needs to be is a big deal.

But it basically essentially put them out of reach for six and half million Americans with Alzheimer's. Just two weeks ago, however, the Department of Veterans Affairs announced they would cover the latest cost for veterans.

Sadly, CMS is still blocking access to this. In fact, CMS refused to even consider the decision even though the Alzheimer's Association is strongly, strongly supporting it. I have met with them.

Given the VA decided to cover this drug, will you commit to working with CMS to try to reconsider that decision?

Because it is devastating I will tell you now, I think, for a lot of people across the country, but especially in Florida.

Secretary BECERRA. Congressman, there is nothing you said that I do not agree with. There is not probably one of us who has not gone through the circumstance where one of our loved ones, our parents, our grandparents, is going through Alzheimer's or some form of dementia.

I have gone through it. My wife has gone through it. It is devastating, especially if like us you are the one who is providing a lot of that care.

And I have said this to the advocates from the Alzheimer's Association. You keep pushing. You are doing everything right.

And what I will tell you is that CMS is moving in the direction which I think will give a lot of Americans heart to believe that their loved one will have an opportunity to get recovery.

Mr. BUCHANAN. Let me get another question in at least.

Secretary BECERRA. Okay.

Mr. BUCHANAN. Because we only get three and half minutes.

Secretary BECERRA. I apologize.

Mr. BUCHANAN. Also I just want to touch base on the year 2024 in terms of Medicare Advantage. They are looking at a cut, 2.3 percent. It will negatively impact 31 million people who have got Medicare. It is huge, over 50 percent, 55 percent of people who have Medicare Advantage.

And they are looking at raising the price from $540 to $830, which is over a 50 percent increase. It is huge because a lot of the seniors, that is all they have. It is very important.

Is that something you can consider to look into as well?

Secretary BECERRA. So, Congressman, here I want to be really clear. We are not doing any of what you just said. I am not sure where you got that information, but we are increasing the amount of reimbursement we are getting to these insurance companies.

If these insurance companies are claiming that they are going to have to cut benefits, it is because they do not want to provide them and they are more willing to take care of their profits over the——

Mr. BUCHANAN. I will get you the information, the backup on that.

Secretary BECERRA. Please.

Mr. BUCHANAN. I read a letter with Chairman Smith interviewing Commerce Chairwoman Rogers and Health Subcommittee Chairman Guthrie. I would like to submit it for the record, asking direct questions about the impact this will have on seniors and how CMS determines these rates.

Chairman SMITH. Without objection.

[The information follows:]

Congress of the United States
House of Representatives
Washington, DC 20515

March 21, 2023

The Honorable Xavier Becerra
Secretary
Department of Health and Human Services
200 Independence Avenue, SW
Washington, D.C. 20201

The Honorable Chiquita Brooks-LaSure
Administrator
Centers for Medicare & Medicaid Services
7500 Security Boulevard
Baltimore, MD 21244

Dear Secretary Becerra and Administrator Brooks-LaSure:

We write to request more information on the proposed Center for Medicare and Medicaid Service's (CMS) Calendar Year (CY) 2024 Advance Notice for the Medicare Advantage (MA) program. House Republicans are committed to protecting and strengthening the Medicare program, and as such, we need clarity on recent changes proposed by President Biden to better understand their impact on patients.

We appreciate the recent guidance document posted by CMS that offers additional context surrounding the CY 2024 Advance Notice. We have outstanding questions with respect to the impact that potential changes may have on patients. To that end, we request answers to the following questions no later than March 31, 2023. Please reply to the specific questions – a narrative response that does not address each question is unacceptable.

1. Please provide the following estimates for plan year 2024 under the policies enumerated in the CY 2024 Advance Notice:
    a. Estimated total bid-based payments to Medicare Advantage Organizations (MAOs);
    b. Estimated total rebate-based payments to MAOs;
    c. Estimated average per-member per-month bid-based payments to MAOs; and
    d. Estimated average per-member per-month rebate-based payments to MAOs.
2. Please provide the following information about the risk score trend estimate:
    a. The specific methodology used to calculate the risk score trend;
    b. The first and third quartile (25^{th} and 75^{th} percentile) of projected risk score growth across all contracts; and
    c. The historical year-over-year risk score trends from the previous five years.
3. Does CMS project behavioral changes from MAOs in response to the proposed changes in the CY 2024 Advance Notice? If so, please detail and, to the extent possible, quantify such projected responses. Are these projected behavioral changes included in the risk score trend?
4. In the FAQ released on March 8, 2023 (the FAQ), CMS stated that MA markets and premiums have remained stable after risk model policy changes. Did CMS conduct a prospective analysis of how the proposed changes in the CY 2024 Advance Notice would impact patient premiums and supplemental benefit offerings?
5. Does CMS project behavioral changes amongst enrollees choosing Medicare Advantage plans? If so, please describe in detail how such changes will impact enrollees' decisions.
6. In the FAQ, CMS stated clinical input was received from a panel of physicians as part of development of the new risk adjustment model. Who specifically constitutes this panel? If this panel made recommendations, please share them.
7. Previous proposed changes to the CMS Hierarchical Condition Category (HCC) model have

included longer periods of evaluation. Changes made by CMS in 2017 were proposed in an October 2015 Health Plan Management System (HPMS) memo. The 21st Century Cures Act required a 60-day comment period for proposed changes to the MA risk adjustment model. Does CMS believe that the statutory minimum of 30 days is sufficient time to evaluate the impacts of CY 2024 Advance Notice proposed changes?

8. Moving the MA risk adjustment model to the ICD-10 diagnosis coding system brings the MA program in line with the American health care delivery system, which has largely been using these granular codes since 2015. Previous changes of this magnitude have been phased in over a period of time. For example, changes proposed in the CY 2014 Advanced Notice were phased in over two years and changes proposed in the CY 2019 Advanced Notice were phased in over three years. Did CMS consider phasing in the transition to ICD-10 codes?
9. Does CMS intend to use the proposed updates to the risk adjustment model for other Medicare programs that currently use HCCs, such as Accountable Care Organizations, and other applicable innovation center models?
10. According to the CY 2024 Advance Notice, the changes will result in a 15.68% reduction in frailty scores and a $50 million reduction in payments to fully-integrated dually-eligible special needs plans (FIDE SNPs). If finalized, does CMS project that this change will reduce the incentive for SNPs to fully integrate?
11. The FAQ stated that the preliminary growth rate increase includes inflation in the calculation. Provide us with the inflation methodology used in this calculation.

Thank you in advance for your attention to these questions. House Republicans remain committed to protecting and strengthening Medicare and look forward to your prompt response on how the CY 2024 Advance Notice will impact patients.

Sincerely,

Jason Smith
Chairman
House Committee on Ways and Means

Cathy McMorris Rodgers
Chair
House Committee on Energy and Commerce

Vern Buchanan
Chairman
Subcommittee on Health

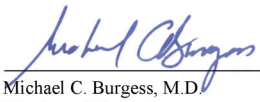
Brett Guthrie
Chairman
Subcommittee on Health

Mike Kelly
Member of Congress

Morgan Griffith
Member of Congress



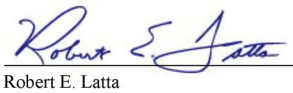
Adrian Smith
Member of Congress



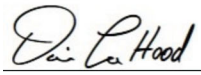
Michael C. Burgess, M.D.
Member of Congress



David Schweikert
Member of Congress



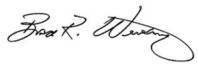
Robert E. Latta
Member of Congress



Darin LaHood
Member of Congress



Gus M. Bilirakis
Member of Congress



Brad R. Wenstrup, D.P.M.
Member of Congress



Bill Johnson
Member of Congress



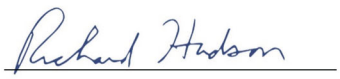
Jodey Arrington
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Larry Bucshon, M.D.
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A Drew. Ferguson, IV
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Richard Hudson
Member of Congress



Ron Estes
Member of Congress



Tim Walberg
Member of Congress



Lloyd Smucker
Member of Congress



Earl L. "Buddy" Carter
Member of Congress



Kevin Hern
Member of Congress



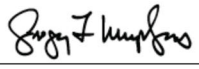
Jeff Duncan
Member of Congress



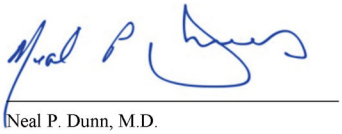
Carol Miller
Member of Congress



Gary Palmer
Member of Congress



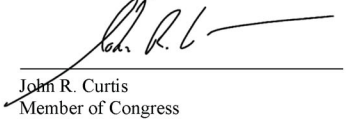
Gregory F. Murphy, M.D.
Member of Congress



Neal P. Dunn, M.D.
Member of Congress



David Kustoff
Member of Congress



John R. Curtis
Member of Congress



Brian Fitzpatrick
Member of Congress



Debbie Lesko
Member of Congress



W. Gregory Steube
Member of Congress



Greg Pence
Member of Congress



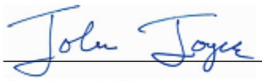
Claudia Tenney
Member of Congress



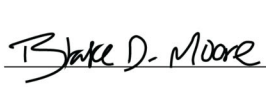
Dan Crenshaw
Member of Congress



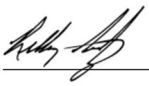
Michelle Fischbach
Member of Congress



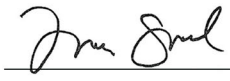
John Joyce, M.D.
Member of Congress



Blake Moore
Member of Congress



Kelly Armstrong
Member of Congress



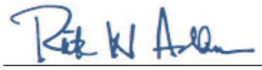
Michelle Steel
Member of Congress



Randy K. Weber
Member of Congress



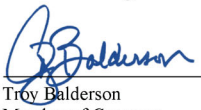
Beth Van Duyne
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Rick W. Allen
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Randy Feenstra
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Troy Balderson
Member of Congress



Nicole Maliotakis
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Russ Fulcher
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Member of Congress

Kat Cammack
Member of Congress

Jay Obernolte
Member of Congress

Secretary BECERRA. I look forward to getting it.

Mr. BUCHANAN. With that I yield back.

Secretary BECERRA. Thank you.

Chairman SMITH. The gentleman from Texas is recognized.

Mr. DOGGETT. Thank you, Mr. Chairman.

And thank you, Mr. Secretary, for your service.

I think among the many positive provisions in the President's budget are those that are designed to strengthen Medicare.

It is not enough to say we will not cut Medicare. It is taking the steps necessary to ensure that it is there not just for today's grandparents, but for tomorrow's grandchildren.

And I think further comment from you is in order about Medicare Advantage. I remember, as you do because you were on the committee, when people came forward and told us how much money Medicare Advantage was going to save Medicare.

Instead we find it to be one of the most profitable sections of the insurance business. I heard the suggestion 31 million Americans are concerned. I think it is rather a few hundred insurance executives that are concerned that getting $1,500 on average per Medicare beneficiary paying that much more for Medicare Advantage than for traditional Medicare is just not enough for them.

MedPAC, an independent agency that looks at these issues, has estimated that we spent about $27 billion in overpayment to Medicare Advantage this year alone.

I have seen those misleading commercials you referred to, and I know our constituents are being bombarded with tales about all that is going to go wrong if the Administration's proposals are adopted.

They are the same folks that get bombarded with one misleading advertisement and phone call after another trying to sell them on a policy that may well provide them lack of access to their physician at a time when they need it the most.

Seeing what you have done to date, is it not correct that you are not cutting Medicare Advantage? You are not really getting back that $27 billion in overpayment. You are actually under your proposal increasing the payments that Medicare Advantage company will get in the next year by one percent.

They are just unhappy that the increase they are getting is not as big as the overly generous increases of the past.

Secretary BECERRA. Congressman, that is right. We are actually increasing the amount of payment that we are making to them from the previous year, and as my mother will ask me when she sees these commercials, she will call me and say, "Can you tell me if I am in the right plan or not?"

I tell here, "Look. What would you expect from a commercial that is peddling a product to you? They want you to buy and so they try to pitch it to you in ways that will sell it."

And unfortunately, once some of these seniors lock into some of these policies, they realize they are not getting what they thought.

Mr. DOGGETT. Well, I hope that in addition to what you do in terms of payment, that we will continue to see a vigorous examination of the false claims that are made to ensure that everyone who relies on Medicare Advantage and takes that approach gets what they are promised.

Thank you very much.

I yield back.

Chairman SMITH. I now recognize Mr. Smith from Nebraska.

Mr. SMITH of Nebraska. Thank you, Mr. Secretary and Mr. Chairman, as well.

Thank you, Mr. Secretary, for joining us today.

I would like to start by calling your attention to a letter I sent to you on March 10th, a February 25th, 2023, article in the New York Times and a subsequent report by the Washington Post that have raised serious concerns about the Office of Refugee Resettlement at HHS.

Everything about this situation, from unaccompanied children at the border to the lack of sponsor vetting to the ORR losing track of these children, I have to say, is troubling. So I hope you will respond to my letter hopefully by April 15th as requested so we can ensure that HHS is able to address these issues.

The COVID public health emergency is scheduled to expire on May 11th. I welcome this expiration. There are hundreds though of waivers, many of which have vastly benefitted patients around the country, which immediately sunset, immediately sunset with the PHE.

These expirations have the potential to impact virtually every medical provider and patient but would have a disproportionate impact, I believe, on rural and underserved areas like my home district in Nebraska.

For example, it appears that without intervention, the following regulations will return to full force on May 12th: the 96-hour and offsite provider telehealth conditions of participation for critical access hospitals; the three-day hospital stay rule for skilled nursing facility admittance; and the long-term care hospital waiver of site neutrality in IPPS.

Mr. Secretary, should we have the concern that the return to full enforcement of these regulations will have impact on patient access to care?

Secretary BECERRA. Congressman, absolutely. And we thank you for the extension to some of those telehealth opportunities that will expire at the end of 2024, but we need to do something permanently.

Mr. SMITH of Nebraska. Okay. So I guess can we count on your support of efforts to make many of these provisions permanent that have proven to be effective and especially for patients themselves?

Secretary BECERRA. We will be there side by side with you if you try to negotiate the terms of that because, again, most of this is baked in in statute, and so we are going to have to make changes through Congress.

Mr. SMITH of Nebraska. Thank you. I appreciate that.

Finally, earlier this year, CMMI released three new models targeting prescription drugs, and to date CMMI tested more than 50 models, only six of which have delivered statistically significant savings and a less than 12 percent success rate, not acceptable in many eyes.

I have been concerned for year that CMMI often overextends itself by attempting to do too many things at once, and this leads to overlapping and counterproductive results which can harm both

patients and providers, while currently wasting Medicare's finite resources.

CMMI Director Fowler even said, quote, "We need to move away from this 'spaghetti against wall, see what flowers bloom' approach," end quote.

Can you perhaps explain how simultaneously launching three different models targeting the same problem is different than the failed scattershot approach of the past?

Secretary BECERRA. And, Congressman, I answer this knowing that as a former member, I like you and many others would always ask CMMI to test certain things. CMMI is supposed to be our incubator, our place to test ideas made on a very small scale.

So if they do not work, we have not spent a ton of money, but if they do work, the return will be phenomenal, and what we want is to promote innovation.

So CMMI is the place where we can tell the private sector give us your best idea. We will help seed it, and if it can go, great. And if it does not, no one, including the taxpayer, loses a whole lot.

So I would want to work with you to make sure that we get good ideas coming forward to CMMI, but I would hate to do anything that stifles the innovation and competitiveness that CMMI promotes.

Mr. SMITH of Nebraska. Thank you.

I yield back.

Chairman SMITH. Mr. Thompson, from California is recognized.

Mr. THOMPSON. Thank you, Mr. Chairman.

And thank you, Mr. Secretary, for being here.

And I just appreciate your pointing out the benefits of the ACA, everything from access to preventive health care, doing away with the preexisting condition limitations.

And remember before we passed the ACA, being a woman was a preexisting condition. Getting a handle on prescription drug costs. No more junk policies.

There are countless examples of my district and everybody else's district of how people that we represent have benefitted from this, and thank you for your ongoing support.

I would like to ask about two priorities of mine, mental health and telemedicine. I am grateful that you and President Biden have made mental health a high priority, but I am concerned that too much of our focus is on treating the symptoms of mental illness as opposed to understanding its underlying causes.

There is not enough money in any President's budget to treat every mental health symptom. We need to get ahead of the curve, and that is why Mr. Kelly and I have legislation that will provide tax incentives for brain research.

I have sent that bill to Treasury to get their comments, and I would appreciate it if we could send it to you and get your team's comments on that as well.

Secretary BECERRA. Absolutely.

Mr. THOMPSON. Thank you.

And I would also like to ask about telemedicine.

And thank you, Mr. Smith, Nebraska's Smith, for raising this issue. It has been a long-time priority of mine, and I think one of the few silver linings in the COVID cloud, as you know, we passed

my legislation to allow Medicare beneficiaries to access health care services via telehealth, and that was a real help to them, and it really provided a better means by which providers could treat their patients.

And last year, we passed a two-year extension of those telehealth flexibilities. Part of the reason we passed that extension was to give agencies, including HHS, the opportunity to study health utilization over the past several years, how it was used, where it can be approved, and how it has affected cost.

I have legislation with Mr. Schweikert along with our colleagues on the Energy and Commerce Committee which would make telehealth a permanent part of Medicare.

That bill, by the way, was sponsored last year by over half of the U.S. Senate.

So as the two-year extension plays out, I would like to know how you envision the role of telehealth in the future, particularly in Medicare programs.

And is there anything specific that your agency is looking at to make sure that we have the best handle on this?

Secretary BECERRA. Congressman, I know we do not have much time, but what I will tell you is that we have seen the dramatic results in behavioral health. We were not sure what would happen with folks who needed mental health care services. We thought perhaps they needed to have that person-to-person contact with their physician and their health care provider.

It turns out that one of the greatest gains was made in mental health where, because you could do this in the privacy of your home, you felt more comfortable coming forward and accessing mental health services.

At the same time, we saw a dramatic drop in missed appointments because now you do not have to worry about traveling there if you did not have transportation.

We hope that we can work with our States to figure out how we deal with the cross-State issues that are involved with licensing of medical practitioners.

Mr. THOMPSON. Are you saying you are for making it permanent?

Secretary BECERRA. We are absolutely. It depends on where we are going, but, yes, there is absolutely a need to continue some of these telehealth flexibilities.

Mr. THOMPSON. Thank you.

I yield back.

Chairman SMITH. I recognize the gentleman from Pennsylvania, Mr. Kelly.

Mr. KELLY. Thank you, Mr. Chairman.

Mr. Becerra, it is good to see you again. It has been a little bit of time in between.

I just wanted to ask you something because I have been in the private sector my whole life, and I am trying to figure out how you put all of these pieces together. You have 83,000 employees; is that right?

Secretary BECERRA. About there, yes.

Mr. Kelly. That is a big payroll. That is a big payroll.

Secretary BECERRA. Yes.

Mr. KELLY. And approximately 4,000 of these employees are based at the CMS, at the Woodlawn, Maryland headquarters.

So how many employees are working today in person, actually in person?

Secretary BECERRA. Congressman, the HHS workforce went back to full-time work from the get-go. We were able to use telehealth during COVID, and now that we are beyond that, we are able to continue workforce at full time.

And you have heard some of the dramatic results of a workforce that has continued forward. Some have never left coming into the office or coming into work. Others are taking advantage of some of the flexibilities that we provide. So they could come in some days and work from a different site other days.

Mr. KELLY. Yes, well, I have a photo. This picture—well, I know you said these people are at work. This is last Monday, okay, March 20th. This is at 10:30 a.m. in the morning.

So a beautiful parking lot. There is everything on there except cars. I guess I do not know how your people get to work, but this is your office building, and you are telling me they are working full time. They must be working full time from home or some other way of doing that.

I just do not understand that.

Secretary BECERRA. Congressman, that is not my——

Mr. KELLY. This year—no, Mr. Secretary, this is the picture. You have seen it before, and you know what it is.

Secretary BECERRA. Yes.

Mr. KELLY. And then we request another $18 million in rent compared to last year. So when you look at the people that fund all this stuff, and these are hardworking American taxpayers. I like the talk that goes back and forth, but what we are going to do for six people, how we are going to shore this thing up, how we are going to do this, how we are going to cover all of this stuff, but at the end of the day, there is only one person signing that check, and that is the taxpayer.

So why should the American people be expected to pay rent for an office building that is not even being used?

There is so much waste in this government. There is so much fat in this government it is impossible. I am embarrassed to go back home and tell people this is the way it is supposed to work.

This is not the way it is supposed to work. This is crazy stuff. Nobody would look at this as a business model and say, "You know, good idea. Let's pay a lot of rent. Nobody has to be there, but we will pay rent."

Now you have said you are going to get the whole workforce back to work. They are actually going to show up in person in their buildings and actually work.

And I am not talking about being on these little things we have set up. All of the little pictures show up and people get a chance to talk.

I do not know. I think that they are so inefficient right now.

Are you telling me—and I want to know this seriously—do you ever expect to be back fully at work at their desk in their buildings doing the work for the American people?

Secretary BECERRA. Congressman, we are fully at work full time.

Mr. KELLY. Well, this was a national holiday then probably, right? This was March 20th.

Secretary BECERRA. You know, Congressman, I do not even recognize that photo. That is not certainly a photo of my office building.

Mr. KELLY. Oh, okay.

Secretary BECERRA. Maybe a parking lot of a building that HHS has employees——

Mr. KELLY. Yeah.

Secretary BECERRA. I doubt that you could say that that speaks to the work that is being——

Mr. KELLY. Well, I would tell you this, that this is Woodlawn. This is Woodlawn, Maryland, your headquarters. If this is your headquarters at 10:30 in the morning on a Monday morning on March 20th, there is something that does not match with what you are telling me.

I do not want to keep grilling you on this because I will tell you what. Both you and I pay a portion of whatever it is that we earned to fund all of these things.

I just am appalled at the way this government works. There is so much fat. The things that we have to do, yes, do them, but you had better learn how to work within a budget and make sense.

I cannot take this home and tell my people that I represent, "You know what? Listen. It may not make sense to you but it does not have to. This is the way we run our government."

This is your parking lot in Woodlawn, Maryland. That is where it took place. It did not take place someplace else.

Secretary BECERRA. But you cannot say that the folks that work in that Maryland site, if there is a site there, are not working.

Mr. KELLY. I do not know. You know what? I would love to go sometime. I would even like to go to the IRS and see those people working at their desk, and I would like to see your people working at their desk.

Eighty-three thousand people getting a paycheck from the American taxpayer and we say if they will work part time, 30 hours a week is part time. I would just say that this government has a lot of people that are part time.

I thank you. I yield back.

Listen. I do appreciate your service because I like you personally. You know that, but I do. More than you, I like our taxpayers, and you are the guy in charge.

It is a heavy lift. My God, 83,000 people.

Secretary BECERRA. And they are working, Congressman.

Mr. KELLY. Yeah, well, I know. I hear what you say. I am just saying the pictures do not reveal that they are working, and I think the American people deserve an answer.

Secretary BECERRA. I will bring you some pictures next time.

Mr. KELLY. Okay. Very good. Thank you.

I will go there with you.

Chairman SMITH. The gentleman from Connecticut is recognized, Mr. Larson.

Mr. LARSON. Thank you, Mr. Chairman.

And thank you, Secretary Becerra, for being here. It is great to have you back with the committee, and thank you for your continued work and support, both while you were here and as Attorney General for the State of California and now in your capacity as Secretary of HHS.

Mr. Secretary, last year we passed the Inflation Reduction Act, and as you hear Ranking Member Neal run through a number of the things that were accomplished, I want to associate myself with his remarks.

But as someone like yourself, who has been a long-time advocate of lower drug prices through Medicare negotiation, we were pleased to see that the President's budget calls on Congress to build on what we did in the Inflation Reduction Act, which keeps money in seniors' pockets, while also making Medicare more solvent.

My question and to give you a time to do this, can you walk us through your agency's progress in implementing the drug cost provisions in the Inflation Reduction Act and tell us how each provision will continue to deliver for the American public?

Secretary BECERRA. Congressman Larson, thank you for your efforts over the years on these issues as well.

Well, today those who are in need of insulin are getting it for $35 a month or less, and that is something that is saving most Americans several hundred dollars for this year alone.

Those same Americans on Medicare now can access a vaccine, whether for the flu, for COVID, for shingles, and I always hear about shingles because apparently that is a pretty expensive vaccine, 100 to $200. Free now, no out-of-pocket cost for folks on Medicare to access that. That is saving people quite a bit of money.

On top of that, we made the announcement that come September we will announce the first ten drugs that will be part of that drug price negotiation that will begin.

The companies that manufacture those drugs will go through the process then of negotiating for the best price for folks on Medicare, and we hope to continue that process because at the end of the day this is about saving people money.

Right now Americans, as you know, are paying two or three times more for the same drugs that are being sold in other countries, even if those drugs may have been manufactured HERE in the U.S.

Mr. LARSON. And so this direct negotiation, seniors have long been anticipating this. So it will be in September that we will hear.

And how many drugs?

Secretary BECERRA. There will be ten drugs, and then next year there will be 15 more. Then the year after that we add more, and every year we get to add them.

I think in your wisdom you said make sure you do it right for the first ten and then let's keep going from there.

Mr. LARSON. Thank you, Mr. Secretary. I greatly appreciate it.

And with that, I will yield back.

Chairman SMITH. The gentleman from Arizona, Mr. Schweikert, is recognized.

Mr. SCHWEIKERT. Thank you, Mr. Chairman.

Mr. Secretary, this may sound odd, but I think you actually have one of the most interesting, if not one of the most difficult, jobs in the world.

Secretary BECERRA. I concur.

Mr. SCHWEIKERT. But I also am constantly frustrated that we do not take your agency dramatically more seriously.

And look. In the President's budget, you have new taxes. The President's budget has new taxes in there for shoring up part of Medicare Part A. That equals out about what, 600, 660 billion over a ten-year cycle?

And I am not asking you to play budget with me. I am just sort of setting up a question.

But the math from 2022 basically said Medicare shortfall over 30 years, with interest, so this is from two years ago, was over $80 trillion.

So I am elated, hey, you are going to talk about shoring up the Medicare Part A Trust Fund, but remember the vast majority of Medicare spending is general fund.

It turns out your agency, our obligation we made to seniors, is the primaries, three-quarters of all the borrowing over the next 30 years. You are the epicenter of what in many ways is the greatest threat to our republic, and that is our debt, you know, whether it be my kids or someone's secure retirement.

So there are some things that are not meant to be got-you, but are there things we could do to help your folks on the innovation side be much more innovative, much more risk taking, much more forward viewing?

We have a document that was working through your numbers saying 31 percent of all Medicare spending is diabetic related. Okay. Could we actually do an all-in approach to stabilize pre-diabetic populations?

Do you remember that there is a phase one that has just begun of a potential cure for diabetes?

In a weird way, you, your agency, break us or the innovation in your folks save us from a future that is just brutal, step-wise.

And I guess my rambling is more about what can I do, what can we as members do. Because I have gotten some really crappy responses sometimes from your innovation folks who say, "We are looking at that," and then we never hear before.

What can we do to make them almost techno-utopians, that we have to to push the solution?

Secretary BECERRA. So, Congressman, let me see if I can give you two or three different points, and you can build on them if you like.

First, I go back to what I said earlier because you hit it on the money. Why are we spending so much money on diabetes? Because so many of these cases of diabetes could have been prevented.

And so rather than try to cure it, as my mom always used to say to me [speaking foreign language], "Better to prevent than to remediate." Why not try to prevent it?

And my whole opening statement was about how moving from an illness care system, which is what you are pointing out, to a wellness care system.

Mr. SCHWEIKERT. But what I beg of you is in your opening statement you said wellness care, but you did not say we need to fix nutrition support. The way we do it, that is not working.

There are actually things we can do to help people manage their blood glucose. You have seen even the discussion of something I can wear on my wrist that may tell me what my blood glucose is.

We now have—and I am going to screw it up—GPL–1 inhibitors and a variety of those that are off patent. The fact in medicine there may be a stem cell therapy coming.

If it is the single biggest driver of debt in our country, where is your all-in approach? Where is the maniacal fixation that we are going to take this on?

Because it is not partisan. It is not Republican/Democrat. It is moral.

And with that I yield back.

Chairman SMITH. Mr. Blumenauer from Oregon is recognized.

Mr. BLUMENAUER. Thank you, Mr. Chairman.

Mr. Secretary, welcome back. I must say you look increasingly distinguished.

Secretary BECERRA. More like you, huh?

Mr. BLUMENAUER. Well, not that distinguished. [Laughter.]

Mr. BLUMENAUER. Thank you for joining us. I want to thank you for the work that the department has done working with the State of Oregon and, I think, Massachusetts dealing with innovative efforts in terms of the waiver, being able to focus on social determinants of health that actually help people with things like nutrition and housing that will lower costs.

I appreciate the creativity and look forward to working with you and the department to realize the benefit of those.

I would, as you know, be remiss if I did not mention one of the topics that we have discussed.

Secretary BECERRA. I see the chart.

Mr. BLUMENAUER. In the last 30 years we have gone from a country where there was no legal State either medical or adult use, and in that period of time we now have 37 States where at least some form of cannabis is legal. In 21 States, it is fully legal.

The American public overwhelmingly supports it, and yet the Federal Government is hopelessly out of step.

I welcome the President's call to do a reappraisal of how we characterize this so we can have the Federal Government catch up with where the American people are as it deals with the reality of cannabis, and I look forward to working with you.

I appreciate your notion of the prescription drug reform. The American senior primarily does not have to pay two, three, four, five times the world price for prescription drugs in order to underwrite medical research for the rest of the world.

I am not certain that the pharmaceutical companies would hold us hostage, but I think it is too steep a price. American consumers, especially seniors, should not be held hostage, and I appreciate the work you are doing implementing this bidding effort.

Let me just touch on one other area. We have talked about some of the concerns we have, for example, in terms of for-profit Hospice, where we found shadow companies that have buildings, get money, but have nobody that they are serving.

I notice that you have $5.2 billion for program integrity. Can you talk about what that is going to enable us to do to make sure the taxpayer is getting full value?

Secretary BECERRA. Congressman, we know that during COVID we had more people die in nursing homes than was acceptable. We know that in too many cases people are profiting off of saying they are caring for some of our most precious loved ones who need help.

And we want to make sure we get to go in and do some oversight. We want to make sure sunshine will be a good disinfectant when it comes to caring for our loved ones.

And so we—hope you will consider, truly consider our request for more money so we can do the oversight.

I speak as a former Attorney General who worked hard to go after some of this abuse against elderly Americans, and we are going to do as much as we can.

Mr. BLUMENAUER. I think you will find bipartisan support on this committee to deal with the integrity of the Hospice Program so we are not cheating patients or the government.

Secretary BECERRA. Amen.

Mr. BLUMENAUER. I yield back.

Chairman SMITH. The gentleman from Illinois, Mr. LaHood, is recognized.

Mr. LAHOOD. Thank you, Mr. Chairman.

Mr. Secretary, welcome. Mr. Secretary, last year you and I spoke about my concerns with the response times from HHS in responding to congressional letters, and unfortunately, I cannot say that that has improved today.

Just this afternoon I received a letter that I sent asking for a response five months ago. I do not find it a coincidence that I received a response today when you are appearing before this committee.

As we all know, Mr. Secretary, workforce challenges are a major concern across industries, but particularly within the healthcare community. This is why last Congress I introduced a bipartisan bill called the TRAIN Act, along with Representatives Blunt Rochester of Delaware, which became law at the end of last year.

This bill addressed a nursing workforce issue caused by CMS in which they began to recoup funds given to hospital-based nursing schools based on a CMS error.

Taking funds away from nursing schools during the pandemic and workforce crisis certainly seemed misguided to me, and so we worked in a bipartisan way to address this issue to prevent the recoupment.

However, we passed that law. It now appears that CMS is going against congressional intent in their recent transmittal notice for implementation of the bill. CMS has created a complicated formula to describe how these impacted schools would get their money back.

The formula would not fully stop recoupment and returning the funds, but instead only provide between 29 and 76 percent of the funds owed back to these schools.

In our bill, CMS was directed to return the funds that were taken from each school. It is beyond frustrating, Mr. Secretary,

that something so clear in the statute could be implemented in this way.

These hospital-based nursing schools, of which I have several in my district, provide hands-on education allowing more nurses to enter the workforce and serve rural and underserved communities.

Before our bill could become law, many of these schools closed and now CMS continues, Mr. Secretary, to impact the remaining schools by only returning a portion of the funds they are owed. This is simply unacceptable.

And I would like your commitment, Mr. Secretary, to look into the creation of this formula and respond to me in writing on why CMS chose to go against our directive and the clear congressional intent on this issue.

Secretary BECERRA. Congressman, let me do this. I will call. After this hearing, I will try to reach out to you and have a specific conversation. You let me know who from CMS you want to have on that conversation and let's follow up so we can make sure that we are following the intent the way it should be.

Mr. LAHOOD. Thank you.

Mr. Secretary, in my remaining time here I would also like to comment briefly on my concerns with CMS determination on coverage with evidence development CED requirements for Alzheimer's treatments.

In February, I along with 74 of my colleagues wrote to you with our concerns on how CMS continues to address the CED process, particularly as it impacts constituents and their families and caregivers in my district who are unable to participate in academic clinical trials.

I have serious concerns about how CMS is making decisions on this issue, and I await your timely response to our letters sent to you on February 6, and I would just say that does not mean waiting five months from now.

You mentioned earlier in Mr. Buchanan's comments that you told the advocates to keep pushing. There is immense frustration that my constituents and many people across the country cannot participate in these academic clinical trials.

If you could, respond to that.

Secretary BECERRA. Yes, and we are trying to make sure that we do provide for a diversity of participation in these trials. Oftentimes we find that folks in rural American do not get to participate in trials. Folks in some urban poor areas of America do not get asked to participate.

So we are trying to make sure that those who will participate include those from all parts of our country. We could do everything we can within the clinical trials, but at the end of the day, it is the investigators who have to make sure that they are pursuing folks to participate.

But I am absolutely prepared to work with you and others who are interested in this subject to make sure what where there is a clinical trial that everyone has an opportunity to participate.

Mr. LAHOOD. Thank you.

Chairman SMITH. The gentleman from New Jersey is recognized.

Mr. PASCRELL. Welcome back, Mr. Secretary. Thanks for the work on the Biden team. You have done an outstanding job.

Americans emerged from the pandemic with the best economy in decades. The pandemic opened their eyes to the titanic need of skilled nursing.

So I welcome the President's bold goal to remake our Nation's 15,000 nursing homes, and I am damned angry when I look at the results.

This is a $130 billion industry. Wall Street's control over nursing homes grows with risks and abuses. Problems in our nursing homes have been ignored for too long.

We need transparency for tax dollars going into big companies, and we must hold bad actors accountable when they provide substandard care for our seniors.

A lot of statistics came out of these last two and a half years, three years. I am not going to go into too many statistics because I have done that before.

Private equity firms, they are having a song and a dance. You wonder why so many nursing homes are closing. You cannot provide service unless you pay the help. You cannot provide service if the help is not up for the job. You have got to pay for that. You get what you pay for.

And private equity gets what they pay for. So we need transparency.

One year into the White House initiative, what has this Administration done to increase transparency of ownership so that we could figure out who owns the darn place and management of our skilled nursing facilities?

What has happened in one year?

Secretary BECERRA. Congressman——

Mr. PASCRELL. Tell me that in two sentences.

Secretary BECERRA. First, thank you for your advocacy in this area.

We have for the first time in as far as I can remember required the disclosure of ownership interest in these facilities because we know that a shell game is often played with regard to who actually handles them.

And probably something which you did not quite say it explicitly is that oftentimes when ownership goes into the hands of a Wall Street firm, they are in there for the money, and so what they do is they extract assets and they oftentimes leave a shell.

And the folks who are needing care are the ones who suffer as a result of having less than ideal services.

We are also moving forward on the idea of having minimum staffing levels so that regardless of who purchases that facility, you cannot move below a certain level.

Mr. PASCRELL. Excuse me, Mr. Secretary. You have been looking at that for years. Your Administration, the previous administration, the administration before that, the administration before that.

What have you done?

Secretary BECERRA. Congressman——

Mr. PASCRELL. Do you want me to give you a list in New Jersey?

Secretary BECERRA. I cannot speak for the previous administration, but I can tell you we are in the process of coming out with a rule that will require minimum staffing levels. That is more than I have seen any administration do.

Mr. PASCRELL. And you are going to work this out with the equity firms?

Secretary BECERRA. We do not need to work that out with any equity firm. We get to do that based on a rule that is based on the authorities you gave us.

Mr. PASCRELL. To your health.

Secretary BECERRA. Thank you.

Mr. PASCRELL. I yield. [Laughter.]

Chairman SMITH. The gentleman from Ohio is recognized.

Mr. WENSTRUP. Thank you, Mr. Chairman.

You go, Bill.

I am deeply concerned, Mr. Secretary, with the state of health services and human services in our country. I continue to hear from providers across the country, which I was one for three decades, they are closing the doors, walking away from providing care to patients every day because of the challenges that have come from this administration and because of some of your decisions, sir.

Physicians are the ones that continue to show up to the front lines and make sure that patients receive the care that they need. Doctors are the ones who provide the health and human services to patients across this country.

And if this pattern continues, there will not be enough doctors left to take care of patients across America.

Your budget grows. You treat no one. You are a lawyer, and you ask providers to do more with less until they close their doors.

Congress spent years negotiating a solution to solve surprise billing and do it in a balanced fashion, and, yes, we took patients out of it. That we did.

Congress passed a No Surprises Act to protect patients, create a balanced process. The President signed it into law. You ignored that.

And we created a bill that created incentive for doctors who want to be in network and for insurance companies to want doctors in network. But you decided to implement the law in a manner that unfairly tips the scale in favor of insurers by placing undue weight on the qualified payment amount, which was just one component of arbitration and did not have weight over any others.

You directly defied the law as written, and it is interesting considering you are a lawyer that you would violate the law.

And your illegal actions have led to a backlog of claims, and you called the claims recently to be frivolous. Well, you ask the patients that got the care if it is frivolous, and you ask the doctors that have to pay their staff and their salaries and to stay open and to be in the black.

You ask them if it is frivolous. You said patients are not affected. They are affected. Doctors retire or they quit taking calls.

You come in in that ambulance and guess what. There is no doctor on call because of the way you have implemented the No Surprises Act. You.

So you are directly harming patients actually. Doctors and hospitals need to be in the black to keep their doors open, to continue to provide a service. And they cannot pay their help if they do not.

What this says to me is you clearly do not value the work of physicians and surgeons and what they do for those in need, and without them we have no health system at all.

Mr. Secretary, will you implement the No Surprise Act as written in statute and not stray from the letter of the law, as you have continued to do, as you have been informed that you have done by the courts, and maybe get out of the courtroom and into the emergency room and the operating room where HHS belongs?

Secretary BECERRA. Congressman, I respect especially the passion with which you speak to the subject, and so what I will tell you is where we have gotten guidance from the courts, we have followed it.

We will try to do the best we can. If you are one of those who helped pass the law, I thank you. You probably remember when that was being discussed, I think at that point people thought ten, maybe 20,000 disputes would be sent for this independent dispute resolution process.

In the first eight months, 164,000 claims were filed.

Mr. WENSTRUP. But you are responsible for that, sir. The way you have implemented the law has driven this. You took away the fair process.

Secretary BECERRA. Congressman, if you look at what we did——

Mr. WENSTRUP. Well, of course they want to go to arbitration.

Secretary BECERRA. Congressman, there is nothing that we did——

Mr. WENSTRUP. You called it frivolous, which is an insult to every provider out there.

Secretary BECERRA. I am not calling it. It is the arbitrators.

Mr. WENSTRUP. I yield back.

Secretary BECERRA. The arbitrators are the ones that are saying that those were frivolous claims.

Chairman SMITH. The gentleman from Illinois, Mr. Davis, is recognized.

Mr. DAVIS. Thank you, Mr. Chairman.

Mr. Chairman, I ask unanimous consent to submit for the record a statement describing the accessibility of imported e-cigarettes and vaping material to young people in our country.

Chairman SMITH. Without objection, so ordered.

[The information follows:]

Committee on Ways and Means Hearing on Proposed Fiscal Year 2024 Budget with Department of Health and Human Services Secretary Becerra Tuesday, March 28, 2023

The prevalence of e-cigarettes (EC) use has increased substantially among adolescents and young adults. Some analysts have reported that the use of EC nicotine products harms brain development that leads to behavioral health problems. I ask to submit Rep. Cherfilus-McCormick press release document for the record to direct the Secretary of Health and Human Services to update the guidance under Section 2 of the Federal Food, Drug, and Cosmetic Act to describe how the agency will prioritize enforcement against disposable ENDs products, including non-tobacco-derived nicotine products.

Rep. Cherfilus-McCormick Introduces Legislation to Protect Children From Flavored Disposable E-Cigarettes

Washington, D.C. – Today, Rep. Shelia Cherfilus-McCormick (D-FL) introduced the ***Disposable ENDS Product Enforcement Act of 2023*** to close the Trump Administration's loophole on disposable electronic nicotine delivery systems (ENDS) (i.e., disposable vapes) containing flavors specifically intended to entice our children into becoming hooked on nicotine for life.

"As the mother of two children and a former healthcare executive, I am pleased to introduce this critical legislation," said **Rep. Cherfilus-McCormick**. "Too many of our youth are forming nicotine addictions, increasing their risk of future addiction to other drugs. I am even more troubled by the fact that Chinese manufacturers and suppliers are flooding the U.S. market with unregulated, harmful substances that are altering our children's brain development and lives. I am calling on the Biden Administration to close this harmful loophole for the sake of our youth and to put an end to this national epidemic."

The ***Disposable ENDS Product Enforcement Act of 2023*** directs the Secretary of Health and Human Services to update the guidance under Section 2 of the Federal Food, Drug, and Cosmetic Act to describe how the agency will prioritize enforcement against disposable ENDS products, including non-tobacco-derived nicotine products.

Rep. Cherfilus-McCormick is helping to lead the charge in Congress to encourage the Biden Administration to close a loophole created by the Trump Administration that allows for the sale of flavored e-cigarettes if the delivery device is disposable. In 2020, the Trump Administration took a half-step forward by prohibiting the sale of flavored e-cigarettes such as fruity pebbles and bubble gum, but only for e-cigarettes that required a cartridge refill. This left an opening for

companies to swoop in and sell disposable versions of the e-cigarettes with the very same flavors intended to be taken off the shelves to protect our children.

According to the 2022 National Youth Tobacco Survey published by the Food and Drug Administration and the Centers for Disease Control and Prevention, disposable e-cigarettes are the device currently most used by youth. That number has skyrocketed since the loophole was created by the Trump Administration in 2020 and is causing a public health crisis among our children.

In Florida, roughly 1,750 youth under the age of 18 become new daily smokers each year. Additionally, statistics show that 270,000 youth under the age of 18 who are alive in Florida will ultimately die prematurely from smoking.

In 2015, Broward County, which is in Rep. Cherfilus-McCormick's district, banned the use of e-cigarettes in county facilities. However, since flavored disposable e-cigarettes are still available under federal law, thanks to the Trump Administration's loophole, they can be sold outside the city limits and made readily available to the children of Broward County.

This is evident because an estimated 15.8% of youth in Broward currently use e-cigarettes. To counter this epidemic, Broward County Public Schools developed a tiered curriculum structure for students to provide greater awareness regarding prevention and intervention resources.

Rep. Cherfilus-McCormick is determined to work with the Biden Administration to close the flavored disposable e-cigarette loophole and is dedicated to the safety and security of our future generations.
The legislation has been endorsed by the American Heart Association.

"The American Heart Association appreciates Rep. Cherfilus-McCormick's leadership to close the disposable e-cigarette loophole, which has kept dangerous products with kid-friendly flavors on the market and easily accessible to our nation's youth. Big Tobacco has been successfully manipulating loopholes such as this one in its ongoing attempts to hook youth and adults to its harmful products. The ***Disposable ENDS Product Enforcement Act*** will provide FDA with a vital tool to hold the tobacco industry accountable and move us one step closer to the Tobacco Endgame," said **Mark Schoeberl, Executive Vice President, Advocacy, American Heart Association**.

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Danny K. Davis
Member of Congress

Mr. DAVIS. Thank you, Mr. Secretary, for your work and the outstanding work of members of your staff.

Medicare physicians' pay and its impact on patient access to care remains a major issue for many of my constituents. In fact, adjusted for inflation, in-practice costs Medicare physicians' pay actually declined 26 percent from 2001 to 2023, or by 1.8 percent per year, on average.

Nonpartisan government stakeholders are recognizing the damage and impact these payments cuts are having on patients' access to care.

The 2021 Medicare Trustees' report states that after the change in the delivery system or level of update by subsequent legislation, the Trustees expect access to Medicare participating physicians to become a significant issue in the long term.

To help address this growing problem, physicians are pushing for an annual Medicare payment update tied to inflation as measured by the Medicare Economic Index, the MEI.

Even the March 2023 MedPAC report to Congress includes recommendations that Congress increase the 2024 Medicare physician payment rate above current law, with an inflation-based payment.

Mr. Secretary, could you share with us some of the Administration's thinking relative to Medicare payments to physicians?

Secretary BECERRA. Absolutely, Congressman, and as you know, the President declared emphatically during the State of the Union that not only was he going to protect Medicare for today's seniors and Americans with disabilities who receive Medicare, but he was going to protect it for the next generation as well.

And so his budget makes sure that Medicare not only remains strong, but it continues to offer benefits that, under traditional Medicare fee for service or under managed care Medicare, either way Americans receive their services.

And that is why the proposal that we have put forward when it comes to reimbursement to providers continues to increase the amount that they will receive.

The amount that we are proposing in this year's proposal is greater than the amount that we had proposed last year, and of course, we protect all Medicare benefits. We do not cut any benefits. We continue to preserve access to those same benefits that all Americans have become accustomed to having under Medicare.

Mr. DAVIS. Thank you very much, and I am sure that the thousands of Medicare physicians, as well as their millions of patients, will be delighted to hear this answer. Thank you so much.

Thank you, Mr. Chairman, and I yield back.

Chairman SMITH. The gentleman from Georgia, Mr. Ferguson, is recognized.

Mr. FERGUSON. Thank you, Mr. Chairman.

And thank you, Mr. Secretary, for being here.

A couple of items here. First of all, one of the things I am very concerned about is antimicrobial resistance. We have not been doing a great job in this country of developing the next generation of antibiotics to fight these resistant infections.

It has cost the system almost $5 billion a year, and really probably somewhere around 35, 36,000 people a year die because of this.

We have a system failure here. It is a failure of the marketplace, and there are some very specific reasons.

Do you think congressional action is needed to correct this, to prepare ourselves for the next pandemic and to address the immediate cost to the system?

Secretary BECERRA. Congressman, first I have to say halleluiah for asking that question because nobody asks about antimicrobial resistance.

It is absolutely essential, and absolutely Congress needs to act because we have to figure out a way to get the market to want to invent some of these new lifesaving treatments.

Mr. FERGUSON. Good. I look forward to working with you on that.

You know, I——

Secretary BECERRA. Can I just add real quickly?

Internationally, we are trying to take this on as well, and so there is a lot of interest internationally to deal with antimicrobial resistance.

Mr. FERGUSON. We just want to make sure that we lead.

Secretary BECERRA. Absolutely.

Mr. FERGUSON. So with that, listen. You touched on Medicare Advantage issues. Again, I just do not share your position on that.

I want to say this. You made a comment to my colleague here from Ohio, Dr. Wenstrup, that you were trying to implement the surprise billing law the way we intended it, and I will simply say that trying is nothing more than failing slowly. Either you are going to do it or you are not.

And I would encourage you to do it. So do not fail slowly. Just get it done the way Congress intended for that and the way that this committee intended for you to implement that and to make the changes.

Next, a couple of series of questions here. Over the past decade and a half or so, really, yeah, about the past decade and a half has there been any sector of the health care environment that has grown at a slower rate than inflation?

Secretary BECERRA. Any sector of——

Mr. FERGUSON. Yes, any sector in our health care economy that has grown slower than inflation.

Secretary BECERRA. We would probably have to crack our heads together to see if we could find one.

Mr. FERGUSON. You will get a split in your skull you will have to crack your head so hard so many times on that.

Has there been an increase or decrease in premiums in the past decade and a half?

Secretary BECERRA. Well, here actually there is some good news. If I take you on the Affordable Care Website, you can find a premium today for——

Mr. FERGUSON. No, no, no, not the cost of individual but the overall cost of the premium including the subsidies that have to be paid to drive that cost lower.

Secretary BECERRA. Okay. Well, we still have to take a look because I am going to——

Mr. FERGUSON. The answer is I do not think you are going to find many folks that are saying that their health care premiums are going down.

Secretary BECERRA. For most the costs have gone down.

Mr. FERGUSON. Really?

Secretary BECERRA. Yes.

Mr. FERGUSON. In what State?

Secretary BECERRA. Pretty much every State that has access to the Affordable Care Act.

Mr. FERGUSON. You are going to tell us that the health care premiums in the State of Georgia are lower now than they were a decade and a half ago?

Secretary BECERRA. Absolutely, absolutely. When you can find a premium at $10 a month or less——

Mr. FERGUSON. No, no, no, no, no, not to the individual. I am talking about the overall cost to the system.

Secretary BECERRA. I get where you are going, but what I am saying to you American——

Mr. FERGUSON. Well, I am getting where I am going because we are spending entirely too much money. We have got an inefficient system.

Reclaiming my time, a couple of other quick questions.

Are there more rural hospitals in America today or fewer? Just more or less.

Fewer. I will answer it for you, at least in my district.

Are Americans healthier today than they were in 2010?

And do we have more solo practitioners or more vertically integrated health care systems where an insurance company owns a PBM that owns a pharmacy that owns the health care system?

Ms. SÁNCHEZ. Mr. Chairman.

Mr. FERGUSON. My point here is that how you judge success——

Ms. SÁNCHEZ. Mr. Chairman.

Mr. FERGUSON [continuing]. Of government-run health care and how we do are maybe two different things.

With that, Mr. Chairman, I would yield back.

Chairman SMITH. Thank you.

The representative from California is recognized. Ms. Sánchez.

Ms. SÁNCHEZ. Thank you, Mr. Chairman.

And thank you, Mr. Secretary, for your testimony today.

My colleagues and I worked tirelessly to pass the Inflation Reduction Act and to lower drug costs under Medicare, and these critical policies are saving beneficiaries an average of $800 per person per year. I call that progress.

I am also pleased to see that the Administration is building on the work in the last Congress to extend ACA premium tax credits as well as put more money in Medicare beneficiaries' pockets by capping out-of-pocket drug costs.

I also think it is important to highlight your plan to close the Medicaid coverage gap, particularly as we see millions of Californians currently go through the redetermination process as the PHE comes to an end.

These are the types of investments that we must continue to make in order to meaningfully reduce the cost weighing heaviest on working families and to help close those health care disparities.

The HHS budget also includes expanded funding for long-term care through Medicaid home and community-based services. I want to bring your attention to that because studies have predicted that the number of seniors over the age of 85 who will need personal care due to fragility of aging and other disabilities will quadruple between now and 2040.

Now, these are folks that do not need 24-hour medical care, but they do need assistance with everyday living tasks like eating, bathing, cleaning. Seniors with dementia, in particular, need these, and these tasks often fall on the shoulders of working families, and these tasks are often uncompensated.

I have experience in this. I have been extremely fortunate to share caregiving responsibilities with my siblings for both of my parents, but I know firsthand how difficult it is to balance being a working mom and a caregiver, even when you have the means to do so.

An average year of long-term care costs over $70,000, and most seniors' entire life savings are a little more than double than that, and Latino and African American households have significantly less in retirement savings than the average household.

For example, half of elderly Latinos rely on Social Security as their sole source of retirement income.

In Medicare, Medicare Advantage, Medigap, none of those insurers cover long-term supportive care. The only option for those who can afford assisted living facilities, costly private long-term insurance plans or if they qualify for Medicaid.

So, Mr. Secretary, I want to know what the department doing to address the predicted rise in long-term care needs.

And how would you suggest financing such a system that does not solely rely on Medicaid?

Secretary BECERRA. Congresswoman, first, thank you for your commitment to this particular subject.

Secondly, I mentioned the work that we are doing to try to improve the services at existing facilities, whether it is a nursing home facility or providing Hospice care.

We are in this budget providing for $150 billion in Medicaid home and community-based services because we know there is the need to increase access to that long-term care.

We are doing everything we can to do more inspection of facilities because we know that there have been a number of complaints, and the need to make sure that there is transparency in the services that are provided, and we are doing as much as we can to try to increase the ability of States to do some of those inspections themselves and to the complaint surveys' response themselves as well.

So we have an investment of about $500 million, a little bit more than $500 million dollars in discretionary monies to help those States do those survey and certification programs.

Ms. SANCHEZ. I thank you for your work on that and for your presence today.

And I yield back.

Chairman SMITH. The gentleman from Kansas, Mr. Estes, is recognized.

Mr. ESTES. Well, thank you, Mr. Chairman.

And thank you, Mr. Secretary, for being here today.

You know, when I combed through the President's budget that adds $17 trillion to the deficit over the next ten years, I see much of the failed policies that have caused record inflation over the last two years, and it is hurting Kansas families.

In fact, a surgery center in Wichita told me that this year more patients are delaying surgery because they simply have to make a choice between having a procedure or putting food on the table.

Secretary Becerra, over the last two years I have heard from numerous doctors in my district and the State that have indicated participation in Medicare is becoming untenable due to the instability of reimbursement year after year. This means patient access is in jeopardy across the country, including my home State of Kansas and particularly in rural areas.

I have got a couple questions that are really yes or no.

I mean do you recognize the instability of the physician fee schedule the past two years that has disproportionately appropriated patients, particularly rural ones, and particularly in specialty care?

Secretary BECERRA. Congressman, I think we all, and I remember being a member of Congress as well. The challenge that we have in trying to make sure that we are adequately reimbursing providers has always been there. It is something that we always have to address and you have to address.

Mr. ESTES. And will you help work with us and commit to helping evaluate the impact on rural access before you make future reimbursement changes?

Secretary BECERRA. Absolutely.

Mr. ESTES. I also am concerned a little bit particularly about changes made under the REMs for mifepristone. Under your direction REMs have been changed so that a woman no longer needs to see her physician in person in order to receive this harmful drug, but one in five women who take this drug need medical intervention following its use. That is one in five.

Your own FDA said that women should not take it if they have an ectopic pregnancy, and FDA explains that if an ectopic pregnancy is not identified and removed, it can rupture and cause abdominal bleeding that can kill the pregnant woman.

Ectopic pregnancies can only be ruled out by a health care provider using blood tests and an ultrasound.

And FDA has further warnings for women if they have problems with their adrenal glands or if they are taking certain medications. This critical information is given by health care providers with access to their medical history.

Do you think the new REMs for this drug put women in danger?

Secretary BECERRA. Congressman, FDA puts out those REMs after reviewing all the science and the evidence that is out there. Mifepristone has been available for more than 20 years. It has been proven to be, as FDA has to show it, to be a safe and effective drug.

And now they are moving forward, based on several years of evidence and especially during COVID where they found that it could

be prescribed safely and effectively without having to have the in-person visit by the patient in order to get access to the drug.

Mr. ESTES. I am just concerned that one in five need additional care afterwards. That has no bearing on that, but it is caused by that, as well as the ectopic pregnancies.

How do you plan to help make sure that they are checked for an ectopic pregnancy before this drug is dispensed to them?

Secretary BECERRA. Yes, and I would need to check those numbers. I have not heard those numbers that you have recited. And I know I hear from my wife, who is a high-risk OB–GYN, all the time about this.

This is a drug that has proven itself over the course of time. You do not just get access to it because you want it. You still have to get it prescribed, and so your physician, your medical provider, would still have to prescribe it.

And so those kinds of areas where you need to have safeguards are still in place. It is just that the in-person requirement that a woman go to a particular spot to get that prescription drug would be removed.

Mr. ESTES. Mr. Chairman, I yield back.

Chairman SMITH. The gentleman from Pennsylvania, Mr. Smucker, is recognized.

Mr. SMUCKER. Thank you, Mr. Chairman.

Good afternoon, Secretary.

The Work and Welfare Subcommittee is having a hearing tomorrow looking at strengthening TANF work requirements, and I am sure you know that only six States have a 50 percent TANF work participation rate requirement, and 34 States have a zero percent requirement.

How is HHS making sure that States are being held accountable in implementing TANF work requirements?

Secretary BECERRA. Congressman, that is a great question, and I hope we can actually work on some of this because we are trying to work with the States to get more information.

We all heard about the situation in Mississippi where a lot of TANF dollars were misused, and that was as a result of State officials not keeping watch of the money.

We would love to work with you to make sure that our work to do oversight continues forward, the program integrity work that we do, but we really need your help.

Mr. SMUCKER. So you agree that it is a problem we need to address and we can work together on that?

Secretary BECERRA. Well, when State officials divert dollars that are meant for needy families, that is absolutely a problem.

Mr. SMUCKER. I am talking specifically about the work requirements.

Secretary BECERRA. We can absolutely talk to you about any number of issues including work requirements, but what we want to do is make sure that we are getting dollars to the families that are needy that qualify for those funds.

Mr. SMUCKER. Thank you. I look forward to talking with you about it.

As you know, as a hospital insurance fund trustee, the trustees currently estimate that Medicare Part A will go insolvent in 2028,

at which point the program will only be able to pay 90 percent of benefits, meaning seniors will face a ten percent cut in benefits; is that right?

Secretary BECERRA. What I can tell you is that the President's budget addresses that to make sure that no senior, no person with disability will face any change in their benefits.

Mr. SMUCKER. Let's talk about that because I do appreciate that there are some proposals in the budget to extend the solvency. I mean that certainly is a goal shared by Republicans and Democrats.

So I do hope that we can work together in a bipartisan fashion. However, I do have trouble seeing how the math adds up in the some of the President's proposal.

And a basic question. I think we will agree on this. If the government raises taxes by $100 and then spends that $100, it is a zero impact on the deficit, correct?

Secretary BECERRA. Are you speaking about the Medicare Program?

Mr. SMUCKER. If the government raises taxes by 100 and then spends 100, what is the net impact on the deficit?

Secretary BECERRA. But if you are going to relate that to Medicare, then I want to make sure we are——

Mr. SMUCKER. No, it is a basic question.

Secretary BECERRA. Well, if you are speaking about Medicare and the President's budget, then I could answer that question because I do not want you to then say that I have said that the President will not strengthen Medicare.

Mr. SMUCKER. That was a basic question, but is it true that the President's budget counts savings from potential drug pricing reforms towards both deficit reduction and then also injecting funds into the Hospital Insurance Trust Fund?

Secretary BECERRA. The President's budget, because it reduces deficits over the course of the next ten years will be good for America and our economy. At the same time, the President's budget will strengthen the Medicare Program without cutting any benefits.

Mr. SMUCKER. But it really sounds like a budget gimmick when you are counting both the same cuts as deficit reduction and also injecting funds into the trust fund.

Secretary BECERRA. Well, the Congressional Budget Office, which is your scorekeeper, also shows that the President's budget will save us money.

Mr. SMUCKER. Is it true that the President's budget increases taxes on small businesses by $650 billion?

Secretary BECERRA. So the President said that no one who earns less than $400,000, and if you are a small business person at the end of the day——

Mr. SMUCKER. The budget does increase taxes by $650 billion. Will those new taxes be used to pay for Medicare solvency?

Secretary BECERRA. And those are taxes on corporations and the wealthiest individuals, but again, anyone earning less than $400,000, whether it is through your small business or through your employment, will not pay any increased taxes.

Mr. SMUCKER. It is the double counting of the same funds that makes no sense.

And, Mr. Chairman, I would like to enter into the record a budget model from Penn Wharton, that their analysis points this out, the double counting and the budget gimmicks that the plan employs.

So I would like to submit that into the record if I could.

Chairman SMITH. Without objection, so ordered.

[The information follows:]

https://budgetmodel.wharton.upenn.edu/issues/2023/3/10/president-bidens-proposal-to-extend-medicare-trust-fund

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PENN WHARTON
UNIVERSITY of PENNSYLVANIA
Budget Model

President Biden's Proposal to Extend the Medicare Trust Fund

Summary: PWBM estimates that President Biden's new Medicare proposal would increase the solvency of the Medicare trust fund from the year 2028 to 2053. However, a significant share of that increase comes from redirecting existing (current law) revenue to the trust fund. Another portion comes from unspecific expenditure reductions that lack the details required to score. Counting only new income without unspecified expenditure reductions, we project, as an illustrative alternative, that the HI trust fund would remain solvent until 2037.

Key Points

- Under current law, the Medicare Hospital Insurance (HI) trust fund faces insolvency in 2028. The White House writes that President Biden's new Medicare proposal "would extend solvency at least into the 2050s."
- We estimate that this proposal would extend trust fund solvency to the start of the year 2053. However, almost 40 percent of that increase comes from redirecting *existing* (current law) revenue to the trust fund account. Each $1 of redirection increases the on-budget deficit by a corresponding $1, thereby only producing an accounting change.
- We also compute an illustrative alternative accounting that includes only new sources of revenue and assumed expenditure reductions contained in the proposal. We estimate that the Medicare trust fund would then remain solvent until the start of 2041. That calculation, however, includes unspecified cost savings from reduced prescription drug expenditures without the details required to score. If, following scoring conventions, we additionally exclude unspecified cost savings, then the trust fund would remain solvent until 2037 under this illustrative alternative.

Introduction

Under current law, the Medicare HI trust fund is projected to face insolvency in 2028. If Congress does not increase revenues or decreases benefits paid, automatic benefit cuts would result in that year.

President Biden's Proposal

President Biden's proposal increases trust fund income and decrease expenditures in three main ways:

- *Increase Tax Rates*. Increase the HI payroll tax and net investment income tax (NIIT) rate from 3.8 percent to 5 percent on households earning more than $400,000 per year.
- *Expand the Tax Base*. Expands the NIIT to apply to more types of income, including the profits of active owners of S corporations, the income of active limited partners, and the sale of business property from active partners.

- *Decrease Prescription Drug Expenditures*. Decreases prescription drug expenditures by expanding the provisions in the Inflation Reduction Act in largely unspecified ways.

President Biden's proposal would also redirect existing resources available under current law to the HI trust fund:

- NIIT revenue that is already collected under the current 3.8 percent tax.

The redirection of existing resources represents an accounting shift that credits the trust fund while increasing the "on-budget" deficit by an equivalent amount.

Estimated Effect on the HI Trust Fund Balance

Table 1 shows the estimated income and expenditure effects over the 2023-2053 period.[1] Over that period, President Biden's proposal decreases HI trust fund deficits by a total of $8.4 trillion, of which $5.2 trillion are from new and $3.1 trillion are from redirecting existing income and expenditures.[2]

Table 1: Effects of President Biden's Proposal on Medicare HI Trust Fund Surplus

Billions of dollars

DOWNLOAD DATA

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Income											
Existing	$45	$47	$50	$49	$54	$55	$58	$62	$65	$67	$72
New	$48	$60	$62	$58	$60	$64	$67	$70	$74	$77	$81
Total Income	$93	$107	$111	$107	$114	$119	$125	$132	$139	$144	$153
Expenditures											
Existing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
New	$0	$0	-$2	-$8	-$17	-$26	-$27	-$31	-$32	-$34	-$36
Total Expenditures	$0	$0	-$2	-$8	-$17	-$26	-$27	-$31	-$32	-$34	-$36
Surplus											
Existing	$45	$47	$50	$49	$54	$55	$58	$62	$65	$67	$72
New	$48	$61	$64	$66	$77	$89	$94	$101	$106	$111	$117
Total Surplus	$93	$108	$113	$115	$131	$145	$152	$163	$171	$178	$189
Memorandum:											
Cumulative change in surplus											
Existing	$45	$92	$141	$191	$244	$300	$358	$420	$485	$553	$625
New	$48	$109	$172	$238	$315	$405	$499	$600	$706	$817	$934
Total cumulative change in surplus	$93	$200	$314	$429	$560	$705	$857	$1,020	$1,191	$1,370	$1,559

	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Income										
Existing	$75	$80	$84	$88	$92	$96	$101	$107	$111	$115
New	$85	$90	$95	$99	$104	$109	$115	$121	$127	$133
Total Income	$160	$171	$179	$187	$196	$205	$215	$228	$238	$248
Expenditures										
Existing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
New	-$38	-$41	-$43	-$46	-$48	-$51	-$54	-$58	-$61	-$65
Total Expenditures	-$38	-$41	-$43	-$46	-$48	-$51	-$54	-$58	-$61	-$65
Surplus										
Existing	$75	$80	$84	$88	$92	$96	$101	$107	$111	$115
New	$124	$131	$138	$145	$153	$160	$169	$179	$188	$198
Total Surplus	$198	$211	$222	$233	$244	$257	$270	$285	$299	$313
Memorandum:										
Cumulative change in surplus										
Existing	$700	$780	$864	$952	$1,044	$1,140	$1,241	$1,347	$1,458	$1,573
New	$1,058	$1,189	$1,326	$1,471	$1,624	$1,784	$1,953	$2,132	$2,320	$2,518
Total cumulative change in surplus	$1,757	$1,969	$2,190	$2,423	$2,667	$2,924	$3,194	$3,479	$3,778	$4,091

	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
Income										
Existing	$124	$131	$136	$141	$150	$156	$161	$176	$183	$193
New	$142	$151	$157	$165	$174	$182	$191	$205	$216	$230
Total Income	$266	$281	$293	$306	$325	$338	$351	$381	$400	$423
Expenditures										
Existing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
New	-$69	-$73	-$77	-$82	-$87	-$92	-$98	-$104	-$110	-$117
Total Expenditures	-$69	-$73	-$77	-$82	-$87	-$92	-$98	-$104	-$110	-$117
Surplus										
Existing	$124	$131	$136	$141	$150	$156	$161	$176	$183	$193
New	$211	$224	$235	$247	$261	$275	$289	$309	$326	$347
Total Surplus	$334	$354	$370	$388	$412	$431	$449	$485	$510	$539
Memorandum:										
Cumulative change in surplus										
Existing	$1,697	$1,828	$1,963	$2,105	$2,255	$2,411	$2,572	$2,748	$2,931	$3,124
New	$2,729	$2,952	$3,187	$3,434	$3,696	$3,970	$4,259	$4,568	$4,894	$5,241
Total cumulative change in surplus	$4,426	$4,780	$5,151	$5,539	$5,951	$6,381	$6,831	$7,316	$7,826	$8,365

Source: Penn Wharton Budget Model, data for New Expenditures were taken from Table S-6 of the Budget of the U.S. Government, Fiscal Year 2024, available at https://www.whitehouse.gov/wp-content/uploads/2023/03/budget_fy2024.pdf.
Notes: Annual growth in CY expenditures past 2032 are assumed to grow at 6.0 percent, the average over the 2028-2032 period. All data in calendar years.

Table 2 shows the effect of President Biden's proposal on the HI trust fund balance. Under current law, the HI trust fund balance turns negative in 2028 (see **"End-of-Year Balance, current law"**). Under the Biden policy, if we count new and existing revenue increases and expenditure reductions, the HI trust fund balance remains positive until 2053 (see **"End-of-Year Balance, policy: Existing and New"**). However, under an illustrative alternative accounting, the trust fund balance remains positive until 2040 if we count only new revenue and new expenditure (see **"End-of-Year Balance, policy: New Only"**). Table 2 shows that these values are roughly unchanged when adjusting expenditure reductions for differences in PWBM versus White House economic forecasts.

Table 2: Penn Wharton Budget Model Projections of Balances in the HI Trust Fund

Billions of dollars

DOWNLOAD DATA

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
End-of-Year Balance, current law	$169	$155	$129	$93	$48	-$9	-$77	-$157	-$247	-$354	-$479
Cumulative change in surplus											
Existing and New	$93	$200	$314	$429	$560	$705	$857	$1,020	$1,191	$1,370	$1,559
New Only	$48	$109	$172	$238	$315	$405	$499	$600	$706	$817	$934
Adjusting for PWBM baseline economic forecast											
Existing and New	$93	$200	$314	$429	$559	$703	$854	$1,015	$1,185	$1,360	$1,547
New Only	$48	$109	$172	$238	$315	$403	$496	$595	$699	$808	$922
Without unspecified expenditure decreases	$48	$108	$170	$228	$288	$352	$418	$489	$563	$640	$721
End-of-Year Balance, policy											
Existing and New	$262	$355	$443	$522	$608	$696	$780	$863	$944	$1,016	$1,080
New Only	$217	$264	$301	$331	$363	$396	$422	$443	$459	$463	$455
Adjusting for PWBM baseline economic forecast											
Existing and New	$262	$355	$443	$522	$607	$694	$777	$858	$938	$1,006	$1,068
New Only	$217	$264	$301	$331	$363	$394	$419	$438	$452	$454	$443
Without unspecified expenditure decreases	$217	$263	$299	$321	$336	$343	$341	$332	$316	$286	$242

	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
End-of-Year Balance, current law	-$619	-$781	-$963	-$1,164	-$1,384	-$1,625	-$1,890	-$2,178	-$2,488	-$2,828
Cumulative change in surplus										
Existing and New	$1,757	$1,969	$2,190	$2,423	$2,667	$2,924	$3,194	$3,479	$3,778	$4,091
New Only	$1,058	$1,189	$1,326	$1,471	$1,624	$1,784	$1,953	$2,132	$2,320	$2,518
Adjusting for PWBM baseline economic forecast										
Existing and New	$1,743	$1,951	$2,169	$2,398	$2,639	$2,892	$3,158	$3,439	$3,733	$4,041
New Only	$1,043	$1,171	$1,305	$1,447	$1,596	$1,752	$1,917	$2,091	$2,275	$2,468
Without unspecified expenditure decreases	$806	$897	$991	$1,090	$1,194	$1,304	$1,418	$1,539	$1,666	$1,799
End-of-Year Balance, policy										
Existing and New	$1,138	$1,188	$1,227	$1,259	$1,283	$1,299	$1,304	$1,301	$1,290	$1,263
New Only	$439	$408	$363	$307	$240	$159	$63	-$46	-$168	-$310
Adjusting for PWBM baseline economic forecast										
Existing and New	$1,124	$1,170	$1,206	$1,234	$1,255	$1,267	$1,268	$1,261	$1,245	$1,213
New Only	$424	$390	$342	$283	$212	$127	$27	-$87	-$213	-$360
Without unspecified expenditure decreases	$187	$116	$28	-$74	-$190	-$321	-$472	-$639	-$822	-$1,029

	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
End-of-Year Balance, current law	-$3,204	-$3,615	-$4,068	-$4,565	-$5,103	-$5,675	-$6,293	-$6,961	-$7,691	-$8,479
Cumulative change in surplus										
Existing and New	$4,426	$4,780	$5,151	$5,539	$5,951	$6,381	$6,831	$7,316	$7,826	$8,365
New Only	$2,729	$2,952	$3,187	$3,434	$3,696	$3,970	$4,259	$4,568	$4,894	$5,241
Adjusting for PWBM baseline economic forecast										
Existing and New	$4,371	$4,719	$5,084	$5,466	$5,871	$6,295	$6,737	$7,214	$7,716	$8,246
New Only	$2,674	$2,892	$3,121	$3,361	$3,616	$3,884	$4,165	$4,466	$4,784	$5,122
Without unspecified expenditure decreases	$1,941	$2,092	$2,249	$2,414	$2,589	$2,771	$2,962	$3,167	$3,384	$3,614
End-of-Year Balance, policy										
Existing and New	$1,222	$1,165	$1,083	$974	$848	$706	$538	$355	$135	-$114
New Only	-$475	-$663	-$881	-$1,131	-$1,407	-$1,705	-$2,034	-$2,393	-$2,797	-$3,238
Adjusting for PWBM baseline economic forecast										
Existing and New	$1,167	$1,104	$1,016	$901	$768	$620	$444	$253	$25	-$233
New Only	-$530	-$723	-$947	-$1,204	-$1,487	-$1,791	-$2,128	-$2,495	-$2,907	-$3,357
Without unspecified expenditure decreases	-$1,263	-$1,523	-$1,819	-$2,151	-$2,514	-$2,904	-$3,331	-$3,794	-$4,307	-$4,865

Source: Penn Wharton Budget Model.
Notes: Data in calendar years.

We are unable to separately estimate the decrease in expenditure that would be credited to the HI trust fund since the budget does not specify how those cost reductions will be achieved within each expenditure category. Instead, the budget presents rounded cost reductions without any further discussion of how those values are achieved. The Inflation Reduction Act specified the mechanism by which Medicare could negotiate price reductions.[3] In contrast, the president's budget simply mentions "expanding upon" the actions taken in the Inflation Reduction Act, including expanded negotiated price reductions.

Scoring convention usually does not credit cost savings in mandatory programs without such details that would enable an actual score.[4] If unspecified expenditure decreases are further omitted from the "New Only" category, we project that the trust fund will remain positive until 2036 under the illustrative alternative accounting (see **"End-of-Year Balance, policy: Without unspecified expenditure decreases"**).

This analysis was produced by Felix Reichling. Jagadeesh Gokhale and John Ricco contributed to the analysis. Prepared for the website by Mariko Paulson.

1. We convert fiscal year (a budget concept) to calendar year (a trust fund concept) for consistency. ↩

2. Differences due to rounding. ↩

3. For example, the IRA specified the number of drugs subject to price negotiation in each future year in enough detail to enable a score. ↩

4. For example, if a hypothetical proposal to cut taxes by $1 trillion over the budget window stated a pay-for offset by cutting "waste, overhead and fraud" but without specifying any details, PWBM and most scoring agencies would record the net cost as $1 trillion. Without this discipline, budget scoring essentially becomes irrelevant. Similarly, claimed cost savings from enhanced price negotiations without specific details would generally not be included. ↩

Mr. SMUCKER. Thank you.

Chairman SMITH. The gentleman from New York is recognized.

Mr. HIGGINS. Thank you, Mr. Chairman.

Thank you, Mr. Secretary, for being here.

In New York, every single hospital is reporting significant nursing shortages that they cannot fill. Over the last three years, contract labor has increased nationally over 250 percent and significantly in New York State as well.

So many nurses across the country have left hospital-based positions and have gone to these traveling staffing agencies. It is understandable because the work is better, the scheduling is more flexible, but these agencies charge hospitals a significant markup to employ their nurses, leading some hospitals to accuse them of price gouging.

The Federal Government pays a lot for health care, probably $1.6 trillion every year for Medicare, Medicaid, tax treatment, VA. It is a lot of money, but it is a lot of leverage.

Is your agency aware of this problem?

And are there other efforts to address the shortage in a legitimate way without profiting significantly, these agencies that employ traveling nurses?

Secretary BECERRA. Congressman, thank you for the question.

And just as the State of New York is suffering through a workforce shortage, so are, I know, my State of California and I suspect every member at this dias would say the same thing.

We are making investments and this budget does make investments to help expand the workforce. It also helps provide States with the opportunity to train more people, whether nurses, doctors, or childcare workers.

We want to increase the size of the workforce. One of the things that would help us increase the size of the workforce is if we get more women back into the workforce. We know that it has been very difficult.

If you cannot find childcare, sometimes it keeps people from being able to go to work, whether you are the father or the mother, but principally we know mothers have that prime responsibility more often than fathers do.

And so we are working where we can. We did a grant proposal. That was, I think, last year, $103 million, where we put it out, and the recipients of the grant, we did not put a lot of restrictions on it. What we said is we want you to use it to try to retain some of your workforce, increase your workforce, or up-train your workforce.

And what we are trying to do is help keep folks in the health care profession.

Mr. HIGGINS. Thank you.

I yield back.

Mrs. MILLER [presiding]. The chair recognizes the gentleman from Oklahoma.

Mr. HERN. Thank you, Madam Chair.

Mr. Secretary, thank you for being here today.

My time is short. So let me be real quick here.

Two years ago during your first budget hearing, you responded to one of my questions by saying that as Secretary of HHS, you are

"in the business of creating more jobs and getting people the health care they need," end quote.

As you know, our current system is complex, unaffordable for small businesses to offer health care.

Do you support the previous administration's policy to allow small businesses to cover the premiums of their employees through individual coverage health reimbursement accounts, also known as ICHRAs?

Secretary BECERRA. Congressman, I want to make sure. If you are talking about plans that would violate the Affordable Care Act and provide less benefits, if they are what we call these junk plans or skinny plans, we do not support those.

Mr. HERN. So you are saying based on your Website on October 17th, 2019, you said you are willing to support plans that are not junk plans.

Secretary BECERRA. Correct. Plans that offer real benefits, they may have a low payment, but the reason they have a low payment is because when you really need to use them, they offer you very little coverage for the services you will use, and you are stuck with the bill for the high coverage of those particular benefits.

Mr. HERN. So just so I am clear, you and I are clear, you are willing to work with us on ICHRAs as long as they are not so-called junk plans?

Secretary BECERRA. Willing to work with you on any plan, whatever the idea is, because you are entitled to that work effort from our folks at the agency.

Mr. HERN. I think that is a yes.

Mr. Secretary——

Secretary BECERRA. That is a yes. That is a yes.

Mr. HERN. Mr. Secretary, since the bipartisan Orphan Drug Act was enacted into law 40 years ago, rare disease and cancer patients have benefitted from the development of over 600 new treatments. This is tremendous achievement though there is more work to be done.

More than 30 million Americans across this country are living with a rare disease or disorder, and too many patients living with rare diseases and cancer still have no treatments available to them.

Some of you may have family members with a rare disease. So you know the pain they face every day and the hope they have in spite of everything. I have a sister who passed away from spina bifida and another sister and her daughter living with spina bifida.

Unfortunately, the Democrats' so-called Inflation Reduction Act threatens the continued success of the Orphan Drug Act. Specifically, it does not protect therapies that treat two or more orphan diseases from the law's price setting scheme.

As a result, we already know of two companies that have cited the IRA as a reason not to continue rare disease drug development. It is sad this budget proposes to expand those harmful policies further.

Mr. Secretary, will you commit to doing what you can, be a guidance in rulemaking to ensure that the pipeline of life-altering therapies continue for patients living with rare diseases and cancers?

Secretary BECERRA. Congressman, we will absolutely do what we can to make sure that some of those orphan drugs are still available because otherwise many of those folks would have no hope.

Mr. HERN. Mr. Chairman, I think that is a yes, and I appreciate it again that you are working with us on these issues because there are problems that we need to work together on that have been falling through loopholes and have been subject to concern based on what is coming out of the recent policies from the Administration.

So I appreciate you working with us.

And I yield back.

Mrs. MILLER. Thank you.

I now yield to myself.

Thank you, Ranking Member Neal, and thank you, Secretary Becerra, for being here today.

One of my biggest concerns about the United States health care is the current workforce shortage that we are all facing around the country. This shortage is particularly concerning in rural communities where hospitals are closing at higher rates than anywhere else in the country.

While inflation caused by the Biden Administration's out-of-control spending is partly to blame for hospitals struggling, a dwindling workforce is often also cited as one of the biggest problems for rural hospitals.

One policy which contributed to the shrinking health care workforce was a vaccine mandate for the health care workers, which was put in place by the Biden Administration. The Centers for Medicare and Medicaid services gave hospitals an ultimatum: force your entire staff to get vaccinated or no Medicaid services, or they will no longer participate in Medicare or Medicaid Program.

In rural America where a disproportionate share of patients are enrolled in Medicare and Medicaid, this gave hospitals an impossible choice. Your agency forced health care workers that did not want to get a vaccine out of the workforce.

Secretary Becerra, on September 18th of last year, President Biden declared that the pandemic was over. The Administration has also announced they plan to end the public health emergency on May 11th of this year.

Can you please explain to me why this Administration intends to keep the CMS vaccine mandate in effect until November of 2024, especially when we know this policy is contributing to the workforce shortage?

Secretary BECERRA. Congresswoman, let me see if I can address your question straight on. COVID is still with us. It is not what it was three years ago, but today two to 300 Americans will likely die from COVID. It is still something we have to take into account and protect against.

It is worse, and you will remember those days, when you could not even walk into a hospital to visit your relative who was sick with COVID because you could become infected as well.

We have to make sure we are protecting each other. And certainly health care workers have to be protected against COVID, and we have to make sure we are protected against health care workers who are treating COVID-infected patients.

And it would be irreconcilable to say that a health care worker who is around COVID should not be vaccinated to make sure that he or she is not inadvertently passing COVID on to people who are not yet infected.

Mrs. MILLER. You just repeated that basically.

I would like to now turn to something that will help bolster our health care workforce. In 2020, Congress took the historic step of adding 1,000 new graduate medical education slots to train additional physicians for the first time ever.

Multiple hospitals in my district utilized the GME Program, and I was so encouraged when Congress put guardrails in to ensure that the slots were distributed to rural areas that face acute provider shortage.

Can you imagine my dismay when I saw recently that nearly 20 percent of the GME slots distributed around went to New York State alone?

Can you commit to the committee that the next round of distribution will better prioritize rural areas?

Secretary BECERRA. Absolutely, Congresswoman. We will work with you because I have also fretted over this. When I was a member of Congress, I raised this issue of GME.

And one of the issues and perhaps for those of you who are in rural parts of the country, it is nearly impossible to get any of these GME slots because rarely do you find any of the medical schools located in rural America. So we have to figure out how to get some of these training slots because oftentimes where you train is where you end up living and practicing.

And so we need to make sure we are directing some of these future doctors to communities like rural America where there is a shortage of them.

Mrs. MILLER. We have three wonderful medical schools in West Virginia.

Thank you.

I yield back my time.

Now, Ms. DelBene.

Ms. DELBENE. Thank you, Madam Chair.

Thank you, Mr. Secretary, for being with us today. It is great to see you.

I first want to commend you for working to improve prior authorization for seniors on Medicare Advantage. I partnered with Congressman Kelly for years to make this archaic process fully electronic and streamlined so seniors can get the care that they deserve faster and so providers are not buried in paperwork.

The last Congress we passed our legislation through the House with unanimous bipartisan support, a rare thing.

In line with our legislation, I appreciate HHS' proposed rules to improve prior authorization, and I would like to highlight your agency's detailed economic analysis, which found that these policies would save physician practices and hospitals over 200 million hours in administrative time over a ten-year period.

That means a total cost savings of $15 billion. So as you work to finalize these rules, I encourage you to require real time prior authorization decisions for routinely approved services, and faster

time frames when there is an emergency. So please keep that in mind.

Secretary BECERRA. Absolutely will.

Ms. DELBENE. Now I want to turn to another important issue. More than 37 million Americans live with kidney disease, including more than 800,000 with kidney failure for which there is no cure.

Although some are lucky enough to receive a transplant, most Americans starting dialysis will die within five years. That includes over 13,000 people who have kidney failure in my home State of Washington.

Medicare spent $150 billion last year just on kidney diseases. That is over 18 percent of Medicare's overall budget. Yet the core technologies to treat and care for people living with kidney failure have not advanced much over the past 50 years.

So I am a strong supporter of the KidneyX Program, which is speeding up the development of new treatments, particularly for the world's first artificial kidney. In January, along with my colleagues in the bipartisan and bicameral colleagues in the Kidney Caucus, I wrote the Administration a letter requesting an increase in funding to $25 million, up from $5 million, for KidneyX, a very humble request.

I have sent similar letters in previous years.

Unfortunately, the President's budget continues to keep funding flat for this critical program. This funding increase is important, a small and yet very, very important investment that would be relatively or especially compared to the current cost of treating kidney failure.

Unlocking new treatment options would be life changing for people with this condition and would significantly improve the physical health of Medicare over the long term.

So when KidneyX was created, there was an expectation of $125 million from the private sector and $125 million from the Federal Government, and we are not meeting our end of the bargain.

So given the success of KidneyX in its first three years and the President's commitment to preserve Medicare for the next generation, why is the Administration not doing more to prioritize this program, which could provide a revolutionary return on investment?

Secretary BECERRA. Congresswoman, first thank you for championing KidneyX and for being such a proponent.

I think you would find so many people at HHS who would support what you have just said. We do have to do what we can with the monies that we have. We are limited.

And whether it is kidney, I was answering questions in a previous hearing on asthma and how we should do more on asthma. We are not going to say we cannot do more or should not do more. We just need more resources.

And so I will put it back to you and say we look forward to working with you so you all can get us more money so we can do more with KidneyX.

Ms. DELBENE. This is a huge cost to Medicare right now so I hope we can make an increase in its investment.

Thank you so much.

I yield back, Mr. Chairman.

Chairman SMITH [presiding]. The gentleman from North Carolina is recognized.

Mr. MURPHY. Thank you, Mr. Chairman.

And thank you, Secretary, for coming.

I want to just follow up on one of my colleagues' comments earlier, Dr. Wenstrup. I personally also as a physician, we sent you all a bipartisan, bicameral bill signed by a President for the No Surprises Act, and you absolutely took it to the left and have hurt, I believe, Americans.

And you talk about all of the disputes that occurred. Absolutely, because it was not interpreted as it was sent over. I will just leave that as a comment.

The one thing that you and I definitely will agree on is the antimicrobial resistance. I have lost patients. I have seen I think the record is now about 35,000 a year that die because we do not have drugs to treat them.

I know you probably know some of this, but just for the edification of some of the other members, from the time it starts, when a drug starts from the beginning to a patented molecule sometimes takes ten, 15 even longer, that many years, and it costs billions of dollars of investment.

And for every one molecule that passes through, there are probably about 100 to 150 that do not make it.

From the time they patent a molecule, it gets a 14-year clock. However, now that 14-year clock has changed to nine years, and as a direct result of that, so many pharmaceutical companies because they cannot—and I am not advocating for pharmaceutical companies. I am advocating for patients.

So many pharmaceutical companies have because of that restriction of their ability to earn and recoup their losses are stopping production, and for the record, Mr. Chairman, I would like to submit an article, as well as source, of a list of 42 companies that have mentioned the IRA this year and delayed launches of their medications, impacts to long-term planning for new cures, and impacts to oncology R&D.

May I just submit these for the record, sir?

Chairman SMITH. Without objection, so ordered.

[The information follows:]

Inflation Reduction Act Analysis from Todd Strategy Group.

TSG
TODD STRATEGY GROUP

Inflation Reduction Act Mentions and Discussions in Biopharma Earnings Calls and Events
As of March 14, 2023

Executive Summary

Biopharmaceutical executives continue to discuss how the Inflation Reduction Act's (IRA) drug pricing provisions impact their companies on earnings calls, SEC filings, various investor events, and media quotes of business executives. The following document summarizes how manufacturers are messaging the consequences of the IRA through these channels.

A previous version of this document compiled commentary starting in October 2022. **Considering the volume of mentions, this version includes only those from January 1, 2023**.

Investor Events Covered

- Cowen Health Care Conference (3/6/23-3/8/23)
- Citi's 2023 Healthcare Services, Medtech, Tools & HCIT Conference (3/1/23 – 3/2/23)
- SVB Securities Biopharma Conference (2/13/23 – 2/16/23)
- Guggenheim Healthcare Talks Oncology (2/9/23)
- J.P. Morgan 41st Annual Healthcare Conference (1/9/23 – 1/12/23)
- Goldman Sachs CEOs Unscripted Conference (1/5/23)

TSG Topline Compilation of Inflation Reduction Act Mentions and Discussions in Biopharma Earnings Calls and Events

(Sorted by Recency of Source)

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Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Pfizer	Analyst Call (3/13/23) WSJ Interview (1/18/23)	**9/13, ADCETRIS, General Impact, OOP Cost (3/13/23 Analyst Call):** During an analyst call to discuss PFE's proposed acquisition of Seagen, Dr. Bourla was asked two questions on the IRA from separate analysts: What is Seagen's exposure, and PFEs perspective on potential impact to ADCETRIS. Dr. Bourla described the 9/13 provision and praised the OOP Cap, stating that both provisions, in regard to acquiring Seagen, are positive developments. Further, Dr. Bourla noted that creating a biosimilar for ADC is a complicated endevour, and he views this as a more durable competitive pressure beyond the expiration of patents and exclusivities. On ADCETRIS, Dr. Bourla declined to elaborate, but described the IRA as something that "is what it is." Lastly, Dr. Bourla proclaimed that the IRA will have a positive impact to drug adherence. (Note: Endpoints News released an article on Dr. Bourla's IRA comments) **General Impact, OOP Cap (1/18/23 WSJ Interview w/ Albert Bourla)**: Speaking to the *WSJ* at Davos 2023, CEO Albert Bourla described several clauses within the IRA as "very bad for innovation," but mostly discussed how there are "some good things," citing the Part D OOP cap. Specifically, Dr. Bourla expressed support for the fact the manufacturer's liability to enact the cap (presumably new 10%/20% share of costs) goes directly to patients and not the "black hole" of the federal budget.
Cerevance	Media Article (3/13/23)	**Delayed Launch in Parkinson's, Indications Incentives (3/13/23 Media Article)**: CEO Craig Thompson told the *Boston Business Journal* that Cerevance, a Boston-based company making drugs for central nervous system disorders, had originally planned to develop its lead drug as an adjuvant treatment for Parkinson's disease, but is now engineering it to be used alone because of the IRA. Mr. Thompson stated that: "It'll delay our launch by 12 to 18 months, but give us a much broader indication at launch...You have to look at ways to make sure that when you launch, it's not additive of indications, because... that strategy isn't going to work. You have to get the broadest reach."
Alnylam	Cowen (3/8/23)	**AMVUTTRA (3/8/23 Cowen):** During the Cowen Event, analyst Ritu Subhalaksmi Baral asked whether the IRA impacted Alnylam's decision to not further pursue the biannual dosing regimen of AMVUTTRA at this time. Alnylam VP & TTR Franchise Lead Rena Denoncourt stated that the IRA is "not key to the decision"

[1] Please note that the quotations from the Evercore ISI HealthCONx Conference are from unnoficial transcripts provided by Refinitiv. If you would like a PDF of a particular transcript please email jon@toddstrategy.com. Quotes from earnings calls are from internal TSG notes of the call or unnoficial transcripts provided by Refinitiv

Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Amgen	Cowen (3/8/23) SVB (2/14/23) J.P. Morgan (1/9/23)	**Biosim Development, 9/13, Inflation Caps, Enbrel (3/8/23 Cowen):** In a discussion on the biosimilar market, Yaron Werber inquired how Amgen thinks about situations including the new high-dose EYLEA BLA, and whether there is a new 13-year clock until negotiation. In response, Executive VP of Global Commercial Operations Murdo Gordon stated that he would have to ask the innovator (REGN) but that "I do think you'll see more companies considering strategies like you're seeing play out in the market because of the IRA and other things." Mr. Gordon further described the IRA as a "wasted opportunity" and criticized the law for not passing on savings to patients, which some in the industry would have understood. Mr. Gordon reiterated that Amgen is in a good position, specifying that they have many products in the single orphan indication. However, Mr. Gordon noted that Amgen will change "some of the way in which we think" due to the 9/13 provision, while they can handle inflation caps. Mr. Gordon also noted that "very little" of Enbrel's ~$4 bn is in Medicare **Long-Term Planning, Exposure to DPNP (2/14/23 SVB):** At the end of Amgen's discussion, David Risinger of SVB Securities asked VP & CFO Peter Griffith to comment on how AMGN has adjusted internal long-term planning and what their exposure is to the DPNP. Mr. Griffith stated that it is too early to discuss AMGN's exposure to the DPNP and that it is "…a little early to provide specifics around the impact of the IRA, to the pipeline or our long-term plans." However, Mr. Griffith noted that like other manufacturers, AMGN is evaluating their portfolio and expect negative longer term impacts post-2030. Mr. Griffirth reiterated AMGN will not "jerk the wheel" but will make "appropriate resource allocation decisions" **General Impact, M&A, Forecast (1/9/23 J.P. Morgan)**: During his presentation, CEO Bob Bradway described the IRA as something that "you either get ahead of it, or it runs you over" and concluded that Amgen has 'gotten ahead of it' due to their portfolio ("…we think is well suited to volume-driven growth in an environment of declining net prices"). Additionally, Mr. Bradway noted that the acquisitions of ChemoCentryx and Horizon are "well-positioned" in a post-IRA world. In concluding his remarks, Mr. Bradway stated that drug pricing legislation was unknown at the time of the last forecast (Feb. 2022). However, the IRA is "..in line with what we expected at that time," and now that it is law, Amgen can adjust accordingly.
AbbVie	Cowen (3/7/23)	**RINVOQ (3/7/23 Cowen)**: Asked about the IRA's impact on RINVOQ, AbbVie Vice Chairman & President Robert Michael stated that as you look at all the indications, if you think about the age split between different indications, you're looking at in the U.S. probably by that time frame of Medicare mix of probably around 10%," which could be impacted by the DPNP in 2028, but the other 90% growth is happening from new indications, and the company has analyzed the situation. In conclusion, Mr. Michael states that "there's going to be robust growth for RINVOQ even during the IRA years"

Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Gilead Sciences	Cowen (3/7/23) Barron's (1/20/23) J.P. Morgan (1/9/23)	**General Impact, Biktarvy, Oncology, (3/7/23 Cowen)**: Responding to questions on the IRA's impact to Gilead generally, Executive VP & CFO Andrew Dickinson stated that Gilead is the world's leader in small molecule drug development combinations, and that the law will impact "how we value opportunities, both internally and externally." On Biktarvy specifically, Mr. Dickinson reiterated that "we're one of the few companies that has a very novel and kind of new pipeline," and while the mandatory price will have a potential impact to Gilead, it will be more modest than other companies. Based on the letter of the law, Mr. Dickinson said Biktarvy could be eligible in 2028, but that "a lot of things can change." Also of note, Mr. Dickinson reminded the analyst (Terry Martin Van Buren) that within the HIV / AIDS portfolio, Gilead products are already significantly discounted, citing Medicaid and 340B. In conclusion, Mr. Dickinson stated that there could be a manageable impact, but it "doesn't change the overall growth profile of the business through the end of the decade and beyond from our perspective" **Encroachment on IP Rights, Small Molecule Development (1/20/23 Barron's)**: In an interview with *Barron's* on the sidelines of JPM '23, CEO Daniel O'Day stated expressed how government 'negotiation' would shorten the exclusivity periods companies have been able to wring out of the patent system, stating that "Anything shorter than 13 years basically challenges our patent." Additionally, Mr. O'Day described how "It [IRA] could have the impact to discourage people from small molecule development" **Previous Guidance (1/9/23 J.P. Morgan)**: Christopher Scott of JPM asked CCO Johanna Mercier if the IRA impacts Gilead's previous guidance from last year's conference to which Ms. Mercier stated that "…the IRA with what we know today, although it's still early days, we do believe that this is going to be manageable. And that's part of the planning that we've put forth with a positive CAGR through 2030"
Johnson & Johnson	Cowen (3/7/23)	**General Impact, Industry Pricing (3/7/23 Cowen)**: During a discussion between Joshua Jennigs of Cowen, J&J Executive VP & CFO Josepth Wolk on industry pricing, Mr. Wolk highlighted J&J's transparency report and the average 4-5% price erosion. Mr. Wolk disagreed on Mr. Jennings' statement that "there may not be much to talk about" on transparency, highlighting the IRA, and J&J being "very concerned about how that could limit incentives for innovation." Also of note, Mr. Wolk noted how PBMs are benefitting from higher list price and that J&J wishes that the IRA could have gone further in terms of addressing PBMs as co-pays and premiums continue rising

Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Royalty Pharma	Cowen (3/7/23) Earnings (2/15/23) J.P. Morgan (1/9/23)	**Impact to Royalty Opportunities, Part D Redesign, Oncology (3/7/23 Cowen)**: Responding to a question on how the IRA impacts Royalty's analyses of potential assets, VP and Head of Research & Investments Marshall Urist stated that Royalty's model is "flexible" and able to incorporate the IRA into the process. However, Mr. Urist noted that there is more unknowns than knowns at this point, but that Royalty can anticipate fewer cancer drugs. Mr. Urist also spoke to the "second order effects" beyond the DPNP including the Part D Redesign. As a follow up question, Stephen Scala of Cowen asked Executive VP & CFO Terrance Coyne whether he believes manufacturers will follow through on initiatives to which Mr. Coyne reiterated Mr. Urist's point on how flexible Royalty's model is, stating that investments can be made "without the burden of historical TA infrastructure or manufacturing infrastructure or whatever." **Impact to Royalty Opportunities, 9/13 (2/15/23 Earnings)**: Terrence Flynn of Morgan Stanley asked Vice Chairman Christopher Hite if the IRA will impact analyses of opportunities as the IRA reduces reimbursement for specific drugs. In response, Mr. Hite stated that Royalty feels there are opportunities, "given the fact that we can really sort of quickly adapt changes in laws and price changes in how we make future investments." Mr. Hite also stated that Royalty is waiting to see if there are any changes to the 9/13 provision **M&A (1/9/23 J.P. Morgan)**: An analyst asked Executive VP and Head of Research & Investments Marshall Urist how the IRA will factor into future deals. Mr. Urist responded that Royalty is doing "a lot of scenario work" and keeping the IRA in mind. (Note: Royalty Pharma is an acquirer of biopharma royalties)
United Therapeutics Corporation	Cowen (3/7/23)	**Part D Redesign & Tyvaso (3/7/23 Cowen)**: Joseph John-Charles Thome of Cowen asked President & COO Michael Benkowitz on the proporation of patients anticipated to move afrom a nebulized Tyvaso over to the Tyvaso DPI. Mr. Benkowitz stated that prior to the IRA, the company believed that the mix would be roughly 50-50 between the nebulizer and the DPI, but that since DPI is under Part D, it will be "e a much more attractive option for patients" because of the OOP Cap. In the long term, Mr. Benkowitz believes a majority of atients will be on DPI
Verona Pharma	Earnings (3/7/23)	**Launch Price of Ensifentrine (3/7/23 Cowen)**: Responding to a question on on pricing generally, SVP of Commercial Christopher Martin statated that Verona has discussed pricing ensifentrine with payers within Part D and MA and their expectations of pricing to be at a premium versus current nebulized products. Mr. Martin also stated that other dynamics when pricing ensifentrine include the IRA and "how we might price ensifentrine going into the market." Mr. Martin concluded that "we feel very confident that ensifentrine's value is great within the marketplace"

Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Seagen	Cowen (3/6/23)	**ADC Biosimilars, General Impact, Oncology R&D, ADCETRIS (3/6/23 Cowen)**: Responding to a question on the difficulty of making ADC biosimilars, CEO & Director David Epstein stated that "someday" a biosimilar can be made, but the regulatory path does not exist today. Elaborating on that point, Mr. Epstein stated that "I think it's more likely at least in our case, that our drugs would have an IRA discussion around price before biosimilar would show up, but it's pretty far out." Having brought up the IRA, a Cowen analyst asked what Mr. Epstein's thoughts are on its general impact. Mr. Epstein described two impacts, one being the increased risk profile of drug development (now that the "clock starts ticking with the first approval") and pricing. On pricing, Mr. Epstein stated that since Seagen is not likely to have a biosimilar in the near term, the company is analyzing when products including ADCETRIS will hit the DPNP threshold, estimating either 2030 or 2031
Regeneron	Cowen (3/6/23) 10-k (2/6/23)	**High-Dose EYLEA, Exclusivity (3/6/23 Cowen)**: Cowen analyst Tyler Martin Van Buren asked Regeneron leadership a two-part question on whether the company is anticipating protection and exclusivity for high-dose EYLEA, and how the IRA will treat the new BLA. In response, VP of IR Ryan Crowe stated that those questions are "separate and distinct" but that on exclusivity, it is "fairly unlikely that we'll get any regulatory exclusivity for this product…aflibercept is aflibercept." However, on the IRA, Regeneron has said that it believes that a new BLA creates a new reference product, and it would not be eligible for the DPNP until the 11-year period has lapsed **EYLEA, Pipeline Impact (2/6/23 10-k)**: "While enacted into law, it is unclear how the provisions of the IRA will be implemented and the extent to which the policy changes will ultimately impact reimbursement levels of our marketed products, including those covered under Medicare Part B (such as EYLEA) or our product candidates that may in the future be covered under Medicare Part B (such as aflibercept 8 mg)"
Thermo Fisher Scientific	Cowen (3/6/23)	**Industry R&D (3/6/23 Cowen)**: In response to a question on what the impact of the IRA is to biopharma R&D generally, Chairman & CEO Marc Casper stated that industry does not know what the longer-term implications are, and that "I also think it's going to be different by companies" but that within the next two years, there will be minimal impact
Biogen	Cowen (3/6/23)	**Biosimilars Business (3/6/23 Cowen)**: Responding to a question regarding the "strategic rationale" for maintaining a biosimilars business at Biogen, CEO Christopher Viehbacher stated that biosimilars is going to be important and that "one of the reasons we have the IRA is that we were actually having an accumulation of cost because new biologics come onto the market, but the older ones are staying there at a high price" and it is the biosimilars "creating the headroom" for innovation. Mr. Viehbacher reiterated that it is a "tough market" but that it is an "important business"

Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Eli Lilly	Cowen (3/6/23) Guggenheim (2/9/23) Reuters (1/13/23)	**Impact to NASH R&D (3/6/23)**: Responding to an audience question on the company's decision ceasing development of a KHK inhibitor in diabetes and nonalcoholic steatohepatitis (NASH), and how the company is approaching the community, Senior VP & President of Lilly Diabetes Michael Mason noted that LLY has not stated anything publicly about efforts that are outside of tirzepatide and the company is looking at NASH. Mr. Mason stated that starting NASH for tirzepatide right now with the IRA/DPNP is "…kind of the downside of the Inflation Reduction Act and the negotiation in Part D…That's a very heavy Part D population." Mr. Mason concluded by stating that the long time to establish indications like NASH "takes away" from justifying the investment, but that a Phase II study will inform further action **Oncology R&D (2/9/23 Guggenheim);** President of LLY Oncology Jacob Van Naarden stated that the IRA, proposals on accelerated approval, and Project Optimus, force companies like LLY to be more disciplined in the oncology space. Additionally, Mr. Van Naarden stated that "I don't know how, at least in oncology, small companies can really like take things to the finish line like reliably anymore from a standing start" **Medicare Benefit Redesign (2/2/23 Earnings):** Andrew Baum of Citigroup asked LLY executives how the company is modeling the potential of GLP-1 uptake increasing due to the $2000 OOP cap in Part D plans; Senior VP and President of Lilly Diabetes Michael Mason responded that the new policy would benefit patients in Part D and have a small or moderate impact on sales due to lower abandonment **"9/13" Provision, R&D (1/13/23 Reuters):** CEO David Ricks was quoted in a *Reuters* report (Here) on the IRA's impact to industry. Specifically, Mr. Ricks stated that "The difference between a nine- and 13-year product line is about 50 or 60% of the value; In 10 years, we'll have far fewer small molecules being developed than we do today." Additionally, the article notes that "Lilly has already dropped a small-molecule blood cancer drug from its pipeline because 'we just couldn't make the math work, Ricks said" and that LLY "…is considering culling more early-stage pill programs and is directing its small molecule development group to only pursue opportunities "that would be clearly good enough within nine years to be winners."
ICON PLC *(Note: ICON is a Clinical Research Organization, or CRO)*	Citi Conference (3/2/23)	**Impact to CROs (3/2/23 Citi Conference**): CFO Brendan Brennan noted that ICON has not gotten any exposure to the IRA's impact yes, but does see an "evolution of the conversation" with drug manufacturers, describing how "[manufacturers] are being more thoughtful about how they do their R&D process as they go forward. And I think that's something maybe that as CROs, we're being more involved in the conversation than we would have done in the past." Mr. Brennan described current conversations with manufacturers as focused on the future ('25-'27) and preparing CROs for the impacts of the law.

Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Guardant Health	Earnings (2/23/23)	**Biopharma Market Dynamics (2/23/23 Earnings):** Noting that CRO's have said on other earnings calls that the IRA has not made a significant impact, Derik De Bruin of Bank of America asked Guardant Chairman Helmy Eltoukhy whether he agrees or not. In response, Mr. Eltoukhy stated he has seen "some potential sort of headwinds" and that "a lot of [biopharma companies] are obviously trading below enterprise value and it's a difficult kind of macro conditions." In conclusion, Mr. Eltoukhy described how some clients are doing more than others and other clients have delays
Halozyme Therapeutics	Earnings (2/23/23)	**Impact on ENHANZE Technology (2/23/23 Earnings)**: In response to a question on how the IRA will treat ENHANZE products, CEO Helen Torley stated that "we are still awaiting CMS to provide their regulations and details" and will provide an update as it becomes clearer. Further, Ms. Torley stated that "obviously the question really is as to whether it's a subcutaneous, which has a different BLA filing and a different launch date would restart a different clock," but that the company does not have an answer
Ionis Pharmaceuticals	Earnings (2/22/23)	**Orphan Drugs, eplontersen, Part D Redesign (2/22/23 Earnings):** Responding to a question on how the IRA impacts Ionis' pipeline, Executive VP Onaiza Cadoret-Manier discussed the orphan drug indication of eplontersen, which has indications of PN and CM, which qualify as a single disease. Specifically, Ms. Cadoret-Manier stated that "Our orphan drug designation is for ATTR, not necessarily for one indication and the other. So you should think that through as you're thinking about that, and we would then be excluded from that maximum fair price negotiation as well."
AbCellera Biologics	Earnings (2/21/23)	**Biologics Market (2/21/23 Earnings):** Responding to a question on whether AbCellera is seeing a shift in manufacturer behavior, CEO Carl Hansen stated that how biologics are treated compared to small molecules "…definitely is a tailwind for us in the business with more people shifting towards potential antibody treatments" and anticipates the IRA being a future headwind
Ironwood Pharmaceuticals	Earnings (2/16/23)	**Impact on LINZESS (2/16/23 Earnings)**: Boris Peaker of Cowen asked CFO Sravan Emany how the IRA will impact LINZESS to which Mr. Emany responded by saying that Ironwood is following the developments with AbbVie but the impact is "unknown" at this stage. Additionally, CEO Thomas McCourt commended Ironwood for currently implementing large rebates during negotiations with plans, stating that "of all the brands that are out there that they're going to be focusing on, we're already in the game and actively negotiating with the major payers…but I think we feel pretty good about the position we're in"

Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Vertex	10-k (2/10/23)	**Implementation Uncertainty Impact to Business (2/10/23 10-k)**: "The Inflation Reduction Act continues a trend in the United States toward reducing drug prices and limiting spending by the federal health care programs on drugs. We cannot predict how CMS will interpret the Inflation Reduction Act or how the provisions of the law will affect our business once fully implemented, but it is possible that these changes or other legislative updates will have an adverse impact on our revenue"
Bristol-Myers Squibb	Guggenheim (2/9/23) Earnings (2/2/23)	**Oncology R&D (2/9/23 Guggenheim)**: CCO Chris Boerner discussed BMY's oncology pipeline and the IRA's impact on at the Guggenheim event, stating that BMY has "...some concerns about the ability, for example, in oncology to move into the adjuvant setting." Mr. Boerner specifically stated that Opdivo adjuvant and periadjuvant studies are just now reading out results, which is many years after the first approval. Mr. Boerner concluded that "we're going to evaluate on a case-by-case basis once we know more about exactly how IRA plays out" **Three IRA Discussion Topics (2/2/23 Earnings)**: Seamus Fernandez of Guggenheim asked two IRA-related questions to BMY executives, spurring conversation on Eliquis, the "9/13" provision of the law, and the unknown impact the IRA will have on other "free drug programs." • Eliquis: Responding on how BMY plans to "temper the impact" if CMS selects Eliquis for the Drug Price Negotiation Program, Mr. Caforio conceded it is "possible that Eliquis is impacted in 2026" and that while Eliquis is an essential brand to the company, BMY splits profits with Pfizer and "it's a smaller brand in terms of determining our earnings trajectory versus what you would think about the revenue line" • 9/13 Provision: Responding to a remark by Mr. Fernandez on the future of small-molecule development under the IRA, Mr. Caforio stated that BMY is "not pleased with" the 9/13 discrepancy (In short, small-molecule drugs are eligible for "negotiation" after nine years, and biologics, 13 years) and any change would need to be done legislatively • Impact on Other Drug Programs: CCO Chris Boerner addressed unspecified "free drug programs" being impacted by the IRA, stating that "...the extent that free drugs and free-drug programs play out for extended periods, it could have a negative impact when you look at the IRA restrictions and price setting coming in, in 9 years" and it will be something to monitor moving forward, especially on a product like Sotyktu

Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Tango Therapeutics	Guggenheim (2/9/23)	**Oncology Regulatory Strategy (2/9/23 Guggenheim):** In response to a question about the five different tumor types Tango is moving forward with their therapies for, CEO Barbara Weber stated that the first chosen therapy (MPNST) was pre-IRA, and it was because "...It's a rare sarcoma that has no other approved therapy, have very high frequency of MTAP deletion, and a potential for an accelerated approval strategy." Next, Tango decided on "non-small cell lung cancer because that's the biggest patient population....The next two were about cholangiocarcinoma and mesothelioma also because in those two tumor types is a relatively straightforward path to registration"
Alkermes	Scrip Intel (2/9/23) J.P. Morgan (1/11/23)	**Immediate Impact to Strategy (2/9/23 Scrip):** Describing how companies are impacted by the IRA now, CEO Richard Pops stated that "This isn't something that we'll see the implications of at the end of the decade as we begin to negotiate prices. Anybody who is paying attention began to shift their business immediately in response to environmental changes that are profound" and reiterated "Make no mistake, bad public policy can destroy industries." **Disparity of IRA Impact Between Small & Large Companies (2/9/23 Scrip**): CEO Richard Pops highlighted the disparity between small companies and large companies in an environment where the lifecycle of a drug could be condensed, requiring more high-risk studies to be conducted earlier. Specifically, Mr. Pops stated that "If you can deploy more capital early in the development program of the drug for more indications, you can actually create more value in a medicine, so there's an arbitrage between the value of a medicine sitting in a small, undercapitalized company versus that same asset sitting in a large, well-capitalized company," **Oncology Spinoff Company (1/11/23 J.P. Morgan):** Responding to an analyst question relating to whether the IRA impacted Alkermes' decision to spinoff its oncology portfolio was due to the IRA as was indicated on the Q3 2022 earnings call, CEO Richard Pops stated that it didn't "drive" the decision, but the underlying logic of the IRA created incentives for the decision. Specifically, Mr. Pops described how the IRA further shifts preferences towards biologics over small molecules, especially in oncology. Mr. Pops concluded that the decision is attractive if Nemvaleukin continues its progress
Bayer	Scrip Intel (2/9/23)	**Immediate Impact to Strategy (2/9/23 Scrip)**: At the BIO Investor Conference, Bayer's pharmaceuticals head of new business development and radiology Lisa Flaifel said the IRA is already impacting business decisions at the German pharma company. Specifically, Md. Flaifel stated that "What we are doing is evaluating the way we do business cases and taking the IRA, as we know it today, into consideration when we're doing our valuations and business case models."

Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Roivant Sciences	Scrip Intel (2/9/23)	**Minimal Impact to Company (2/9/23 Scrip)**: During a panel on M&A, CEO Matt Gline stated that "A facile but easy to hold view as a biotech company is the biggest impact the IRA is going to have is on drugs that end up on the price control list, and if you wind up on a price control list, you are a pretty big drug" and that "Biotech companies are a little bit less concerned…If you think your drug is the next Humira, it is going to matter to you"
Saghmos Therapeutics	Scrip Intel (2/9/23)	**Minimal Impact to Company (2/9/23 Scrip)**: On the impact of the IRA to Saghmos, CEO Anna Kazanchyan stated that "It's basically the nature of the beast. If you look at biotech companies, there are only a handful of companies that have multiple marketed products"
Enanta Pharmaceuticals	10-k (2/7/23)	**MAVYRET (2/7/23)**: "Depending on the share of Medicare spending each year that is attributed to MAVYRET or any other drug we may develop or out-license, and whether or not those drugs become eligible for Medicare negotiation, those drugs and our revenue may be adversely impacted by this provision"
Neurocrine Biosciences	Earnings (2/6/23)	**Small Biotech Exemption (2/6/23):** Executive Director and Senior Analyst stated that "…we think there's a lot more work that needs to be done with the legislation that passes the fact that the small manufacturer and small biotech exemptions and they're extremely helpful to companies like Neurocrine"

Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Novartis	10-k (2/1/23) Earnings (2/1/23) Scrip News (1/16/23) Pink Sheet (1/9/23)	**Agrees to Participate in MDPNP (2/1/23):** "Novartis will participate in the Medicare negotiation process if Novartis drugs are selected. Pharmaceutical manufacturers that choose not to participate in the negotiation process will be subject to an excise tax of up to 95% of sales" **9/13 (2/1/23 Earnings):** Matthew Weston of Crédit Suisse AG asked about the "9/13" policy in the Inflation Reduction Act and pricing pressures in Europe. Mr. Narasimhan stated that there are three core priorities for the industry including correcting "the distortion of" the 9/13 provision (Note: It was unclear if Mr. Narasimhan was speaking for himself or as the incoming PhRMA Board Chair, as the question was framed by noting he will become the Chair shortly). Elaborating on the 9/13 provision, Mr. Narasimhan stated the industry has "very good arguments" about the unintended consequences, citing how indication expansions in cancer medicines can take longer than cardiovascular disease or in respiratory disease. However, while expressing that 9/13 reform is a top priority, Mr. Narasimhan explained that "all things need to be considered" and that the "key" for reform will be "…when, in the coming years, there's a legislative vehicle for us to be able to pursue that." **Business Strategy (1/16/23 Scrip News)**: According to *Scrip News*, Victor Bulto of NVS stated that "We have incorporated all of these considerations [IRA negotiation] into every discussion that we have in pulling products forward or how we prioritize them, which indications we are going to prioritize, the moment the legislation was out we started incorporating that" **PhRMA Priorities, General Impact (1/9/23 Pink Sheet)**: According to *The Pink Sheet*, during a 'welcoming cocktail reception' hosted by PhRMA, CEO Vas Narasimhan, who is the incoming PhRMA board Chair, said that "Throughout this year, the priority is going to be how do we shape an IRA that will not punish innovation, particularly innovation in small molecules and new technology areas." Also of note, Mr. Narasimhan described the IRA as a challenge the industry can meet, noting how FDA laws, Hatch/Waxman, and Part D also brought uncertainties and challenges
GSK	Earnings (2/1/23)	**Shingrex, Vaccine Coverage (2/1/23 Earnings):** Peter Welford of Jefferies asked about Shingrix's outlook for 2023, to which Chief Commercial Officer Luke Miels mentioned that the IRA's provision (See: Section 11401) requiring Part D plans to cover all ACIP-recommended adult vaccines with no patient co-pay will be helpful as 8% of patients reject a Shingrix shot based on co-pay concerns. Next, Dominic Lunn of Crédit Suisse asked executives about pricing strategy, noting that list prices have risen throughout the industry as inflation has risen, and there is still room to grow under the IRA's price capping provision. Ms. Walmsley stated that GSK has been "very responsible" for pricing. Mr. Miels stated that decisions made over the past two years are a good indicator of behavior moving forward.

Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Sage Therapeutics	Barron's (1/20/23) Scrip News (1/16/23)	**Company Reactions (1/20/23 Barron's):** In an interview with *Barron's* on the sidelines of JPM '23, CEO Barry Greene stated that "What's being communicated here at J.P. Morgan by many companies is how they're going to kind of IRA-proof themselves with diversification, with more drugs" **General Impacts (1/16/23 Scrip News)**: CEO Barry Greene on the Inflation Reduction Act: "I think the IRA is **a** bad law," he said. "Fundamentally, government picking a price for a medicine, given the current health care system is just not a good idea and it can be a stunter of innovation. Now, for those companies that had long-range plans that were growth through price increases or growth through multiple indications for **a** drug on the market for 10 or 15 years, they're in trouble" **M&A (1/16/23 Scrip News)**: CEO Barry Greene: "The lemonade I see in this kind of lemon of **a** law" is that biopharmaceutical companies with novel medicines could benefit from increased interest in mergers and acquisitions and other deal-making. In addition to the upcoming patent cliff that many big pharmas are facing later in this decade, the impending likelihood that sales of key products will decline sooner than anticipated due to Medicare price negotiations means that firms have even more need to add new products to their portfolios"
Mirati Therapeutics	Bloomberg (1/12/23)	**General Impact (1/12/23 Bloomberg Interview)**: Mirati Therapeurics CEO David Meek discussed the IRA during an interview with Bloomberg, stating that "You may say, we can get there faster, but it's going to hurt us over time, so let's take a few more months, or whatever it works out to be, to get to the bigger opportunity,"
Zymeworks	J.P. Morgan (1/12/23)	**Exploring Non-U.S. Markets Due to IRA (1/12/23 J.P. Morgan Presentation)**: Discussing Zymework's pipeline product ZW49, CEO Kenneth Galbraith stated that he believes it will be necessary to adapt to the IRA, which will "truncate sales eventually earlier than you might have expected in the U.S" and that the imperative is now "to explore ex U.S. markets in a much more significant way to make up that delta you're going to lose as a commercial opportunity later on"
Genmab	J.P. Morgan (1/11/23)	**Manufacturer Incentives in Oncology (1/11/23 J.P. Morgan)**: Answering a question on how GeN3014 compares to Janssen's Darzalex, CEO Jan G.J. van de Winkel stated that the IRA may incentivize Janssen may prolong indications on daratumumab. Specifically, Mr. van de Winkel said "Another possibility is the new legislation, the IRA legislation in the U.S. now coming into effect, that this could be a very interesting molecule for Janssen to simply prolong the income profile for daratumumab even when it would be roughly similar or a bit better than dara. It could be a very significant commercial advantage to actually have a CD38 antibody, switching daratumumab to a new molecule, then they are extending the income time line for the company, because what we see is that actually in multiple myeloma, CD38 antibodies are there to stay."

Company	Sources[1] (Type, Link, Date)	Mentions of the Inflation Reduction Act
Karuna Therapeutics	J.P. Morgan (1/10/23)	**General Impacts (1/10/23 J.P. Morgan Presentation)**: Discussing general reimbursement issues, CEO William Meury seemingly contradicted other manufacturers who expressed concern by stating that "I think the [IRA] actually provides a little bit more predictability"
Insmed	J.P. Morgan (1/10/23)	**OOP Cap, Indication Decision-making (1/10/23 J.P. Morgan Presentation)**: Responding to a question on how the IRA impacts Insmed, CEO William Lewis praised the legislation for the OOP Cap, stating that Arikayce will become more affordable. Additionally, Mr. Lewis described how the IRA is "…going to drive us to think very carefully about how many indications to take Brensocatib into and whether it might make sense to have additional DPP1 candidates that we bring forward in the pipeline" but that more clarity is needed before those decisions are made
Neurocrine Biosciences	J.P. Morgan (1/9/23)	**Ingrezza, Policy Changes (1/9/23 J.P. Morgan)**: Responding to a question about the exposure of Ingrezza, CEO Kevin Gorman stated that Neurocrine falls under the small biotech exemption, and they don't anticipate 'negotiation' to hit them until 2031. Additionally, Mr. Gorman stated that implementation of the law may change provisions (citing ACA implementation), describing how nine years is a "lifetime" in DC, and a lot will change before the IRA hits Neurocrine
BioMarin	J.P. Morgan (1/9/23)	**Enzyme Business (1/9/23 J.P. Morgan)**: During his presentation, CEO Jean-Jacques Bienaime highlighted how BioMarin's "base business of enzymes" is protected from IRA regulations because of the small Medicare impact. Of note, an IRA-related slide (See Below) was discussed on social media
Merck & Co.	Goldman Event (1/5/23)	**Impact on Imago (1/5/23 Goldman Event)**: CEO Bob Davis stated that "…I can tell you with Imago, the deal we did recently, [IRA] factored into our thinking. I will tell you, in that case, it actually fortunately is -- hits the rare disease exception for what is the major indication we're coming out with probably first. So it's in there, but it was in our valuation. It was in our diligence, and it's how we thought about the strategy" **Preferred Clarifications from CMS (1/5/23 Goldman Event):** Responding to a question on what MRK would like clarified by CMS, CEO Bob Davis stated that how CMS will calculate spending (gross or net), issue the biosimilar exception, types of data used for selection, operating the MFP as preferred clarifications
Incyte	Goldman Event (1/5/23)	**General Impact, Jakafi, "9/13" (1/5/23 Goldman Event)**: CEO Herve Hoppenot stated that "…Overall, I see it as a positive for Incyte…I must be the outlier in the world of biopharma, mostly because of the reduction of the out-of-pocket for patients." Additionally, Mr. Hoppenot stated that the IRA will have an impact on Jakafi, not on negotiation because Incyte is a small biotech. Lastly, Mr. Hoppenot stated that the 9/13 provision "makes absolutely no sense" and needs to be fixed

Mr. MURPHY. And so we go back to the antimicrobial resistance. We really have not had a new generation come along. We have had it in the quinolones and there are some fifth generation cephalosporins that are helping.

How can the IRA and then with the fact that Biden wants to have the moonshot program and develop these new cancer cures, how can that fit with the fact now that we are killing American R&D and trying to develop new cures because we are cutting their ability to actually fund for them?

Secretary BECERRA. Congressman, here is my difficulty in following the logic of your question. If a company——

Mr. MURPHY. I think I was pretty clear. It calls for somebody to develop drugs who are cutting them out from earning that money so they will not develop the drugs.

Secretary BECERRA. And if they are putting that drug out there on a competitive price, what would be the problem?

It is when you put a drug out there for an uncompetitive price, where you essentially charge Americans two to three times more than what you charge others around the world, that is what the Inflation Reduction Act attacks. It lets us negotiate to get the best price.

Mr. MURPHY. Well, tell that to the 42 companies now.

Secretary BECERRA. I would say that to the 42 companies.

Mr. MURPHY. That have stopped production of cures and treatments, which include antibiotics.

Secretary BECERRA. Competition should not stop anyone from trying to develop a drug.

Mr. MURPHY. I am not pleading for pharmaceutical profits. Please do not take me that way.

But I am saying it costs billions of dollars to do this, and now we have 42 companies that say they are not going to do it because if the IRA.

Secretary BECERRA. And how those 42 companies can make a decision on a law that just took effect and that will not be negotiating prices for several years to come is beyond me.

But what I can tell you is——

Mr. MURPHY. That is planning in corporate America. That is planning. You have to plan 20 years for these drugs. That is how long it takes for these drugs to come out.

Secretary BECERRA. And you are entitled to plan to make a profit. You are just not entitled to gouge Americans for the——

Mr. MURPHY. I agree 100 percent. I agree 100 percent.

Secretary BECERRA. So why would the companies not want to create a drug in America, the richest country in the world, so they could sell it and make a profit, not gouge, but make a profit?

Mr. MURPHY. Because their timeline to make that profit has been cut by 30 percent.

Thank you, Mr. Chairman. I am going to yield back.

Chairman SMITH. The gentleman from Tennessee is recognized.

Mr. KUSTOFF. Thank you, Mr. Chairman.

Thank you, Mr. Secretary, for appearing today.

I want to ask you about a New York Times article dated February 25, 2023, the headline, "Alone and Exploited Migrant Children Work Brutal Jobs Across the U.S. Arriving in record numbers,

they are ending up in dangerous jobs that violate child labor laws, including in factories that make products for well known brands like Cheetos and Fruit of the Loom."

The article talks about migrant children have been coming into the United States without their parents in record numbers, are ending up in some of the most punishing jobs in the country.

A New York Times investigation found, it says, 12-year-old groupers in Florida and in Tennessee. The article goes on to say that the number of unaccompanied minors entering the United States climbed to a record 130,000 last year, three times what it was five years earlier, and this summer is expected to bring another wave.

The Federal Government knows they are in the United States, and the Department of Health and Human Services is responsible for ensuring sponsors will support them and protect them from trafficking or exploitation.

But as more and more children have arrived, the Biden White House has ramped up demand on staffers to move the children quickly out of shelters and releasee them to adults. Case workers say they rushed them through vetting sponsors.

While HHS checks on all minors by calling them a month after they begin living with their sponsors, data obtained by the Times showed that over the last two years the agency could not reach more than 85,000 children.

Overall the agency lost contact with a third of migrant children.

Mr. Secretary, is the New York Times correct that HHS cannot account for 85,000 migrant children in the U.S.?

Secretary BECERRA. Congressman, no, they are not.

Mr. KUSTOFF. Okay. What is the number then, Mr. Secretary?

Secretary BECERRA. You have to understand the responsibility that HHS has. We do a follow-up check on these migrant children by contacting the children and their sponsors, but our authority that Congress gave us goes toward caring for the child while they are in our custody.

Once they are in the custody of those sponsors, we do not have jurisdiction over the children.

And so for the New York Times to say that we lost contact with them, it is not that we lost contact. We try to make an effort to follow up with them, but they are under no obligation to respond to us, neither the child nor the sponsor.

And so the New York Time could have done a little bit more homework to figure out what HHS' responsibilities truly are.

Mr. KUSTOFF. All right. Let me ask this because the article specifically says the agency cannot reach more than 85,000 children. You are saying that is an incorrect statement.

Secretary BECERRA. That is an incorrect statement.

Mr. KUSTOFF. And you do or do not know what that actual number is?

Secretary BECERRA. I can tell you the number of children that we have placed in the care of sponsors, and every one of those children we follow up with.

Mr. KUSTOFF. What is the number of children that you do not have contact with?

Secretary BECERRA. Congressman, as I just explained, we no longer have jurisdiction over the children once they are placed in the care. You did not give us the authority to keep in contact with those kids.

Mr. KUSTOFF. You do not know what the number of children is that you do not have contact with, correct?

Secretary BECERRA. We make contact. We try to make contact with every child that has been in our care that we place in the hands of a sponsor.

Mr. KUSTOFF. Thank you.

My time has expired. I yield back.

Chairman SMITH. The representative from California, Ms. Chu, is recognized.

Ms. CHU. Secretary Becerra, I wanted to thank you so much for your visit to my district in Monterey Park, California, last month. The visit meant so much to the people of Monterey Park who are still reeling from the mass shooting that took 11 lives in January.

The shooter was a person who was deteriorating mentally, who should not have had a gun but did, and did terrible harm.

The wide availability of guns in the wrong hands has yielded a drastic increase in gun violence deaths, as AEPI youth, in fact, have the fastest growing firearm suicide rate of any racial or ethnic group, which is a 71 percent increase in the last decade.

Because of this I will soon be releasing legislation to ensure that all communities, including limited English proficient and immigrant communities, have access to gun safety and prevention strategies, such as safe gun storage recommendations and mental health services for suicide prevention that are recommended by CDC.

One part of the President's budget that is so important is an increase of $50 million for the suicide prevention program to expand CDC's work to reduce suicide.

How will you ensure that this important research and safety guidance will be accessible to these LEP and immigrant communities?

Secretary BECERRA. Congresswoman, first, that was a special visit. As you know, I used to live in Monterey Park. I still have a home there, and you could see it in so many of the people's expressions, how not just painful, but how appreciative they were when anyone would give them a chance to just speak their mind.

And speak their mind is important for your point because oftentimes they are not able to communicate with authorities because they do not converse easily in English.

We are doing everything we can to make sure that we provide culturally and linguistically appropriate services. The materials, we try to translate them into appropriate languages. The people we hire, we want them to not only know different languages, but also have lived experiences that relate to the people that we are trying to help, and in so many ways we will try to support the work that you are doing to make sure that we are approaching people with services that accommodate their needs.

Ms. CHU. Thank you so much.

I would like to have your comments on Title 10 and Medicaid. You know, Title 10 family planning has been flatlined for the last ten years, and yet the need is greater than ever now.

So I commend you and the Biden Administration for proposing $512 million for the Title 10 Family Planning Program, the first increase since 2014.

And then there is the Medicaid unwinding, the continuous coverage requirements, you know, started during COVID, but unwinding this Friday, and millions could lose coverage.

So can you speak to the importance of Title 10 and also how does the department plan to protect those most vulnerable to losing coverage once Medicaid unwinding begins?

Secretary BECERRA. Congresswoman, we have been in conversations with governors throughout the country to make sure that they are aware of what is coming once the public health emergency comes down. We want to make sure that no American loses health coverage because the public health emergency has ceased.

And we continue to work with States. Some are better positioned than others. Some are doing more than others, but every State is aware that there are a number of individuals—so it could be close to 14, 15, up to 16 million Americans—who could lose their coverage even though they qualify for other coverage, whether it is through the Affordable Care Act or whether it is through existing Medicaid programs where if they reapply, they will still qualify.

And we want to make sure everyone is aware that that is available to them, including employer insurance, which maybe they did not have when COVID hit and they got onto Medicaid but now they are employed and they have access to coverage. They need to know those things so we do not lose coverage for those Americans.

Ms. CHU. Thank you.

I yield back.

Chairman SMITH. Ms. Van Duyne from Texas is recognized.

Ms. VAN DUYNE. Thank you very much, Mr. Chairman.

And thank you, Secretary for being here today.

Mr. Secretary, as you know, the Hospice Care Program is a vital part of the health care system, with over 50 percent of Medicare patients utilizing the program.

But it is also one of the hardest realities that a family can endure. We know how personal this issue is for you as you and your family provided for your father excellent end-of-life care.

But not everyone is as lucky. The system had been overrun with rampant fraud and abuse, and your agency's responses to the crisis has been extremely alarming. We have been told just last week to, quote, "be patient" while CMS investigates.

But families only have one chance to provide excellent end-of-life care for loved ones, and while CMS asks for patience, more and more fraudulent Hospice providers are gaming the system. They are stealing Medicare dollars, assessing opioid medication, and depriving patients of access to the care that they need.

Mr. Chairman, I ask for unanimous consent to enter into the record the ProPublica article entitled "End Game, How the Visionary Hospice Movement Became a Nonprofit Hustle."

Chairman SMITH. Without objection, so ordered.

[The information follows:]

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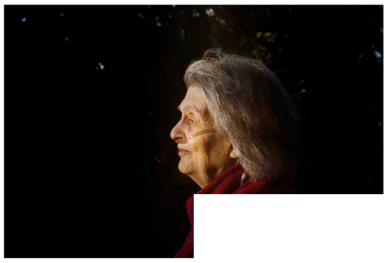
Health Care

Endgame: How the Visionary Hospice Movement Became a For-Profit Hustle

by Ava Kofman

Nov. 28, 2022, 6 a.m. EST

Half of all Americans now die in hospice care. Easy money and a lack of regulation transformed a crusade to provide death with dignity into an industry rife with fraud and exploitation.



Former hospice patient Patricia Marble Melissa Lyttle for ProPublica

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Over the years, Marsha Farmer had learned what to look for. As she drove the back roads of rural Alabama, she kept an eye out for dilapidated homes and trailers with wheelchair ramps. Some days, she'd ride the one-car ferry across the river to Lower Peach Tree and other secluded hamlets where a few houses lacked running water and bare soil was visible beneath the floorboards. Other times, she'd scan church prayer lists for the names of families with ailing members.

Farmer was selling hospice, which, strictly speaking, is for the dying. To qualify, patients must agree to forgo curative care and be certified by doctors as having less than six months to live. But at AseraCare, a national chain where Farmer worked, she solicited recruits regardless of whether they were near death. She canvassed birthday parties at housing projects and went door to door promoting the program to loggers and textile workers. She sent colleagues to cadge rides on the Meals on Wheels van or to chat up veterans at the American Legion bar. "We'd find run-down places where people were more on the poverty line," she told me. "You're looking for uneducated people, if you will, because you're able to provide something to them and meet a need."

Farmer, who has doe eyes and a nonchalant smile, often wore scrubs on her sales routes, despite not having a medical background. That way, she said, "I would automatically be seen as a help." She tried not to mention death in her opening pitch, or even hospice if she could avoid it. Instead, she described an amazing government benefit that offered medications, nursing visits, nutritional supplements and light

housekeeping — all for free. "Why not try us just for a few days?" she'd ask families, glancing down at her watch as she'd been trained to do, to pressure them into a quick decision.

Once a prospective patient expressed interest, a nurse would assess whether any of the person's conditions fit — or could be made to fit — a fatal prognosis. The Black Belt, a swath of the Deep South that includes parts of Alabama, has some of the highest rates of heart disease, diabetes and emphysema in the country. On paper, Farmer knew, it was possible to finesse chronic symptoms, like shortness of breath, into proof of terminal decline.

When Farmer started out in the hospice business, in 2002, it felt less like a sales gig than like a calling. At 30, she'd become a "community educator," or marketer, at Hospice South, a regional chain that had an office in her hometown, Monroeville, Alabama. Monroeville was the kind of place where, if someone went into hospice, word got around and people sent baked goods. She often asked patients to write cards or make tape recordings for milestones — birthdays, anniversaries, weddings — that they might not live to see. She became an employee of the month and, within a year, was promoted to executive director of the branch, training a staff of her own to evangelize for end-of-life care.

Things began to change in 2004, when Hospice South was bought by Beverly Enterprises, the second-largest nursing-home chain in the country, and got folded into one of its subsidiaries, AseraCare. Not long before the sale, Beverly had agreed to pay a $5 million criminal fine and a $175 million civil settlement after being accused of Medicare fraud. Its stock value had slumped, and Beverly's CEO had decided that expanding its empire of hospices would help the company attract steadier revenue in "high-growth, high-margin areas of health care services." Less than two years later, as part of a wave of consolidations in the long-term-care industry, Beverly was sold to a private-equity firm, which rebranded it as Golden Living.

It might be counterintuitive to run an enterprise that is wholly dependent on clients who aren't long for this world, but companies in the hospice business can expect some of the biggest returns for the least amount of effort of any sector in American health care. Medicare pays providers a set rate per patient per day, regardless of how much help they deliver. Since most hospice care takes place at home and nurses aren't required to visit more than twice a month, it's not difficult to keep overhead low and to outsource the bulk of the labor to unpaid family members — assuming that willing family members are at hand.

Up to a point, the way Medicare has designed the hospice benefit rewards providers for recruiting patients who aren't imminently dying. Long hospice stays translate into larger margins, and stable patients require fewer expensive medications and supplies than those in the final throes of illness. Although two doctors must initially certify that a patient is terminally ill, she can be recertified as such again and again.

Almost immediately after the AseraCare takeover, Farmer's supervisors set steep targets for the number of patients marketers had to sign up and presented those who met admissions quotas with cash bonuses and perks, including popcorn machines and massage chairs. Employees who couldn't hit their numbers were fired. Farmer prided herself on being competitive and liked to say, "I can sell ice to an Eskimo." But as her remit expanded to include the management of AseraCare outposts in Foley and Mobile, she began to resent the demand to bring in more bodies. Before one meeting with her supervisor, Jeff Boling, she stayed up late crunching data on car wrecks, cancer and heart disease to figure out how many people in her territories might be expected to die that year. When she showed Boling that the numbers didn't match what she called his "ungodly quotas," he was unmoved. "If you can't do it," she recalled him telling her, "we'll find someone who can."

Farmer's bigger problem was that her patients weren't dying fast enough. Some fished, drove tractors and babysat grandchildren. Their longevity prompted concern around the office because of a complicated formula that governs the Medicare benefit. The federal government, recognizing that an individual patient might not die within the predicted six months, effectively demands repayment from hospices when the average length of stay of all patients exceeds six months.

But Farmer's company, like many of its competitors, had found ways to game the system and keep its money. One tactic was to "dump," or discharge, patients with overly long stays. The industry euphemism is "graduated" from hospice, though the patient experience is often more akin to getting expelled: losing diapers, pain medications, wheelchairs, nursing care and a hospital-grade bed that a person might not otherwise be able to afford. In 2007, according to Farmer's calculations around the time, 70% of the patients served by her Mobile office left hospice alive.

Another way to hold on to Medicare money was to consistently pad the roster with new patients. One day in 2008, facing the possibility of a repayment, AseraCare asked some of its executive directors to "get double digit admits" and to "have the kind of day that will go down in the record books." A follow-up email, just an hour later, urged staff to "go around the barriers and make this happen now, your families need you."



Former AseraCare employee Marsha Farmer Edmund Fountain for ProPublica

That summer, Boling pushed Farmer to lobby oncologists to turn over their "last breath" patients: those with only weeks or days to live. At the time, Farmer's 59-year-old mother was dying of metastatic colon cancer. Although Farmer knew that the service might do those last-breath people good, it enraged her that her hospice was chasing them cynically, to balance its books. The pressure was so relentless that sometimes she felt like choking someone, but she had two small children and couldn't quit. Her husband, who had been a co-worker at AseraCare, had already done so. Earlier that year, after fights with Boling and other supervisors about quotas, he had left for a lower-paying job at Verizon.

Farmer's confidante at work, Dawn Richardson, shared her frustration. A gifted nurse who was, as Farmer put it, "as country as a turnip," Richardson hated admitting people who weren't appropriate or dumping patients who were. She was a single mom, though, and needed a paycheck. One evening in early 2009, the two happened upon another way out.

The local news was reporting that two nurses at SouthernCare, a prominent Alabama-based competitor, had accused the company of stealing taxpayer dollars by enrolling ineligible patients in hospice. SouthernCare, which admitted no wrongdoing, settled with the Justice Department for nearly $25 million, and the nurses, as whistle-blowers, had received a share of the sum — $4.9 million, to be exact. Farmer and Richardson had long felt uneasy about what AseraCare asked them to do. Now, they realized, what they were doing might be illegal. They decided to call James Barger, a lawyer who had represented one of the SouthernCare nurses. That March, he helped Farmer and Richardson file a whistleblower complaint against AseraCare and Golden Living in the Northern District of Alabama, accusing the company of Medicare fraud. The case would go on to become the most consequential lawsuit the hospice industry had ever faced.

The philosophy of hospice was imported to the United States in the 1960s by Dame Cicely Saunders, an English doctor and social worker who'd grown appalled by the "wretched habits of big, busy hospitals where everyone tiptoes past the bed and the dying soon learn to pretend to be asleep." Her counterpractice, which she refined at a Catholic clinic for the poor in East London, was to treat a dying patient's "total pain" — his physical suffering, spiritual needs and existential disquiet. In a pilot program, Saunders prescribed terminally ill patients cocktails of morphine, cocaine and alcohol — whiskey, gin or brandy, depending on which they preferred. Early results were striking. Before-and-after photos of cancer patients showed formerly anguished figures knitting scarves and raising toasts.

Saunders' vision went mainstream in 1969, when the Swiss-born psychiatrist Elisabeth Kübler-Ross published her groundbreaking study, "On Death and Dying." The subjects in her account were living their final days in a Chicago hospital, and some of them described how lonely and harsh it felt to be in an intensive-care unit, separated from family. Many Americans came away from the book convinced that end-of-life care in hospitals was inhumane. Kübler-Ross and Saunders, like their contemporaries in the women's-health and deinstitutionalization movements, pushed for greater patient autonomy — in this case, for people to have more control over how they would exit the world. The first American hospice opened in Connecticut in 1974. By 1981, hundreds more hospices had started, and, soon after, President Ronald Reagan recognized the potential federal savings — many people undergo unnecessary, expensive hospitalizations just before they die — and authorized Medicare to cover the cost.

Forty years on, half of all Americans die in hospice care. Most of these deaths take place at home. When done right, the program allows people to experience as little pain as possible and to spend meaningful time with their loved ones. Nurses stop by to manage symptoms. Aides assist with bathing, medications and housekeeping. Social workers help families over bureaucratic hurdles. Clergy offer what comfort they can, and bereavement counselors provide support in the aftermath. This year, I spoke about hospice with more than 150 patients, families, hospice employees, regulators, attorneys, fraud investigators and end-of-life researchers, and all of them praised its vital mission. But many were concerned about how easy money and a lack of regulation had given rise to an industry rife with exploitation. In the decades since Saunders and her followers spread her radical concept across the country, hospice has evolved from a constellation of charities, mostly reliant on volunteers, into a $22 billion juggernaut funded almost entirely by taxpayers.

For-profit providers made up 30% of the field at the start of this century. Today, they represent more than 70%, and between 2011 and 2019, research shows, the number of hospices owned by private-equity firms tripled. The aggregate Medicare margins of for-profit providers are three times that of their nonprofit counterparts. Under the daily-payment structure, a small hospice that bills for just 20 patients at the basic rate can take in more than a million dollars a year. A large hospice billing for thousands of patients can take in hundreds of millions. Those federal payments are distributed in what is essentially an honor system. Although the government occasionally requests more information from billers, it generally trusts that providers will submit accurate claims for payment — a model that critics deride as "pay and chase."

Jean Stone, who worked for years as a program-integrity senior specialist at the Centers for Medicare and Medicaid Services, said that hospice was a particularly thorny sector to police for three reasons: "No one wants to be seen as limiting an important service"; it's difficult to retrospectively judge a patient's eligibility; and "no one wants to talk about the end of life." Although a quarter of all people in hospice enter it only in their final five days, most of the Medicare spending on hospice is for patients whose stays exceed six months. In 2018, the Office of Inspector General at the Department of Health and Human Services estimated that inappropriate billing by hospice providers had cost taxpayers "hundreds of millions of dollars." Stone and others I spoke to believe the figure to be far higher.

Some hospice firms bribe physicians to bring them new patients by offering all-expenses-paid trips to Las Vegas nightclubs, complete with bottle service and private security details. (The former mayor of Rio Bravo, Texas, who was also a doctor, received outright kickbacks.) Other audacious for-profit players enlist family and friends to act as make-believe clients, lure addicts with the promise of free painkillers, dupe people into the program by claiming that it's free home health care or steal personal information to enroll

"phantom patients." A 29-year-old pregnant woman learned that she'd been enrolled in Revelation Hospice, in the Mississippi Delta (which at one time discharged 93% of its patients alive), only when she visited her doctor for a blood test. In Frisco, Texas, according to the FBI, a hospice owner tried to evade the Medicare-repayment problem by instructing staff to overdose patients who were staying on the service too long. He texted a nurse about one patient: "He better not make it tomorrow. Or I will blame u." The owner was sentenced to more than 13 years in prison for fraud, in a plea deal that made no allegations about patient deaths.

A medical background is not required to enter the business. I've come across hospices owned by accountants; vacation-rental superhosts; a criminal-defense attorney who represented a hospice employee convicted of fraud and was later investigated for hospice fraud himself; and a man convicted of drug distribution who went on to fraudulently bill Medicare more than $5 million for an end-of-life-care business that involved handling large quantities of narcotics.

Once a hospice is up and running, oversight is scarce. Regulations require surveyors to inspect hospice operations once every three years, even though complaints about quality of care are widespread. A government review of inspection reports from 2012 to 2016 found that the majority of all hospices had serious deficiencies, such as failures to train staff, manage pain and treat bedsores. Still, regulators rarely punish bad actors. Between 2014 and 2017, according to the Government Accountability Office, only 19 of the more than 4,000 U.S. hospices were cut off from Medicare funding.

Because patients who enroll in the service forgo curative care, hospice may harm patients who aren't actually dying. Sandy Morales, who until recently was a case manager at the California Senior Medicare Patrol hotline, told me about a cancer patient who'd lost access to his chemotherapy treatment after being put in hospice without his knowledge. Other unwitting recruits were denied kidney dialysis, mammograms, coverage for lifesaving medications or a place on the waiting list for a liver transplant. In response to concerns from families, Morales and her community partners recently posted warnings in Spanish and English in senior apartment buildings, libraries and doughnut shops across the state. "Have you suddenly lost access to your doctor?" the notices read. "Can't get your medications at the pharmacy? Beware! You may have been tricked into signing up for a program that is medically unnecessary for you."

Some providers capitalize on the fact that most hospice care takes place behind closed doors, and that those who might protest poor treatment are often too sick or stressed to do so. One way of increasing company returns is to ghost the dying. A 2016 study in JAMA Internal Medicine of more than 600,000 patients found that 12% received no visits from hospice workers in the last two days of life. (Patients who died on a Sunday had some of the worst luck.) For-profit hospices have been found to have higher rates of no-shows and substantiated complaints than their nonprofit counterparts, and to disproportionately discharge patients alive when they approach Medicare's reimbursement limit.

"There are so many ways to do fraud, so why pick this one?" Stone said. This was more or less what Marsha Farmer and Dawn Richardson had been wondering when they filed their complaint against AseraCare in 2009. Now, working undercover, they imagined themselves as part of the solution.

In the absence of guardrails, whistleblowers like Farmer and Richardson have become the government's primary defense against hospice wrongdoing — an arrangement that James Barger, their lawyer, describes as placing "a ludicrous amount of optimism in a system with a capitalist payee and a socialist payer." Seven out of 10 of the largest hospices in the U.S. have been sued at least once by former employees under the federal False Claims Act. The law includes a "qui tam" provision — the term derives from a Latin phrase that translates as "he who sues on behalf of the King as well as himself" — that deputizes private citizens to bring lawsuits that accuse government contractors of fraud and lets them share in any money recovered. Qui-tam complaints, like Farmer and Richardson's, are initially filed secretly, under seal, to give the Justice Department a chance to investigate a target without exposing the tipster. If the government decides to

proceed, it takes over the litigation. In 2021 alone, the government recovered more than $1.6 billion from qui-tam lawsuits, and the total amount awarded to whistleblowers was $237 million.

In the two years after Farmer and Richardson filed their complaint, both slept poorly. But their covert undertaking also felt cathartic — mental indemnification against a job that troubled their consciences. Farmer continued to bring in patients at AseraCare while passing company documents to Barger, including spreadsheets analyzing admissions quotas and a training PowerPoint used by the company's national medical adviser, Dr. James Avery. A pulmonologist who was fond of citing Seneca, Tolstoy and Primo Levi in his slides, Avery urged nurses to "be a detective" and to "look for clues" if a patient didn't initially appear to fit a common hospice diagnosis. (Avery said that he never encouraged employees to admit ineligible patients.) He sometimes concluded his lectures with a spin on an idea from Goethe's "Faust": "Perpetual striving that has no goal but only progress or increase is a horror."

Barger was impressed by the records that Farmer collected and even more so by her candor about her involvement in AseraCare's schemes. She and Richardson reminded him of friends he'd had growing up: smart, always finishing each other's sentences and not, he said, "trying to be heroes." Nor, as it turned out, were they the only AseraCare employees raising questions about company ethics. The year before, three nurses in the Milwaukee office had filed a qui-tam complaint outlining similar corporate practices. The False Claims Act has a "first to file" rule, so the Wisconsin nurses could have tried to block Farmer and Richardson from proceeding with their case. Instead, the nurses decided to team up with their Alabama colleagues, even if it meant that they'd each receive a smaller share of the potential recovery. Also joining the crew was Dr. Joseph Micca, a former medical director at an AseraCare hospice in Atlanta. Every hospice is required to hire or contract with a doctor to sign forms certifying a patient's eligibility for the program, and Micca accused the company of both ineligible enrollments and lapses in patient care. In his deposition, he described one patient who was given morphine against his orders and was kept in hospice care for months after she'd recovered from a heart attack. The woman, who was eventually discharged, lived several more years.



Whistleblower lawyer James Barger Kate Medley for ProPublica

Among the most critical pieces of evidence to emerge in the discovery process was an audit that echoed many of the allegations made by the whistleblowers. In 2007 and 2008, AseraCare had hired the Corridor Group, a consulting firm, to visit nine of its agencies across the country, including the Monroeville office that Farmer oversaw. The Corridor auditors observed a "lack of focus" on patient care and "little discussion of eligibility" at regular patient-certification meetings. Clinical staff were undertrained, with a "high potential for care delivery failures," and appeared reluctant to discharge inappropriate patients out of fear of being fired. Emails showed that the problems raised by the audit were much discussed among AseraCare's top leadership, including its vice president of clinical operations, Angie Hollis-Sells.

One morning in the spring of 2011, Hollis-Sells strode into the old bank building that housed the Monroeville office, her expression uncommonly stern. Farmer knew at once that her role in the case had been exposed. She was sent home on paid leave, and that evening half a dozen colleagues showed up at her clapboard house in the center of town. Some felt betrayed. Their manager had kept from them a secret that might upend their livelihoods; worse, her accusations seemed to condemn them for work she'd asked them to do. But shortly afterward, when Farmer took a job as the executive director of a new hospice company in Monroeville, Richardson and several other former co-workers joined her.

Less than a year later, the Justice Department, after conducting its own investigation, intervened in the whistleblowers' complaint, eventually seeking from AseraCare a record $200 million in fines and damages. As Barger informed his clients, the company was likely to settle. Most False Claims Act cases never reach a jury, in part because trials can cost more than fines and carry with them the threat of exclusion from the Medicare program — an outcome tantamount to bankruptcy for many medical providers. In 2014, Farmer traveled to Birmingham for her deposition, imagining that the case would soon end. But, in the first of a series of unexpected events, AseraCare decided to fight.

United States v. AseraCare, which began on Aug. 10, 2015, in a federal courthouse in Birmingham, was one of the most bizarre trials in the history of the False Claims Act. To build its case against AseraCare, the government had identified some 2,100 of the company's patients who had been in hospice for at least a year between 2007 and 2011. From that pool, a palliative care expert, Dr. Solomon Liao, of the University of California, Irvine, reviewed the records of a random sample of 233 patients. He found that around half of the patients in the sample were ineligible for some or all of the hospice care they'd received. He also concluded that ineligible AseraCare patients who had treatable or reversible issues at the root of their decline were unable to get the care they needed, and that being in hospice "worsened or impeded the opportunity to improve their quality of life."

Before the trial started, the judge in the case, Karon O. Bowdre, disclosed that she'd had good experiences with hospice. Her mother, who had an ALS diagnosis, had spent a year and a half on the service, and her father-in-law had died in hospice shortly before the trial. Principals in the case disagree about whether she disclosed that the firm handling AseraCare's defense, Bradley Arant, had just hired her son as a summer associate.

The defense team had petitioned Bowdre to separate the proceedings into two parts: the first phase limited to evidence about the "falsity" of the 123 claims in question, and the second part examining, among other things, the company's "knowledge of falsity." The Justice Department objected to this "arbitrary hurdle," arguing that the purpose of the False Claims Act was to combat intentional fraud, not accidental mistakes. "The fact that AseraCare knowingly carried out a scheme to submit false claims is highly relevant evidence that the claims were, in fact, false," the government wrote. Nonetheless, in an unprecedented legal move, Bowdre granted AseraCare's request.

Trial lawyers are expected to squabble over the relevance of the opposing party's evidence — and, in the private sector, they are compensated handsomely for doing so. But the government lawyers seemed genuinely confused about what the judge would and wouldn't allow into the courtroom during the trial's "falsity" phase. In long sidebar discussions, during which jurors languished and white noise was piped in through the speakers, Bowdre berated the prosecution for its efforts to "poison the well" with "all this extraneous stuff that the government wants to stir up to play on the emotions of the jury." Much of her vexation was directed at Jeffrey Wertkin, one of the Justice Department's top picks for difficult fraud assignments. A prosecutor in his late 30s, he had a harried, caffeinated air about him and had helped bring about settlements in more than a dozen cases. This was only his second trial, however, and Bowdre was reprimanding him like a schoolboy. "It made me sick to watch her treatment of him," Henry Frohsin, one of Barger's partners, recalled. "At some point, I couldn't watch it, so I just got up and left."

The judge's prohibition on "knowledge" during the trial's first phase constrained testimony in sometimes puzzling ways. Richardson, for instance, could talk about admitting patients, but she couldn't allude to the pressure she was under to do so. The audit by the Corridor Group that corroborated whistleblower claims was forbidden because it wasn't directly tied to the specific patients in the government's sample. Micca, the former medical director from Atlanta, was not allowed to testify for the same reason. Nonetheless, over several days, the government's witnesses managed to paint a picture of AseraCare's cavalier attitude toward patient eligibility. Its medical directors were part time, as is common in the industry, and workers testified that they'd presented these doctors with misleading patient records to secure admissions. One said that a director had pre-signed blank admissions forms. "Ask yourself: How could a doctor be exercising their clinical judgment," Wertkin told the jury at one point, "if he's signing a blank form?"

When Farmer took the stand, Wertkin asked if she was nervous. "A lot nervous today," she replied. She thought the jurors might judge her for trolling for wheelchair ramps or other recruitment tactics. She needn't have worried. Bowdre's restrictions prevented Farmer from testifying about much of anything. "I felt like the judge did not want to know the truth," she said. "The whole time that I was on the stand, I kept thinking, Why would you not listen to the story?"

The bulk of phase one was dominated by doctors: Liao, the government's expert, read selections from thousands of pages of medical files to explain why he'd concluded that patients were ineligible, and AseraCare's medical experts took the stand and disagreed with most of his conclusions. However, the crux of AseraCare's defense was that the entire debate about eligibility was essentially moot because, although death is certain, its timing is not. A medical director who signed a hospice certification form would have had no way of anticipating whether a patient's illness would deviate from the expected trajectory of decline. Even Medicare, the defense team emphasized, has noted that predicting life expectancy is "not an exact science."

After nearly two months of testimony, the jurors deliberated for nine days on phase one. On Oct. 15, 2015, they found 86% of the patient sample ineligible for some period of hospice care. Elated, Barger rushed out of the courtroom to call Farmer and tell her that the jury had come back overwhelmingly in the government's favor. The next part of the trial will be icing on the cake, she remembers thinking.

The next part never happened. A few days later, Bowdre made a startling announcement: She had messed up. The instructions that she'd given the jury had been incomplete, she said, and because of this "major reversible error" she was overturning the jury's findings and granting a request by AseraCare for a new trial. She invited the government to submit evidence other than Liao's opinion to prove that the claims were false; the government replied that the record presented ample evidence of falsity. Five months later, in March 2016, Bowdre granted summary judgment to AseraCare.

It's unusual for a judge to overturn a jury's findings, order a new trial and then declare summary judgment on her own accord, Zack Buck, a legal scholar at the University of Tennessee who studies health care fraud, told me. The case, he said, "just kept getting weirder." Wertkin, who had expected to return to Washington, D.C., with that rare article — a jury verdict in a False Claims Act case — later said he felt as though the "rug had been ripped out from under me."

In a widely circulated opinion, Bowdre wrote that clinical disagreement among doctors was not enough on its own to render a claim false. Otherwise, hospice providers would be subject to liability "any time the Government could find a medical expert who disagreed" with their physician, and "the court refuses to go down that road." The Justice Department appealed Bowdre's ruling, but many in the hospice industry celebrated the opinion. "There are huge implications," Buck said. "So much of our system is based on a doctor's discretion, and if you can't say the doctor is wrong you've really hamstrung the government's ability to bring these kinds of cases." In op-eds and on the lecture circuit, defense lawyers for health care companies hailed the beginning of a post-AseraCare era.



Family practitioner Scott Nelson Edmund Fountain for ProPublica

That year, Dr. Scott Nelson, a family practitioner in Cleveland, Mississippi, was wrapping up a lucrative tour of duty in the hospice trade. Since 2005, Nelson had referred approximately 763 patients to 25

hospices, 14 of which employed him as the medical director, according to a special agent in the Department of Health and Human Services' Office of Inspector General. Some of Nelson's patients, however, didn't know that they were dying and a decade or more later remained stubbornly alive.

In the course of roughly six years, by the doctor's own account, he received around $400,000 for moonlighting as the medical director at eight of the companies. Meanwhile, those hospice owners, some of whom were related to one another, received a total of more than $15 million from Medicare for the patients he'd certified. In a scheme that the special agent, Mike Loggins, later testified was spreading across the Mississippi Delta "like cancer," hospices bused in vans of people to Nelson's clinic. The owner of Word of Deliverance Hospice — one small-town provider that briefly put Nelson on its payroll — bought a $300,000 Rolls-Royce that was later confiscated by the government. Nelson, who was convicted earlier this year of seven counts of health care fraud, told me that he'd fallen victim to greedy hospice entrepreneurs who had done hundreds of "third-grader-level forgeries" of his signature when racking up illegal enrollments, and that he'd assumed other forms he'd signed were truthful. Nelson awaits sentencing and has filed a motion challenging the verdict.

The Mississippi Delta has an acute shortage of primary-care providers — a problem that contributes to the region's poor health outcomes. When I visited some of the fraud victims in the case, all of whom were Black, they told me that the experience of being duped had deepened their mistrust of a health care system that already seemed out of reach. Some of the patients Nelson had approved for hospice were in their 40s and 50s. One had cognitive disabilities, and another couldn't read. Marjorie and Jimmie Brown, former high school sweethearts in their 70s, found out that they had been enrolled in Lion Hospice only in 2017, when Loggins knocked on the front door of their yellow brick bungalow. A worker for Lion had tricked the Browns into trading away their right to curative care, and Nelson — whom they'd never heard of, let alone seen — was one of two doctors whose names were on the paperwork.

Losing access to care is hardly the only thing that can go wrong for patients inappropriately assigned to hospice. In May 2016, Lyman Marble found his wife, Patricia, unresponsive and lying face down in their bed. At a hospital near their home in Whitman, Massachusetts, doctors were shocked by the high doses of opiates she'd been prescribed. An addiction specialist later observed that she was ingesting the equivalent of dozens of Percocet pills a day. Only after Lyman told the doctors to "flush her out like Elvis" did her family come to suspect that her health crisis was caused by hospice care itself.

The Marbles, who had been married for more than 50 years, worked together in a variety of jobs, among them operating an outer-space-themed carnival ride. Five years earlier, Patricia had been admitted to a hospice owned by Amedisys, the third-largest provider in the country. The diagnosis was end-stage chronic obstructive pulmonary disease.

She was 70 years old and had health troubles: She used a wheelchair and supplemental oxygen, and had diabetes, hypertension and a benign tumor that caused her pain. That pain had been treated by a fentanyl patch, but once she was in hospice the medical director, Dr. Peter Roos, prescribed morphine, Vicodin, Ativan and gabapentin, too. Over the next five years, he kept prescribing narcotics, recertifying her for hospice 30 times. (Roos, who said in a deposition that he prescribed morphine to ease Marble's respiratory distress, did not respond to requests for comment.) Court documents later revealed that cash bonuses were a reward for good enrollment numbers at that branch of Amedisys, and that nurses had resigned after being pressured to admit and recertify patients who they didn't think were dying.



Patricia Marble and her husband, Lyman Melissa Lyttle for ProPublica

While under the care of Amedisys, Patricia sometimes couldn't remember who or where she was. "I felt like I was dead," she later said. "It just made me feel like 'That's right, I'm in the right place because I'm going to die.'" But after Lyman learned that he could "fire hospice," as he put it, and Patricia was slowly weaned from narcotics, her memory began to return and her breathing improved. Lyman, who had thought that he might lose his wife at any moment (at one point, Amedisys had asked if he was making funeral arrangements), was stunned by her transformation. Today, more than a decade after first enrolling in hospice, Patricia remains opioid-free and has described her lost years as like being on "the moon or someplace." For that misadventure, the company billed Medicare almost half a million dollars. Last year, Amedisys settled a suit brought by the Marbles for $7.75 million. The company declined to comment, stating that the settlement was confidential.

Because pinpointing what constitutes a "good death" is nearly as difficult as determining what makes a good life, families may not always realize when hospice is failing them — even when they work in the industry. In November 2014, Carl Evans, a 77-year-old former janitor from Orange County, took a fall and, when hospitalized, was tentatively diagnosed as having end-stage thymus cancer. Soon after, he was discharged to a nursing home and enrolled in a hospice run by Vitas, one of the largest providers of end-of-life care in the United States. Andrea Crawford, one of his daughters, was a hospice nurse and had worked for the company early in her career. When she visited her father in his private room, which had a sofa and a flat-screen TV, he told her that he was being treated "like a king."

Evans had been living independently, with his longtime girlfriend, before his fall. And, unlike many hospice patients, he remained mobile and gregarious, with a big appetite much noted in his charts. Early in the morning of Nov. 22, in search of a non-institutional meal, he climbed out a window and got on a bus to his girlfriend's house. (His preferred ride, a lovingly maintained burgundy Trans Am, was unavailable.) A family friend eventually located him, 30 miles away.

On Evans' return, Dr. Thomas Bui, a medical director at Vitas, placed an urgent order for him to receive phenobarbital, a barbiturate that is sometimes prescribed for agitation and can cause extreme drowsiness. A few days later, Vitas records show, Bui added Keppra, an anti-seizure medication that also has sedative properties, to the mix. Evans had no known history of seizures, and Crawford later suspected that the two drugs had been prescribed to subdue him for the convenience of the staff. After the addition of Keppra, his chart shows, Evans became wobbly on his feet and then so lethargic that he couldn't get out of bed — though he remained alert enough to be terrified at his sudden decline. Crawford, concerned, attributed the change to the drugs he was taking, as did a Vitas employee, according to medical records. On Dec. 6, Evans died.



A photo of Carl Evans held by his daughter Andrea Crawford Philip Salata for ProPublica

The official cause of death was cancer (hospice patients are not typically given autopsies), but Evans' family filed a suit against Vitas and Bui. The lawsuit was settled, and Vitas denies allegations of wrongdoing. Bui, who said in a deposition that he medicated Evans to soothe his agitation, didn't respond to requests for comment. The California medical board disciplined him for his handling of the case. He was placed on a three-year probation, during which he was prohibited from practicing alone, and was ordered to take a course on safe prescribing.

Malpractice cases against hospices are rare. As Reza Sobati, an elder-abuse lawyer who represented Evans' family, told me: "The defense we often get in a nursing home case is that they were going to die anyway from their issues. That's even harder to overcome with hospice, since a doctor has literally certified it will happen."

Afterward, as Crawford reviewed medical charts and tried to understand what had happened to her father, she came across some notes that surprised her. When Evans entered hospice, Vitas had certified him for a heightened level of care intended for patients with uncontrolled pain or severe and demanding symptoms, which Evans didn't have. As a hospice nurse, Crawford knew that such coding allowed Vitas to bill Medicare more — roughly four times more — per day than the rate for a routine patient. (Vitas denies inappropriate billing.)

In 2016, not long after Judge Bowdre dismissed the AseraCare case, someone began to anonymously contact companies that were the subjects of sealed qui-tam complaints. Those sealed complaints named the whistleblowers and the details of their accusations — information that the accused companies could use to get ahead of government investigators and their subpoenas or possibly to intimidate informers into silence. When a general counsel at a tech firm returned the mysterious voicemail, the insider, who called himself Dan, offered to share a complaint that named the company in exchange for a "consulting fee" of $300,000, preferably paid in bitcoin.

The lawyer alerted the FBI and began recording his conversations with Dan, including one arranging the handoff of the documents in Silicon Valley. On the morning of Jan. 31, 2017, Dan texted an FBI agent posing as one of the tech company's employees the address of a hotel in Cupertino and instructed him to sit in the lobby on "a chair with a newspaper on it" just past "the water station." Moments after the undercover agent sat down, Dan approached him with a copy of the complaint and was arrested. It turned out that Dan, who the FBI said was disguised in a wig, was the former government prosecutor Jeffrey Wertkin.

By then, Wertkin had left the Department of Justice to become a partner at the elite law firm Akin Gump, a job that paid $450,000 a year. His bio on the company's website noted that, after leading more than 20 fraud cases, he had "first-hand knowledge of the legal and practical considerations that shape government investigations." As part of a plot that his former Justice Department colleagues termed "the most serious

and egregious example of public corruption by a DOJ attorney in recent memory," Wertkin had, on his way out the door, taken at least 40 sealed qui-tam complaints belonging to the Civil Fraud Section.

He later ascribed his short-lived criminal spree, which his defense team compared to "a scene out of a B-grade action movie," to what had occurred in Judge Bowdre's courtroom. Wertkin's wife said in a letter to the court that he had returned home from the AseraCare trial a "shell of a man" who drank heavily and spent several days watching movies on his phone in bed. Wertkin, who pleaded guilty in 2017 and was sentenced to two and a half years in prison, wrote in a statement that the government's reversal of fortune in the case had led him "to question things I never doubted before. Does the system even work?" At his sentencing hearing, a prosecutor argued that the False Claims Act itself was one of Wertkin's victims. "The False Claims Act is incapable of deterring fraud if the Department of Justice can't be trusted by whistleblowers," she said. "We have no way of measuring what chilling impact there might be on whistleblowers based on what the defendant did in compromising their secrecy."

On Sept. 9, 2019, the False Claims Act took a second hit when the U.S. Court of Appeals for the Eleventh Circuit published a long-anticipated ruling on the AseraCare case. The judges concurred with Bowdre that the government needed more than the testimony of an outside expert to prove a claim was false. However, they vacated Bowdre's summary judgment, saying that the prosecution should have been able to present all its evidence, including AseraCare's alleged "knowledge of falsity," and sent the case back to her courtroom for a retrial. "When the goalpost gets moved in the final seconds of a game," the judges wrote, "the team with the ball should, at the least, have one more opportunity to punch it into the endzone."

The government did not appear enthusiastic about trying the AseraCare case for a second time before Bowdre, though. Wertkin had been disbarred and was serving his sentence, and some of his former colleagues had left for the private sector. In February, 2020, 11 years after Farmer and Richardson filed their complaint, the government reached a settlement with AseraCare for a million dollars. As in most such settlements, AseraCare paid the sum, admitted no wrongdoing and was allowed to keep billing Medicare. Jack Selden, a partner at Bradley Arant who worked on the defense team, told the trade journal Law360, "When a case settles for $1 million where the claims have been for over $200 million, I think that speaks for itself."

From a certain point of view, Wertkin's attempts to shake down government contractors made manifest the transactional logic that governs the False Claims Act. Even to some of their biggest beneficiaries, these qui-tam settlements have come to resemble a mutual-protection racket: Executives keep their jobs and their companies keep billing Medicare; whistleblowers and their lawyers get a cut; and Justice Department attorneys can cash in on their tough-on-fraud reputations by heading to white-shoe law firms to defend the companies they once prosecuted.

In 2020, not long after AseraCare settled with the government, the company was bought for $235 million by Amedisys, which was facing qui-tam troubles of its own. A nurse from an Amedisys office in South Carolina had filed a lawsuit accusing the corporation of admitting ineligible patients, falsifying paperwork and handing out bonuses to staff to entice new recruits. (Amedisys denies the allegations.) This time, the government has declined to join the nurse's case.

Earlier this year, when I visited Farmer at her home in Alabama, boxes were piled in the living room. She was preparing for an upcoming move to Missouri, where her husband had taken a job with a nonprofit hospice and home health company. Farmer had remained close with Richardson, who told me: "I have a whole different view of justice in America now. It's definitely powered by the dollar bill." But the women no longer talked about the trial. "Nobody really cared," Farmer said. "The government didn't care, the judge didn't care, and all of these people's money was wasted." Sitting in a plush reclining chair, Farmer let out a short, sharp cough as she spoke. In December, she had been diagnosed as having an aggressive form of breast cancer, and the chemotherapy had left her vulnerable to lingering infections.

The hospice benefit imposes a dichotomy between caring for the living and caring for the dying, when, in truth, the categories are often indistinguishable. Most older people will face a chronic disability or a disease in the last years of their life and will need extra care to remain safely at home. That help is rarely available, and Americans often end up in a social-welfare purgatory, forced to spend down their savings to become eligible for a government-funded aide or a nursing home bed. "We all think it's not going to affect us, but if you have a stroke and go bankrupt you're not just going to go out and shoot yourself in the desert," Dr. Joanne Lynn, an elder-care advocate and a former medical officer at the Centers for Medicare and Medicaid Services, told me. Once you cross over into the kingdom of the sick, she said, it's easier to see that some problems classified as hospice fraud are really problems of the inadequate long-term-care system in this country.

In the 1970s, Lynn worked at one of the first hospices in the United States. At the time, most of the patients had cancer and died within weeks; the six-month guidance was originally designed around their needs. Today, the majority of hospice patients have chronic illnesses, including heart disease and dementia. And some of them — regardless of whether they have six months or six years to live — depend on hospice for in-home support and holistic services that would otherwise be unavailable. Yet under the current system, as the number of patients with ambiguous prognoses rises, providers (including ethical ones) are under financial pressure to abandon those who don't die quickly enough. It's a typically American failure of imagination that people with dire but unpredictable declines are all but left for dead.

Elisabeth Kübler-Ross thought she understood why societies isolate the old and the dying: They remind the rest of us of our own mortality. This aversion might partly explain why decades of warnings about hospice care — including a full quarter century of pointed alerts from the inspector general's office at the Department of Health and Human Services — have gone largely unheeded. Recently, though, some of the reports were so disturbing (maggots circling feeding tubes, crater-like bedsores) that members of Congress have called for reforms, and the Centers for Medicare and Medicaid Services is enacting a few. The agency has just begun making available to the public a greater range of data on hospice providers, including the average number of visits that nurses and social workers make in the last days of a person's life. More significantly, the agency now has the power to impose fines on problem providers, should it choose to use it. (Previously, the agency's only consequential penalty for bad hospices was to boot them from the Medicare program, an option it seldom exercised.)

Some state lawmakers, too, are asking deeper questions about end-of-life care. This year, in the wake of a Los Angeles Times investigation, California placed a moratorium on new hospices, and state auditors raised alarms about a raft of tiny new hospices, some with fictional patients and medical staff, that were engaged in "a large-scale, targeted effort to defraud Medicare." In Los Angeles County alone, there are more than a thousand hospices, 99% of them for-profit. By comparison, Florida, which, unlike California, requires new providers to prove a need for their services, has 51 hospices.

But when regulators close a door they sometimes open a window. Licensing data I've reviewed suggests that, as scrutiny of end-of-life-care providers intensified in California, the hospice boom traveled eastward. In Clark County, which contains Las Vegas, the number of new hospices has more than doubled in the past two years, and in Harris County, which encompasses Houston, the number has grown almost as quickly. Sheila Clark, the president of the California Hospice and Palliative Care Association, attributed some of the surge in new licenses to a scheme called "churn and burn."

"Providers open up a hospice and bill, bill, bill," she said. Once that hospice is audited or reaches the Medicare-reimbursement limit, it shuts down, keeps the money, buys a pristine license that comes with a new Medicare billing number, transfers its patients over and rakes in the dollars again. The directors of two nonprofit hospices in the Southwest told me that they had been accepting patients who were fleeing such new providers. Some patients switched because while they were with the startup hospices they hadn't seen a nurse in two weeks, and no one was answering the phone.



An office building in Phoenix that is home to dozens of new hospices Lara Cerri for ProPublica

On a rainy morning in November, I found myself in a vast, sand-colored commercial plaza on the outskirts of Phoenix. The complex was designed in the style of a Spanish hacienda, with a central courtyard, a stone fountain and a stately bell tower. Maricopa County was another place where the number of hospices had doubled in two years; 33 new ones, licensing data indicated, had appeared at this single address. There was no building directory, but eventually I realized that most of the hospices were clustered together on the basement level. All the hospices listed the same phone number for inspectors to call, and some had taped the same apology to their door: "Sorry we missed you! We'll be back in 45 mins, if you need immediate assistance pls call us." Each time I called the listed number, I got an answering machine whose mailbox was full.

When I buzzed the Ring video doorbell of B-116, which housed at least nine hospices, I was told by the man who answered that the manager was currently on the other side of the building. When I walked to the other side and rang B-117, the same man picked up. Sensing my confusion, he said, "I'm just the voice at the door." His name was Ted Garcia, and he had been hired to monitor the hospices from his laptop at home. I told him that I was searching for a registered nurse named Svetik Harutyunyan, who was listed as the CEO of multiple hospices in the neighborhood, among them Ruby, Sapphire and Garnet, which were within the complex, as well as Platinum, Bright Star and First Light, down the road. I told Garcia that I particularly wanted to ask Harutyunyan about Ruby Hospice, which I'd seen listed for sale in an online ad for a quarter of a million dollars.

The day before, I'd searched for her at a squat building in Los Angeles that had drawn auditors' attention. That address holds, according to state records, 129 hospices — a tenth of the city's supply. When I knocked on the door of a hospice that the licensing data had linked to Harutyunyan, a worker told me that no one by that name was involved. Later, when Harutyunyan and I spoke by phone, she acknowledged owning hospices in California and Arizona and said that the arrangement was legal. She had wanted every member of her family to have one, she said.

Garcia told me through the doorbell that, as far as he understood, the hospices he monitored weren't seeing actual patients; instead, the offices were a kind of "holding pen" to keep the licenses viable with requisite physical addresses until demand could be drummed up. The remote work was dull, he allowed. Apart from inspectors occasionally stopping by and transient people defecating outside the doors at night, my visit was the most action he'd seen in months. As the rain let up and I sat in the deserted courtyard trying to decide which of Harutyunyan's holdings to visit next, it occurred to me that this world of paper hospices — empty of patients, valued at six figures, watched over by virtual guards — might be the clearest expression of the industry's untamed frontier that I was going to encounter.

Later that afternoon, Garcia told me that he'd begun to research whether he could open a hospice himself. The market was bigger and more lucrative than he'd realized. People in Montana and Texas and Tennessee,

he said, were posting ads online for “turnkey-ready hospices” for as much as half a million dollars. He called an ex-cop he knew to see if he wanted in. “We can turn a profit and split it,” he said.

How We Reported the Story

For this investigation, Ava Kofman drew on medical records; state and federal licenses; inspection and complaint surveys; government watchdog reports; thousands of pages of court documents; and interviews with more than a hundred families, hospice employees, elder care experts, attorneys and government officials.

Doris Burke contributed research.

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Ms. VAN DUYNE. So, Mr. Secretary, we are well beyond the time to be patient and the time for action is now. Families deserve more from this Administration.

We have a bipartisan group of lawmakers, including my colleague from Oregon, Mr. Blumenauer, ready to address this issue.

And, Mr. Secretary, you served as a member of Congress representing Los Angeles County and on this committee at a time when your district was seeing an increase in fraudulent Hospice activity.

You also served as the Attorney General of California as this crisis continued to build. Now you are HHS Secretary. How can we trust that you are finally going to take this issue seriously?

Will you review how penalties actually prevent fraud?

And when can we honest to God expect an answer from CMS on what is going on?

Secretary BECERRA. So, Congresswoman, I am surprised you did not get the answer that you wanted from CMS, and we can actually follow up if you would like with CMS.

Ms. VAN DUYNE. That would be great.

Secretary BECERRA. But they are not sitting around. We are acting aggressively. In fact, in this budget we are asking for money to do exactly that, to go after the fraud and the abuse that is going on.

Ms. VAN DUYNE. And I appreciate that you are doing this, and I know. Look. We have three and a half minutes because you limited your time in front of this committee. I will be following up with requesting a legitimate answer in writing from your office.

Now, I know that you actually do have a history of not responding to our requests for information from this committee. So I am going to ask you will you commit to answering my questions which will be submitted for the record regarding Hospice care?

Secretary BECERRA. Having been a former member of Congress and made requests for answers in writing,——

Ms. VAN DUYNE. Is that a yes?

Secretary BECERRA [continuing]. We make every effort to make sure we respond——

Ms. VAN DUYNE. Thank you very much.

I want to turn to a completely different topic, Mr. Secretary. Approximately 100 facilities nationwide, also known as pediatric transgender clinics, are performing gender-affirming treatment in the form of hormone therapy and surgery on children at age 11 or younger.

There are even allegations that some of these clinics perform these treatments without conducting thorough mental health assessments beforehand or even bypassing certain parental consent.

Ten States have now restricted these treatments for children including eight States that ban this treatment for children outright.

Are you aware of any medical facilities conducting pediatric gender-affirming treatment that either receive HHS grants or Medicare or Medicaid reimbursement?

Secretary BECERRA. Congresswoman, there are a number of facilities that could receive funding from HHS so long as it is a federally prescribed service, and so therefore, we would make sure that they are using the monies appropriately.

Ms. VAN DUYNE. So, Mr. Secretary, can you confirm that these facilities, none of them are using a dime of Federal taxpayer dollars to provide pediatric gender-affirming treatments to children?

Secretary BECERRA. Congresswoman, those facilities are under law required to make sure they are using any federally provided money in the appropriate——

Ms. VAN DUYNE. They are or they are not providing that service?

Secretary BECERRA. Now you are asking me about every facility in the country. I can tell you that CMS has an obligation to make sure that we are doing oversight. If you help us with our budget——

Ms. VAN DUYNE. Okay. Thank you very much.

Secretary BECERRA [continuing]. We will do as much as we can.

Ms. VAN DUYNE. I yield back.

Chairman SMITH. The gentleman from Pennsylvania, Mr. Fitzpatrick, is recognized.

Mr. FITZPATRICK. Thank you, Mr. Chairman.

Thank you, Mr. Secretary, for being with us today.

Mr. Secretary, my constituent Phil Guttes was diagnosed with early onset Alzheimer's seven years ago. He received this diagnosis as part of a clinical trial for Aducanumab, a drug, and has been on this drug for almost I would say probably the last seven years or so.

He will receive two more infusions as part of this trial, and then because of the discriminatory and unprecedented decision by CMS not to cover this drug and FDA-approved drugs like it, he will be faced with either wiping out his retirement savings to pay for the drug on his own, outside of Medicare, or go without treatment altogether.

Mr. Secretary, never before, to my knowledge, has CMS refused to provide coverage for an FDA-approved drug. So my question: what does the Administration have to say to the millions of patients, caregivers and families who will be denied access to these breakthrough treatments, like my constituent Phil, many other people like him across America?

And what is the Administration doing to ensure that access to these FDA-approved drugs will be provided to our seniors?

Secretary BECERRA. Congressman, I would say to those individuals what my wife and I said to our own family members who, when we were experiencing these same issues of dementia, Alzheimer's, and that is we are going to work together. We will do everything now, and as the Secretary, I will do everything we can to make sure that lifesaving treatments are made available whether it is first through FDA, which has to ensure that a drug can be put out onto the market safely and effectively, or whether it is through CMS, which has to make sure that for purposes of Medicare, that it is a drug that will get coverage under the Medicare Program.

But I will say it, as Secretary as I would say it as the father or the son-in-law or as the son of those who might be affected by these types of illnesses, that we will do everything we can to make sure that we are providing the care that they need.

Mr. FITZPATRICK. Well, see, everything you can, and it is your decision, your purview of your department——

Secretary BECERRA. Yes.

Mr. FITZPATRICK [continuing]. Regarding the decision of CMS to refuse to provide coverage for this medication.

Secretary BECERRA. Congressman, we apply the laws that you pass, and the laws require Medicare services to go through a certain type of check. We have to abide by that law.

The law that governs CMS is different from the law that governs FDA. If you wish to wish to have the law that governs CMS be the same as the law that governs FDA, then it is up to you to make that change.

Mr. FITZPATRICK. Lastly, Mr. Secretary, I have a question which is going to extend beyond my time. So, Mr. Chairman, I ask unanimous consent to enter this question into the record regarding the effect of GPOs and PBMs on drug shortages and drug prices.

Chairman SMITH. Without objection.

Mr. FITZPATRICK. And, Mr. Secretary, if I could get your commitment to a timely response to this question that we enter.

Secretary BECERRA. We will make every effort to respond as quickly as we can, Congressman.

Mr. FITZPATRICK. I yield back, Mr. Chairman.

Chairman SMITH. Thank you, Representative.

I recognize the lady, the gentlelady from Wisconsin, Ms. Moore.

Ms. MOORE of Wisconsin. Thank you so much, Mr. Chairman.

And I, too, want to thank you, Secretary Becerra for coming to my district and really doing an amazing job to educate my community about the importance of the various investments that have been made in our community.

Just very quickly, I am looking at your written testimony, and on page 5, you said, "The budget also proposes to further expand the health care workforce by allowing community health workers to be able to bill for select services under Medicare."

Can you share with me what those might be? That is very exciting.

Secretary BECERRA. I am sorry. Can you pose the question——

Ms. MOORE of Wisconsin. Your written testimony says that you are going to allow community health workers to be able to bill for select services under Medicare.

Secretary BECERRA. We are trying to move both the Medicare Program and the Medicaid Program to a space where we make access to services more readily available because one of the things we found, Congresswoman, is too often people are deprived of services even though they are eligible for them because they do not know how to access them.

And so whether it is in Medicare or Medicaid, we are going to do everything we can to make sure access is being most available.

Ms. MOORE of Wisconsin. Thank you, Mr. Secretary.

I am so pleased to see this. This is like a dream come true to look at a budget that is really centered around children and women, and I do not have enough time to address everything, but I was curious about the foster care provision that just came onboard in January 2023 that would enable foster youth to have Medicaid through age 26.

And I am concerned about the implementation of that program, whether or not there is a sort of plan to contact foster youth who

may or may not know that if aged out of foster care, that they are still eligible for Medicaid.

Secretary BECERRA. Yes, that is one of the biggest issues, is when you leave the foster care program, sometimes there is no safety net to catch you.

We are going to try to do what we can to follow up. Simply because you turn a particular age, 19, 21, depending on what it is, it should not mean that all of a sudden you fall over a cliff when it comes to the services that you need.

Foster kids, as you know, are the most in need of service. They are the ones that are calling the 988 suicide prevention hotline——

Ms. MOORE of Wisconsin. Exactly.

Secretary BECERRA [continuing]. More often than not.

Ms. MOORE of Wisconsin. Exactly.

Secretary BECERRA. So we are going to do everything we can to make sure no foster care child believes that they are second class.

Ms. MOORE of Wisconsin. I am really happy to see that you are very intentional about moving into mental health.

And you know, we talk about mental health parity all the time, at least as long as I have been a member of Congress, and so I am wondering what in particular that we wrap our arms around are you doing to make sure that mental health parity is more than just a conversation?

Secretary BECERRA. Congresswoman, we are doing as much as we can to get insurance companies to follow the law, and so that if you are an insurance company, you provide reimbursement for physical health care, benefits and services that a patient receives, that you are also providing reimbursement for mental health services in an——

Ms. MOORE of Wisconsin. This is a really big problem. I mean, women postpartum have severe depression, and it has a real impact on the wellbeing of the entire family.

You know, when Mama ain't okay, nobody is okay.

I yield back.

Chairman SMITH. The gentleman from Florida, Mr. Steube, is recognized.

Mr. STEUBE. Thank you, Mr. Chairman.

On January 30th of this year, a Corcoran Report was released, and it found that for, and I quote, "medical and surgical masks," and a separate analysis for N95 P2 respirators, and I quote again, "Compared with wearing no mask in the community studies, only wearing a mask may have little to no difference in how many people caught a flu-like illness or COVID-like illness."

Are you aware of the analysis that I am referencing?

Secretary BECERRA. Congressman, I have heard of a lot of analyses. I know that at the end of the day wearing a mask has helped keep Americans alive.

Mr. STEUBE. Well, not according to the Corcoran.

The medical and surgical mask analysis reviewed nine studies in over 276,000 people. The N95 P2 analysis reviewed five studies in over 8,400 people.

But then on March 10th, Corcoran put out a statement noting that their analysis was actually inconclusive and that the exact

quote from their analysis that I just read was, quote, "misleading" after they had just found all of that based on all of those studies.

So it is clear that somebody in the Administration or somebody somewhere influence Corcoran's attempt to back-tread from their previous findings three months prior.

So my first question is is it true that you had conversations with Corcoran regarding their January findings after their report was released?

Secretary BECERRA. If your "you" refers to me, that is not true.

Mr. STEUBE. Okay. Did anyone acting on behalf of HHS contact Corcoran about their January 30 findings after their report?

Secretary BECERRA. Best I know, no, but I can try to find out if you would like.

Mr. STEUBE. So would you be willing to give any documents or correspondence that anybody in your agency had with Corcoran between January and March 10th of this year?

Secretary BECERRA. We will provide to you whatever documents are disclosable by law.

Mr. STEUBE. Okay. I will put that into a letter.

Is it true that someone from HHS or the Biden Administration pressured Corcoran to change or back away from their January 30 findings?

Secretary BECERRA. I know nothing of that ever happening.

Mr. STEUBE. So you are not aware, but you are saying that you are not aware that somebody in the agency may have had conversations with them?

Secretary BECERRA. As far as I know, I know of no one in the agency who engaged in that kind of a conversation.

Mr. STEUBE. And your testimony here today is that you would be willing to provide correspondence between anybody in HHS with Corcoran after January of this year, after the findings?

Secretary BECERRA. We are prepared to provide you with whatever documents legally you are eligible to request.

Mr. STEUBE. Okay. Has HHS ever contacted social media platforms, such as Twitter or Facebook, to pressure them to remove statements about COVID–19 that the Administration did not want circulated?

Secretary BECERRA. I believe now you are making reference to some lawsuits that sort of make those kinds of allegations, but I can say to you that I am not aware of anything like that, at least not from me.

Mr. STEUBE. So you have not had any conversations with any social medica platforms about anything related to COVID and the information that they are putting out to the American public?

Secretary BECERRA. Other than perhaps using some of these platforms to put out information.

Mr. STEUBE. So you have had conversations with social media platforms as it relates to putting out information?

Secretary BECERRA. I have put out information on some of these social media platforms. I have not had conversations with the representatives or the leaderships of these platforms trying to influence them to do one thing or the other.

Mr. STEUBE. So your testimony is that you put things on platforms, but you have not had conversations with executives or anybody at Twitter or Facebook or otherwise.

Secretary BECERRA. Now you are stretching it. Have I ever had conversations——

Mr. STEUBE. Well, I am following up on your testimony.

Secretary BECERRA. So the answer is there may have been occasions for me to have conversations with executives from any of those media platforms on any number of subjects.

Mr. STEUBE. Did Surgeon General Vivek Murthy participate in meetings with White House officials and social media company officials discussing what information should be hidden from the public?

Secretary BECERRA. I suggest you ask Surgeon General——

Mr. STEUBE. Are you aware of any conversations that they had?

Secretary BECERRA. I know that he has conversations with lots of entities and individuals, but I could not specify if in this particular case——

Mr. STEUBE. I'm asking if you are aware that he had conversations with those social media platforms.

Secretary BECERRA. I am not aware.

Mr. STEUBE. Mr. Chairman, I ask unanimous consent to add to the record the Corcoran Library analysis, Physical Interventions to Interrupt or Reduce the Spread of Respiratory Viruses, and the Corcoran three months' later statement on physical interventions to interrupt or reduce the spread of respiratory viruses.

Chairman SMITH. Without objection, so ordered.

[The information follows:]



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Physical interventions to interrupt or reduce the spread of respiratory viruses (Review)

Jefferson T, Dooley L, Ferroni E, Al-Ansary LA, van Driel ML, Bawazeer GA, Jones MA, Hoffmann TC, Clark J, Beller EM, Glasziou PP, Conly JM

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[Intervention Review]

Physical interventions to interrupt or reduce the spread of respiratory viruses

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ABSTRACT

Background

Viral epidemics or pandemics of acute respiratory infections (ARIs) pose a global threat. Examples are influenza (H1N1) caused by the H1N1pdm09 virus in 2009, severe acute respiratory syndrome (SARS) in 2003, and coronavirus disease 2019 (COVID-19) caused by SARS-CoV-2 in 2019. Antiviral drugs and vaccines may be insufficient to prevent their spread. This is an update of a Cochrane Review last published in 2020. We include results from studies from the current COVID-19 pandemic.

Objectives

To assess the effectiveness of physical interventions to interrupt or reduce the spread of acute respiratory viruses.

Search methods

We searched CENTRAL, PubMed, Embase, CINAHL, and two trials registers in October 2022, with backwards and forwards citation analysis on the new studies.

Selection criteria

We included randomised controlled trials (RCTs) and cluster-RCTs investigating physical interventions (screening at entry ports, isolation, quarantine, physical distancing, personal protection, hand hygiene, face masks, glasses, and gargling) to prevent respiratory virus transmission.

Data collection and analysis

We used standard Cochrane methodological procedures.

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Main results

We included 11 new RCTs and cluster-RCTs (610,872 participants) in this update, bringing the total number of RCTs to 78. Six of the new trials were conducted during the COVID-19 pandemic; two from Mexico, and one each from Denmark, Bangladesh, England, and Norway. We identified four ongoing studies, of which one is completed, but unreported, evaluating masks concurrent with the COVID-19 pandemic.

Many studies were conducted during non-epidemic influenza periods. Several were conducted during the 2009 H1N1 influenza pandemic, and others in epidemic influenza seasons up to 2016. Therefore, many studies were conducted in the context of lower respiratory viral circulation and transmission compared to COVID-19. The included studies were conducted in heterogeneous settings, ranging from suburban schools to hospital wards in high-income countries; crowded inner city settings in low-income countries; and an immigrant neighbourhood in a high-income country. Adherence with interventions was low in many studies.

The risk of bias for the RCTs and cluster-RCTs was mostly high or unclear.

Medical/surgical masks compared to no masks

We included 12 trials (10 cluster-RCTs) comparing medical/surgical masks versus no masks to prevent the spread of viral respiratory illness (two trials with healthcare workers and 10 in the community). Wearing masks in the community probably makes little or no difference to the outcome of influenza-like illness (ILI)/COVID-19 like illness compared to not wearing masks (risk ratio (RR) 0.95, 95% confidence interval (CI) 0.84 to 1.09; 9 trials, 276,917 participants; moderate-certainty evidence. Wearing masks in the community probably makes little or no difference to the outcome of laboratory-confirmed influenza/SARS-CoV-2 compared to not wearing masks (RR 1.01, 95% CI 0.72 to 1.42; 6 trials, 13,919 participants; moderate-certainty evidence). Harms were rarely measured and poorly reported (very low-certainty evidence).

N95/P2 respirators compared to medical/surgical masks

We pooled trials comparing N95/P2 respirators with medical/surgical masks (four in healthcare settings and one in a household setting). We are very uncertain on the effects of N95/P2 respirators compared with medical/surgical masks on the outcome of clinical respiratory illness (RR 0.70, 95% CI 0.45 to 1.10; 3 trials, 7779 participants; very low-certainty evidence). N95/P2 respirators compared with medical/surgical masks may be effective for ILI (RR 0.82, 95% CI 0.66 to 1.03; 5 trials, 8407 participants; low-certainty evidence). Evidence is limited by imprecision and heterogeneity for these subjective outcomes. The use of a N95/P2 respirators compared to medical/surgical masks probably makes little or no difference for the objective and more precise outcome of laboratory-confirmed influenza infection (RR 1.10, 95% CI 0.90 to 1.34; 5 trials, 8407 participants; moderate-certainty evidence). Restricting pooling to healthcare workers made no difference to the overall findings. Harms were poorly measured and reported, but discomfort wearing medical/surgical masks or N95/P2 respirators was mentioned in several studies (very low-certainty evidence).

One previously reported ongoing RCT has now been published and observed that medical/surgical masks were non-inferior to N95 respirators in a large study of 1009 healthcare workers in four countries providing direct care to COVID-19 patients.

Hand hygiene compared to control

Nineteen trials compared hand hygiene interventions with controls with sufficient data to include in meta-analyses. Settings included schools, childcare centres and homes. Comparing hand hygiene interventions with controls (i.e. no intervention), there was a 14% relative reduction in the number of people with ARIs in the hand hygiene group (RR 0.86, 95% CI 0.81 to 0.90; 9 trials, 52,105 participants; moderate-certainty evidence), suggesting a probable benefit. In absolute terms this benefit would result in a reduction from 380 events per 1000 people to 327 per 1000 people (95% CI 308 to 342). When considering the more strictly defined outcomes of ILI and laboratory-confirmed influenza, the estimates of effect for ILI (RR 0.94, 95% CI 0.81 to 1.09; 11 trials, 34,503 participants; low-certainty evidence), and laboratory-confirmed influenza (RR 0.91, 95% CI 0.63 to 1.30; 8 trials, 8332 participants; low-certainty evidence), suggest the intervention made little or no difference. We pooled 19 trials (71, 210 participants) for the composite outcome of ARI or ILI or influenza, with each study only contributing once and the most comprehensive outcome reported. Pooled data showed that hand hygiene may be beneficial with an 11% relative reduction of respiratory illness (RR 0.89, 95% CI 0.83 to 0.94; low-certainty evidence), but with high heterogeneity. In absolute terms this benefit would result in a reduction from 200 events per 1000 people to 178 per 1000 people (95% CI 166 to 188). Few trials measured and reported harms (very low-certainty evidence).

We found no RCTs on gowns and gloves, face shields, or screening at entry ports.

Authors' conclusions

The high risk of bias in the trials, variation in outcome measurement, and relatively low adherence with the interventions during the studies hampers drawing firm conclusions. There were additional RCTs during the pandemic related to physical interventions but a relative paucity given the importance of the question of masking and its relative effectiveness and the concomitant measures of mask adherence which would be highly relevant to the measurement of effectiveness, especially in the elderly and in young children.

There is uncertainty about the effects of face masks. The low to moderate certainty of evidence means our confidence in the effect estimate is limited, and that the true effect may be different from the observed estimate of the effect. The pooled results of RCTs did not show a clear reduction in respiratory viral infection with the use of medical/surgical masks. There were no clear differences between the use

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of medical/surgical masks compared with N95/P2 respirators in healthcare workers when used in routine care to reduce respiratory viral infection. Hand hygiene is likely to modestly reduce the burden of respiratory illness, and although this effect was also present when ILI and laboratory-confirmed influenza were analysed separately, it was not found to be a significant difference for the latter two outcomes. Harms associated with physical interventions were under-investigated.

There is a need for large, well-designed RCTs addressing the effectiveness of many of these interventions in multiple settings and populations, as well as the impact of adherence on effectiveness, especially in those most at risk of ARIs.

PLAIN LANGUAGE SUMMARY

Do physical measures such as hand-washing or wearing masks stop or slow down the spread of respiratory viruses?

Key messages
We are uncertain whether wearing masks or N95/P2 respirators helps to slow the spread of respiratory viruses based on the studies we assessed.

Hand hygiene programmes may help to slow the spread of respiratory viruses.

How do respiratory viruses spread?
Respiratory viruses are viruses that infect the cells in your airways: nose, throat, and lungs. These infections can cause serious problems and affect normal breathing. They can cause flu (influenza), severe acute respiratory syndrome (SARS), and COVID-19.

People infected with a respiratory virus spread virus particles into the air when they cough or sneeze. Other people become infected if they come into contact with these virus particles in the air or on surfaces on which they land. Respiratory viruses can spread quickly through a community, through populations and countries (causing epidemics), and around the world (causing pandemics).

Physical measures to try to prevent respiratory viruses spreading between people include:

· washing hands often;

· not touching your eyes, nose, or mouth;

· sneezing or coughing into your elbow;

· wiping surfaces with disinfectant;

· wearing masks, eye protection, gloves, and protective gowns;

· avoiding contact with other people (isolation or quarantine);

· keeping a certain distance away from other people (distancing); and

· examining people entering a country for signs of infection (screening).

What did we want to find out?
We wanted to find out whether physical measures stop or slow the spread of respiratory viruses from well-controlled studies in which one intervention is compared to another, known as randomised controlled trials.

What did we do?
We searched for randomised controlled studies that looked at physical measures to stop people acquiring a respiratory virus infection.

We were interested in how many people in the studies caught a respiratory virus infection, and whether the physical measures had any unwanted effects.

What did we find?
We identified 78 relevant studies. They took place in low-, middle-, and high-income countries worldwide: in hospitals, schools, homes, offices, childcare centres, and communities during non-epidemic influenza periods, the global H1N1 influenza pandemic in 2009, epidemic influenza seasons up to 2016, and during the COVID-19 pandemic. We identified five ongoing, unpublished studies; two of them evaluate masks in COVID-19. Five trials were funded by government and pharmaceutical companies, and nine trials were funded by pharmaceutical companies.

No studies looked at face shields, gowns and gloves, or screening people when they entered a country.

We assessed the effects of:

· medical or surgical masks;

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· N95/P2 respirators (close-fitting masks that filter the air breathed in, more commonly used by healthcare workers than the general public); and

· hand hygiene (hand-washing and using hand sanitiser).

We obtained the following results:

Medical or surgical masks

Ten studies took place in the community, and two studies in healthcare workers. Compared with wearing no mask in the community studies only, wearing a mask may make little to no difference in how many people caught a flu-like illness/COVID-like illness (9 studies; 276,917 people); and probably makes little or no difference in how many people have flu/COVID confirmed by a laboratory test (6 studies; 13,919 people). Unwanted effects were rarely reported; discomfort was mentioned.

N95/P2 respirators

Four studies were in healthcare workers, and one small study was in the community. Compared with wearing medical or surgical masks, wearing N95/P2 respirators probably makes little to no difference in how many people have confirmed flu (5 studies; 8407 people); and may make little to no difference in how many people catch a flu-like illness (5 studies; 8407 people), or respiratory illness (3 studies; 7799 people). Unwanted effects were not well-reported; discomfort was mentioned.

Hand hygiene

Following a hand hygiene programme may reduce the number of people who catch a respiratory or flu-like illness, or have confirmed flu, compared with people not following such a programme (19 studies; 71,210 people), although this effect was not confirmed as statistically significant reduction when ILI and laboratory-confirmed ILI were analysed separately. Few studies measured unwanted effects; skin irritation in people using hand sanitiser was mentioned.

What are the limitations of the evidence?
Our confidence in these results is generally low to moderate for the subjective outcomes related to respiratory illness, but moderate for the more precisely defined laboratory-confirmed respiratory virus infection, related to masks and N95/P2 respirators. The results might change when further evidence becomes available. Relatively low numbers of people followed the guidance about wearing masks or about hand hygiene, which may have affected the results of the studies.

How up to date is this evidence?
We included evidence published up to October 2022.

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SUMMARY OF FINDINGS

Summary of findings 1. Medical/surgical masks compared to no masks for preventing the spread of viral respiratory illness

Randomised studies: medical/surgical masks compared to no masks for preventing the spread of viral respiratory illness

Patient or population: general population
Setting: community and hospitals
Intervention: medical/surgical masks
Comparison: no masks

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with no masks	Risk with randomised studies: masks				
Viral respiratory illness - influenza/COVID-like illness	Study population		RR 0.95 (0.84 to 1.09)	276,917 (9 RCTs)	⊕⊕⊕⊖ Moderate[a]	
	160 per 1000	152 per 1000 (134 to 174)				
Viral respiratory illness - laboratory-confirmed influenza/SARS-CoV-2	Study population		RR 1.01 (0.72 to 1.42)	13,919 (6 RCTs)	⊕⊕⊕⊖ Moderate[b]	
	40 per 1000	40 per 1000 (29 to 57)				
Adverse events	-		-	(3 RCTs)	⊕⊖⊖⊖ Very low[a,c]	Adverse events were not reported consistently and could not be meta-analysed. Adverse events reported for masks included warmth, discomfort, respiratory difficulties, humidity, pain, and shortness of breath, in up to 45% of participants.

***The risk in the intervention group** (and its 95% confidence interval) is based on the median observed risk in the comparison group of included studies and the **relative effect** of the intervention (and its 95% CI).
CI: confidence interval; **RCT:** randomised controlled trial; **RR:** risk ratio

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.

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Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

[a]Downgraded one level for study limitations (lack of blinding).
[b]Downgraded one level for imprecision (wide confidence intervals).
[c]Downgraded two levels for imprecision (only three studies enumerated adverse events; another study mentioned no adverse events).

Summary of findings 2. N95 respirators compared to medical/surgical masks for preventing the spread of viral respiratory illness

Randomised studies: N95 respirators compared to medical/surgical masks for preventing the spread of viral respiratory illness

Patient or population: general population and healthcare workers
Setting: hospitals and households
Intervention: N95 masks
Comparison: medical/surgical masks

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with medical masks	Risk with randomised studies: N95				
Viral respiratory illness - clinical respiratory illness	Study population		RR 0.70 (0.45 to 1.10)	7799 (3 RCTs)	⊕⊝⊝⊝ Very Low[a,b,c]	All studies were conducted in hospital settings with healthcare workers.
	120 per 1000	84 per 1000 (54 to 132)				
Viral respiratory illness - influenza-like illness	Study population		RR 0.82 (0.66 to 1.03)	8407 (5 RCTs)	⊕⊕⊝⊝ Low[a,b]	1 study was conducted in households (MacIntyre 2009).
	50 per 1000	41 per 1000 (33 to 52)				
Viral respiratory illness - laboratory-confirmed influenza	Study population		RR 1.10 (0.90 to 1.34)	8407 (5 RCTs)	⊕⊕⊕⊝ Moderate[b]	1 study was conducted in households (MacIntyre 2009).
	70 per 1000	77 per 1000 (63 to 94)				
Adverse events	-		-	(5 RCTs)	⊕⊝⊝⊝ Very Low[a,b,c]	There was insufficient consistent reporting of adverse events to enable meta-analysis. Only 1 study reported detailed adverse events: discomfort was reported in 41.9% of N95 wearers versus 9.8% of medical mask wearers ($P < 0.001$); headaches

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were more common with N95 (13.4% versus 3.9%; P < 0.001); difficulty breathing was reported more often in the N95 group (19.4% versus 12.5%; P = 0.01); and N95 caused more problems with pressure on the nose (52.2% versus 11.0%; P < 0.001). 4 RCTs either reported no adverse events or only reported on comfort wearing masks.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the median risk in the comparison group and the observed **relative effect** of the intervention (and its 95% CI).
CI: confidence interval; **RCT:** randomised controlled trial; **RR:** risk ratio

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

[a]Downgraded one level for study limitations (lack of blinding).
[b]Downgraded one level for imprecision (wide confidence interval or no meta-analysis conducted).
[c]Downgraded one level for inconsistency of results (heterogeneity).

Summary of findings 3. Hand hygiene compared to control for preventing the spread of viral respiratory illness

Hand hygiene compared to control for preventing the spread of viral respiratory illness

Patient or population: general population and healthcare workers
Setting: schools, childcare centres, homes, offices, nursing homes
Intervention: hand hygiene
Comparison: control

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with control	Risk with hand hygiene				
Acute respiratory illness	Study population		RR 0.86 (0.81 to 0.90)	52,105 (9 RCTs)	⊕⊕⊕⊖ Moderate[d]	
	380 per 1000	327 per 1000 (308 to 342)				

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Influenza-like illness	Study population		RR 0.94 (0.81 to 1.09)	34,503 (11 RCTs)	⊕⊕⊖⊖ Low[a,b]	
	90 per 1000	85 per 1000 (73 to 98)				
Laboratory-confirmed influenza	Study population		RR 0.91 (0.63 to 1.30)	8332 (8 RCTs)	⊕⊕⊖⊖ Low[b,c]	
	80 per 1000	73 per 1000 (50 to 104)				
Composite of acute respiratory illness, influenza-like illness, laboratory-confirmed influenza	Study population		RR 0.89 (0.83 to 0.94)	71,210 (19 RCTs)	⊕⊕⊖⊖ Low[a,b]	
	200 per 1000	178 per 1000 (166 to 188)				
Adverse events	-		-	(2 RCTs)	⊕⊖⊖⊖ Very low[a,b,c]	Data were insufficient to conduct meta-analysis. 1 study reported that no adverse events were observed, and another study reported that skin reaction was recorded for 10.4% of participants in the hand sanitiser group versus 10.3% in the control group.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the median observed risk in the comparison groups of included studies and the __relative effect__ of the intervention (and its 95% CI).
CI: confidence interval; **RCT:** randomised controlled trial; **RR:** risk ratio

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

[a]Downgraded one level for study limitation (majority of studies were unblinded, with participant-assessed outcome).
[b]Downgraded one level for inconsistent results across studies.
[c]Downgraded one level for imprecision (wide confidence interval or no meta-analysis conducted).

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BACKGROUND

Description of the condition

Epidemic and pandemic viral infections pose a serious threat to people worldwide. Epidemics of note include severe acute respiratory syndrome (SARS) in 2003 and the Middle East respiratory syndrome (MERS), which began in 2012, and the current SARS-CoV-2 pandemic. Major pandemics include the H1N1 influenza caused by the H1N1pdm09 virus in 2009 and the coronavirus disease 2019 (COVID-19) caused by SARS-CoV-2.

Even non-epidemic acute respiratory infections (ARIs) place a huge burden on healthcare systems around the world, and are a prominent cause of morbidity (WHO 2017). Furthermore, ARIs are often antecedents to lower respiratory tract infections (RTIs) caused by bacterial pathogens (i.e. pneumonia), which cause millions of deaths worldwide, mostly in low-income countries (Schwartz 2018).

High viral load, high levels of transmissibility, susceptible populations, and symptomatic patients are considered to be the drivers of such epidemics and pandemics (Jefferson 2006a). Preventing the spread of respiratory viruses from person to person may be effective at reducing the spread of outbreaks.

Physical interventions, such as the use of masks and physical distancing measures, might prevent the spread of respiratory viruses which are considered to be transmitted by multiple modes of transmission including by respiratory particles of varying sizes spreading from infected to susceptible people and through direct and indirect contact (Kutter 2018; Leung 2021). It is recognised that there is a continuum of respiratory particle sizes varying between large droplet to fine aerosols, which is an important concept. Particles of a variety of sizes may be expelled from the human airway during coughing, sneezing, singing, talking, and during certain medical procedures (WHO 2021). In addition, transmission of respiratory viruses is likely highly complex, dependent on multiple host, virus and environmental factors, plus the myriad of interactions between these factors, which may influence the predominant modes of transmission in any given setting (Broderick 2008; Hendley 1988; Kutter 2018; Leung 2021). Current evidence suggests that the virus responsible for the current COVID-19 pandemic spreads mainly between people who are in close contact with each other (Onakpoya 2022a).

It is also unknown if all respiratory viruses or different strains of a specific respiratory virus transmit in a similar manner, further adding to the complexity of respiratory virus transmission.

Description of the intervention

Single measures of intervention such as the use of vaccines or antivirals, may be insufficient to contain the spread of influenza, but combinations of interventions may reduce the reproduction number to below 1 (Demicheli 2018a; Demicheli 2018b; Jefferson 2014; Jefferson 2018; Thomas 2010). When the reproduction number (or R0) is below 1, each infection causes less than one new secondary infection and the disease will eventually die out. For some respiratory viruses there are no licensed interventions, and a combination of social and physical interventions may be the only option to reduce the spread of outbreaks, particularly those that may be capable of becoming epidemic or pandemic in nature (Luby 2005). Such interventions were emphasised in the World Health Organization's latest Global Influenza Strategy 2019 to 2030, and have several possible advantages over other methods of suppressing ARI outbreaks since they may be instituted rapidly and may be independent of any specific type of infective agent, including novel viruses. In addition, the possible effectiveness of public health measures during the Spanish flu pandemic of 1918 to 1919 in US cities supports the impetus to investigate the existing evidence on the effectiveness of such interventions (Bootsma 2007), including quarantine (such as isolation, physical distancing) and the use of disinfectants. We also considered the major societal implications for any community adopting these measures (CDC 2005a; CDC 2005b; WHO 2006b; WHO 2020a; WHO 2020b).

How the intervention might work

Epidemics and pandemics are more likely during antigenic change (changes in the viral composition) in the virus or transmission from animals (domestic or wild) when there is no natural human immunity (Bonn 1997). High viral load, high levels of transmissibility, and symptomatic patients are considered to be the drivers of such epidemics and pandemics (Jefferson 2006b).

Physical interventions, such as the use of masks (Greenhalgh 2020; Howard 2020), physical distancing measures, school closures, and limitations of mass gatherings, might prevent the spread of the virus transmitted by infectious respiratory particles from infected to susceptible individuals. The use of hand hygiene, gloves, and protective gowns can also prevent the spread by limiting the transfer of viral particles onto and from fomites (inanimate objects such as flat surfaces, tabletops, utensils, porous surfaces, or nowadays cell phones, which can transmit the agent if contaminated) (Onakpoya 2022b). Such public health measures were widely adopted during the Spanish flu pandemic and have been the source of considerable debate (Bootsma 2007).

Why it is important to do this review

Although the benefits of physical interventions seem self-evident, given the global importance of interrupting respiratory virus transmission, having up-to-date estimates of their effectiveness is necessary to inform planning, decision-making, and policy. The continuance of outbreaks of COVID-19 and the reporting of several new trials assessing different barrier interventions in preventing the spread of SARS-COV-2 virus, have prompted this update (WHO 2022). Physical methods have several possible advantages over other methods of suppressing ARI outbreaks, including their rapid deployment and ability to be independent of the infective agent, including novel viruses.

The hallmark of the 2020 update was shifting from including all types of studies to a focus on randomised controlled trials (RCTs) only, which had substantially increased in number. This change enabled more robust evidence summaries from high-quality studies, which are much less prone to the risk of the multiple biases associated with observational studies, to help policy and decision makers in making national and global recommendations. The 2020 update identified 67 relevant studies, but none were carried out during the COVID-19 pandemic (Jefferson 2020). The three key messages of that update were: (1) hand hygiene programmes may help to slow the spread of respiratory viruses; (2) uncertainty whether wearing masks or N95/P2 respirators would help in slowing the spread of respiratory viruses; and (3) few studies were identified for other interventions. One study looked

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at quarantine, and none looked at eye protection, gowns and gloves, or screening people when they entered a country. However, during the last search of the 2020 update, six ongoing, unpublished studies were identified; three of them evaluate masks in COVID-19. The review authors are aware that several trials have now been published since the publication of the 2020 update, warranting this new update.

This is the fifth update (Jefferson 2009; Jefferson 2010; Jefferson 2011; Jefferson 2020) of a Cochrane Review first published in 2007 (Jefferson 2007).

OBJECTIVES

To assess the effectiveness of physical interventions to interrupt or reduce the spread of acute respiratory viruses.

METHODS

Criteria for considering studies for this review

Types of studies

For this 2022 update we only considered individual-level randomised controlled trials (RCTs), or cluster-RCTs, or quasi-RCTs for inclusion.

In versions of this review prior to 2020 we also included observational studies (cohorts, case-controls, before-after, and time series studies). However, for this update there were sufficient randomised studies to address our study aims, so we excluded observational studies because randomisation is the optimal method to prevent systematic differences between participants in different intervention groups and, further, deciding who receives an intervention and who does not is influenced by many factors, including prognostic factors (Higgins 2011). This point is particularly relevant here because individuals who chose to implement physical interventions are likely to use multiple interventions, thus making it difficult to separate out the effect of single interventions. Further, they are likely to be different from individuals who do not implement physical interventions in ways that are difficult to measure.

Types of participants

People of all ages.

Types of interventions

We included RCTs and cluster-RCTs of trials investigating physical interventions or combinations of interventions to prevent respiratory virus transmission compared with doing nothing or with other interventions. The interventions of interest included: screening at entry ports, isolation, quarantine, physical distancing, personal protection (clothing, gloves, devices), hand hygiene, face masks, gargling, nasal washes, eye protective devices, face shields, disinfecting, and school closure.

Types of outcome measures

For the outcomes listed below we had no predetermined key time points of interest or adverse events of special interest, however, methods of assessment of cases of viral respiratory illness based on laboratory-confirmation needed to be based on an accurate test in combination with critical additional information. For example, a polymerase chain reaction (PCR) test in combination with symptoms of disease, or a serological test at baseline as well as at the end of follow-up were acceptable methods. Further, we stratified analyses by study-specific definitions for cases of viral respiratory illness which included a broad definition of acute respiratory infection (ARI), a more specific definition of influenza-like-illness (ILI), and the most precise definition of a laboratory-confirmed respiratory infection that identified the actual viral pathogen. For the studies conducted during the COVID-19 pandemic, we assumed that COVID-like illness was interchangeable with ILI. In the case of laboratory-confirmed respiratory infection we separated out SARS-CoV-2/influenza and other viral pathogens. We did not pool these outcomes as it cannot be assumed that the effects of physical interventions will be the same for the different viral pathogens. The one exception was for the comparison of hand-hygiene versus control where the estimated effects for ARI, ILI and laboratory-confirmed infection were highly consistent.

Primary outcomes

1. Numbers of cases of viral respiratory illness (including acute respiratory infections (ARI), influenza-like illness (ILI), COVID-like illness and laboratory-confirmed influenza, SARS-CoV-2 or other viral pathogens).
2. Adverse events related to the intervention.

Secondary outcomes

1. Deaths.
2. Severity of viral respiratory illness as reported in the studies.
3. Absenteeism.
4. Hospital admissions.
5. Complications related to the illness, e.g. pneumonia.

Search methods for identification of studies

Electronic searches

For this 2022 update, we refined the original search strategy using a combination of previously included studies and automation tools (Clark 2020). We converted this search using the Polyglot Search Translator (Clark 2020), and ran the searches in the following databases:

1. the Cochrane Central Register of Controlled Trials (CENTRAL) (2022, Issue 09), which includes the Acute Respiratory Infections Group's Specialised Register (searched 04 October 2022) (Appendix 1);
2. PubMed (01 January 2020 to 04 October 2022) (Appendix 2);
3. Embase (01 January 2020 to 04 October 2022) (Appendix 3);
4. CINAHL (Cumulative Index to Nursing and Allied Health Literature) (01 January 2020 to 04 October) (Appendix 4);
5. US National Institutes of Health Ongoing Trials Register ClinicalTrials.gov (January 2010 to 04 October 2022); and
6. World Health Organization International Clinical Trials Registry Platform (January 2010 to 04 October 2022).

We combined the database searches with the Cochrane Highly Sensitive Search Strategy for identifying randomised trials in MEDLINE: sensitivity- and precision-maximising version (2008 revision) (Lefebvre 2011). Details of previous searches are available in Appendix 5.

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Searching other resources

We conducted a backwards-and-forwards citation analysis in Scopus on all newly included studies to identify other potentially relevant studies.

Data collection and analysis

Selection of studies

The search and citation analysis results were initially screened via the RobotSearch tool (Marshall 2018) to exclude all studies that were obviously not RCTs. We scanned the titles and abstracts of studies identified by the searches. We obtained the full-text articles of studies that either appeared to meet our eligibility criteria or for which there was insufficient information to exclude it. We then used a standardised form to assess the eligibility of each study based on the full article.

Data extraction and management

Five review authors (LA/GB/EF/EB/TOJ) independently applied the inclusion criteria to all identified and retrieved articles, and extracted data using a standard template that had been developed for and applied to previous versions of the review, but was revised to reflect our focus on RCTs and cluster-RCTs for this update. We resolved any disagreements through discussion with either PG or JMC acting as arbiter. We extracted and reported descriptions of interventions using the Template for Intervention Description and Replication (TIDieR) template (Table 1).

Assessment of risk of bias in included studies

Four review authors (EF/EB/GB/MJ) independently assessed risk of bias for the method of random sequence generation and allocation concealment (selection bias), blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias), outcome reporting (attrition bias), and selective reporting (reporting bias). In addition, for the cluster trials, we assessed selection bias due to how recruitment of participants was conducted. Participants should be identified before the cluster is randomised or, if not, recruitment should be by someone masked to the cluster allocation. Further, we considered whether there were sufficient numbers of clusters in each treatment group to ensure comparable groups, and excluded one study from the analysis due to insufficient number of clusters. We used the Cochrane risk of bias tool to assess risk of bias, classifying each risk of bias domain as 'low', 'high', or 'unclear'. The following were indications for low risk of bias:

1. method of random sequence generation: the method was well-described and is likely to produce balanced and truly random groups;
2. allocation concealment: the next treatment allocation was not known to participant/cluster or treating staff until after consent to join the study;
3. blinding of participants and personnel: the method is likely to maintain blinding throughout the study;
4. blinding of outcome assessors: all outcome assessors were unaware of treatment allocation;
5. outcome reporting: participant attrition throughout the study is reported, and reasons for loss are appropriately described; and
6. selective reporting: all likely planned and collected outcomes have been reported.

Measures of treatment effect

When possible, we performed meta-analysis and summarised effectiveness as risk ratio (RR) using 95% confidence intervals (CIs). For studies that could not be pooled, we used the effect measures reported by the trial authors (such as RR or incidence rate ratio (IRR) with 95% CI or, when these were not available, relevant P values). Where multiple analyses were reported on the same outcome we chose the analysis based on preferences for: (1) an adjusted analysis (over an unadjusted analysis), and (2) an analysis based on a longer follow-up period, or a greater number of outcomes events.

Unit of analysis issues

Many of the included studies were cluster-RCTs. To avoid any unit of analysis issues, we only included treatment effect estimates that were based on methods that were appropriate for the analysis of cluster trials, such as mixed models and generalised estimating equations. Given this restriction, we used the generalised inverse-variance method of meta-analysis. Some cluster-RCTs that did not report cluster-adjusted treatment effects provided sufficient data (number of events and participants by treatment group and intraclass correlations) for us to calculate appropriate treatment effect estimates and standard errors using the methods described in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2021a). For studies with multiple treatment groups but only one control group, where appropriate, we adjusted standard errors upwards to avoid unit of analysis errors in the meta-analyses. We did this by splitting the control group into equal sized groups and adjusting standard errors upwards to account for the reduced sample size of the control subgroups (Higgins 2021b).

Dealing with missing data

Previously, whenever details of studies were unclear, or studies were only known to us by abstracts or communications at meetings, we corresponded with first or corresponding authors. For this 2022 review, we did not contact authors of studies.

Assessment of heterogeneity

Aggregation of data was dependent on types of comparisons, sensitivity and homogeneity of definitions of exposure, populations and outcomes used. We calculated the I^2statistic and Chi^2 test for each pooled estimate to assess the presence of statistical heterogeneity (Higgins 2002; Higgins 2003).

Assessment of reporting biases

Given the widely disparate nature of our evidence base, we limited our assessment of possible reporting biases to funnel plot visual inspection if we had > 10 included studies for any single meta-analysis.

Data synthesis

If possible and appropriate, we combined studies in a meta-analysis. We used the generalised inverse-variance random-effects model where cluster-RCTs were included in the analysis. We chose the random-effects model because we expected clinical heterogeneity due to differences in pooled interventions and outcome definitions, and methodological heterogeneity due to pooling of RCTs and cluster-RCTs.

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Subgroup analysis and investigation of heterogeneity

We conducted one post hoc subgroup analyses of adults (18 years +) versus children (0 to 18 years) for the comparison of hand hygiene versus control.

We did not conduct further investigation of heterogeneity due to insufficient numbers of studies included in the comparisons.

Sensitivity analysis

We conducted a sensitivity analysis for hand hygiene versus control where we included the most precise and unequivocal measure of viral respiratory illness reported for each included study.

Summary of findings and assessment of the certainty of the evidence

We created three summary of findings tables using the following outcomes: numbers of cases of viral respiratory illness (including ARIs, ILI, COVID-like illness and laboratory-confirmed influenza/SARS-CoV-2 or other respiratory viruses), and adverse events related to the intervention (Summary of findings 1; Summary of findings 2; Summary of findings 3). We planned to include the secondary outcomes of deaths; severity of viral respiratory illness as reported in the studies; absenteeism; hospital admissions; and complications related to the illness (e.g. pneumonia). However, these data were poorly reported in the included studies. We used the five GRADE considerations (study limitations, consistency of effect, imprecision, indirectness, and publication bias) to assess the certainty of evidence as it related to the studies which contributed data to the meta-analyses for the prespecified outcomes (Atkins 2004). We used the methods and recommendations described in Section 8.5 and Chapter 12 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011), employing GRADEpro GDT software (GRADEpro GDT). We justified all decisions to down- or upgrade the certainty of the evidence in footnotes, and made comments to aid the reader's understanding of the review where necessary.

RESULTS

Description of studies

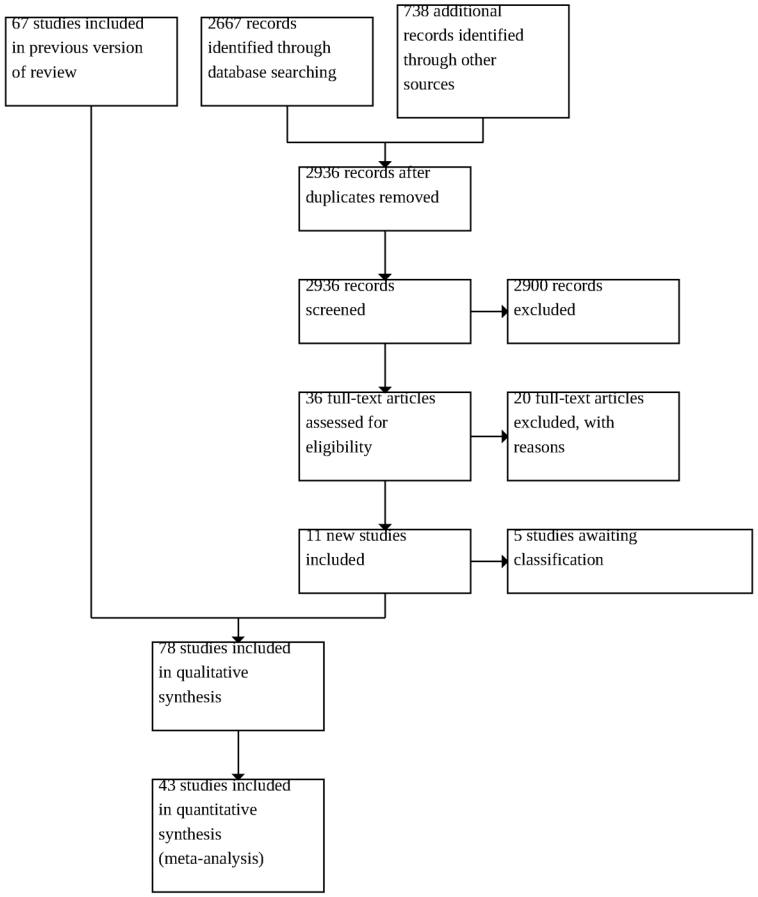
See Characteristics of included studies and Characteristics of excluded studies tables. Five trials were funded by government and pharmaceutical companies (Aiello 2010; Aiello 2012; Chard 2019; Yeung 2011; Zomer 2015), and nine trials were funded by pharmaceutical companies (Arbogast 2016; Carabin 1999; Luby 2005; Nicholson 2014; Sandora 2005; Sandora 2008; Turner 2004a; Turner 2004b; Turner 2012).

Results of the search

For this 2022 update we found 2667 records through database and trial registry searching, as well as 738 record through citation searching. After removing duplicates we had 2936 records that underwent title and abstract screening.
We identified a total of 202 titles in this 2022 update. We excluded 180 titles and retrieved the full papers of 35 studies, to include 11 new studies. See Figure 1.

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Figure 1. Study flow diagram.



Included studies

In this 2022 update we included 11 new studies (610,872 participants); randomised controlled trials (RCTs) (n = 5) or cluster-RCTs (n = 6) published between 2020 and 2022. In total 78 studies are included in this review update. For detailed descriptions of the interventions of the included studies, see Table 1.

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Eighteen trials focused on using masks (Abaluck 2022; Aiello 2010; Aiello 2012; Alfelali 2020; Barasheed 2014; Bundgaard 2021; Canini 2010; Cowling 2008; Ide 2016; Jacobs 2009; Loeb 2009; MacIntyre 2009; MacIntyre 2011; MacIntyre 2013; MacIntyre 2015; MacIntyre 2016; Radonovich 2019; Suess 2012). Thirteen of the 18 trials compared medical/surgical masks to no mask (control) (Abaluck 2022; Aiello 2010; Aiello 2012; Alfelali 2020; Barasheed 2014; Bundgaard 2021; Canini 2010; Cowling 2008; Jacobs 2009; MacIntyre 2009; MacIntyre 2015; MacIntyre 2016; Suess 2012). One study compared catechin-treated masks to no mask (Ide 2016), and one study included cloth masks versus control (third arm in MacIntyre 2015). Three of the 18 trials were in healthcare workers (Ide 2016; Jacobs 2009; MacIntyre 2015), whilst the remaining trials were in non-healthcare workers (students, households, families, or pilgrims). Only one trial was conducted during the H1N1 pandemic season (Suess 2012), and two trials were conducted during the SARS-CoV-2 pandemic (Abaluck 2022; Bundgaard 2021).

Five of the 18 trials compared N95 masks or P2 masks to medical/surgical masks (Loeb 2009; MacIntyre 2009; MacIntyre 2011; MacIntyre 2013; Radonovich 2019). All of these trials, except for one study that was conducted on household individuals (MacIntyre 2009), included healthcare workers either in a hospital setting, Loeb 2009; MacIntyre 2011; MacIntyre 2013, or an outpatient setting (MacIntyre 2009; Radonovich 2019).

One trial evaluated the effectiveness of quarantining workers of one of two sibling companies in Japan whose family members had developed an influenza-like illness (ILI) during the 2009 to 2010 H1N1 influenza pandemic (Miyaki 2011). Another trial conducted during the SARS-CoV-2 pandemic in Norway investigated fitness centre access with physical distancing compared to no access (Helsingen 2021); and one cluster trial compared daily testing for contacts of individuals with SARS-CoV-2 compared to self-isolation at home in English secondary schools (Young 2021).

Nineteen trials compared hand hygiene interventions with no hand hygiene (control) and provided data suitable for meta-analysis. The populations in these trials included adults, children, and families, in settings such as schools (Biswas 2019; Stebbins 2011), childcare centres (Azor-Martinez 2018; Correa 2012; Roberts 2000; Zomer 2015), homes/households (Cowling 2008; Cowling 2009; Larson 2010; Little 2015; Nicholson 2014; Ram 2015; Sandora 2005; Simmerman 2011), offices (Hubner 2010), military trainees (Millar 2016), villages (Ashraf 2020; Swarthout 2020), and nursing homes (Teesing 2021). None of the trials were conducted during a pandemic, although some of the studies were conducted during peak influenza seasons.

A further 10 trials that compared a variety of hand hygiene modalities to control provided insufficient information to include in meta-analyses. Three trials were in children: one was conducted in daycare centres in Denmark examining a multimodal hygiene programme (Ladegaard 1999), and two trials compared a hand hygiene campaign or workshop in an elementary school environment in Saudi Arabia, Alzaher 2018, and Egypt, Talaat 2011. Three trials tested virucidal hand treatment in an experimental setting, Gwaltney 1980; Turner 2004a, and in a community, Turner 2012, in the USA. Feldman 2016 compared hand-washing with chlorhexidine gluconate amongst Israeli sailors. One trial compared hand sanitiser packaged in a multimodal hygiene programme amongst office employees in the USA (Arbogast 2016). Two trials were conducted in a long-term facility setting: one trial examined the effect of a bundled hand hygiene programme on infectious risk in nursing home residents in France (Temime 2018), and the other trial compared the effect of using hand sanitisers in healthcare workers on the rate of infections (including respiratory infections) in nursing home residents in Hong Kong (Yeung 2011).

Five trials compared different hand hygiene interventions in a variety of settings such as schools (Morton 2004, in kindergartens and elementary schools in the USA; Priest 2014, in primary schools in New Zealand; and Pandejpong 2012 in kindergartens in Thailand). One study was conducted in low-income neighbourhoods in Karachi, Pakistan (Luby 2005), and one was conducted in a workplace environment in Finland (Savolainen-Kopra 2012). A variety of interventions were used across these trials such as soap and water (Luby 2005; Savolainen-Kopra 2012), hand sanitiser (Morton 2004; Pandejpong 2012; Priest 2014; Savolainen-Kopra 2012), body wash (Luby 2005), and alcohol-based hand wipes (Morton 2004), with or without additional hygiene education. There was considerable variation in interventions, and the information in the trial reports was insufficient to permit meta-analysis.

Seven trials compared a combined intervention of hand hygiene and face masks with control. Four of these trials were carried out in households in Germany (Suess 2012), Thailand (Simmerman 2011), Hispanic immigrant communities in the USA (Larson 2010), and households in Hong Kong (Cowling 2009). Two trials were conducted amongst university student residences (Aiello 2010; Aiello 2012), and two trials in groups of pilgrims at the annual Hajj (Aelami 2015; Alfelali 2020). Moreover, six trials evaluated the incremental benefit of combining surgical masks in addition to hand hygiene with soap (Simmerman 2011), hand sanitiser (Aiello 2010; Aiello 2012; Larson 2010; Suess 2012), or both (Cowling 2009), versus mask or hand hygiene alone on the outcomes of ILI and influenza. Aelami 2015 investigated a hygienic package (alcohol-based hand rub (gel or spray), surgical masks, soap, and paper handkerchiefs) with a control group.

Seven trials compared a multimodal combination of hand hygiene and disinfection of surfaces, toys, linen, or other components of the environment with a control (Ban 2015; Carabin 1999; Ibfelt 2015; Kotch 1994; McConeghy 2017; Sandora 2008; White 2001). Variation in scope and type of interventions and insufficient data in trial reports precluded meta-analysis. All studies except for one were in children (McConeghy 2017), which was in a nursing home population).

Three trials included in two papers investigated the role of virucidal tissues in interrupting transmission of naturally occurring respiratory infections in households (Farr 1988a; Farr 1988b; Longini 1988). Four cluster-RCTs implemented complex, multimodal sanitation, education, cooking, and hygiene interventions (Chard 2019; Hartinger 2016; Huda 2012; Najnin 2019). All four of these trials were conducted in low-income countries in settings with minimal to no access to basic sanitation.

Three trials assessed the effect of gargling on the incidence of upper respiratory tract infections (URTIs) or influenza: gargling with povidone-iodine (Satomura 2005), green tea (Ide 2014), and tap water (Goodall 2014). Two trials investigated the use of mouth/nasal washes on the incidence of SARS-CoV-2 infection in healthcare workers during the COVID-19 pandemic (Almanza-Reyes 2021; Gutiérrez-García 2022). One trial investigated the use of glasses against the transmission of SARS-CoV-2 (Fretheim 2022a).

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Ongoing studies

We identified four ongoing studies during the course of the COVID-19 pandemic, of which one is completed, but unreported (NCT04471766). The trials evaluated masks concurrent with the COVID-19 pandemic. Three trials on other interventions are ongoing (Brass 2021; NCT03454009; NCT04267952).

Studies awaiting classification

We identified five studies awaiting classification (Contreras 2022; Croke 2022; Delaguerre 2022; Loeb 2022; Varela 2022).

A previous RCT (NCT04296643) reported as ongoing in the last version has now been recently published but was not able to be included in the summary of findings pooled results (Loeb 2022). In a multicentre, randomised non-inferiority trial of 1009 healthcare workers (HCWs) across four countries randomised to medical mask versus fit-tested N95 respirators for direct care of COVID-19 patients or long-term care residents, laboratory-confirmed SARS-CoV-2 was found in 10.46% (52/497) versus 9.27% (47/507) in the medical/surgical mask group and fit-tested N95 respirator group (hazard ratio 1.14 (95% CI 0.77 to 1.69), respectively. There was a 1.19% absolute increase in risk of COVID-19 with medical masks versus N95 respirator 95% CI (-2.5% to 4.9%). There were 47 (10.8%) adverse events related to the intervention reported in the medical mask group and 59 (13.6%) in the N95 respirator group. The use of medical masks was found to be non-inferior to N95 respirators in the direct care of COVID-19 patients and the study crossed over into the more transmissible Omicron variant period of the COVID-19 pandemic.

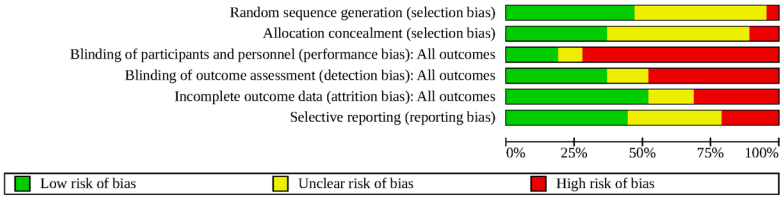
Excluded studies

We excluded a total of 180 studies. We identified 20 new studies for exclusion at the data extraction stage of this 2022 update, all of which appeared to be eligible at screening. Five of the 20 studies were ineligible due to evaluating treatments for patients with disease (Cyril Vitug 2021; Ferrer 2021; Meister 2022; Sanchez Barrueco 2022; Sevinc Gul 2022), two were excluded because they did not assess clinical outcomes (Costa 2021; Seneviratne 2021), four were excluded due to not assessing viral outcomes (Gharebaghi 2020; Giuliano 2021; Karakaya 2021; Kawyannejad 2020), five were excluded as they were experiments that did not measure any of our outcomes of interest (Ahmadian 2022; Dalakoti 2022; Egger 2022; Malaczek 2022; Montero-Vilchez 2022); three were excluded because they were not RCTs (Chen 2022; Lim 2022; Mo 2022), and one was excluded as it was a report of another study (Munoz-Basagoiti 2022).

Risk of bias in included studies

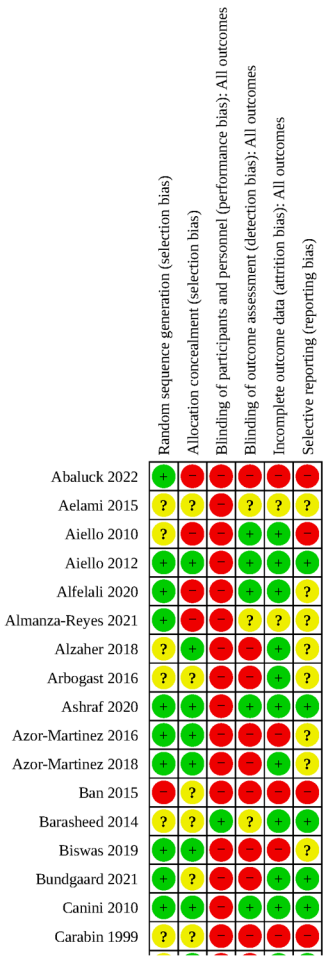
The overall risk of bias is presented graphically in Figure 2 and summarised by included study in Figure 3. Details on the judgements can be found in the descriptions of individual included studies (Characteristics of included studies table). Out of 78 included studies, only two were rated as low risk of bias for all domains. One of those studies compared two different types of masks (Radonovich 2019), and the other compared hand sanitiser to no treatment (Turner 2012). Notably, neither of these two studies was blinded, however, trial procedures were sufficiently robust that the risk of performance bias was low. Overall,approximately only 20% of the studies were rated as low risk of performance bias. This risk of bias domain was particularly problematic because most interventions studied could not be blinded from participants and/or investigators. The two risks of bias domains that were rated the least problematic were attrition bias and random sequence generation where around 50% of studies were rated as low risk of bias. Allocation concealment, blinded outcome assessment and selective reporting were rated as low risk of bias for around 40% of the included studies. Many of the included studies were cluster-RCTs where the randomisation process was not well reported leading to ratings of unclear risk of bias.

Figure 2. 'Risk of bias' graph: review authors' judgements about each risk of bias item presented as percentages across all included trials.



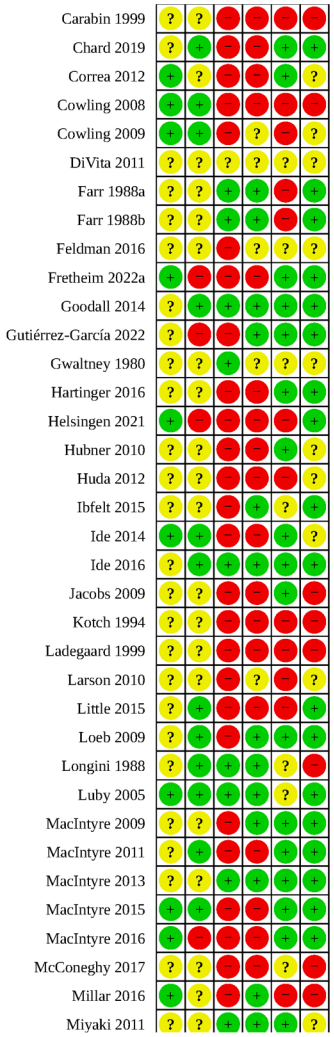
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Figure 3. 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included trial.



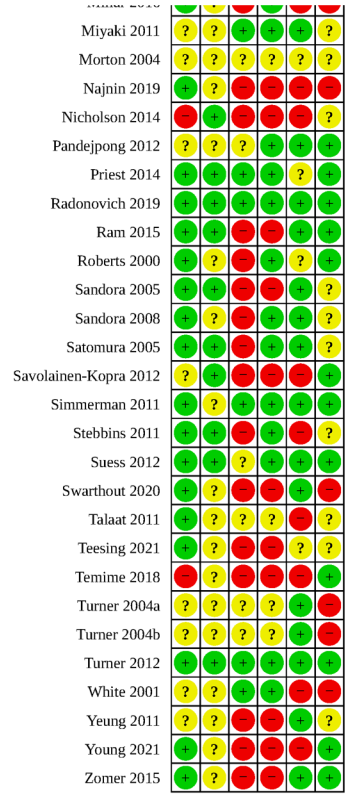
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Figure 3. (Continued)



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Figure 3. (Continued)



Allocation

For this 2022 review, 10 of the 11 newly included studies provided adequate information on randomisation and were judged to have low risk of bias (Abaluck 2022; Alfelali 2020; Almanza-Reyes 2021; Ashraf 2020; Bundgaard 2021; Fretheim 2022a; Helsingen 2021; Swarthout 2020; Teesing 2021; Young 2021). Six of these studies described the use of a computerised random number generator (Almanza-Reyes 2021; Bundgaard 2021; Helsingen 2021; Swarthout 2020; Teesing 2021; Young 2021). Almanza-Reyes 2021 described the use of computer-generated stratified block scheme, while Bundgaard 2021 reported the use of a computer algorithm stratified by the five regions of Denmark. In Fretheim 2022a, the investigators used a digital platform (Nettskjema) for recruitment, randomisation and allocation. Three studies mentioned the use of a random number generator, with no additional specifics (Helsingen 2021; Swarthout 2020; Teesing 2021), while Young 2021 mentioned that randomisation was performed in blocks of two and stratified using nine strata to ensure a sample representative of schools and colleges in England. Abaluck 2022 reported pairwise cross randomisation, whilst Ashraf 2020 reported using a block random number generator. Alfelali 2020 described using coin-tossing by an individual who was not a member of the research team (i.e. a fellow pilgrim who was not a participant in the trial, a tour operator, or a medical volunteer). One study provided insufficient information to judge the sequence generation bias (Gutiérrez-García 2022).

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The success of randomisation was judged as low risk of bias in one study only that used an off-site investigator to allocate groups (Ashraf 2020). Four new studies provided insufficient information to make a judgment on the adequacy of the process (Bundgaard 2021; Swarthout 2020; Teesing 2021; Young 2021). The remaining six newly included studies were judged as high risk of allocation bias (Abaluck 2022; Alfelali 2020; Almanza-Reyes 2021; Fretheim 2022a; Gutiérrez-García 2022; Helsingen 2021). In Abaluck 2022, there was a significant difference in the numbers of households included in each treatment group, suggestive of a lack of allocation concealment. Alfelali 2020 used coin tossing, which can lead to a large imbalance. In Almanza-Reyes 2021 baseline prognostic factors (vaccination and frequency of handwashing) were unbalanced between the two arms. In Fretheim 2022a, a higher number of participants used face masks in the intervention group. In Gutiérrez-García 2022 there as a significant age difference between the two groups. Helsingen 2021 described assigning the randomised sequence by a member of the research team, with no further description.

For the review published in 2020, information on sequence generation was overall poorly reported in most of the included studies. Nineteen of the included studies provided adequate information on the randomisation scheme and were judged as at low risk of bias (Aiello 2012; Azor-Martinez 2016; Azor-Martinez 2018; Biswas 2019; Canini 2010; Correa 2012; Ide 2014; MacIntyre 2015; MacIntyre 2016; Millar 2016; Najnin 2019; Radonovich 2019; Ram 2015; Simmerman 2011; Stebbins 2011; Suess 2012; Talaat 2011; Turner 2012; Zomer 2015). Nine studies described the use of computerised sequence generation program/software (Aiello 2012; Azor-Martinez 2018; Biswas 2019; Canini 2010; Millar 2016; Najnin 2019; Radonovich 2019; Talaat 2011; Turner 2012). One study used random number tables for sequence generation (Azor-Martinez 2016). Three studies described using the random function in Microsoft Excel (Microsoft Excel 2018) (Correa 2012; MacIntyre 2016; Suess 2012). Two studies used statistical software to generate a randomisation allocation (MacIntyre 2015; Priest 2014). Two studies reported using block randomisation: Ram 2015 used block randomisation, and an independent investigator-generated the list of random assignments, whilst Simmerman 2011 performed block randomisation. Stebbins 2011 used constrained randomisation, and Zomer 2015 reported using stratified randomisation by means of computer generation with a 1:1 ratio in each of the strata.

Fourteen studies reported insufficient information to permit a judgement on the adequacy of the process to minimise selection bias (Aelami 2015; Alzaher 2018; Arbogast 2016; Barasheed 2014; Chard 2019; DiVita 2011; Feldman 2016; Hubner 2010; Ibfelt 2015; McConeghy 2017; Miyaki 2011; Pandejpong 2012; Savolainen-Kopra 2012; Yeung 2011). Six studies provided some description about sequence generation, but it was still unclear (Hartinger 2016; Huda 2012; Ide 2016; Little 2015; MacIntyre 2011; MacIntyre 2013). Huda 2012 mentioned random number tables, but it was unclear if this was for random selection or randomisation. Ide 2016 used computer-generated randomisation, but the method was not stated. Hartinger 2016 used covariate-constrained randomisation, but the method was not described. In Little 2015, participants were automatically randomly assigned by the intervention software, but the sequence generation was not described. Two studies used a secure computerised randomisation program (MacIntyre 2011; MacIntyre 2013), but the sequence generation was not described.

Three of the studies included in the 2020 review, were poorly randomised (Ban 2015; Nicholson 2014; Temime 2018). Ban 2015 included only two clusters, and the randomisation scheme was not reported. Nicholson 2014 used coin tossing, which can lead to a large imbalance. Temime 2018 used "simple randomisation" with no further description.

For the RCTs included in previous versions of the review, three were poorly reported with no description of randomisation sequence or concealment of allocation (Gwaltney 1980; Turner 2004a; Turner 2004b). The quality of the cluster-RCTs varied, with four studies not providing a description of the randomisation procedure (Carabin 1999; Kotch 1994; Morton 2004; White 2001). We rated seven studies as at low risk of bias for sequence generation (Cowling 2008; Cowling 2009; Luby 2005; Roberts 2000; Sandora 2005; Sandora 2008; Satomura 2005), and a further six studies as at unclear risk of bias (Farr 1988a; Farr 1988b; Ladegaard 1999; Loeb 2009; Longini 1988; MacIntyre 2009).

Many of the newly included cluster-RCTs did not report adequately on allocation concealment. Twenty-one of these studies reported adequate allocation and were judged as at low risk of bias (Aiello 2012; Alzaher 2018; Azor-Martinez 2016; Azor-Martinez 2018; Biswas 2019; Canini 2010; Chard 2019; Goodall 2014; Ide 2014; Ide 2016; Little 2015; MacIntyre 2011; MacIntyre 2015; Nicholson 2014; Priest 2014; Radonovich 2019; Ram 2015; Savolainen-Kopra 2012; Stebbins 2011; Suess 2012; Turner 2012). Aiello 2012 randomised all residence houses in each of the residence halls prior to the intervention implementation. Alzaher 2018 allocated schools prior to all schoolgirls attending selected schools being invited to participate. Azor-Martinez 2016 allocated schools/classes prior to children's recruitment. Azor-Martinez 2018 assigned clusters prior to recruitment. Biswas 2019 completed the allocation prior to individuals being recruited. Chard 2019 allocated schools prior to individuals being recruited. Goodall 2014 used opaque, sealed, serially numbered envelopes that were only accessed when two study personnel were present. Ide 2014 also reported using individual drawing of sealed, opaque envelopes to randomly assign participants to the study groups. MacIntyre 2011 randomised hospitals prior to inclusion of participants. In MacIntyre 2015, hospital wards were randomised prior to recruitment of individuals. Nicholson 2014 used coin tossing to assign communities to intervention or control arms. Radonovich 2019 used constrained randomisation to resolve any potential imbalance between covariates between the trial arms. Four studies reported the use of central randomisation: Canini 2010 used central randomisation by employing an interactive voice response system; Ide 2016 used central randomisation services; Little 2015 participants were automatically randomly assigned by the intervention software; and Ram 2015 described a central allocation through data collectors notifying the field research officer, who consulted the block randomisation list to make the assignment of the household compound to intervention or control. Savolainen-Kopra 2012 randomised clusters by matching prior to the onset of the interventions. Four studies reported that allocation was assigned by personnel (investigator, physician, or statistician) unaware of the randomisation sequence (Priest 2014; Stebbins 2011; Suess 2012; Turner 2012). Twenty-two studies reported insufficient information to permit a judgement on the adequacy of the process to minimise selection bias (Aelami 2015; Arbogast 2016; Ban 2015; Barasheed 2014; Correa 2012; DiVita 2011; Feldman 2016; Hartinger 2016; Hubner 2010; Huda 2012; Ibfelt 2015; MacIntyre

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2013; McConeghy 2017; Millar 2016; Miyaki 2011; Najnin 2019; Pandejpong 2012; Simmerman 2011; Talaat 2011; Temime 2018; Yeung 2011; Zomer 2015). Two studies provided some information about allocation, but it was not enough to permit a judgement on the risk of bias (Barasheed 2014; Simmerman 2011). Barasheed 2014 randomised pilgrim tents using an independent study co-ordinator who was not an investigator, but did not describe how this was done. Simmerman 2011 described using a study co-ordinator to assign households to the study arm (after consent was obtained). Only one of the newly added studies was judged as at high risk of bias, where the random assignment was allocated by doctors enrolling the participants (MacIntyre 2016). Of the previously included RCTs, 14 provided no or an insufficient description of concealment of allocation (Carabin 1999; Farr 1988a; Farr 1988b; Gwaltney 1980; Kotch 1994; Ladegaard 1999; Larson 2010; MacIntyre 2009; Morton 2004; Roberts 2000; Sandora 2008; Turner 2004a; Turner 2004b; White 2001). We assessed all of the remaining studies as at low risk of bias (Canini 2010; Cowling 2008; Cowling 2009; Loeb 2009; Longini 1988; LLuby 2005; Sandora 2005;Satomura 2005). Aiello 2010 used the drawing of a uniform ticket with the name of each hall out of a container and was rated as at high risk of bias.

Blinding

Although blinding is less of a concern in cluster-RCTs, the risk of bias is substantial when the outcomes are subjective and the outcome assessor is not blinded.

In this 2022 review, five RCTs (Almanza-Reyes 2021; Bundgaard 2021; Fretheim 2022a; Gutiérrez-García 2022; Helsingen 2021), and six cluster-RCTs were all judged to have a high risk of detection bias (Abaluck 2022; Alfelali 2020; Ashraf 2020; Swarthout 2020; Teesing 2021; Young 2021).

We judged two of the newly included studies to have a low risk of detection bias as the outcome is laboratory-confirmed (Alfelali 2020; Gutiérrez-García 2022). One study provided insufficient information to enable judgment (Almanza-Reyes 2021). The remaining eight of the 11 new studies have a high risk of detection bias (Abaluck 2022; Ashraf 2020; Bundgaard 2021; Fretheim 2022a; Helsingen 2021; Swarthout 2020; Teesing 2021; Young 2021). In Abaluck 2022, investigators dropped individuals for whom symptom data were missing. In addition, other outcomes were subjective and can be influenced by the unblinded mask promoters, and mask surveillance staff. Moreover, blood testing in the protocol specified baseline testing which was not done, and no further explanation was provided. In Ashraf 2020, although the data collection team was separate from the intervention team, they were not blinded, and the outcome was respiratory illness measured through caregiver-reported symptoms. In Bundgaard 2021, case detection was based on patient-reported symptoms on home tests. In Fretheim 2022a, the outcome was self-reported positive COVID-19 test result, notified to the Norwegian Surveillance System for Communicable Diseases (MSIS). However, the public policy requiring confirmatory PCR-test had changed during the study, which may have affected reporting. In Helsingen 2021, although the outcome was a positive test for COVID-19 based on SARS-CoV-2 ribonucleic acid, the samples were collected and sent by participants, and there was a difference in adherence in testing between the two groups. Swarthout 2020, Teesing 2021, and Young 2021 all had subjective outcomes and assessors were not blinded. As for the detection bias, six of the newly included studies were considered to have a high risk of detection bias (Bundgaard 2021; Gutiérrez-García 2022; Helsingen 2021; Swarthout 2020; Teesing 2021; Young 2021. In Bundgaard 2021, case detection was based on patient-reported symptoms and results from home point-of-care (POCT) testing. The primary outcome of Gutiérrez-García 2022 was participants' self-reported symptoms. Case detection in Helsingen 2021 was based on a home-test kit. Swarthout 2020, Teesing 2021, and Young 2021 had subjective outcomes.

In the 2020 review, we judged 36 studies to have a high risk of bias (Aiello 2012; Abaluck 2022; Alfelali 2020; Almanza-Reyes 2021; Alzaher 2018; Arbogast 2016; Ashraf 2020; Azor-Martinez 2016; Azor-Martinez 2018; Ban 2015; Biswas 2019; Bundgaard 2021; Carabin 1999; Chard 2019; Correa 2012; Cowling 2008; Gutiérrez-García 2022; Helsingen 2021; Ide 2014; Kotch 1994; Ladegaard 1999; Little 2015; MacIntyre 2011; MacIntyre 2015; MacIntyre 2016; McConeghy 2017; Najnin 2019; Nicholson 2014; Ram 2015; Sandora 2008; Savolainen-Kopra 2012; Swarthout 2020; Teesing 2021; Temime 2018; Young 2021; Zomer 2015). We assessed five cluster-RCTs as at low risk of bias. Farr 1988a and Farr 1988b were double-blinded studies and were judged as at low risk of bias. MacIntyre 2013 and Simmerman 2011 reported laboratory-confirmed influenza, and blinding would not have affected the result. In Miyaki 2011 the self-reported respiratory symptoms were confirmed by a physician.

We judged four cluster-RCTs to have a low risk of detection bias because the outcome was laboratory-confirmed influenza (Alfelali 2020; Barasheed 2014; Suess 2012), or physician-confirmed ILI, Pandejpong 2012. Another two cluster-RCTs were judged to have a low risk of bias because outcome assessors were blinded (Abaluck 2022; Ashraf 2020). One RCT (Almanza-Reyes 2021) and two cluster-RCTs (Talaat 2011; Yeung 2011) provided insufficient data to judge the effect of non-blinding. Talaat 2011 included outcomes that were both self-reported ILI and laboratory-confirmed influenza. In Yeung 2011 the detection of cases was based on records for hospitalisation related to infection (including pneumonia). Eleven cluster-RCTs were not blinded, but we judged the primary outcome to be unaffected by non-blinding. Seven trials reported laboratory-confirmed influenza (Aiello 2012; Cowling 2009; Larson 2010; Loeb 2009; MacIntyre 2009; Millar 2016; Stebbins 2011). Four studies reported self-reported outcomes (Canini 2010; Priest 2014; Roberts 2000; Sandora 2008), but outcome assessors were not aware of the intervention assignment. Five RCTs were double-blinded and were judged as at low risk of bias (Goodall 2014; Ide 2016; Longini 1988; Luby 2005; White 2001), whilst two studies were single-blinded where investigators, Radonovich 2019, or laboratory personnel, Turner 2012, were blinded. Four RCTs were not blinded and were judged as at high risk of bias given the subjective nature of the outcome assessed (Hubner 2010; Ibfelt 2015; Jacobs 2009; Satomura 2005). Turner 2004a and Turner 2004b were double-blind studies, but insufficient information was provided to assess the risk of bias.

Incomplete outcome data

In this 2022 review, six of the 11 newly included studies had reasonable attrition and provided sufficient evidence about participant flow throughout the study and reasons of loss to follow-up, and hence were assessed as having a low risk of attrition bias (Alfelali 2020; Ashraf 2020; Bundgaard 2021; Fretheim 2022a; Gutiérrez-García 2022; Swarthout 2020). Two studies provided insufficient information to assess the attrition risk (Almanza-

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Reyes 2021; Teesing 2021). The remaining three studies were judged at high risk of attrition bias. In Abaluck 2022, laboratory testing results were only available for 40% of the symptomatic participants. In Helsingen 2021, more people in the control group withdrew from the study and reasons for withdrawal were not provided. In the Young 2021 study there was high attrition at different rates between the two groups.

In the 2020 review, we assessed 26 newly included trials as having a low risk of attrition bias, with sufficient evidence from the participant flow chart, and explanation of loss to follow-up (which was minimal) similar between groups (Aiello 2012; Alzaher 2018; Arbogast 2016; Azor-Martinez 2018; Barasheed 2014; Canini 2010; Chard 2019; Correa 2012; Goodall 2014; Hartinger 2016; Hubner 2010; Ide 2014; Ide 2016; MacIntyre 2011; MacIntyre 2013; MacIntyre 2015; MacIntyre 2016; Miyaki 2011; Pandejpong 2012; Radonovich 2019; Ram 2015; Simmerman 2011; Suess 2012; Turner 2012; Yeung 2011; Zomer 2015). Seven studies did not report sufficient information on incomplete data (attrition bias) (Aelami 2015; DiVita 2011; Feldman 2016; Hartinger 2016; Ibfelt 2015; McConeghy 2017; Priest 2014). Twelve studies had a high risk of attrition bias (Azor-Martinez 2016; Ban 2015; Biswas 2019; Huda 2012; Little 2015; Millar 2016; Najnin 2019; Nicholson 2014; Savolainen-Kopra 2012; Stebbins 2011; Talaat 2011; Temime 2018). In Azor-Martinez 2016, attrition levels were high and differed between the two groups. Ban 2015 did not report on reasons for loss to follow-up. Biswas 2019 did not provide information on missing participants (28 children in the control schools and two children in the intervention schools). Huda 2012 did not provide a flow diagram of study participants. Little 2015 had high attrition that differed between the two groups. Attrition in Millar 2016 differed amongst the three groups. In addition, ARI cases were captured utilising clinic-based medical records for those participants who sought hospital care only. In Najnin 2019, there was high migration movement during the study, which could have distorted the baseline characteristics even more. There was no description of how such migration and changes in the intervention group were dealt with. In Nicholson 2014, households were removed from the study if they provided no data for five consecutive weeks. Although attrition was reported in Savolainen-Kopra 2012, and 76% of volunteers who were recruited at the beginning of the reporting period completed the study, new recruits were added during the study to replace volunteers lost in most clusters. The total number of reporting participants at the end of the trial was 626 (91.7%) compared to the beginning, meaning that 15.7% of participants were replaced during the study. In Stebbins 2011,reasons for episodes of absence in 66% of the study participants were not reported. Talaat 2011 did not provide a flow chart of clusters flow during the study period and provided no information on withdrawal. Temime 2018 was greatly biased due to underreporting of outcomes in the control groups. Furthermore, no study flow chart was provided, and there was no reporting on any exclusions.

Selective reporting

For this 2022 review update, six of the 11 newly included studies reported all specified outcomes and were judged to have a low risk of selective reporting (Ashraf 2020; Bundgaard 2021; Fretheim 2022a; Gutiérrez-García 2022; Helsingen 2021; Young 2021). Three studies had no published protocol and were considered to have an unclear risk of selective reporting (Alfelali 2020; Almanza-Reyes 2021; Teesing 2021). The remaining two new included studies are considered to have a high risk of bias in this domain. Abaluck 2022 did not report on prespecified seroconversion, while in Swarthout 2020, none of the outcomes reported were prespecified in the trial registry.

In the 2020 review, 22 included studies reported all specified outcomes and were judged as at low risk of reporting bias (Aiello 2012; Barasheed 2014; Canini 2010; Chard 2019; Goodall 2014; Hartinger 2016; Ibfelt 2015; Ide 2016; Little 2015; MacIntyre 2011; MacIntyre 2013; MacIntyre 2015; MacIntyre 2016; Pandejpong 2012; Priest 2014; Radonovich 2019; Savolainen-Kopra 2012; Simmerman 2011; Suess 2012; Temime 2018; Turner 2012; Zomer 2015). For 18 studies, it is unlikely that other outcomes were measured and not reported, although no protocol was available to assess reporting bias (Aelami 2015; Alzaher 2018; Arbogast 2016; Azor-Martinez 2016; Azor-Martinez 2018; Ban 2015; Biswas 2019; Correa 2012; DiVita 2011; Feldman 2016; Hubner 2010; Huda 2012; Ide 2014; Miyaki 2011; Nicholson 2014; Stebbins 2011; Talaat 2011; Yeung 2011). Three studies were at high risk of reporting bias (McConeghy 2017; Millar 2016; Najnin 2019). In McConeghy 2017, URTI was mentioned in the methods (the intervention presumably would have targeted these), but only lower respiratory tract infection (LRTI) and overall infection were reported. Millar 2016 was originally conducted for another purpose; we could not find the respiratory outcomes reported in the study as part of the original study protocol. In Najnin 2019, the published study protocol did not include respiratory illness as an outcome.

Other potential sources of bias

An additional consideration for cluster-RCTs is identification/recruitment bias, where individuals are recruited in the trial after clusters are randomised. Such bias can introduce an imbalance amongst groups.

In this 2022 review, of the six cluster-RCTs included, we judged four to have a low risk of identification/recruitment bias (Abaluck 2022; Ashraf 2020; Swarthout 2020; Teesing 2021). In Abaluck 2022, all of people in the village were assigned to one study arm (control, cloth mask or surgical mask villages). In Ashraf 2020, participants were unaware of their intervention group assignment until after the baseline survey and randomisation. In Swarthout 2020, village clusters comprised of 12 enrolled households, while in Teesing 2021 randomisation was done per nursing home. Alfelali 2020 recruited individuals after cluster-randomisation and is judged to have a high risk of recruitment bias, while in Young 2021, participation of students and staff contacts were made after random assignment of the school through written consent or electronic completion of a consent form.

Of the cluster-RCTs included in our 2020 review, we judged 13 to have a low risk of identification/recruitment bias (Arbogast 2016; Biswas 2019; Canini 2010; Cowling 2008; Longini 1988; Luby 2005; MacIntyre 2015; MacIntyre 2016; Roberts 2000; Sandora 2005; Suess 2012; Temime 2018; White 2001). In Arbogast 2016, all identified individuals (office workers) were included in the assigned cluster. Schools were identified and then randomised to the clusters; students were then randomly selected from each classroom and school. Nine studies described the identification of participants, consenting/enrolling, and then randomising to the clusters (Canini 2010; Cowling 2008; Longini 1988; Luby 2005; MacIntyre 2015; MacIntyre 2016; Roberts 2000; Sandora 2005; White 2001). Suess 2012 identified and consented patients, then recruitment was performed by physicians unaware of cluster assignment. In Temime

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2018, directors of the included nursing homes agreed to participate in the study before randomisation, and written consent was not required from the residents.

Amongst the newly included studies, we judged four cluster-RCTs as at low risk of identification/recruitment bias (Abaluck 2022; Swarthout 2020; Teesing 2021; Young 2021). In Abaluck 2022, the village was the unit of randomisation and all households received one arm of the study (control, surgical mask or cloth mask). In Swarthout 2020, village clusters were each randomised by blocks (group of nine adjacent clusters) into eight groups. In Teesing 2021 nursing homes were computer randomised after baseline hand hygiene measurements to either the intervention arm or the control arm. In Young 2021, schools were randomly assigned (1:1) to either a policy of offering contacts daily testing over seven days to allow continued school attendance (intervention group) or to follow the usual policy of isolation of contacts for 10 days (control group). In two studies there were insufficient details to permit a judgement of the risk of bias (Alfelali 2020; Ashraf 2020).

In the 2020 review, we judged 11 cluster-RCTs as at high risk of identification/recruitment bias (Aiello 2010; Aiello 2012; Azor-Martinez 2018; Chard 2019; Correa 2012; Cowling 2009; Larson 2010; McConeghy 2017; Nicholson 2014; Priest 2014; Savolainen-Kopra 2012). In Aiello 2010 and Aiello 2012, recruitment continued for two weeks after the start of the study, which could have introduced bias. Six trials identified and recruited participants after cluster randomisation (Azor-Martinez 2018; Chard 2019; Cowling 2009; Larson 2010; McConeghy 2017; Nicholson 2014). Three trials recruited new participants after the start of the study to replace those lost to follow-up (Correa 2012; Priest 2014; Savolainen-Kopra 2012). We judged five cluster-RCTs to have probable identification/recruitment bias (Alzaher 2018; Barasheed 2014; MacIntyre 2011; Najnin 2019; Radonovich 2019), whereas in 19 studies there were insufficient details to permit a judgement of risk of bias (Carabin 1999; DiVita 2011; Feldman 2016; Hartinger 2016; Huda 2012; Ibfelt 2015; Kotch 1994; Ladegaard 1999; MacIntyre 2009; MacIntyre 2013; Millar 2016; Miyaki 2011; Pandejpong 2012; Radonovich 2019; Sandora 2008; Stebbins 2011; Talaat 2011; Yeung 2011; Zomer 2015).

Two of the newly included cluster-RCTs reported intracluster correlation coefficient (ICC) to adjust sample size, taking into consideration clustering effects, and described adjusting outcomes for clustering effect using different statistical methods, or provided justification for not performing adjusted analysis for clustering (Alfelali 2020; Swarthout 2020). For four studies there were insufficient details to permit a judgement of risk of bias (Abaluck 2022; Ashraf 2020; Teesing 2021; Young 2021) since they provided insufficient details on ICC and/or did not perform adjusted analysis or justified the absence of it.

Twenty-six cluster-RCTs identified in the 2020 review reported intracluster correlation coefficient (ICC) to adjust sample size, taking into consideration clustering effects, and described adjusting outcomes for clustering effect using different statistical methods, or provided justification for not performing adjusted analysis for clustering (Aiello 2010; Aiello 2012; Arbogast 2016; Canini 2010; Carabin 1999; Correa 2012; Cowling 2008; Cowling 2009; Hartinger 2016; Huda 2012; Little 2015; Luby 2005; MacIntyre 2009; MacIntyre 2011; MacIntyre 2013; MacIntyre 2015; MacIntyre 2016; McConeghy 2017; Priest 2014; Radonovich 2019; Ram 2015; Roberts 2000; Stebbins 2011; Suess 2012; Talaat 2011; Temime 2018). Five cluster-RCTs did not report the ICC but described adjusting outcomes for clustering effect using different statistical methods, or explained why adjusted analysis for clustering was not performed (Biswas 2019; Chard 2019; McConeghy 2017; Simmerman 2011; Zomer 2015). Thirteen cluster-RCTs provided insufficient details on ICC and/or did not perform adjusted analysis or justified the absence of it (Alzaher 2018; Azor-Martinez 2016; Azor-Martinez 2018; Barasheed 2014; Feldman 2016; Larson 2010; Millar 2016; Miyaki 2011; Najnin 2019; Nicholson 2014; Pandejpong 2012; Savolainen-Kopra 2012; Yeung 2011). Two cluster-RCTs reported the ICC but did not perform adjusted analysis or justified the absence of it (Sandora 2005; Sandora 2008).

Effects of interventions

See: **Summary of findings 1** Medical/surgical masks compared to no masks for preventing the spread of viral respiratory illness; **Summary of findings 2** N95 respirators compared to medical/surgical masks for preventing the spread of viral respiratory illness; **Summary of findings 3** Hand hygiene compared to control for preventing the spread of viral respiratory illness

Comparison 1: Medical/surgical masks compared to no masks

We included 12 trials (10 of which were cluster-RCTs) comparing medical/surgical masks versus no masks (Abaluck 2022; Alfelali 2020; Aiello 2012; Barasheed 2014; Bundgaard 2021; Canini 2010; Cowling 2008; Jacobs 2009; MacIntyre 2009; MacIntyre 2015; MacIntyre 2016; Suess 2012). Two trials were conducted with healthcare workers (HCWs) (Jacobs 2009; MacIntyre 2015), whilst the other 10 studies included people living in the community. In the acute care hospital setting, as opposed to the community setting, variable mask use occurred, according to usual practices in the settings where the studies were undertaken, varying from just under 16% most of the time to 23.6% wearing for > 70% of all working hours (Jacobs 2009; MacIntyre 2015). We therefore excluded the two studies in the acute care hospital setting from the meta-analysis, and report results from these studies narratively. Ten trials were conducted in non-pandemic settings, and two were conducted during the SARS-CoV-2 pandemic (Abaluck 2022; Bundgaard 2021).

Primary outcomes

1. Numbers of cases of viral respiratory illness

Influenza/COVID-like illness

Pooling of nine trials conducted in the community found an estimate of effect for the outcomes of influenza/COVID-like illness cases (risk ratio (RR) 0.95, 95% confidence interval (CI) 0.84 to 1.09; 9 trials; 276,917 participants; moderate-certainty evidence; Analysis 1.1) suggesting that wearing a medical/surgical mask will probably make little or no difference for this outcome. Two studies in healthcare workers provided inconclusive results with very wide confidence intervals: RR 0.88, 95% CI 0.02 to 32; and RR 0.26, 95% CI 0.03 to 2.51, respectively (Jacobs 2009; MacIntyre 2015).

Laboratory-confirmed influenza/SARS-CoV-2 cases

Similarly, the estimate of effect for laboratory-confirmed influenza/SARS-CoV-2 cases (RR 1.01, 95% CI 0.72 to 1.42; 6 trials, 13,919 participants; moderate-certainty evidence; Analysis 1.1) suggests that wearing a medical/surgical mask probably makes little or no difference compared to not wearing a mask for this outcome.

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Laboratory-confirmed other respiratory viruses

One community study reported on laboratory-confirmed other respiratory viruses, showing RR 0.58, 95% CI 0.25 to 1.31; Analysis 1.1, and another study in healthcare workers reported RR 0.79, 95% CI 0.42 to 1.52 (MacIntyre 2015).

Assessing both source control and personal protection

The design of most trials assessed whether masks protected the wearer. Six trials were cluster-RCTs, with all participants in the intervention clusters required to wear masks, thus assessing both source control and personal protection. In two trials the clusters were households with a member with new influenza; neither of these studies found any protective effect (RR 1.03 in 105 households (Canini 2010); RR 1.21 in 145 households (MacIntyre 2009)). In two trials the clusters were college dormitories during the influenza season; neither study found any reduction (RR 1.10 in 37 dormitories (Aiello 2012); RR 0.90 in three dormitories (Aiello 2010)).

Studies conducted during the SARS-CoV-2 pandemic

Two studies were conducted during the SARS-CoV-2 pandemic (Abaluck 2022; Bundgaard 2021), with the former being a very large cluster-RCT of villages in Bangledesh and the latter a large RCT conducted in Denmark.

Exclusion of study due to insufficient number of clusters

We excluded Aiello 2010 from the meta-analysis since we did not consider 'randomisation' of three clusters to three arms to be a proper randomised trial.

2. Adverse events related to the intervention

Canini 2010 reported that 38 (75%) of participants in the intervention arm experienced discomfort with the mask use due to warmth (45%), respiratory difficulties (33%), and humidity (33%). Children reported feeling pain more frequently (3/12) than other participants wearing adult face masks (1/39; P = 0.04). In MacIntyre 2015, adverse events associated with face mask use were reported in 40.4% (227/562) of HCWs in the medical-mask arm. General discomfort (35.1%; 397/1130) and breathing problems (18.3%; 207/1130) were the most frequently reported adverse events. Suess 2012 reported that the majority of participants (107/172; 62%) did not report any problems with mask-wearing. More adults reported no problems (71%) compared to children (36/72; 50%; P = 0.005). The main issues when wearing a face mask for adults as well as for children were "heat/humidity" (18/34; 53% of children; 10/29; 35% of adults; P = 0.1), followed by "pain" and "shortness of breath". Alfelali 2020 reported the most common side effects of wearing a mask in Hajj pilgrims were difficulty in breathing (26%) and discomfort (22%). Although no details were provided, Bundgaard 2021 mentioned that 14% of participants had adverse reactions. Cowling 2008 and Abaluck 2022 mentioned that no adverse events were reported. The other trials did not report measuring adverse outcomes.

Secondary outcomes

1. Deaths

Not reported.

2. Severity of viral respiratory illness as reported in the studies

Jacobs 2009 reported that participants in the mask group were significantly more likely to experience more days with headache and feeling bad. They found no significant differences between the two groups for symptom severity scores. None of the other trials reported this outcome.

3. Absenteeism

Not reported.

4. Hospital admissions

Not reported.

5. Complications related to the illness (e.g. pneumonia)

Not reported.

Comparison 2: N95/P2 respirators compared to medical/surgical masks

We included five trials comparing medical/surgical masks with N95/P2 respirators (Loeb 2009; MacIntyre 2009; MacIntyre 2011; MacIntyre 2013; Radonovich 2019). All of these trials except MacIntyre 2009 included HCWs. MacIntyre 2009 included carers and household members of children with a respiratory illness recruited from a paediatric outpatient department and a paediatric primary care practice in Sydney, Australia. None of the trials were conducted during the SARS-CoV-2 pandemic.

Primary outcomes

1. Numbers of cases of viral respiratory illness

Clinical respiratory illness

Pooling of three trials found an estimate of effect suggesting considerable uncertainty as to whether an N95/P2 respirator provides any benefit compared to medical/surgical masks for the outcome of clinical respiratory illness (RR 0.70, 95% CI 0.45 to 1.10; 7799 participants, very low-certainty evidence; Analysis 2.1) (MacIntyre 2011; MacIntyre 2013 (two arms); Radonovich 2019).

Influenza-like-illness

Based on five trials conducted in four healthcare settings and one household, the estimates of effect for the outcome of ILI (RR 0.82, 95% CI 0.66 to 1.03; 8407 participants, low-certainty evidence; Analysis 2.1) suggest that N95/P2 respirators may make little or no difference for this outcome (Loeb 2009; MacIntyre 2009; MacIntyre 2011; MacIntyre 2013; Radonovich 2019).

Laboratory-confirmed influenza

The estimate of the effect for the outcome of laboratory-confirmed influenza infection (RR 1.10, 95% CI 0.90 to 1.34; 8407 participants, moderate-certainty evidence; Analysis 2.1) suggests that the use of a N95/P2 respirator compared to a medical/surgical mask probably makes little or no difference for this more precise and objective outcome.

The outcomes clinical respiratory illness and ILI were reported separately. Considering how these outcomes were defined, it is highly likely that there was considerable overlap between the two, therefore these outcomes were not combined into a single clinical outcome (Analysis 2.1). The laboratory-confirmed viral respiratory infection outcome included influenza primarily but multiple other

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common viral respiratory pathogens were also included in several studies. The laboratory-confirmed viral infection outcome was considered more precise and objective in comparison to the clinical outcomes, which were more subjective and considered to be less precise. The findings did not change when we restricted the evidence to HCWs (Analysis 2.2).

2. Adverse events related to the intervention

Harms were poorly reported, but generally discomfort wearing medical/surgical masks and N95/P32 respirators was mentioned in several studies. Radonovich 2019 mentioned that participants wearing the N95 respirator reported skin irritation and worsening of acne. MacIntyre 2011 reported that adverse events were more common with N95 respirators; in particular, discomfort was reported in 41.9% of N95 wearers versus 9.8% of medical-mask wearers (P < 0.01); headaches were more common with N95 (13.4% versus 3.9%; P < 0.01); difficulty breathing was reported more often in the N95 group (19.4% versus 12.5%; P = 0.01); and N95 caused more problems with pressure on the nose (52.2% versus 11.0%; P < 0.01). In MacIntyre 2013, fewer participants using the N95 respirator reported problems (38% (195/512) versus 48% (274/571) of participants in the medical-mask arm; P = 0.001). Loeb 2009 mentioned that no adverse events were reported.

The one trial conducted in the community mentioned that more than 50% of participants reported concerns with both types of masks, mainly that wearing them was uncomfortable, but there were no significant differences between the P2 (N95) and surgical-mask groups (MacIntyre 2009).

Secondary outcomes

1. Deaths

Not reported.

2. Severity of viral respiratory illness as reported in the studies

Not reported.

3. Absenteeism

Loeb 2009 reported that 42 participants (19.8%) in the surgical-mask group reported an episode of work-related absenteeism compared with 39 (18.6%) of participants in the N95 respiratory group (absolute risk difference −1.24%, 95% CI −8.75% to 6.27%; P = 0.75).

4. Hospital admissions

Not reported.

5. Complications related to the illness (e.g. pneumonia)

Loeb 2009 reported that there were no episodes of LRTIs.

Comparison 3: Hand hygiene compared to control

Nineteen trials compared hand hygiene interventions with control and provided sufficient data to include in meta-analyses (Ashraf 2020; Azor-Martinez 2018; Biswas 2019; Correa 2012; Cowling 2008; Cowling 2009; Hubner 2010; Larson 2010; Little 2015; Millar 2016; Nicholson 2014; Ram 2015; Roberts 2000; Sandora 2005; Simmerman 2011; Stebbins 2011; Swarthout 2020; Teesing 2021; Zomer 2015). The populations of these studies included adults, children, and families, in settings such as schools, childcare centres, homes, and offices. None of the studies was conducted during a pandemic, although a few studies were conducted during peak influenza seasons. A further 16 trials comparing hand hygiene to a control had other outcomes or insufficient information to include in meta-analyses (Alzaher 2018; Arbogast 2016; Azor-Martinez 2016; DiVita 2011; Feldman 2016; Gwaltney 1980; Ladegaard 1999; Luby 2005; Morton 2004; Priest 2014; Savolainen-Kopra 2012; Talaat 2011; Temime 2018; Turner 2012; White 2001; Yeung 2011). The results of these trials were consistent with the findings of our meta-analyses. The results for all outcomes from the 19 trials that were meta-analysed and the 16 trials that were not meta-analysed are shown in Table 2.

Primary outcomes

1. Numbers of cases of viral respiratory illness

Acute respiratory infection (ARI)

Pooling of nine trials for the broad outcome of ARI showed a 14% relative reduction in the numbers of participants with ARI (RR 0.86, 95% CI 0.81 to 0.90; 52,105 participants, moderate-certainty evidence; Analysis 3.1.1) in the hand hygiene group (Analysis 3.1), suggesting a probable benefit (Ashraf 2020; Azor-Martinez 2018; Correa 2012; Larson 2010; Little 2015; Millar 2016; Nicholson 2014; Sandora 2005; Swarthout 2020).

Influenza-like-illness (ILI) and laboratory-confirmed influenza

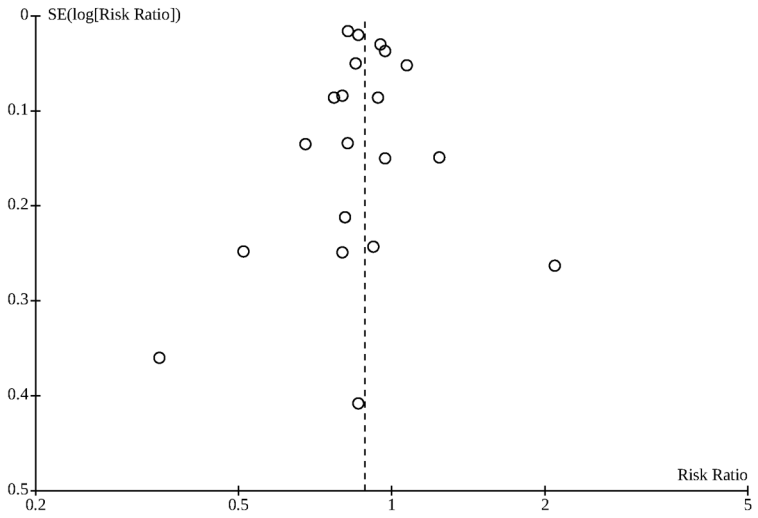
When considering the more strictly defined outcomes of ILI (Biswas 2019; Cowling 2008; Cowling 2009; Hubner 2010; Larson 2010; Little 2015; Ram 2015; Roberts 2000; Simmerman 2011; Teesing 2021; Zomer 2015), and laboratory-confirmed influenza (Biswas 2019; Cowling 2008; Cowling 2009; Hubner 2010; Larson 2010; Ram 2015; Simmerman 2011; Stebbins 2011) the estimates of the effect were heterogeneous, suggesting that hand hygiene may make little or no difference (RR 0.94, 95% CI 0.81 to 1.09 for ILI; 34,503 participants, low-certainty evidence; Analysis 3.1.2); (RR 0.91, 95% CI 0.63 to 1.30 for laboratory-confirmed influenza; 8332 participants; low-certainty evidence; Analysis 3.1.3).

Composite outcome 'ARI or ILI or influenza'

All 19 trials could be pooled for analysis of the composite outcome 'ARI or ILI or influenza', with each study only contributing once with the most comprehensive outcome (in terms of number of events) reported showing an 11% relative reduction in participants with a respiratory illness, suggesting that hand hygiene may offer a benefit (RR 0.89, 95% CI 0.83 to 0.94; low-certainty evidence; Analysis 3.2), but with high heterogeneity. A funnel plot of the 19 trial results did not appear to suggest any small study effects for this outcome (Figure 4).

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Figure 4.



Sensitivity analysis

In a sensitivity analysis we used only the most precise and unequivocal (with laboratory confirmed considered the most precise and an undefined ARI considered the least precise) outcome reported in each of 12 studies identified by JMC, an infectious disease physician, and found an estimate of effect in favour of hand hygiene, but with wider CIs (RR 0.88, 95% CI 0.77 to 1.02; Analysis 3.3).

Subgroup analysis by age group

We considered that studies in children might have a different effect than studies in adults, so we conducted subgroup analysis by age group. We found no evidence of a difference in treatment effect by age group (P = 0.18; Analysis 3.4).

2. Adverse events related to the intervention

Correa 2012 reported that no adverse events were observed; in the study by Priest 2014, skin reaction was recorded for 10.4% of participants in the hand sanitiser group versus 10.3% in the control group (RR 1.01, 95% CI 0.78 to 1.30).

Secondary outcomes

1. Deaths

Not reported.

2. Severity of viral respiratory illness as reported in the studies

Not reported.

3. Absenteeism

Three trials measured absenteeism from school or work and demonstrated a 36% relative reduction in the numbers of participants with absence in the hand hygiene group (RR 0.64, 95% CI 0.58 to 0.71; Analysis 3.5) (Azor-Martinez 2016; Hubner 2010; Nicholson 2014).

4. Hospital admissions

Not reported.

5. Complications related to the illness (e.g. pneumonia)

Not reported.

Comparison 4: Hand hygiene + medical/surgical masks compared to control

Primary outcomes

1. Numbers of cases of viral respiratory illness (including ARIs, ILI, and laboratory-confirmed influenza)

Six trials (Aelami 2015; Aiello 2012; Cowling 2009; Larson 2010; Simmerman 2011; Suess 2012) were able to be pooled to compare the use of the combination of hand hygiene and medical/surgical masks with control. Four of these trials were in households, two in university student residences, and one at the annual Hajj pilgrimage. For the outcomes ILI and laboratory-confirmed influenza, pooling demonstrated an estimate of effect suggesting little or no difference between the hand hygiene and medical/surgical mask combination and control. The number of trials and

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events was lower than for comparisons of hand hygiene alone, or medical/surgical masks alone, and the confidence interval was wide. For ILI, the RR for intervention compared to control was 1.03 (95% CI 0.77 to 1.37; 4504 participants; Analysis 4.1.1), and for influenza it was 0.97 (95% CI 0.69 to 1.36; 3121 participants; Analysis 4.1.2). Full results of these trials are shown in Table 3

2. Adverse events related to the intervention

Adverse events related to mask wearing in the study by Suess 2012 are reported under Comparison 1 (medical/surgical masks). There was no mention of adverse events related to hand hygiene.

Secondary outcomes

1. Deaths

Not reported.

2. Severity of viral respiratory illness as reported in the studies

Not reported.

3. Absenteeism

Not reported.

4. Hospital admissions

Not reported.

5. Complications related to the illness, e.g. pneumonia

Not reported.

Comparison 5: Hand hygiene + medical/surgical masks compared to hand hygiene

Primary outcomes

1. Numbers of cases of viral respiratory illness (including ARIs, ILI and laboratory-confirmed influenza)

Three trials studied the addition of medical/surgical masks to hand hygiene (Cowling 2009; Larson 2010; Simmerman 2011). All three trials had three arms, and are also included in the comparison of hand hygiene plus medical/surgical mask versus control (Comparison 4). All three studies showed no difference between hand hygiene plus medical/surgical mask groups and hand hygiene alone, for all outcomes. The estimates of effect suggested little or no difference when adding masks to hand hygiene compared to hand hygiene alone: for the outcome ILI (RR 1.03, 95% CI 0.69 to 1.53; 3 trials) and the outcome laboratory-confirmed influenza (RR 0.99, 95% CI 0.69 to 1.44), the estimates of effect were not different and the CIs were relatively wide, suggesting little or no difference (Analysis 5.1). However, the CIs around the estimates were wide and do not rule out an important benefit.

2. Adverse events related to the intervention

Not reported.

Secondary outcomes

1. Deaths

Not reported.

2. Severity of viral respiratory illness as reported in the studies

Not reported.

3. Absenteeism

Not reported.

4. Hospital admissions

Not reported.

5. Complications related to the illness (e.g. pneumonia)

Not reported.

Comparison 6: Medical/surgical masks compared to other (non-N95) masks

One trial compared medical/surgical masks with cloth masks in hospital healthcare workers (MacIntyre 2015), and another trial compared catechin-treated masks versus control masks in healthcare workers and staff of hospitals, rehabilitation centres, and nursing homes in Japan (Ide 2016).

Primary outcomes

1. Numbers of cases of viral respiratory illness (including ARIs, ILI, and laboratory-confirmed influenza)

MacIntyre 2015 found that the rate of ILI was higher in the cloth mask arm compared to the medical/surgical masks arm (RR 13.25, 95% CI 1.74 to 100.97).

Ide 2016 did not find a benefit from the catechin-treated masks over untreated masks on influenza infection rates (adjusted odds ratio (OR) 2.35, 95% CI 0.40 to 13.72; P = 0.34).

2. Adverse events related to the intervention

In MacIntyre 2015 adverse events associated with face mask use were reported in 40.4% (227/562) of HCWs in the medical/surgical mask arm and 42.6% (242/568) in the cloth mask arm (P = 0.45). The most frequently reported adverse events were general discomfort (35.1%; 397/1130) and breathing problems (18.3%; 207/1130). Laboratory tests showed the penetration of particles through the cloth masks to be very high (97%) compared with medical/surgical masks (44%). Ide 2016 reported that there were no serious adverse events associated with the intervention.

Secondary outcomes

1. Deaths

Not reported.

2. Severity of viral respiratory illness as reported in the studies

Not reported.

3. Absenteeism

Not reported.

4. Hospital admissions

Not reported.

5. Complications related to the illness (e.g. pneumonia)

Not reported.

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Comparison 7: Soap + water compared to sanitiser, and comparisons of different types of sanitiser

Two trials compared soap and water with sanitiser (Azor-Martinez 2018; Savolainen-Kopra 2012). Another trial compared different types of hand sanitiser in a virus challenge study (Turner 2004a; Turner 2004b), and one trial studied the frequency of use of hand sanitiser (Pandejpong 2012). The full results of these four trials are shown in Table 4.

Primary outcomes

1. Numbers of cases of viral respiratory illness (including ARIs, ILI, and laboratory-confirmed influenza)

In the trial by Azor-Martinez 2018, ARI incidence was significantly higher in the soap-and-water group compared with the hand sanitiser group (rate ratio 1.21, 95% CI 1.06 to 1.39). In contrast, there was no significant difference between interventions in Savolainen-Kopra 2012. In the rhinovirus challenge study (Turner 2004a; Turner 2004b), all hand sanitisers tested led to a significant lowering of infection rates, but no differences between sanitisers were observed. The study sample size was small.

2. Adverse events related to the intervention

Two trials stated that no adverse events were observed (Pandejpong 2012; Savolainen-Kopra 2012).

Secondary outcomes

1. Deaths

Not reported.

2. Severity of viral respiratory illness as reported in the studies

Not reported.

3. Absenteeism

The authors of Azor-Martinez 2018 also observed a significant benefit for hand sanitiser in reduction in days absent, whereas there was no difference between intervention groups in the Savolainen-Kopra 2012 trial. The study on frequency of use of sanitiser found that use of sanitiser every hour significantly reduced days absent compared with use every two hours or with use only before the lunch break (Pandejpong 2012).

4. Hospital admissions

Not reported.

5. Complications related to the illness (e.g. pneumonia)

Not reported.

Comparison 8: Surface/object disinfection (with or without hand hygiene) compared to control

Primary outcomes

1. Numbers of cases of viral respiratory illness (including ARIs, ILI, and laboratory-confirmed influenza)

Six trials contributed data to this comparison (Ban 2015; Carabin 1999; Ibfelt 2015; Kotch 1994; McConeghy 2017; Sandora 2008). Full results of these trials are shown in Table 5. Five of the six trials combined disinfection with other interventions such as hand hygiene education, provision of hand hygiene products, and audits. Ban 2015 utilised a combination of provision of hand hygiene products, and cleaning and disinfection of surfaces, and demonstrated a significant reduction in ARI in the intervention group (OR 0.47, 95% CI 0.48 to 0.65). A similar result was seen in Carabin 1999, with a significant reduction in episodes of ARI. Two studies tested multi component interventions and observed no significant difference in ARI outcomes (Kotch 1994; McConeghy 2017).

One trial compared disinfection alone to usual care (Ibfelt 2015). This study demonstrated a significant reduction in some viruses detected on surfaces in the childcare centres (adenovirus, rhinovirus, respiratory syncytial virus (RSV), and metapneumovirus), but not in other viruses, including coronavirus.

2. Adverse events related to the intervention

Not reported.

Secondary outcomes

1. Deaths

Not reported.

2. Severity of viral respiratory illness as reported in the studies

Not reported.

3. Absenteeism

Only one study measured this outcome (Sandora 2008), observing no significant difference between groups for the outcome of absence due to respiratory illness (rate ratio for intervention to control 1.10, 95% CI 0.97 to 1.24).

4. Hospital admissions

Not reported.

5. Complications related to the illness (e.g. pneumonia)

Not reported.

Comparison 9: Complex interventions compared to control

Complex interventions are either multifaceted environmental programmes (such as those in low-income countries) or combined interventions including hygiene measures and gloves, gowns, and masks.

Four trials studied complex hygiene and sanitation interventions in low-income country settings (Chard 2019; Hartinger 2016; Huda 2012; Najnin 2019). Full results from these studies are given in Table 6.

Primary outcomes

1. Numbers of cases of viral respiratory illness (including ARIs, ILI, and laboratory-confirmed influenza)

All four trials of complex interventions observed no significant differences between groups in rates of viral respiratory illness.

2. Adverse events related to the intervention

Not reported.

Secondary outcomes

1. Deaths

Not reported.

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2. Severity of viral respiratory illness as reported in the studies

Not reported.

3. Absenteeism

Not reported.

4. Hospital admissions

Not reported.

5. Complications related to the illness (e.g. pneumonia)

Not reported.

Comparison 10: Physical distancing/quarantine

We found three RCTs that assessed physical distancing/quarantine interventions. A quasi-cluster-RCT assessed the effectiveness of quarantining workers of one of two sibling companies in Japan whose family members developed an ILI during the 2009 to 2010 H1N1 influenza pandemic (Miyaki 2011). Workers in the intervention group were asked to stay home on full pay until five days after the household member(s) showed resolution of symptoms or two days after alleviation of fever. A second RCT conducted during the SARS-CoV-2 pandemic investigated whether attending fitness centres with physical distancing was non-inferior compared to no access in terms of COVID-19 transmission (Helsingen 2021). The third study was a cluster-RCT conducted during the SARS-CoV-2 pandemic that compared voluntary daily lateral flow device testing for seven days with negative contacts remaining at school to self-isolation of school-based COVID-19 contacts for 10 days in a non-inferiority design (Young 2021).

Primary outcomes

1. Numbers of cases of viral respiratory illness (including laboratory-confirmed influenza and SARS-CoV-2)

Miyaki 2011 reported adherence with the intervention was 100%. In the intervention group 2.75% of workers contracted influenza, compared with 3.18% in the control group (Cox hazard ratio 0.799, 95% CI 0.66 to 0.97; P = 0.02), indicating that the rate of infection was reduced by 20% in the intervention group. However, the risk of a worker being infected was 2.17-fold higher in the intervention group where workers stayed at home with their infected family members. The authors concluded that quarantining workers who have infected household members could be a useful additional measure to control the spread of respiratory viruses in an epidemic setting.

Helsingen 2021 reported 3016 participants were tested for SARS-CoV-2 resulting in one positive case in the fitness centre access arm versus zero in the no access arm at 14 days (risk difference (RD) 0.053%, 95% CI − 0.050 to 0.156%; P = 0.32). In addition, 11 in the fitness centre access arm versus 27 in the no access arm tested positive for SARS-CoV-2 antibodies at one month (RD − 0.87%, 95% CI − 1.52% to − 0.23%; P = 0.001). The authors concluded that access to fitness centres with physical distancing and low population prevalence of SARS-CoV-2 infection did not increase risk of SARS-CoV-2 infection.

Results from Young 2021 suggested no difference between the two treatment arms for SARS-CoV-2 infection (RR 0.96, 95% CI 0.75 to 1.22) leading the study authors to conclude non-inferiority of daily contact testing of school-based contacts (intervention) compared to self-isolation (control).

2. Adverse events related to the intervention

Not reported.

Secondary outcomes

1. Deaths

Not reported.

2. Severity of viral respiratory illness as reported in the studies

Not reported.

3. Absenteeism

Young 2021 reported COVID-19 related absences from school were similar in the two treatment groups (RR 0.80, 95% CI 0.54 to 1.19).

4. Hospital admissions

Helsingen 2021 reported no hospital admissions in either treatment arm.

5. Complications related to the illness (e.g. pneumonia)

Not reported.

Comparison 11: Eye protection compared to control

Primary outcomes

1. Numbers of cases of viral respiratory illness (including laboratory-confirmed influenza and SARS-CoV-2)

We only identified one trial of eye protection which was a preprint only (Fretheim 2022a). This was a pragmatic RCT conducted in Norway from 2 February to 24 April 2022, where 3717 participants were randomised to an intervention group asked to wear glasses (e.g. sunglasses) for two weeks when close to others in public spaces. COVID-19 cases in the national registry were 3.7% in the intervention group (68/1852) and 3.5% (65/1865) in the control group (RR 1.10, 95% CI 0.75 to 1.50). Positive COVID-19 tests based on self-reporting were 9.6% and 11.5% (RR 0.83, 95% CI 0.69 to 1.00). Given the high risk of bias and wide CIs, no policy conclusions can be drawn, but replication studies are clearly warranted. Almost a third of the participants reported respiratory infections. However, a lower proportion of those (215 participants) were in the intervention group compared to the control group (RR 0.90; 95% CI 0.82 to 0.99).

2. Adverse events related to the intervention

A total of 76 participants reported a negative experience from participating in the trial (53 in the intervention group and 23 in the control group). The most common complaint related to the combination of wearing glasses and face masks, and 21 participants in the intervention group cited fogging as an issue. Some participants reported feeling tired or uncomfortable wearing glasses, and a few participants complained of reduced vision when wearing sunglasses or reading glasses. In the control group some participants reported headaches from not being able to wear glasses, and one participant in the intervention group reported a fall due to reduced vision.

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Secondary outcomes

1. Deaths

Not reported.

2. Severity of viral respiratory illness as reported in the studies

Not reported.

3. Absenteeism

Not reported.

4. Hospital admissions

Not reported.

5. Complications related to the illness, e.g. pneumonia

Not reported.

Comparison 12: Gargling/nose rinsing compared to control

Five trials investigated the effect of gargling/nose rinsing. Satomura 2005 compared throat gargling with povidone-iodine versus tap water in healthy adults. Ide 2014 compared gargling with green tea versus tap water in high school students, and Goodall 2014 compared gargling with tap water with no gargling in university students. Two additional trials were conducted during the SARS-CoV-2 pandemic: Almanza-Reyes 2021 compared silver mouth wash/nose rinse versus conventional mouthwashes and nose rinse in health workers; and Gutiérrez-García 2022 compared neutral electrolysed water mouth and nose rinses versus no rinses in health workers.

Primary outcomes

1. Numbers of cases of viral respiratory illness (including ARIs, ILI, and laboratory-confirmed influenza and SARS-CoV-2)

Satomura 2005 reported that gargling with tap water reduced the incidence of URTIs compared to the control group (usual care) (hazard ratio (HR) 0.60, 95% CI 0.39 to 0.95). Gargling with povidone-iodine did not reduce the incidence of URTIs compared to the control group (HR 0.88, 95% CI 0.58 to 1.34).

Goodall 2014 found no difference in laboratory-confirmed URTIs between the gargling (tap water) and no-gargling groups (RR for gargling versus no gargling 0.82, 95% CI 0.53 to 1.26; P = 0.36).

In a meta-analysis of gargling versus control based on two trials the pooled estimate of effect suggested little or no difference for the outcome of clinical URTI due to gargling (RR 0.91, 95% CI 0.63 to 1.31; 830 participants; Analysis 6.1) (Goodall 2014; Satomura 2005).

There was no difference in the incidence of laboratory-confirmed influenza between high school students gargling with green tea compared with those using tap water (adjusted OR 0.69, 95% CI 0.37 to 1.28; P = 0.24) (Ide 2014). There was also no difference in the incidence of clinically defined influenza (adjusted OR 0.75, 95% CI 0.50 to 1.13; P = 0.17). However, the authors reported that adherence to the interventions amongst students was low.

Almanza-Reyes 2021 reported the incidence of SARS-CoV-2 infection was statistically significantly lower in the silver mouth wash/nose rinse group (two out of 114, 1.8%) compared to the conventional mouthwash group (33 out of 117, 28.2%), and Gutiérrez-García 2022 reported the incidence of COVID-19-positive cases in the nasal and oral rinses group was 1% compared to 13% in the control group (RR 0.09, 95% CI of 0.01 to 0.72). A meta-analysis of these two studies showed a 93% reduction in risk of SARS-CoV-2 (RR 0.07, 95% CI 0.02 to 0.23; 394 participants; Analysis 6.2).

2. Adverse events related to the intervention

Satomura 2005 reported no adverse events during the 60-day intervention period. Ide 2014 also did not observe any adverse events during the study. Goodall 2014 did not report on adverse effects. There were no adverse reactions in the study by Almanza-Reyes 2021 or side effects in the study by Gutiérrez-García 2022.

Secondary outcomes

1. Deaths

Not reported.

2. Severity of viral respiratory illness as reported in the studies

Satomura 2005 reported that the mean peak score in bronchial symptoms was lower in the water gargling group (0.97) than in the povidone-iodine gargling group (1.41) and the control group (1.40), P = 0.055. Other symptoms were not significantly different between groups. Goodall 2014 reported that symptom severity was greater in the gargling group for clinical and laboratory-confirmed URTI, but this was not statistically significant (225.3 versus 191.8, and 210.5 versus 191.8, respectively). Ide 2014 did not report symptom or illness severity.

3. Absenteeism

Not reported.

4. Hospital admissions

Not reported.

5. Complications related to the illness (e.g. pneumonia)

Not reported.

Comparison 13: Virucidal tissues compared to control

Two reports (three trials) conducted in the USA studied the effect of virucidal tissues (Farr 1988a; Farr 1988b; Longini 1988). Full results from these studies are given in Table 7.

Primary outcomes

1. Numbers of cases of viral respiratory illness (including ARIs, ILI, and laboratory-confirmed influenza)

The three trials of virucidal tissues reported no differences in infection rates between tissues and placebo, and between tissues and no tissues (Farr 1988a; Farr 1988b; Longini 1988).

2. Adverse events related to the intervention

Farr 1988b reported cough in 4% of participants using virucidal tissues versus 57% in the placebo group, but 24% reported nasal burning in the virucidal tissue group versus 8% in the placebo group. Longini 1988 did not report on adverse effects.

Secondary outcomes

1. Deaths

Not reported.

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2. Severity of viral respiratory illness as reported in the studies

Not reported.

3. Absenteeism

Not reported.

4. Hospital admissions

Not reported.

5. Complications related to the illness (e.g. pneumonia)

Not reported.

DISCUSSION

Summary of main results

See Table 8.

1. Medical/surgical masks compared to no masks

The pooled estimates of effect from randomised controlled trials (RCTs) and cluster-RCTs for wearing medical/surgical masks compared to no masks in the community suggests probably little or no difference in interrupting the spread of influenza-like illness (ILI)/COVID-19 like illness (risk ratio (RR) 0.95, 95% confidence interval (CI) 0.84 to 1.09; moderate-certainty evidence), or laboratory-confirmed influenza/SARS-CoV-2 (RR 1.01, 95% CI 0.72 to 1.42; moderate-certainty evidence). Six trials were cluster-RCTs, with all participants in the intervention clusters required to wear masks, thus assessing both source control and personal protection. In two trials the clusters were households with a member with new influenza; neither trial found any protective effect (RR 1.03 in 105 households (Canini 2010); RR 1.21 in 145 households (MacIntyre 2009). In two trials the clusters were college dormitories during the influenza season; neither trial found any reduction (RR 1.10 in 37 dormitories (Aiello 2012); RR 0.90 in three dormitories (Aiello 2010)). Two studies were conducted during the COVID-19 pandemic and their addition had minimal impact on the pooled estimate of effect previously reported from the earlier studies focused on influenza (Abaluck 2022; Bundgaard 2021). We excluded Aiello 2010 from meta-analysis since we did not consider 'randomisation' of three clusters to three arms was a proper randomised trial.

Less than half of the trials comparing masks with no masks addressed harms of mask wearing (Canini 2010; Cowling 2008; MacIntyre 2015; Suess 2012). Warmth, respiratory difficulties, humidity, and general discomfort were the most frequently reported adverse events. Neither of the RCTs conducted during the COVID-19 pandemic directly assessed harms of mask wearing. More adults reported no harms compared to children.

In one trial cloth masks were associated with a significantly higher risk of both ILI and laboratory-confirmed respiratory virus infection in healthcare workers (HCWs) (MacIntyre 2015). In addition, filtration capacity of the two-ply cotton cloth masks was found to be only 3% and markedly less than with medical/surgical masks based on standardised particle testing. The authors suggested moisture retention, poor filtration, and penetration of the virus through the mask as plausible explanations for the increased risk of infection.

We did not find any randomised trials assessing the effectiveness of barrier interventions using a combination of masks, gloves, and gowns.

2. N95 respirators compared to medical/surgical masks

Comparisons between N95 respirators and medical/surgical masks, used as needed for exposure to at-risk patients, for the outcomes of clinical respiratory illness and the outcome of laboratory-confirmed influenza showed estimates of effect suggesting considerable uncertainty for any benefit of N95 respirators for the former outcome and probably little or no difference for the latter outcome. Five trials (four in healthcare settings and one in a household setting) compared N95/P2 respirators with medical/surgical masks. Pooling of three of these trials showed an estimate of effect suggesting considerable uncertainty as to whether there was any benefit comparing N95 respirators and medical/surgical face masks for the outcome of clinical respiratory illness (RR 0.70, 95% CI 0.45 to 1.10; very low-certainty evidence), and that N95 respirators may make little or no difference for the outcome of ILI (RR 0.82, 95% CI 0.66 to 1.03; low-certainty evidence), and probably little or no difference for the outcome of laboratory-confirmed influenza (RR 1.10, 95% CI 0.90 to 1.34; moderate-certainty evidence). The presence of imprecision (wide CIs) and heterogeneity, particularly for the more subjective and less precise outcomes of clinical respiratory illness and ILI compared to laboratory-confirmed influenza infection, makes it difficult to assess whether there may be a benefit of either medical/surgical masks or N95/P2 respirators. Restricting the pooling to HCWs made no difference to the overall findings. The two trials with the largest event rates were quite consistent in their findings of no significant differences between N95 and medical/surgical masks for the outcomes of laboratory-confirmed influenza and all laboratory-confirmed viral infections (Loeb 2009; Radonovich 2019). Three of the trials contributing to this analysis were carried out by members of the same group (MacIntyre 2009; MacIntyre 2011; MacIntyre 2013).

In general, harms were poorly reported or not reported at all in trials comparing N95 respirators with surgical masks. General discomfort resulting in reduced wear adherence was the most frequently reported harm.

3. Hand hygiene compared to control

We found that the estimate of effect may offer a benefit for hand hygiene for the composite outcome 'acute respiratory infections (ARI) or ILI or influenza' (RR 0.89, 95% CI 0.83 to 0.94; low-certainty evidence), and probably offers a benefit for the outcomes ARI alone (RR 0.86, 95% CI 0.81 to 0.90; moderate-certainty evidence), and absenteeism (RR 0.64, 95% CI 0.58 to 0.71). An observed estimate of effect in favour of hand hygiene for laboratory-confirmed influenza, but with wider CIs may be a consequence of smaller sample sizes in conjunction with a more rigorous outcome measure.

4. Hand hygiene + medical/surgical masks compared to control

The estimate of effect of combined hand hygiene and medical/surgical mask interventions compared to control in six (mostly small) trials suggested that the intervention may make little or no difference for the outcomes ILI (RR 1.03, 95% CI 0.77 to 1.37), and laboratory-confirmed influenza (four trials) (RR 0.97, 95% CI 0.69 to 1.36).

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5. Hand hygiene + medical/surgical masks compared to hand hygiene

We also found an estimate of effect suggesting that adding medical/surgical masks to hand hygiene compared to hand hygiene alone may make little or no difference for the outcomes ILI (RR 1.03, 95% CI 0.69 to 1.53; 3 trials), and laboratory-confirmed influenza (RR 0.99, 95% CI 0.69 to 1.44).

6. Medical/surgical masks compared to other (non-N95) masks

One trial found that medical/surgical masks were more effective than cloth masks at reducing the rate of ILI (RR 13.25, 95% CI 1.74 to 100.97) (MacIntyre 2015), but the extremely wide CIs make this finding difficult to interpret. One trial did not find a benefit from catechin-treated masks over untreated masks on influenza infection rates (adjusted odds ratio (OR) 2.35, 95% CI 0.40 to 13.72; P = 0.34) (Ide 2016).

Harms of wearing masks were reported in 40.4% of HCWs using medical/surgical masks, and in 42.6% of those wearing cloth masks (P = 0.45) (MacIntyre 2015). The penetration of particles was higher in cloth masks (97%) compared to medical/surgical masks (44%).

7. Soap + water compared to sanitiser, and comparisons of different types of sanitiser

There were too few trials comparing different types of hand hygiene interventions to be certain of any true differences between soap and water, alcohol-based hand sanitisers, or other types of interventions. Also, it is uncertain whether the incremental effect of adding virucidals or antiseptics to hand-washing actually decreased the respiratory disease burden outside the confines of the rather atypical studies. The extra benefit may have been, at least in part, accrued by confounding additional routines.

8. Surface/object disinfection (with or without hand hygiene) compared to control

We identified six trials on surface/object disinfection (with or without hand hygiene), and although they were heterogeneous (and therefore could not be pooled), three of them showed a clear benefit compared to controls (Ban 2015; Carabin 1999; Ibfelt 2015).

We found no RCTs of nose disinfection, or disinfection of living quarters, as described in observational studies reported in Jefferson 2011.

9. Complex interventions compared to control

Four trials studied complex hygiene and sanitation interventions, all in low-income country settings (Chard 2019; Hartinger 2016; Huda 2012; Najnin 2019). These trials could not be pooled due to the heterogeneity of the interventions and settings. All four trials found no significant differences between groups in the rates of viral respiratory illness.

10. Physical distancing/quarantine compared to control

We identified one trial that evaluated the effect of quarantine and found a reduction in influenza transmission to co-workers when those with infected household members stayed home from work (Miyaki 2011). However, staying home increased their risk of being infected two-fold. Two studies conducted during the COVID-19 pandemic on SARS-cov-2 transmission showed (1) non-inferiority of daily contact testing of school-based contacts (intervention) compared to self-isolation (control) (Young 2021); and (2) access to fitness centres with physical distancing and low population prevalence of SARS-CoV-2 infection did not increase risk of SARS-cov-2 infection (Helsingen 2021).

11. Eye protection compared to control

We only identified one trial of eye protection which was a preprint only (Fretheim 2022a).

12. Gargling compared to control

Three trials addressed the use of gargling in preventing respiratory infections (Goodall 2014; Ide 2014; Satomura 2005). Although the trials used a variety of liquids and different outcomes, pooling the results of the two trials that compared gargling with tap water versus control did not show a favourable effect in reducing URTIs (RR 0.91, 95% CI 0.63 to 1.31) (Goodall 2014; Satomura 2005). Two trials of mouthwash/nose rinse were conducted during the SARS-cov-2 pandemic in HCWs: Almanza-Reyes 2021 compared silver mouth wash/nose rinse versus conventional mouthwashes and nose rinse; and Gutiérrez-García 2022 compared neutral electrolysed water mouth and nose rinses versus no rinses. Both studies reported large protective effects of the intervention on SARS-CoV-2 infection with reported outcomes of SARS-C0V-2 infection in 28.2% and 12.7% in the HCWs not using the interventions versus 1.8% and 1.2% in those using the intervention, despite the use of full personal protective equipment (PPE) and the high outcome rates raise questions about risk of bias, and no data were provided about baseline rates in other settings with full use of PPE.

13. Virucidal tissues compared to control

Two reports (three trials) identified in Jefferson 2011 studied the effect of virucidal tissues compared to placebo or no tissues (Farr 1988a; Farr 1988b; Longini 1988). These trials found no differences in infection rates and could not be pooled.

Overall completeness and applicability of evidence

Several features need consideration before making generalisations based on the included studies.

The settings of the included studies, which were conducted over five decades, were heterogeneous and ranged from suburban schools, Carabin 1999, to emergency departments, intensive care units, and paediatric wards, Loeb 2009, in high-income countries; slums in low-income countries (Luby 2005); and an upper Manhattan immigrant Latino neighbourhood (Larson 2010). Few attempts were made to obtain socio-economic diversity by (for example) involving more schools in the evaluations of the same programme. We identified only a few studies from low-income countries, where the vast majority of the burden of ARIs lies and where inexpensive interventions are so critical. Additionally, limited availability of over-the-counter medications and national universal comprehensive health insurance provided with consequent physician prescription of symptomatic treatment may further limit the generalisability of findings.

The included trials generally reported few events and were conducted mostly during non-epidemic periods with the exception of the trials carried out during the influenza H1N1 and SARS-CoV-2 pandemics. The large study by Radonovich 2019 is an exception as it crossed over two of the highest reporting years for influenza in

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the USA between 2010 and 2017 (Elflein 2019). None of the trials were conducted during pandemics of SARS-CoV-1or in outbreaks of Middle East respiratory syndrome (MERS).

Of the trials assessing the effect of masks, six were carried out in those at greater exposure (i.e. HCWs) (Jacobs 2009; Loeb 2009; MacIntyre 2011; MacIntyre 2013; MacIntyre 2015; Radonovich 2019). None of these studies included HCWs undertaking aerosol-generating procedures, for which the World Health Organization (WHO) currently recommends the N95 or equivalent mask. Three trials on hand hygiene interventions were carried out in nursing homes, and included HCWs (McConeghy 2017; Temime 2018; Yeung 2011). The scarcity of RCTs on HCWs limits the generalisability of such results.

The variable quality of the methods of some studies is striking. Incomplete or no reporting of randomisation (Turner 2004a), blinding (Farr 1988a; Farr 1988b), numerators and denominators (Carabin 1999; Kotch 1994), interventions, and cluster coefficients in the relevant trials (Carabin 1999), led to a considerable loss of information. Potential biases were often not discussed.

Inappropriate placebos caused design problems. In some studies the placebo probably carried sufficient effect to dilute the intervention effects (Longini 1988). Two valiant attempts with virucidal tissues probably failed because placebo handkerchiefs were impregnated with a dummy compound that stung the users' nostrils (Farr 1988a; Farr 1988b).

Some studies used impractical interventions. Volunteers subjected to the intervention hand cleaner (organic acids) were not allowed to use their hands between cleaning and virus challenge, so the effect of normal use of the hands on the intervention remains unknown (Turner 2004a; Turner 2004b). Two per cent aqueous iodine painted on the hands, although a successful antiviral intervention, causes unacceptable cosmetic staining, which is impractical for all but those at the highest risk of epidemic contagion (Gwaltney 1980).

Adherence with interventions, especially educational programmes, was a problem for many studies despite the importance of many such low-cost interventions. Adherence with mask wearing varied; it was generally around 60% to 80%, but was reported to be as low as 40% (see Table 1). Overall, the logistics of carrying out trials that involve sustained behaviour change are demanding, particularly in challenging settings such as immigrant neighbourhoods or students' halls of residence.

The identified trials provided sparse and unsystematic data on adverse effects of the intervention, and few of the RCTs measured or reported adherence with the intervention, which is especially important for the use of medical/surgical masks or N95 respirators. No studies investigated how the level of adherence may have influenced the effect size.

We identified one study assessing the effects of eye protection (Fretheim 2022a), and we identified three studies on physical distancing/quarantine (Helsingen 2021; Miyaki 2011; Young 2021). The dearth of evidence and predominant setting of seasonal viral circulation limits generalisability of our findings to other contexts and any future epidemics due to other respiratory viruses such as the COVID-19 pandemic although there have been increasing numbers of RCTs and cluster-RCTs in the latter setting which are adding to the evidence base.

The two recent small trials from Mexico assessing local mouth/nose rinses airways prophylactic as interventions treatments report large but uncertain reductions in transmission to healthcare workers which warrant further study and replication by other investigator (Almanza-Reyes 2021; Gutiérrez-García 2022).

Certainty of the evidence

We found the available evidence base identified through our search processes to be of variable quality. Reporting of sequence generation and allocation concealment were poor in 30% to 50% of studies across the categories of intervention comparisons. Given the nature of the intervention comparison, blinding of treatment allocation after randomisation was rarely achieved. Although blinding of outcome assessment is highly feasible and desirable, most outcomes were assessed by self-reports. Outcomes in some studies were poorly defined, with a lack of clarity as to the possible aetiological agents (bacterial versus viral). Some studies used laboratory-confirmed outcomes, both adding precision and avoiding indirectness by having an accurate outcome measure and lowering the risk of bias (see Table 9 for heterogeneity of trial outcome definitions). We found no evidence of selective reporting of outcomes within the included studies. We believe publication bias is unlikely, as the included studies demonstrated a range of effects, both positive and negative, over all study sizes. The variable quality of the studies hampers drawing any firm conclusions.

Potential biases in the review process

The non-drug (and often locally manufactured) nature of most of the interventions in this review, the lack of effective regulation in some settings, and the possible endless number of manufacturers make it difficult to gauge the existence of unpublished data. Non-drug interventions typically have no or very loose regulation.

In this 2022 update, we again focused on RCTs and cluster-RCTs, providing a higher level of evidence compared with the previous version of the review, which also meta-analysed observational studies when appropriate (Jefferson 2011). However, many of the trials were small and hence underpowered, and at high or unclear risk of bias due to poor reporting of methods and lack of blinding. The populations, outcomes, comparators, and interventions tested were heterogeneous.

Due to the urgency of this update in the context of the COVID-19 pandemic, we did not contact trial authors to request missing data. This means that we have not considered studies that included other non-respiratory infections, and did not provide stratified data by type of infection.

Agreements and disagreements with other studies or reviews

Several reviews of RCTs have found broadly similar results to this review for face masks. In a meta-analysis comparing surgical masks with N95 respirators, Smith 2016 pooled three trials and found an estimate of effect suggesting no difference for laboratory-confirmed respiratory infections (OR 0.89, 95% CI 0.64 to 1.24) or ILI (OR 0.51, 95% CI 0.19 to 1.41) (Loeb 2009; MacIntyre 2011; MacIntyre 2013). A similar meta-analysis, Offeddu 2017, based on two trials concluded that masks (either N95/P2 respirators or medical/surgical masks) were effective against clinical respiratory infections (RR 0.59, 95% CI 0.46 to 0.77) and ILI (RR 0.34, 95% CI 0.14

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to 0.82) (MacIntyre 2011; MacIntyre 2015). Pooling of two studies (MacIntyre 2011; MacIntyre 2013) also found an estimate of effect that favoured N95 respirators to medical/surgical masks for clinical respiratory infections (RR 0.47, 95% CI 0.36 to 0.62), but not for ILI, (RR 0.59, 95% CI 0.27 to 1.28) based on three studies (Loeb 2009: MacIntyre 2011; MacIntyre 2013). The outcome of clinical respiratory infection is considered to be the most subjective and least precise outcome.

A recent meta-analysis included five trials comparing N95/P2 respirators with medical/surgical masks and found no difference between groups for either influenza (RR 1.09, 95% CI 0.92 to 1.28), or respiratory viral infections (RR 0.89, 95% CI 0.70 to 1.11) (Long 2020). By excluding Loeb 2009 (an open, non-inferiority RCT that compared medical/surgical masks with N95 respirators in protecting HCWs against influenza), the authors reported a significant protective effect against viral infections (RR 0.61, 95% CI 0.39 to 0.98). The authors do not report a rationale for the exclusion in the sensitivity analysis, and do not report on exclusion of the studies with low weighting, which arguably would be more relevant in a sensitivity analysis. The two trials that make up 96% of the weighting demonstrated no significant differences in the outcome events (Loeb 2009; Radonovich 2019). A recent meta-analysis of four RCTs adjusting for clustering, which compared N95 respirators with the use of medical/surgical masks, found pooled estimates of effect that did not demonstrate any difference in any laboratory-confirmed viral respiratory infection (OR 1.06, 95% CI 0.90 to 1.25), laboratory-confirmed influenza (OR 0.94, 95% CI 0.73 to 1.20), or clinical respiratory illness (OR 1.49, 95% CI 0.98 to 2.28), with the evidence profile suggesting that there was greater imprecision and inconsistency in the outcome of clinical respiratory illness (Bartoszko 2020). Moreover, in another recent systematic review that assessed the effectiveness of personal protective and environmental measures in non-healthcare settings (funded by the WHO), 10 RCTs reporting estimates of the effectiveness of face masks in reducing laboratory-confirmed influenza virus infections in the community were identified (Xiao 2020). The evidence from these RCTs suggested that the use of face masks either by infected persons or by uninfected persons does not have a substantial effect on influenza transmission.

The findings from several systematic reviews and meta-analyses over the last decade have not demonstrated any difference in the clinical effectiveness of N95 respirators or equivalent compared to the use of surgical masks when used by HCWs in multiple healthcare settings for the prevention of respiratory virus infections, including influenza.

Reviews based on observational studies have usually found a stronger protective effect for face masks, but have important biases. The review by Chu 2020 did not consider RCTs of influenza transmission, but only the observational studies examining impact on SARS, MERS, or SARS-CoV-2. For N95 masks versus no mask in HCWs, there was a large protective effective with an OR of 0.04 (95% CI 0.004 to 0.30); for surgical masks versus no masks, there was an OR of 0.33 (0.17 to 0.61) overall, but four of these studies were in healthcare settings. Chu 2020 has been criticised for several reasons: use of an outdated 'Risk of bias' tool; inaccuracy of distance measures; and not adequately addressing multiple sources of bias, including recall and classification bias and in particular confounding. Confounding is very likely, as preventive behaviours such as mask use, social distancing, and hand hygiene are correlated behaviours, and hence any effect estimates are likely to be overly optimistic.

The two RCTs of medical/surgical masks during the SARS-CoV-2 pandemic found uncertain evidence of a small or no effect (Abaluck 2022; Bundgaard 2021). The study by Abaluck 2022 found a statistically significant benefit of masks versus no masks for COVID-like-illness, however, this study was rated at high risk of bias for five of the six domains due to issues including baseline imbalance, subjective outcome assessment and incomplete follow-up across the groups. Despite this study contributing 45% of the weight towards the meta-analysis of influenza/COVID-like-illness for masks versus no masks, the updated conclusions from the analysis strengthened around little or no effect of mask use.

Also based on observational studies, Jefferson 2011 found a protective effect of wearing surgical masks with hygienic measures compared to not wearing masks in the SARS 2003 outbreak (OR 0.32, 95% CI 0.26 to 0.39). However, the evidence was based on case-control studies carried out during the outbreak. There was some additional but very limited supportive evidence from the cohort studies in Jefferson 2011.

Although the use of eye protection and physical distancing measures are widely believed to be effective in reducing transmission of respiratory viruses and mitigating the impact of an influenza pandemic, we found only one trial investigating the role of self-quarantine in reducing the incidence of H1N1 influenza events in the workplace, and no trials examining the effect of eye protection. The evidence for these measures was derived largely from observational studies and simulation studies, and the overall certainty of supporting evidence is relatively low. The finding of limited evidence evaluating these interventions was also consistent with a recent review funded by the WHO for the preparation of its guidelines on the use of non-pharmaceutical interventions for pandemic influenza in non-medical settings (Fong 2020).

There are several previous systematic reviews on hand hygiene and respiratory infections. Five of them reviewed the evidence in a community setting (Moncion 2019; Rabie 2006; Saunders-Hastings 2017; Warren-Gash 2013: Wong 2014), and three focused on children (Mbakaya 2017; Willmott 2016; Zivich 2018). The earliest review in 2006 included eight studies, three of which were RCTs (Rabie 2006). The pooled estimate of seven studies was described as “indicative” of the effect of hand hygiene, but the studies were of poor quality. The Warren-Gash 2013 review included 16 studies (10 of which were RCTs) and reported mixed and inconclusive results. A 2014 review identified 10 RCTs and reported that the combination of hand hygiene with face masks in high-income countries (five trials) significantly reduced the incidence of laboratory-confirmed influenza and ILI, whilst hand hygiene alone did not (Wong 2014). This significant reduction in laboratory-confirmed influenza and ILI for hand hygiene and face masks may have been based on the raw numbers without adjusting for any clustering effects in the included cluster trials, which produced inappropriately narrow CIs, and possibly biased treatment effect estimates. Moreover, trials from the low-income countries were not included in the review, and this significant effect was not demonstrated when all the trials identified in the review were combined. The Saunders-Hastings 2017 review of studies evaluating the effectiveness of personal protective measures in interrupting pandemic influenza transmission only

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identified two RCTs (Azor-Martinez 2014; Suess 2012), which reported a significant effect of hand hygiene. The Moncion 2019 review identified seven RCTs of hand hygiene compared to control, with mixed results for preventing the transmission of laboratory-confirmed or possible influenza. Systematic reviews of RCTs of hand hygiene interventions amongst children, Mbakaya 2017 and Willmott 2016, or at a non-clinical workplace, Zivich 2018, identified heterogeneous trials with quality problems including small numbers of clusters and participants, inadequate randomisation, and self-reported outcomes. Evidence of impact on respiratory infections was equivocal.

A rapid search for other systematic reviews of RCTs was conducted in September 2022, and none of high quality were found.

AUTHORS' CONCLUSIONS

Implications for practice

The evidence summarised in this review on the use of masks is largely based on studies conducted during traditional peak respiratory virus infection seasons up until 2016. Two relevant randomised trials conducted during the COVID-19 pandemic have been published, but their addition had minimal impact on the overall pooled estimate of effect. The observed lack of effect of mask wearing in interrupting the spread of influenza-like illness (ILI) or influenza/COVID-19 in our review has many potential reasons, including: poor study design; insufficiently powered studies arising from low viral circulation in some studies; lower adherence with mask wearing, especially amongst children; quality of the masks used; self-contamination of the mask by hands; lack of protection from eye exposure from respiratory droplets (allowing a route of entry of respiratory viruses into the nose via the lacrimal duct); saturation of masks with saliva from extended use (promoting virus survival in proteinaceous material); and possible risk compensation behaviour leading to an exaggerated sense of security (Ammann 2022; Brosseau 2020; Byambasuren 2021; Canini 2010; Cassell 2006; Coroiu 2021; MacIntyre 2015; Rengasamy 2010; Zamora 2006).

Our findings show that hand hygiene has a modest effect as a physical intervention to interrupt the spread of respiratory viruses, but several questions remain. First, the high heterogeneity between studies may suggest that there are differences in the effect of different interventions. The poor reporting limited our ability to extract the information needed to assess any 'dose response' relationship, and there are few head-to-head trials comparing hand hygiene materials (such as alcohol-based sanitiser or soap and water). Second, the sustainability of hand hygiene is unclear where participants in some studies achieved 5 to 10 hand-washings per day, but adherence may have diminished with time as motivation decreased, or due to adverse effects from frequent hand-washing. Third, there is little evidence about the effectiveness of combinations of hand hygiene with other interventions, and how those are best introduced and sustained. Finally, some interventions were intensively implemented within small organisations, and involved education or training as a component, and the ability to scale these up to broader interventions is unclear.

Our findings with respect to hand hygiene should be considered generally relevant to all viral respiratory infections, given the diverse populations where transmission of viral respiratory infections occurs. The participants were adults, children and families, and multiple congregation settings including schools, childcare centres, homes, and offices. Most respiratory viruses, including the pandemic SARS-CoV-2, are considered to be predominantly spread via respiratory particles of varying size or contact routes, or both (WHO 2020c). Data from studies of SARS-CoV-2 contamination of the environment based on the presence of viral ribonucleic acid and infectious virus suggest significant fomite contamination (Lin 2022; Onakpoya 2022b; Ong 2020; Wu 2020). Hand hygiene would be expected to be beneficial in reducing the spread of SARS-CoV-2 similar to other beta coronaviruses (SARS-CoV-1, Middle East respiratory syndrome (MERS), and human coronaviruses), which are very susceptible to the concentrations of alcohol commonly found in most hand-sanitiser preparations (Rabenau 2005; WHO 2020c). Support for this effect is the finding that poor hand hygiene, despite the use of full personal protective equipment (PPE), was independently associated with an increased risk of SARS-CoV-2 transmission to healthcare workers in a retrospective cohort study in Wuhan, China in both a high-risk and low-risk clinical unit for patients infected with COVID-19 (Ran 2020). The practice of hand hygiene appears to have a consistent effect in all settings, and should be an essential component of other interventions.

The highest-quality cluster-RCTs indicate that the most effect on preventing respiratory virus spread from hygienic measures occurs in younger children. This may be because younger children are least capable of hygienic behaviour themselves (Roberts 2000), and have longer-lived infections and greater social contact, thereby acting as portals of infection into the household (Monto 1969). Additional benefit from reduced transmission from them to other members of the household is broadly supported by the results of other study designs where the potential for confounding is greater.

Routine long-term implementation of some of the interventions covered in this review may be problematic, particularly maintaining strict hygiene and barrier routines for long periods of time. This would probably only be feasible in highly motivated environments, such as hospitals. Many of the trial authors commented on the major logistical burdens that barrier routines imposed at the community level. However, the threat of a looming epidemic may provide stimulus for their inception.

Implications for research

Public health measures and physical interventions can be highly effective to interrupt the spread of respiratory viral infections, especially when they are part of a structured and co-ordinated programme that includes instruction and education, and when they are delivered together and with high adherence. Our review has provided important insights into research gaps that need to be addressed with respect to these physical interventions and their implementation and have been brought into a sharper focus as a result of the COVID-19 pandemic. The 2014 WHO document 'Infection prevention and control of epidemic - and pandemic-prone acute respiratory infections in health care' identified several research gaps as part of their GRADE assessment of their infection prevention and control recommendations, which remain very relevant (WHO 2014). Research gaps identified during the course of our review and the WHO 2014 document may be considered from the perspective of both general and specific themes.

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A general theme identified was the need to provide outcomes with explicitly defined clinical criteria for acute respiratory infections (ARIs) and discrete laboratory-confirmed outcomes of viral ARIs using molecular diagnostic tools which are now widely available. Our review found large disparities between studies with respect to the clinical outcome events, which were imprecisely defined in several studies, and there were differences in the extent to which laboratory-confirmed viruses were included in the studies that assessed them. Another general theme identified was the lack of consideration of sociocultural factors that might affect adherence with the interventions, especially those employed in the community setting. A prime example of this latter point was illustrated by the observations of the use of masks versus mask mandates during the COVID-19 pandemic. In addition, the cost and resource implications of the physical interventions employed in different settings would have important relevance for low- to middle-income countries. Resources have been a major issue with the COVID-19 pandemic, with global shortages of several components of PPE. Several specific research gaps related to physical interventions were identified within the WHO 2014 document and are congruent with many of the findings of this 2022 update, including the following: transmission dynamics of respiratory viruses from patients to healthcare workers during aerosol-generating procedures; a continued lack of precision with regards to defining aerosol-generating procedures; the safety of cohorting of patients with the same suspected but unconfirmed diagnosis in a common unit or ward with patients infected with the same known pathogen in healthcare settings; the optimal duration of the use of physical interruptions to prevent spread of ARI viruses; use of spatial separation or physical distancing (in healthcare and community settings, respectively) alone versus spatial separation or physical distancing with the use of other added physical interventions coupled with examining discrete distance parameters (e.g. one metre, two metres, or > two metres); the effectiveness of respiratory etiquette (i.e. coughing/sneezing into tissues or a sleeved bent elbow); the effectiveness of triage and early identification of infected individuals with an ARI in both hospital and community settings; the utility of entrance screening to healthcare facilities; use of frequent disinfection techniques appropriate to the setting (high-touch surfaces in the environment, gargling with oral disinfectants, and virucidal tissues or clothing) alone or in combination with facial masks and hand hygiene; the use of visors, goggles or other eyewear; the use of ultraviolet light germicidal irradiation for disinfection of air in healthcare and selected community settings; the use of air scrubbers and /or high-efficiency particulate absorbing filters and the use of widespread adherence with effective vaccination strategies.

There is a clear requirement to conduct large, pragmatic trials to evaluate the best combinations in the community and in healthcare settings with multiple respiratory viruses and in different sociocultural settings. Randomised controlled trials (RCTs) with a pragmatic design, similar to the Luby 2005 trial or the Bundgaard 2020 trial, should be conducted whenever possible. Similar to what has been observed in pharmaceutical interventions where multiple RCTs were rapidly and successfully completed during the COVID-19 pandemic, proving they can be accomplished, there should be a deliberate emphasis and directed funding opportunities provided to conduct well-designed RCTs to address the effectiveness of many of the physical interventions in multiple settings and populations, especially in those most at risk, and in very specific well-defined populations with monitoring of the adherence to the interventions.

Several specific research gaps deserve expedited attention and may be highlighted within the context of the COVID-19 pandemic. The use of face masks in the community setting represents one of the most pressing needs to address, given the polarised opinions around the world, and the increasing concerns over widespread microplastic pollution from the discarding of masks (Shen 2021). Both broad-based ecological studies, adjusting for confounding and high quality RCTs, may be necessary to determine if there is an independent contribution to their use as a physical intervention, and how they may best be deployed to optimise their contribution. The type of fabric and weave used in the face mask is an equally pressing concern, given that surgical masks with their cotton-polypropylene fabric appear to be effective in the healthcare setting, but there are questions about the effectiveness of simple cotton masks. In addition, any masking intervention studies should focus on measuring not only benefits but also adherence, harms, and risk compensation if the latter may lead to a lower protective effect. In addition, although the use of medical/surgical masks versus N95 respirators demonstrates no differences in clinical effectiveness to date, their use needs to be further studied within the context of a well-designed RCT in the setting of COVID-19, and with concomitant measurement of harms, which to date have been poorly studied. The recently published Loeb RCT conducted over a prolonged course in the current pandemic has provided the only evidence to date in this area (Loeb 2022).

Physical distancing represents another major research gap which needs to be addressed expediently, especially within the context of the COVID-19 pandemic setting as well as in future epidemic settings. The use of quarantine and screening at entry ports needs to be investigated in well-designed, high-quality RCTs given the controversies related to airports and travel restrictions which emerged during the COVID-19 pandemic. We found only one RCT investigating quarantine, and no trials of screening at entry ports or physical distancing. Given that these and other physical interventions are some of the primary strategies applied globally in the face of the COVID-19 pandemic, future trials of high quality should be a major global priority to be conducted within the context of this pandemic, as well as in future epidemics with other respiratory viruses of less virulence.

The variable quality and small scale of some studies is known from descriptive studies (Aiello 2002; Fung 2006; WHO 2006b), and systematic reviews of selected interventions (Meadows 2004). In summary, more high-quality RCTs are needed to evaluate the most effective strategies to implement successful physical interventions in practice, both on a small scale and at a population level. It is very unfortunate that more rigorous planning, effort and funding was not provided during the current COVID-19 pandemic towards high-quality RCTs of the basic public health measures. Finally, we emphasise that more attention should be paid to describing and quantifying the harms of the interventions assessed in this review, and their relationship with adherence.

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The following people conducted the editorial process for this 2022 update:

- Sign-off Editor (final editorial decision): Michael Brown (Michigan State University College of Human Medicine, USA).
- Managing Editor (selected peer reviewers, collated peer reviewer comments, provided editorial guidance to authors): Fiona Russell (Bond University, Australia).
- Contact Editor (assessed peer review comments and recommended an editorial decision): Allen Cheng (Monash University, Australia).
- Statistical Editor (provided comments): Teresa Neeman (Biological Data Science Institute, Australian National University, Australia).
- Copy Editor (copy-editing and production): Heather Maxwell.

Peer reviewers (provided comments and recommended an editorial decision):

- Clinical/content review: Roderick P. Venekamp.
- Consumer review: Janet Wale (Independent consumer representative).
- Methods review: Leslie Choi (Evidence Synthesis Development Editor, Cochrane Central Executive Team).

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REFERENCES

References to studies included in this review

Abaluck 2022 *{published data only}*

Abaluck J, Kwong LH, Styczynski A, Haque A, Kabir MA, Bates-Jefferys E, et al. Impact of community masking on COVID-19: a cluster-randomized trial in Bangladesh. *Science* 2022;**375**(6577):eabi9069. [DOI: 10.1126/science.abi9069]

Aelami 2015 *{published data only}*

Aelami MH, Khajehdalouee M, Yagoubian H, Amel Jamahdar S, Pittet D. Implementation of an educational intervention among Iranian hajj pilgrims for the prevention of influenza-like illness. *Antimicrobial Resistance and Infection Control* 2015;**4**(1):48.

Aiello 2010 *{published data only}*

Aiello AE, Murray GF, Perez V, Coulborn RM, Davis BM, Uddin M, et al. Mask use, hand hygiene, and seasonal influenza-like illness among young adults: a randomized intervention trial. *Journal of Infectious Diseases* 2010;**201**(4):491-8.

Aiello 2012 *{published data only}*

Aiello AE, Perez V, Coulborn RM, Davis BM, Uddin M, Monto AS. Facemasks, hand hygiene, and influenza among young adults: a randomized intervention trial. *PLOS One* 2012;**7**(1):e29744. [CTG: NCT00490633]

Alfelali 2020 *{published data only}*

Alfelali M, Haworth EA, Barasheed O, Badahdah AM, Bokhary H, Tashani M, et al. Facemask against viral respiratory infections among Hajj pilgrims: a challenging cluster-randomized trial. *PLOS One* 2020;**15**(10):e0240287. [DOI: 10.1371/journal.pone.0240287]

Almanza-Reyes 2021 *{published data only}*

Almanza-Reyes H, Moreno S, Plascencia-López I, Alvarado-Vera M, Patrón-Romero L, Borrego B, et al. Evaluation of silver nanoparticles for the prevention of SARS-CoV-2 infection in health workers: in vitro and invivo. *PLOS One* 2021;**16**(8):e0256401. [DOI: 10.1371/journal.pone.0256401]

Alzaher 2018 *{published data only}***10.15537/smj.2018.10.23344**

Alzaher AA, Almudarra SS, Mustafa MH, Gosadi IM. The importance of hand hygiene education on primary schoolgirls' absence due to upper respiratory infections in Saudi Arabia. *Saudi Medical Journal* 2018;**39**(10):1044-9. [DOI: 10.15537/smj.2018.10.23344]

Arbogast 2016 *{published data only}*

Arbogast JW, Moore-Schiltz L, Jarvis WR, Harpster-Hagen A, Hughes J, Parker A. Impact of a comprehensive workplace hand hygiene program on employer health care insurance claims and costs, absenteeism, and employee perceptions and practices. *Journal of Occupational and Environmental Medicine* 2016;**58**(6):e231-40.

Ashraf 2020 *{published data only}*

Ashraf S, Islam M, Unicomb L, Rahman M, Winch PJ, Arnold BF, et al. Effect of improved water quality, sanitation, hygiene and nutrition interventions on respiratory illness in young children in rural Bangladesh: a multi-arm cluster-randomized controlled trial. *American Journal of Tropical Medicine and Hygiene* 2020;**102**(5):1124-30. [DOI: 10.4269/ajtmh.19-0769]

Azor-Martinez 2016 *{published data only}*

Azor-Martinez E, Cobos-Carrascosa E, Seijas-Vazquez ML, Fernández-Sánchez C, Strizzi JM, Torres-Alegre P, et al. Hand hygiene program decreases school absenteeism due to upper respiratory infections. *Journal of School Health* 2016;**86**(12):873-81.

Azor-Martinez 2018 *{published data only}*

Azor-Martinez E, Yui-Hifume R, Muñoz-Vico FJ, Jimenez-Noguera E, Strizzi JM, Martinez-Martinez I, et al. Effectiveness of a hand hygiene program at child care centers: a cluster randomized trial. *Pediatrics* 2018;**142**(5):e20181245.

Ban 2015 *{published data only}*

Ban HQ, Li T, Shen J, Li J, Peng PZ, Ye HP, et al. Effects of multiple cleaning and disinfection interventions on infectious diseases in children: a group randomized trial in China. *Biomedical and Environmental Sciences* 2015;**28**(11):779-87.

Barasheed 2014 *{published data only}***12613001007729**

Barasheed O, Almasri N, Badahdah AM, Heron L, Taylor J, McPhee K, et al, Hajj Research Team. Pilot randomised controlled trial to test effectiveness of facemasks in preventing influenza-like illness transmission among Australian hajj pilgrims in 2011. *Infectious Disorders Drug Targets* 2014;**14**(2):110-6. [DOI: 10.2174/1871526514666141021112855]

Biswas 2019 *{published data only}*

Biswas D, Ahmed M, Roguski K, Ghosh PK, Parveen S, Nizame FA, et al. Effectiveness of a behavior change intervention with hand sanitizer use and respiratory hygiene in reducing laboratory-confirmed influenza among schoolchildren in Bangladesh: a cluster randomized controlled trial. *American Journal of Tropical Medicine and Hygiene* 2019;**101**(6):1446-55. [DOI: 10.4269/ajtmh.19-0376]

Bundgaard 2021 *{published data only}*

Bundgaard H, Bundgaard JS, Raaschou-Pedersen DE, von Buchwald C, Todsen T, Boesgaard Norsk J, et al. Effectiveness of adding a mask recommendation to other public health measures to prevent SARS-CoV-2 infection in Danish mask wearers: a randomized controlled trial. *Annals of Internal Medicine* 2021;**174**(3):335-43. [DOI: 10.7326/M20-6817]

Canini 2010 *{published data only}*

Canini L, Andreoletti L, Ferrari P, D'Angelo R, Blanchon T, Lemaitre M, et al. Surgical mask to prevent influenza transmission in households: a cluster randomized trial. *PLOS One* 2010;**5**(11):e13998. [DOI: 10.1371/journal.pone.0013998]

Carabin 1999 *{published data only}*

Carabin H, Gyorkos TW, Soto JC, Joseph L, Payment P, Collet JP. Effectiveness of a training program in reducing infections in toddlers attending day care centers. *Epidemiology* 1999;**10**(3):219-27.

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Chard 2019 *{published data only}*10.7189/jogh.09.020402

Chard AN, Garn JV, Chang HW, Clasen T, Freeman MC. Impact of a school-based water, sanitation, and hygiene intervention on school absence, diarrhea, respiratory infection, and soil-transmitted helminths: results from the WASH HELPS cluster-randomized trial. *Journal of Global Health* 2019;**9**(2):1-14. [DOI: 10.7189/jogh.09.020402]

Correa 2012 *{published data only}*

Correa JC, Pinto D, Salas LA, Camaccho JC, Rondon M, Quintero J. A cluster-randomized controlled trial of handrubs for prevention of infectious diseases among children in Colombia. *Journal of Public Health* 2012;**31**(6):476-84.

Cowling 2008 *{published data only}*

Cowling BJ, Fung RO, Cheng CK, Fang VJ, Chan KH, Seto WH, et al. Preliminary findings of a randomized trial of non-pharmaceutical interventions to prevent influenza transmission in households. *PLOS One* 2008;**3**(5):e2101.

Cowling 2009 *{published data only}*

Cowling BJ, Chan KH, Fang VJ, Cheng CK, Fung ROP, Wai W, et al. Facemasks and hand hygiene to prevent influenza transmission in households. A randomized trial. *Annals of Internal Medicine* 2009;**151**(7):437-46.

DiVita 2011 *{published data only}*

DiVita MA, Khatun-e-Jannat K, Islam M, Cercone E, Rook K, Sohel BM, et al. Impact of intensive handwashing promotion on household transmission of influenza in a low income setting: preliminary results of a randomized controlled clinical trial. *American Journal of Tropical Medicine and Hygiene* 2011;**85**(6):381.

Farr 1988a *{published data only}*

Farr BM, Hendley JO, Kaiser DL, Gwaltney JM. Two randomised controlled trials of virucidal nasal tissues in the prevention of natural upper respiratory infections. *American Journal of Epidemiology* 1988;**128**:1162-72.

Farr 1988b *{published data only}*

Farr BM, Hendley JO, Kaiser DL, Gwaltney JM. Two randomised controlled trials of virucidal nasal tissues in the prevention of natural upper respiratory infection. *American Journal of Epidemiology* 1988;**128**:1162-72.

Feldman 2016 *{published data only}*

Feldman L, Galili E, Cohen Y, Hartal M, Yavnai N, Netzer I. Routine chlorhexidine gluconate use onboard navy surface vessels to reduce infection: a cluster randomized controlled trial. *American Journal of Infection Control* 2016;**44**(12):1535-8.

Fretheim 2022a *{published data only}*

Fretheim A, Elgersma IH, Helleve A, Elstrøm P, Kacelnik O, Hemkens LG. Glasses against transmission of 1 SARS-CoV-2 in the community (GLASSY): a pragmatic randomized trial. medRxiv preprint doi: https://doi.org/10.1101/2022.07.31.22278223 accessed 20 September 2022.

Goodall 2014 *{published data only}*

Goodall EC, Granados AC, Luinstra K, Pullenayegum E, Coleman BL, Loeb M, et al. Vitamin D3 and gargling for the prevention of upper respiratory tract infections: a randomized controlled trial. *BMC Infectious Diseases* 2014;**14**:273.

Gutiérrez-García 2022 *{published data only}*

Gutiérrez-García R, De La Cerda-Ángeles JC, Cabrera-Licona A, Delgado-Enciso I, Mervitch-Sigal N, Paz-Michel BA. Nasopharyngeal and oropharyngeal rinses with neutral electrolyzed water prevents COVID-19 in front-line health professionals: a randomized, open-label, controlled trial in a general hospital in Mexico City. *Biomedical Reports* 2021;**16**(2):11. [DOI: 10.3892/br.2021.1494]

Gwaltney 1980 *{published data only}*

Gwaltney JM Jr, Moskalski PB, Hendley JO. Interruption of experimental rhinovirus transmission. *Journal of Infectious Diseases* 1980;**142**(6):811-5.

Hartinger 2016 *{published data only}*

Hartinger SM, Lanata CF, Hattendorf J, Verastegui H, Gil AI, Wolf J, et al. Improving household air, drinking water and hygiene in rural Peru: a community-randomized controlled trial of an integrated environmental home-based intervention package to improve child health. *International Journal of Epidemiology* 2016;**45**(6):2089-99.

Helsingen 2021 *{published data only}*

Helsingen LM, Løberg M, Refsum E, Gjøstein DK, Wieszczy P, Olsvik Ø, et al, for the TRAiN study group. Covid-19 transmission in fitness centers in Norway - a randomized trial. *BMC Public Health* 2021;**21**(1):2103. [DOI: 10.1186/s12889 - 021 - 12073 - 0]

Hubner 2010 *{published data only}*

Hubner NO, Hubner C, Wodny M, Kampf G, Kramer A. Effectiveness of alcohol-based hand disinfectants in a public administration: impact on health and work performance related to acute respiratory symptoms and diarrhoea. *BMC Infectious Diseases* 2010;**10**(250):1-8.

Huda 2012 *{published data only}*

Huda TM, Unicomb L, Johnston RB, Halder AK, Yushuf Sharker MA, Luby SP. Interim evaluation of a large scale sanitation, hygiene and water improvement programme on childhood diarrhea and respiratory disease in rural Bangladesh. *Social Science & Medicine* 2012;**75**(4):604-11.

Ibfelt 2015 *{published data only}*

Ibfelt T, Engelund EH, Schultz AC, Andersen LP. Effect of cleaning and disinfection of toys on infectious diseases and micro-organisms in daycare nurseries. *Journal of Hospital Infection* 2015;**89**(2):109-15.

Ide 2014 *{published data only}*

Ide K, Yamada H, Matsushita K, Ito M, Nojiri K, Toyoizumi K, et al. Effects of green tea gargling on the prevention of influenza infection in high school students: a randomized controlled study. *PLOS One* 2014;**9**(5):e96373.

Copyright © 2023 The Authors. Cochrane Database of Systematic Reviews published by John Wiley & Sons, Ltd. on behalf of The Cochrane Collaboration.

Ide 2016 *{published data only}*

Ide K, Yamada H, Takuma N, Kawasaki Y, Morohoshi H, Takenaka A, et al. Effects of catechin-treated masks on the prevention of influenza infection: an exploratory randomized study. *Japanese Journal of Clinical Pharmacology and Therapeutics* 2016;**47**(6):229-34.

Jacobs 2009 *{published data only}*

Jacobs JL, Ohde S, Takahashi O, Tokuda Y, Omata F, Fukui T. Use of surgical face masks to reduce the incidence of the common cold among health care workers in Japan: a randomized controlled trial. *American Journal of Infection Control* 2009;**37**(5):417-9.

Kotch 1994 *{published data only}*

Kotch JB, Weigle KA, Weber DJ, Clifford RM, Harms TO, Loda FA, et al. Evaluation of an hygienic intervention in child day-care centers. *Pediatrics* 1994;**94**(6 Pt 2):991-4.

Ladegaard 1999 *{published data only}*

Ladegaard MB, Stage V. Hand hygiene and sickness among small children attending day care centres. An interventional study. *Ukesgrift von Laeger* 1999;**161**:4396-400.

Larson 2010 *{published data only}*

Larson EL, Ferng Y, Wong-McLoughlin J, Wang S, Haber M, Morse SS. Impact of non-pharmaceutical interventions on URIs and influenza in crowded, urban households. *Public Health Reports* 2010;**125**(2):178-91.

Little 2015 *{published data only}*

Little P, Stuart B, Hobbs FD, Moore M, Barnett J, Popoola D, et al. An internet-delivered handwashing intervention to modify influenza-like illness and respiratory infection transmission (PRIMIT): a primary care randomised trial. *Lancet* 2015;**386**:1631–9.

Loeb 2009 *{published data only}*

Loeb M, Dafoe N, Mahony J, John M, Sarabia A, Glavin V, et al. Surgical mask vs N95 respirator for preventing influenza among health care workers: a randomized trial. *JAMA* 2009;**302**(17):1865-71.

Longini 1988 *{published data only}*

Longini IM Jr, Monto AS. Efficacy of virucidal nasal tissues in interrupting familial transmission of respiratory agents. A field trial in Tecumseh, Michigan. *American Journal of Epidemiology* 1988;**128**(3):639-44.

Luby 2005 *{published data only}*

Luby SP, Agboatwalla M, Feikin DR, Painter J, Billhimer W, Altaf A, et al. Effect of handwashing on child health: a randomised controlled trial. *Lancet* 2005;**366**(9481):225-33.

MacIntyre 2009 *{published data only}*

MacIntyre CR, Cauchemez S, Dwyer DE, Seale H, Cheung P, Browne G, et al. Face mask use and control of respiratory virus transmission in households. *Emerging Infectious Diseases* 2009;**15**(2):233-41.

MacIntyre 2011 *{published data only}*

* MacIntyre CR, Wang Q, Cauchemez S, Seale H, Dwyer DE, Yang P, et al. A cluster randomized clinical trial comparing fit-tested and non-fit-tested N95 respirators to medical masks to prevent respiratory virus infection in health care workers. *Influenza and Other Respiratory Viruses* 2011;**5**(3):170–9.

MacIntyre CR, Wang Q, Rahman B, Seale H, Ridda I, Gao Z, et al. Efficacy of face masks and respirators in preventing upper respiratory tract bacterial colonization and co-infection in hospital healthcare workers. *Preventive Medicine* 2014;**62**:1-7.

MacIntyre 2013 *{published data only}***12609000778280**

MacIntyre CR, Wang Q, Seale H, Yang P, Shi W, Gao Z, et al. A randomized clinical trial of three options for N95 respirators and medical masks in health workers. *American Journal of Respiratory and Critical Care Medicine* 2013;**187**(9):960-6. [DOI: 10.1164/rccm.201207-1164OC]

MacIntyre 2015 *{published data only}*

MacIntyre CR, Seale H, Dung TC, Hien NT, Nga PT, Chughtai AA, et al. A cluster randomised trial of cloth masks compared with medical masks in healthcare workers. *BMJ Open* 2015;**5**(4):e006577.

MacIntyre 2016 *{published data only}*

MacIntyre CR, Zhang Y, Chughtai AA, Seale H, Zhang D, Chu Y, et al. Cluster randomised controlled trial to examine medical mask use as source control for people with respiratory illness. *BMJ Open* 2016;**6**(12):e012330. [DOI: 10.1136/bmjopen-2016-012330]

McConeghy 2017 *{published data only}*

McConeghy KW, Baier R, McGrath KP, Baer CJ, Mor V. Implementing a pilot trial of an infection control program in nursing homes: results of a matched cluster randomized trial. *Journal of the American Medical Directors Association* 2017;**18**(8):707-12.

Millar 2016 *{published data only}***10.1017/ice.2016.154**

Millar EV, Schlett CD, Law NN, Chen WJ, D'Onofrio MJ, Bennett JW, et al. Reduction in acute respiratory infection among military trainees: secondary effects of a hygiene-based cluster-randomized trial for skin and soft-tissue infection prevention. *Infection Control and Hospital Epidemiology* 2016;**37**(9):1118-20.

Miyaki 2011 *{published data only}*

Miyaki K, Sakurazawa H, Mikurube H, Nishizaka M, Ando H, Song Y, et al. An effective quarantine measure reduced the total incidence of influenza A H1N1 in the workplace: another way to control the H1N1 flu pandemic. *Journal of Occupational Health* 2011;**53**(4):287-92. [DOI: 10.1539/joh.10-0024-fs]

Morton 2004 *{published data only}*

Morton JL, Schultz AA. Healthy hands: use of alcohol gel as an adjunct to handwashing in elementary school children. *Journal of School Nursing* 2004;**20**(3):161-7.

Copyright © 2023 The Authors. Cochrane Database of Systematic Reviews published by John Wiley & Sons, Ltd. on behalf of The Cochrane Collaboration.

Najnin 2019 *{published data only}*

Najnin N, Leder K, Forbes A, Unicomb L, Winch PJ, Ram PK, et al. Impact of a large-scale handwashing intervention on reported respiratory illness: findings from a cluster-randomized controlled trial. *American Journal of Tropical Medicine and Hygiene* 2019;**100**(3):742-9.

Nicholson 2014 *{published data only}*

Nicholson JA, Naeeni M, Hoptroff M, Matheson JR, Roberts AJ, Taylor D, et al. An investigation of the effects of a hand washing intervention on health outcomes and school absence using a randomised trial in Indian urban communities. *Tropical Medicine and International Health* 2014;**19**(3):284-92. [DOI: 10.1111/tmi.12254]

Pandejpong 2012 *{published data only}*

Pandejpong D, Danchaivijitr S, Vanprapa N, Pandejpong T, Cook EF. Appropriate time-interval application of alcohol hand gel on reducing influenza-like illness among preschool children: a randomized, controlled trial. *American Journal of Infection Control* 2012;**40**(6):507-11. [DOI: 10.1016/j.ajic.2011.08.020]

Priest 2014 *{published data only}***12609000478213**

Priest P, McKenzie JE, Audas R, Poore M, Brunton C, Reeves L. Hand sanitiser provision for reducing illness absences in primary school children: a cluster randomised trial. *PLOS Medicine* 2014;**11**(8):e1001700.

Radonovich 2019 *{published data only}*

Radonovich LJ Jr, Simberkoff MS, Bessesen MT, Brown AC, Cummings DA, Gaydos CA, et al, ResPECT investigators. N95 respirators vs medical masks for preventing influenza among health care personnel: a randomized clinical trial. *JAMA* 2019;**322**(9):824-33.

Ram 2015 *{published data only}*

Ram PK, DiVita MA, Khatun-e-Jannat K, Islam M, Krytus K, Cercone E, et al. Impact of intensive handwashing promotion on secondary household influenza-like illness in rural Bangladesh: findings from a randomized controlled trial. *PLOS One* 2015;**10**(6):e0125200. [DOI: 10.1371/journal.pone.0125200]

Roberts 2000 *{published data only}*

Roberts L, Smith W, Jorm L, Patel M, Douglas RM, McGilchrist C. Effect of infection control measures on the frequency of upper respiratory infection in child care: a randomised controlled study. *Pediatrics* 2000;**105**:738-42.

Sandora 2005 *{published data only}*

Sandora TJ, Taveras EM, Shih MC, Resnick EA, Lee GM, Ross-Degnan D, et al. A randomized, controlled trial of a multifaceted intervention including alcohol-based hand sanitizer and hand-hygiene education to reduce illness transmission in the home. *Pediatrics* 2005;**116**(3):587-94.

Sandora 2008 *{published data only}*

Sandora TJ, Shih MC, Goldmann DA. Reducing absenteeism from gastrointestinal and respiratory illness in elementary school students: a randomized, controlled trial of an infection-control intervention. *Pediatrics* 2008;**121**(6):e1555-62.

Satomura 2005 *{published data only}*

Kitamura T, Satomura K, Kawamura T, Yamada S, Takashima K, Suganuma N, et al. Can we prevent influenza-like illnesses by gargling? *Internal Medicine* 2007;**46**(18):1623-4.

* Satomura K, Kitamura T, Kawamura T, Shimbo T, Watanabe M, Kamei M, et al. Prevention of upper respiratory tract infections by gargling: a randomized trial. *American Journal of Preventive Medicine* 2005;**29**(4):302-7.

Savolainen-Kopra 2012 *{published data only}*

Savolainen-Kopra C, Haapakoski J, Peltola PA, Ziegler T, Korpela T, Anttila P, et al. Hand washing with soap and water together with behavioural recommendations prevents infections in common work environment: an open cluster-randomized trial. *Trials* 2012;**13**:10. [DOI: 10.1186/1745-6215-13-10]

Simmerman 2011 *{published data only}*

Simmerman JM, Suntarattiwong P, Levy J, Jarman RG, Kaewchana S, Gibbons RV, et al. Findings from a household randomized controlled trial of hand washing and face masks to reduce influenza transmission in Bangkok, Thailand. *Influenza and Other Respiratory Viruses* 2011;**5**(4):256-67. [DOI: 10.1111/j.1750-2659.2011.00205.x]

Stebbins 2011 *{published data only}*

Stebbins S, Cummings DA, Stark JH, Vukotich C, Mitruka K, Thompson W, et al. Reduction in the incidence of influenza A but not influenza B associated with use of hand sanitizer and cough hygiene in schools: a randomized controlled trial. *Pediatric Infectious Disease Journal* 2011;**30**(11):921-6. [DOI: 10.1097/INF.0b013e3182218656]

Suess 2012 *{published data only}*

Suess T, Remschmidt C, Schink SB, Schweiger B, Nitsche A, Schroeder K, et al. The role of facemasks and hand hygiene in the prevention of influenza transmission in households: results from a cluster randomised trial; Berlin, Germany, 2009-2011. *BMC Infectious Disease* 2012;**12**:26. [DOI: 10.1186/1471-2334-12-26]

Swarthout 2020 *{published data only}*

Swarthout J, Ram PK, Arnold CD, Dentz HN, Arnold BF, Kalungu S, et al. Effects of individual and combined water, sanitation, handwashing, and nutritional interventions on child respiratory infections in rural Kenya: a cluster-randomized controlled trial. *American Journal of Tropical Medicine and Hygiene* 2020;**102**(6):1286-95. [DOI: 10.4269/ajtmh.19-0779]

Talaat 2011 *{published data only}*

Talaat M, Afifi S, Dueger E, El-Ashry N, Marfin A, Kandeel A, et al. Effects of hand hygiene campaigns on incidence of laboratory-confirmed influenza and absenteeism in schoolchildren, Cairo, Egypt. *Emerging Infectious Diseases* 2011;**17**(4):619-25. [DOI: 10.3201/eid1704.101353]

Teesing 2021 *{published data only}*

Teesing GR, Richardus JH, Nieboer D, Petrignani M, Erasmus V, Verduijn-Leenman A, et al. The effect of a hand hygiene intervention on infections in residents of nursing

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homes: a cluster randomized controlled trial. *Antimicrobial Resistance & Infection Control* 2021;**10**(1):80. [DOI: 10.1186/s13756-021-00946-3.]

Temime 2018 *{published data only}***16474757**

Temime L, Cohen N, Ait-Bouziad K, Denormandie P, Dab W, Hocine MN. Impact of a multicomponent hand hygiene-related intervention on the infectious risk in nursing homes: a cluster randomized trial. *American Journal of Infection Control* 2018;**46**(2):173-9. [DOI: 10.1016/j.ajic.2017.08.030]

Turner 2004a *{published data only}*

Turner RB, Biedermann KA, Morgan JM, Keswick B, Ertel KD, Barker MF. Efficacy of organic acids in hand cleansers for prevention of rhinovirus infections. *Antimicrobial Agents and Chemotherapy* 2004;**48**(7):2595-8.

Turner 2004b *{published data only}*

Turner RB, Biedermann KA, Morgan JM, Keswick B, Ertel KD, Barker MF. Efficacy of organic acids in hand cleansers for prevention of rhinovirus infections. *Antimicrobial Agents and Chemotherapy* 2004;**48**(7):2595-8.

Turner 2012 *{published data only}*

Turner RB, Fuls JL, Rodgers ND, Goldfarb HB, Lockhart LK, Aust LB. A randomized trial of the efficacy of hand disinfection for prevention of rhinovirus infection. *Clinical Infectious Diseases* 2012;**54**(10):1422-6. [DOI: 10.1093/cid/cis201]

White 2001 *{published data only}*

White CG, Shinder FS, Shinder AL, Dyer DL. Reduction of illness absenteeism in elementary schools using an alcohol-free instant hand sanitizer. *Journal of School Nursing* 2001;**17**(5):258-65.

Yeung 2011 *{published data only}*

Yeung WK, Tam WS, Wong TW. Cluster randomized controlled trial of a hand hygiene intervention involving pocket-sized containers of alcohol-based hand rub for the control of infections in long-term care facilities. *Infection Control and Hospital Epidemiology* 2011;**32**:67-76.

Young 2021 *{published data only}*

Young BC, Eyre DW, Kendrick S, White C, Smith S, Beveridge G, et al. Daily testing for contacts of individuals with SARS-CoV-2 infection and attendance and SARS-CoV-2 transmission in English secondary schools and colleges: an open-label, cluster-randomised trial. *Lancet* 2021;**398**:1217-29. [DOI: .1016/S0140 - 6736(21)01908 - 5]

Zomer 2015 *{published data only}***NTR3000**

Zomer TP, Erasmus V, Looman CW, Tjon-A-Tsien A, Van Beeck EF, De Graaf JM, et al. A hand hygiene intervention to reduce infections in child daycare: a randomized controlled trial. *Epidemiology and Infection* 2015;**143**(12):2494-502. [DOI: 10.1017/S095026881400329X]

References to studies excluded from this review

Abou El Hassan 2004 *{published data only}*

Abou El Hassan MA, van der Meulen-Muileman I, Abbas S, Kruyt FA. Conditionally replicating adenoviruses kill tumor cells via a basic apoptotic machinery-independent mechanism that resembles necrosis-like programmed cell death. *Journal of Virology* 2004;**78**(22):12243-51.

Ahmadian 2022 *{published data only}*

Ahmadian M, Ghasemi M, Nasrollahi Borujeni N, Afshan S, Fallah M, Ayaseh H, et al. Does wearing a mask while exercising amid COVID-19 pandemic affect hemodynamic and hematologic function among healthy individuals? Implications of mask modality, sex, and exercise intensity. *Physician and Sportsmedicine* 2022;**50**(3):257-68.

Amirav 2005 *{published data only}*

Amirav I, Oron A, Tal G, Cesar K, Ballin A, Houri S, et al. Aerosol delivery in respiratory syncytial virus bronchiolitis: hood or face mask? *Journal of Pediatrics* 2005;**147**(5):627-31.

Anderson 2004 *{published data only}*

Anderson RM, Fraser C, Ghani AC, Donnelly CA, Riley S, Ferguson NM, et al. Epidemiology, transmission dynamics and control of SARS: the 2002-2003 epidemic. *Philosophical Transactions of the Royal Society of London - Series B: Biological Sciences* 2004;**359**(1447):1091-105.

Anonymous 2002 *{published data only}*

Anon. Antiseptic skin cleansers may prevent rhinovirus transmission. *Clinical Infectious Diseases* 2002;**34**(3):ii.

Anonymous 2004 *{published data only}*

Anon. Can antiviral tissues prevent the spread of colds? *Consumer Reports* 2004;**69**(12):56.

Anonymous 2005a *{published data only}*

Anon. Antiviral Kleenex. *Medical Letter on Drugs & Therapeutics* 2005;**47**(1199):3-4.

Anonymous 2005b *{published data only}*

Anon. Focusing on this year's flu...use healthy handwashing...and when soap and water aren't handy, hand gels work well, too. *Child Health Alert* 2005;**23**:1-2.

Anonymous 2005c *{published data only}*

How long is a cold contagious? Is there any way to prevent transmitting a cold? Johns Hopkins Medical Letter, Health After 50 2005;**17**(10):8.

Apisarnthanarak 2009 *{published data only}*

Apisarnthanarak A, Apisarnthanarak P, Cheevakumjorn B, Mundy LM. Intervention with an infection control bundle to reduce transmission of influenza-like illnesses in a Thai preschool. *Infection Control and Hospital Epidemiology* 2009;**30**(9):817-22.

Apisarnthanarak 2010 *{published data only}*

Apisarnthanarak A, Uyeki TM, Puthavathana P, Kitphati R, Mundy LM. Reduction of seasonal influenza transmission

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among healthcare workers in an intensive care unit: a 4-year intervention study in Thailand. *Infection Control and Hospital Epidemiology* 2010;**31**(10):996-1003.

Aragon 2005 *{published data only}*

Aragon D, Sole ML, Brown S. Outcomes of an infection prevention project focusing on hand hygiene and isolation practices. *AACN Clinical Issues* 2005;**16**(2):121-3.

Azor-Martinez 2014 *{published data only}*

Azor-Martinez E, Gonzalez-Jimenez Y, Seijas-Vazquez ML, Cobos-Carrascosa E, Santisteban-Martinez J, Martinez-Lopez JM, et al. The impact of common infections on school absenteeism during an academic year. *American Journal of Infection Control* 2014;**42**(6):632-7.

Barros 1999 *{published data only}*

Barros AJ, Ross DA, Fonseca WV, Williams LA, Moreira-Filho DC. Preventing acute respiratory infections and diarrhoea in child care centres. *Acta Paediatrica* 1999;**88**(10):1113-8.

Bauer 2009 *{published data only}*

Bauer G, Bossi L, Santoalla M, Rodríguez S, Fariña D, Speranza AM. Impacto de un programa de prevención de infecciones respiratorias en lactantes prematuros de alto riesgo: estudio prospectivo y multicéntrico. *Archivos Argentinos de Pediatria* 2009;**107**(2):111-8.

Bell 2004 *{published data only}*

Bell DM. World Health Organization Working Group on International and Community Transmission of SARS. *Emerging Infectious Diseases* 2004;**10**(11):1900-6.

Bellissimo-Rodrigues 2009 *{published data only}*

Bellissimo-Rodrigues F, Bellissimo-Rodrigues WT, Viana JM, Teixeira GC, Nicolini E, Auxiliadora-Martins M, et al. Effectiveness of oral rinse with chlorhexidine in preventing nosocomial respiratory tract infections among intensive care unit patients. *Infection Control and Hospital Epidemiology* 2009;**30**(10):952-8.

Ben-Abraham 2002 *{published data only}*

Ben-Abraham R, Keller N, Szold O, Vardi A, Weinberg M, Barzilay Z, et al. Do isolation rooms reduce the rate of nosocomial infections in the pediatric intensive care unit? *Journal of Critical Care* 2002;**17**(3):176-80.

Black 1981 *{published data only}*

Black RE, Dykes AC, Anderson KE, Wells JG, Sinclair SP, Gary GW, et al. Handwashing to prevent diarrhea in day-care centers. *American Journal of Epidemiology* 1981;**113**(4):445-51.

Borkow 2010 *{published data only}*

Borkow G, Zhou SS, Page T, Gabbay J. A novel anti-influenza copper oxide containing respiratory face mask. *PLOS One* 2010;**5**(6):1-8.

Bouadma 2010 *{published data only}*

Bouadma L, Mourvillier B, Deiler V, Le Corre B, Lolom I, Régnier B, et al. A multifaceted program to prevent ventilator-associated pneumonia: impact on compliance with preventive measures. *Critical Care Medicine* 2010;**38**(3):789-96.

Bowen 2007 *{published data only}*

Bowen A, Ma H, Ou J, Billhimer W, Long T, Mintz E, et al. A cluster-randomized controlled trial evaluating the effect of a handwashing-promotion program in Chinese primary schools. *American Journal of Tropical Medicine and Hygiene* 2007;**76**(6):1166-73.

Breugelmans 2004 *{published data only}*

Breugelmans JG, Zucs P, Porten K, Broll S, Niedrig M, Ammon A, et al. SARS transmission and commercial aircraft. *Emerging Infectious Diseases* 2004;**10**(8):1502-3.

Cai 2009 *{published data only}*

Cai W, Schweiger B, Buchholz U, Buda S, Littmann M, Heusler J, et al. Protective measures and H5N1-seroprevalence among personnel tasked with bird collection during an outbreak of avian influenza A/H5N1 in wild birds, Ruegen, Germany, 2006. *BMC Infectious Diseases* 2009;**9**:170.

Cantagalli 2010 *{published data only}*

Cantagalli MR, Alvim VF, Andrade EC, Leite IC. Associação entre desnutrição energético-protéica e infecção respiratória aguda em crianças na atenção primária à saúde. *Revista de APS* 2010;**13**(1):26-33.

Carbonell-Estrany 2008 *{published data only}*

Carbonell-Estrany X, Bont L, Doering G, Gouyon JB, Lanari M. Clinical relevance of prevention of respiratory syncytial virus lower respiratory tract infection in preterm infants born between 33 and 35 weeks gestational age. *European Journal of Clinical Microbiology and Infectious Diseases* 2008;**27**(10):891-9.

Carter 2002 *{published data only}*

Carter JM. Hand washing decreases risk of colds and flu. *Journal of the National Medical Association* 2002;**94**(2):A11.

Castillo-Chavez 2003 *{published data only}*

Castillo-Chavez C, Castillo-Garsow CW, Yakubu AA. Mathematical models of isolation and quarantine. *JAMA* 2003;**290**(21):2876-7.

Cava 2005a *{published data only}*

Cava MA, Fay KE, Beanlands HJ, McCay EA, Wignall R. Risk perception and compliance with quarantine during the SARS outbreak. *Journal of Nursing Scholarship* 2005;**37**(4):343-7.

Cava 2005b *{published data only}*

Cava MA, Fay KE, Beanlands HJ, McCay EA, Wignall R. The experience of quarantine for individuals affected by SARS in Toronto. *Public Health Nursing* 2005;**22**(5):398-406.

CDC 2003a *{published data only}*

Centers for Disease Control and Prevention. Cluster of severe acute respiratory syndrome cases among protected health-care workers - Toronto, Canada, April 2003. *Morbidity & Mortality Weekly Report* 2003;**52**(19):433-6.

CDC 2003b *{published data only}*

Centers for Disease Control and Prevention. Use of quarantine to prevent transmission of severe acute respiratory

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syndrome - Taiwan, 2003. *Morbidity & Mortality Weekly Report* 2003;**52**(29):680-3.

Chai 2005 *{published data only}*

Chai LY, Ng TM, Habib AG, Singh K, Kumarasinghe G, Tambyah PA. Paradoxical increase in methicillin-resistant Staphylococcus aureus acquisition rates despite barrier precautions and increased hand washing compliance during an outbreak of severe acute respiratory syndrome. *Clinical Infectious Diseases* 2005;**40**(4):623-3.

Chami 2012 *{published data only}*

Chami K, Gavazzi G, Bar-Hen A, Carrat F, de Wazières B, Lejeune B, et al. A short-term, multicomponent infection control program in nursing homes: a cluster randomized controlled trial. *Journal of the American Medical Directors Association* 2012;**13**(6):569.e9-569.e17.

Chaovavanich 2004 *{published data only}*

Chaovavanich A, Wongsawat J, Dowell SF, Inthong Y, Sangsajja C, Sanguanwongse N, et al. Early containment of severe acute respiratory syndrome (SARS); experience from Bamrasnaradura Institute, Thailand. *Journal of the Medical Association of Thailand* 2004;**87**(10):1182-7.

Chau 2003 *{published data only}*

Chau PH, Yip PS. Monitoring the severe acute respiratory syndrome epidemic and assessing effectiveness of interventions in Hong Kong Special Administrative Region. *Journal of Epidemiology and Community Health* 2003;**57**(10):766-9.

Chau 2008 *{published data only}*

Chau JP, Thompson DR, Twinn S, Lee DT, Lopez V, Ho LS. An evaluation of SARS and droplet infection control practices in acute and rehabilitation hospitals in Hong Kong. *Hong Kong Medical Journal* 2008;**14**(Suppl 4):44-7.

Chen 2007 *{published data only}*

Chen YC, Chiang LC. Effectiveness of hand-washing teaching programs for families of children in paediatric intensive care units. *Journal of Clinical Nursing* 2007;**16**(6):1173-9.

Chen 2022 *{published data only}*

Chen MH, Chang PC. The effectiveness of mouthwash against SARS-CoV-2 infection: A review of scientific and clinical evidence. *Journal of the Formosan Medical Association* 2022;**121**(5):879-85. [10.1016/j.jfma.2021.10.001]

Cheng 2010 *{published data only}*

Cheng VC, Tai JW, Wong LM, Chan JF, Li IW, To KK, et al. Prevention of nosocomial transmission of swine-origin pandemic influenza virus A/H1N1 by infection control bundle. *Journal of Hospital Infection* 2010;**74**(3):271-7.

Chia 2005 *{published data only}*

Chia SE, Koh D, Fones C, Qian F, Ng V, Tan BH, et al. Appropriate use of personal protective equipment among healthcare workers in public sector hospitals and primary healthcare polyclinics during the SARS outbreak in Singapore. *Occupational and Environmental Medicine* 2005;**62**(7):473-7.

Clynes 2010 *{published data only}*

Clynes N. Surgical masks vs N95 respirators for preventing influenza. *JAMA* 2010;**303**(10):937-9.

Costa 2021 *{published data only}*

Costa DD, Brites C, Nunes Vaz S, Souzade Santana D, Nunesdos Santos J, Ramos Cury P. Chlorhexidine mouthwash reduces the salivary viral load of SARS-CoV-2: a randomized clinical trial. *Oral Diseases* 2021;**00**:1-9. [DOI: 10.1111/odi.14086]

Cowling 2007 *{published data only}*

Cowling BJ, Muller MP, Wong IO, Ho LM, Louie M, McGeer A, et al. Alternative methods of estimating an incubation distribution: examples from severe acute respiratory syndrome. *Epidemiology* 2007;**18**(2):253-9.

Cyril Vitug 2021 *{published data only}*

Cyril Vitug L, Santiaguel J, Exconde MA, Bautista MA. Oral gargle of ethanol-based mouthwash solution and its effects on adult patients with mild COVID-19 infection: an open-label randomized controlled trial. *Chest* 2021;**160**(4):A2504. [DOI: 10.1016/j.chest.2021.08.014]

Dalakoti 2022 *{published data only}*

Dalakoti M, Long C, Bains A, Djohan A, Ahmad I, Chan SP, et al. Effect of surgical mask use on peak physical performance during exercise treadmill testing - a real world, crossover study. *Frontiers in Physiology* 2022;**13**:913974. [DOI: 10.3389/fphys.2022.913974]

Daniels 2010 *{published data only}*

Daniels TL, Talbot TR. Unmasking the confusion of respiratory protection to prevent influenza-like illness in crowded community settings. *Journal of Infectious Diseases* 2010;**201**(4):483-5.

Daugherty 2008 *{published data only}*

Daugherty EL. Health care worker protection in mass casualty respiratory failure: infection control, decontamination, and personal protective equipment. *Respiratory Care* 2008;**53**(2):201-12; discussion 212-4.

Davies 1994 *{published data only}*

Davies KJ, Herbert AM, Westmoreland D, Bagg J. Seroepidemiological study of respiratory virus infections among dental surgeons. *British Dental Journal* 1994;**176**(7):262-5.

Day 1993 *{published data only}*

Day RA, St Arnaud S, Monsma M. Effectiveness of a handwashing program. *Clinical Nursing Research* 1993;**2**(1):24-40.

Day 2006 *{published data only}*

Day T, Park A, Madras N, Gumel A, Wu J. When is quarantine a useful control strategy for emerging infectious diseases? *American Journal of Epidemiology* 2006;**163**(5):479-85.

Dell'Omodarme 2005 *{published data only}*

Dell'Omodarme M, Prati MC. The probability of failing in detecting an infectious disease at entry points into a country. *Statistics in Medicine* 2005;**24**(17):2669-79.

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Denbak 2018 *{published data only}*

Denbak AM, Andersen A, Bonnesen CT, Laursen B, Ersbøll AK, Due P, et al. Effect evaluation of a randomized trial to reduce infectious illness and illness-related absenteeism among schoolchildren: The Hi Five Study. *Pediatric Infectious Disease Journal* 2018;**37**(1):16-21.

Desenclos 2004 *{published data only}*

Desenclos JC, van der Werf S, Bonmarin I, Levy-Bruhl D, Yazdanpanah Y, Hoen B, et al. Introduction of SARS in France, March-April, 2003. *Emerging Infectious Diseases* 2004;**10**(2):195-200.

DiGiovanni 2004 *{published data only}*

DiGiovanni C, Conley J, Chiu D, Zaborski J. Factors influencing compliance with quarantine in Toronto during the 2003 SARS outbreak. *Biosecurity and Bioterrorism* 2004;**2**(4):265-72.

Doebbeling 1992 *{published data only}*

Doebbeling BN, Stanley GL, Sheetz CT. Comparative efficacy of alternative hand-washing agents in reducing nosocomial infections in intensive care units. *New England Journal of Medicine* 1992;**327**(2):88-92.

Dwosh 2003 *{published data only}*

Dwosh HA, Hong HH, Austgarden D, Herman S, Schabas R. Identification and containment of an outbreak of SARS in a community hospital. *Canadian Medical Association Journal* 2003;**168**(11):1415-20.

Edmonds 2010 *{published data only}*

Edmonds S, Dzyakanava V, Macinga D. Efficacy of hand hygiene products against pandemic H1N1 influenza. *American Journal of Infection Control* 2010;**38**(5):E132-3.

Egger 2022 *{published data only}*

Egger F, Blumenauer D, Fischer P, Venhorst A, Kulenthiran S, Bewarder Y, et al. Effects of face masks on performance and cardiorespiratory response in well-trained athletes. *Clinical Infectious Diseases* 2022;**111**(3):264-71. [DOI: 10.1007/s00392-021-01877-0]

Fendler 2002 *{published data only}*

Fendler EJ, Ali Y, Hammond BS, Lyons MK, Kelley MB, Vowell NA. The impact of alcohol hand sanitizer use on infection rates in an extended care facility. *American Journal of Infection Control* 2002;**30**(4):226-33.

Ferrer 2021 *{published data only}*

Ferrer MD, Sánchez Barrueco A, Martinez-Beneyto Y, Mateos-Moreno MV, Ausina-Márquez V, García-Vázquez E, et al. Clinical evaluation of antiseptic mouth rinses to reduce salivary load of SARS-CoV-2. *Scientific Reports* 2021;**11**:24392. [DOI: https://doi.org/10.1038/s41598-021-03461-y]

Flint 2003 *{published data only}*

Flint J, Burton S, Macey JF, Deeks SL, Tam TW, King A, et al. Assessment of in-flight transmission of SARS - results of contact tracing. *Canadian Communicable Disease Report* 2003;**29**(12):105-10.

Fung 2004 *{published data only}*

Fung CP, Hsieh TL, Tan KH, Loh CH, Wu JS, Li C, et al. Rapid creation of a temporary isolation ward for patients with severe acute respiratory syndrome in Taiwan. *Infection Control and Hospital Epidemiology* 2004;**25**(12):1026-32.

Garcia 2010 *{published data only}*

Garcia MC. The protection against influenza provided by surgical masks is not inferior to what the FFP2 (N95) respiratory protector can give. *FMC Formacion Medica Continuada en Atencion Primaria* 2010;**17**(5):365.

Gaydos 2001 *{published data only}*

Gaydos JC. Returning to the past: respiratory illness, vaccines, and handwashing. *American Journal of Preventive Medicine* 2001;**21**(2):150-1.

Gensini 2004 *{published data only}*

Gensini GF, Yacoub MH, Conti AA. The concept of quarantine in history: from plague to SARS. *Journal of Infection* 2004;**49**(4):257-61.

Gharebaghi 2020 *{published data only}*

Gharebaghi N, Valizade Hasanloei MA, Mosarrezaii Agdam A, Mohsenirad S. The effect of combined mouth wash gentamycine, colistin and vancomycine in prevention of ventilator associated pneumonia in mechanical ventilatory patients admitted to intensive care unit: a randomized clinical trial. *Scientific Journal of Kurdistan University of Medical Sciences* 2020;**104**:105-16. [DOI: 10.52547/sjku.25.1.105]

Girou 2002 *{published data only}*

Girou E, Loyeau S, Legrand P, Oppein F, Brun-Buisson C. Efficacy of handrubbing with alcohol based solution versus standard handwashing with antiseptic soap: randomised clinical trial. *BMJ* 2002;**325**:362.

Giuliano 2021 *{published data only}*

Giuliano KK, Penoyer D, Middleton A. Oral care as prevention for nonventilator hospital-acquired pneumonia: a four-unit cluster randomized study. *American Journal of Nursing* 2021;**121**(6):24-33.

Glass 2006 *{published data only}*

Glass K, Becker NG. Evaluation of measures to reduce international spread of SARS. *Epidemiology and Infection* 2006;**134**(5):1092-101.

Goel 2007 *{published data only}*

Goel S, Gupta AK, Singh A, Lenka SR. Preparations and limitations for prevention of severe acute respiratory syndrome in a tertiary care centre of India. *Journal of Hospital Infection* 2007;**66**(2):142-7.

Gomersall 2006 *{published data only}*

Gomersall CD, Joynt GM, Ho OM, Ip M, Yap F, Derrick JL, et al. Transmission of SARS to healthcare workers. The experience of a Hong Kong ICU. *Intensive Care Medicine* 2006;**32**(4):564-9.

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Gore 2001 *{published data only}*

Gore J, Lambert JA. Does use of an instant hand sanitizer reduce elementary school illness absenteeism? *Journal of Family Practice* 2001;**50**(1):64.

Gostin 2003 *{published data only}*

Gostin LO, Bayer R, Fairchild AL. Ethical and legal challenges posed by severe acute respiratory syndrome: implications for the control of severe infectious disease threats. *JAMA* 2003;**290**(24):3229-37.

Gralton 2010 *{published data only}*

Gralton J, McLaws ML. Protecting healthcare workers from pandemic influenza: N95 or surgical masks? *Critical Care Medicine* 2010;**38**(2):657-67.

Guinan 2002 *{published data only}*

Guinan M, McGukin M, Ali Y. The effect of a comprehensive handwashing program on absenteeism in elementary schools. *American Journal of Infection Control* 2002;**30**(4):217-20.

Gupta 2005 *{published data only}*

Gupta AG, Moyer CA, Stern DT. The economic impact of quarantine: SARS in Toronto as a case study. *Journal of Infection* 2005;**50**(5):386-93.

Gwaltney 1982 *{published data only}*

Gwaltney JM Jr, Hendley JO. Transmission of experimental rhinovirus infection by contaminated surfaces. *American Journal of Epidemiology* 1982;**116**:828-33.

Han 2003 *{published data only}*

Han H, Li X, Qu W, Shen T, Xu F, Gao D, et al. The building and practice of the emergency isolation radiology information system at the department of radiology in polyclinic during the epidemic outbreak stage of SARS. *Beijing Da Xue Xue Bao [Journal of Peking University]* 2003;**35**(Suppl):86-8.

Hayden 1985 *{published data only}*

Hayden GF, Hendley JO, Gwaltney JM Jr. The effect of placebo and virucidal paper handkerchiefs on viral contamination of the hand and transmission of experimental rhinoviral infection. *Journal of Infectious Diseases* 1985;**152**(2):403-7.

Hendley 1988 *{published data only}*

Hendley JO, Gwaltney JM Jr. Mechanisms of transmission of rhinovirus infections. *Epidemiologic Reviews* 1988;**10**:243-58.

Hens 2009 *{published data only}*

Hens N, Ayele GM, Goeyvaerts N, Aerts M, Mossong J, Edmunds JW, et al. Estimating the impact of school closure on social mixing behaviour and the transmission of close contact infections in eight European countries. *BMC Infectious Diseases* 2009;**9**:187.

Heymann 2009 *{published data only}*

Heymann AD, Hoch I, Valinsky L, Kokia E, Steinberg DM. School closure may be effective in reducing transmission of respiratory viruses in the community. *Epidemiology and Infection* 2009;**137**(10):1369-76.

Hilburn 2003 *{published data only}*

Hilburn J, Hammond BS, Fendler EJ, Groziak PA. Use of alcohol hand sanitizer as an infection control strategy in an acute care facility. *American Journal of Infection Control* 2003;**31**(2):109-16.

Hilmarsson 2007 *{published data only}*

Hilmarsson H, Traustason BS, Kristmundsdottir T, Thormar H. Virucidal activities of medium- and long-chain fatty alcohols and lipids against respiratory syncytial virus and parainfluenza virus type 2: comparison at different pH levels. *Archives of Virology* 2007;**152**(1):2225-36.

Hirsch 2006 *{published data only}*

Hirsch HH, Steffen I, Francioli P, Widmer AF. Respiratory syncytial virus infections: measures in immunocompromised patients [Respiratorisches syncytial-virus (RSV)-infektion: massnahmen beim immunsupprimierten patienten]. *Praxis* 2006;**95**(3):61-6.

Ho 2003 *{published data only}*

Ho AS, Sung JJ, Chan-Yeung M. An outbreak of severe acute respiratory syndrome among hospital workers in a community hospital in Hong Kong. *Annals of Internal Medicine* 2003;**139**(7):564-7.

Hsieh 2007 *{published data only}*

Hsieh YH, King CC, Chen CW, Ho MS, Hsu SB, Wu YC. Impact of quarantine on the 2003 SARS outbreak: a retrospective modeling study. *Journal of Theoretical Biology* 2007;**244**(4):729-36.

Hugonnet 2007 *{published data only}*

Hugonnet S, Legros D, Roth C, Pessoa-Silva CL. Nosocomial transmission of severe acute respiratory syndrome: better quality of evidence is needed. *Clinical Infectious Diseases* 2007;**45**(12):1651.

Jiang 2003 *{published data only}*

* Jiang S, Huang L, Chen X, Wang J, Wu W, Yin S. Ventilation of wards and nosocomial outbreak of severe acute respiratory syndrome among healthcare workers. *Chinese Medical Journal* 2003;**116**(9):1293-7.

Jiang SP, Huang LW, Wang JF, Wu W, Yin SM, Chen WX. A study of the architectural factors and the infection rates of healthcare workers in isolation units for severe acute respiratory syndrome. *Chung-Hua Chieh Ho Ho Hu Hsi Tsa Chih [Chinese Journal of Tuberculosis & Respiratory Diseases]* 2003;**26**(10):594-7.

Johnson 2009 *{published data only}*

Johnson DF, Druce JD, Birch C, Grayson ML. A quantitative assessment of the efficacy of surgical and N95 masks to filter influenza virus in patients with acute influenza infection. *Clinical Infectious Diseases* 2009;**49**(2):275-7.

Jones 2005 *{published data only}*

Jones EW. "Co-operation in All Human Endeavour": quarantine and immigrant disease vectors in the 1918-1919 influenza pandemic in Winnipeg. *Canadian Bulletin of Medical History* 2005;**22**(1):57-82.

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Karakaya 2021 *{published data only}*

Karakaya Z, Duyu M, Yersel MN . Oral mucosal mouthwash with chlorhexidine does not reduce the incidence of ventilator-associated pneumonia in critically ill children: a randomised controlled trial. *Australian Critical Care* 2021;**35**(4):336-44. [DOI: https://doi.org/10.1016/j.aucc.2021.06.011]

Kawyannejad 2020 *{published data only}*

Kawyannejad R, Aminisaman J, Mohammadi S, Amini S, Mirzaei M, Karimpour H . Comparing the effects of orthodentol and chlorhexidine mouthwash on prevention of ventilator-associated pneumonia in patients of intensive care unit: a randomized controlled clinical trial . *Scientific Journal of Kurdistan University of Medical Sciences* 2020;**25**(1):93-104. [DOI: 10.52547/sjku.25.1.93]

Kaydos-Daniels 2004 *{published data only}*

Kaydos-Daniels SC, Olowokure B, Chang HJ, Barwick RS, Deng JF, Lee ML, et al. Body temperature monitoring and SARS fever hotline, Taiwan. *Emerging Infectious Diseases* 2004;**10**(2):373-6.

Kelso 2009 *{published data only}*

Kelso JK, Milne GJ, Kelly H. Simulation suggests that rapid activation of social distancing can arrest epidemic development due to a novel strain of influenza. *BMC Public Health* 2009;**9**:117.

Khaw 2008 *{published data only}*

Khaw KS, Ngan Kee WD, Tam YH, Wong MK, Lee SW. Survey and evaluation of modified oxygen delivery devices used for suspected severe acute respiratory syndrome and other high-risk patients in Hong Kong. *Hong Kong Medical Journal* 2008;**14**(Suppl 5):27-31.

Kilabuko 2007 *{published data only}*

Kilabuko JH, Nakai S. Effects of cooking fuels on acute respiratory infections in children in Tanzania. *International Journal of Environmental Research and Public Health* 2007;**4**(4):283-8.

Kosugi 2004 *{published data only}*

Kosugi Y, Ishikawa T, Chimura Y, Annaka M, Shibazaki S, Adachi K, et al. Control of hospital infection of influenza: administration of neuraminidase inhibitor and cohort isolation of influenza patients. *Kansenshogaku Zasshi [Journal of the Japanese Association for Infectious Diseases]* 2004;**78**(12):995-9.

Lam 2004 *{published data only}*

Lam BC, Lee J, Lau YL. Hand hygiene practices in a neonatal intensive care unit: a multimodal intervention and impact on nosocomial infection. *Pediatrics* 2004;**114**(5):e565-71.

Lange 2004 *{published data only}*

Lange JH. Use of disposable face masks for public health protection against SARS. *Journal of Epidemiology and Community Health* 2004;**58**(5):434.

Larson 2004a *{published data only}*

Larson EL, Lin SX, Gomez-Pichardo C, Della-Latta P. Effect of antibacterial home cleaning and handwashing products on infectious disease symptoms: a randomized, double-blind trial. *Annals of Internal Medicine* 2004;**140**(5):321-9.

Larson 2004b *{published data only}*

Larson EL, Lin SX, Gomez-Pichardo C, Della-Latta P. Effect of antibacterial home cleaning and handwashing products on infectious disease symptoms: a randomized, double-blind trial. *Annals of Internal Medicine* 2004;**140**(5):321-9.

Larson 2005 *{published data only}*

Larson EL, Cimiotti J, Haas J, Parides M, Nesin M, Della-Latta P, et al. Effect of antiseptic handwashing vs alcohol sanitizer on health care-associated infections in neonatal intensive care units. *Archives of Pediatrics & Adolescent Medicine* 2005;**159**(4):377-83.

Lau 2004 *{published data only}*

Lau JT, Yang X, Tsui HY, Pang E. SARS related preventive and risk behaviours practised by Hong Kong-mainland China cross border travellers during the outbreak of the SARS epidemic in Hong Kong. *Journal of Epidemiology and Community Health* 2004;**58**(12):988-96.

Lau 2005 *{published data only}*

Lau JT, Leung PC, Wong EL, Fong C, Cheng KF, Zhang SC, et al. The use of an herbal formula by hospital care workers during the severe acute respiratory syndrome epidemic in Hong Kong to prevent severe acute respiratory syndrome transmission, relieve influenza-related symptoms, and improve quality of life: a prospective cohort study. *Alternative & Complementary Medicine* 2005;**11**(1):49-55.

Lee 2005 *{published data only}*

Lee GM, Salomon JA, Friedman JF, Hibberd PL, Ross-Degnan D, Zasloff E, et al. Illness transmission in the home: a possible role for alcohol-based hand gels. *Pediatrics* 2005;**115**(4):852-60.

Lee 2010 *{published data only}*

Lee VJ, Yap J, Cook AR, Chen MI, Tay JK, Barr I, et al. Effectiveness of public health measures in mitigating pandemic influenza spread: a prospective sero-epidemiological cohort study. *Journal of Infectious Diseases* 2010;**202**(9):1319-26.

Lennell 2008 *{published data only}*

Lennell A, Kühlmann-Berenzon S, Geli P, Hedin K, Petersson C, Cars O, et al. Alcohol-based hand-disinfection reduced children's absence from Swedish day care centers. *Acta Paediatrica* 2008;**97**(12):1672-80.

Lim 2022 *{published data only}*

Lim NA, Teng O, Ng CY, Bao LX, Tambyah PA, Quek AM, et al. Repurposing povidone-iodine to reduce the risk of SARS-CoV-2 infection and transmission: a narrative review. *Annals of Medicine* 2022;**54**(1):1488-99. [DOI: 10.1080/07853890.2022.2076902]

Lipsitch 2003 *{published data only}*

Lipsitch M, Cohen T, Cooper B, Robins JM, Ma S, James L, et al. Transmission dynamics and control of severe acute respiratory syndrome. *Science* 2003;**300**(5627):1966-70.

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Luckingham 1984 *{published data only}*

Luckingham B. To mask or not to mask: a note on the 1918 Spanish influenza epidemic in Tucson. *Journal of Arizona History* 1984;**25**(2):191-204.

Ma 2004 *{published data only}*

Ma HJ, Wang HW, Fang LQ, Jiang JF, Wei MT, Liu W, et al. A case-control study on the risk factors of severe acute respiratory syndromes among health care workers. *Chung-Hua Liu Hsing Ping Hsueh Tsa Chih [Chinese Journal of Epidemiology]* 2004;**25**(9):741-4.

MacIntyre 2010 *{published data only}*

MacIntyre CR. Cluster randomised controlled trial: hand hygiene and face mask use within 36 hours of index patient symptom onset reduces flu transmission to household contacts. *Evidence-Based Medicine* 2010;**15**(2):48-9.

Malaczek 2022 *{published data only}*

Maleczek M, Toemboel F, Van Erp M, Thalhammer F, Rössler B. Reusable respirators as personal protective equipment in clinical practice: User experience in times of a pandemic. *Wiener Klinische Wochenschrift* 2022;**134**(13-4):522-8.

Malone 2009 *{published data only}*

Malone JD, Brigantic R, Muller GA, Gadgil A, Delp W, McMahon BH, et al. U.S. airport entry screening in response to pandemic influenza: modeling and analysis. *Travel Medicine and Infectious Disease* 2009;**7**(4):181-91.

Marin 1991 *{published data only}*

Marin J, Dragas AZ, Mavsar B. Virus permeability of protective gloves used in medical practice. *Zentralblatt fur Hygiene und Umweltmedizin [International Journal of Hygiene and Environmental Medicine]* 1991;**191**(5-6):516-22.

McSweeny 2007 *{published data only}*

McSweeny K, Colman A, Fancourt N, Parnell M, Stantiall S, Rice G, et al. Was rurality protective in the 1918 influenza pandemic in New Zealand? *New Zealand Medical Journal* 2007;**120**(1256):2579.

Meister 2022 *{published data only}*

Meister TL, Gottsauner JM, Schmidt B, Heinen N, Todt D, Audebert F, et al. Mouthrinses against SARS-CoV-2 - high antiviral effectivity by membrane disruption in vitro translates to mild effects in a randomized placebo-controlled clinical trial. *Virus Research* 2022;**316**:198791.

Mielke 2009 *{published data only}*

Mielke M, Nassauer A. Pandemic influenza: nonpharmaceutical protective measures in ambulatory care. *Fortschritte der Medizin* 2009;**151**(40):32-4.

Mikolajczyk 2008 *{published data only}*

Mikolajczyk RT, Akmatov MK, Rastin S, Kretzschmar M. Social contacts of school children and the transmission of respiratory-spread pathogens. *Epidemiology and Infection* 2008;**136**(6):813-22.

Mo 2022 *{published data only}*

Mo Y, Pham TM, Lim C, Horby P, Stewardson AJ, Harbarth S, et al. The effect of hand hygiene frequency on reducing acute respiratory infections in the community: a meta-analysis. *Epidemiology and Infection* 2022;**150**:e79. [DOI: 10.1017/S0950268822000516]

Monsma 1992 *{published data only}*

Monsma M, Day R, St Arnaud S. Handwashing. *Journal of School Health* 1992;**62**(3):109-11.

Montero-Vilchez 2022 *{published data only}*

Montero-Vilchez T, Martinez-Lopez A, Cuenca-Barrales C, Quiñones-Vico MI, Sierra-Sanchez A, Molina-Leyva A, et al. Assessment of hand hygiene strategies on skin barrier function during COVID-19 pandemic: a randomized clinical trial. *Contact Dermatitis* 2022;**86**(4):276-85. [DOI: 10.1111/cod.14034]

Munoz-Basagoiti 2022 *{published data only}*

Muñoz-Basagoiti J, Alemany A, Perez-Zsolt D, Ouchi D, Raïch-Regué D, Trinité B, et al. Cetylpyridinim cholride mouthwashes to reduce the shedding of viable SARS-CoV-2. *Topics in Antiviral Medicine* 2022;**30**(Suppl 1):181-2.

Nandrup-Bus 2009 *{published data only}*

Nandrup-Bus I. Mandatory handwashing in elementary schools reduces absenteeism due to infectious illness among pupils: a pilot intervention study. *American Journal of Infection Control* 2009;**37**(10):820-6.

Nishiura 2009 *{published data only}*

Nishiura H, Wilson N, Baker MG. Quarantine for pandemic influenza control at the borders of small island nations. *BMC Infectious Diseases* 2009;**9**:27.

O'Callaghan 1993 *{published data only}*

O'Callaghan CA. Prevention of nosocomial respiratory syncytial virus infection. *Lancet* 1993;**341**(8838):182.

Olsen 2003 *{published data only}*

Olsen SJ, Chang HL, Cheung TY, Tang AF, Fisk TL, Ooi SP. Transmission of the severe acute respiratory syndrome on aircraft. *New England Journal of Medicine* 2003;**349**(25):2416-22.

Ooi 2005 *{published data only}*

Ooi PL, Lim S, Chew SK. Use of quarantine in the control of SARS in Singapore. *American Journal of Infection Control* 2005;**33**(5):252-7.

Orellano 2010 *{published data only}*

Orellano PW, Grassi A, Reynoso JI, Palmieri A, Uez O, Carlino O. Impact of school closings on the influenza A (H1N1) outbreak in Tierra del Fuego, Argentina. *Pan American Journal of Public Health* 2010;**27**(3):226-9.

Panchabhai 2009 *{published data only}*

Panchabhai TS, Dangayach NS, Krishnan A, Kothari VM, Karnad KR. Oropharyngeal cleansing with 0.2% chlorhexidine for prevention of nosocomial pneumonia in critically ill patients: an open-label randomized trial with 0.01% potassium permanganate as control. *Chest* 2009;**135**(5):1150-6.

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Pang 2004 *{published data only}*

Pang XH, Liu DL, Gong XH, Xu FJ, Liu ZJ, Zhang Z, et al. Study on the risk factors related to severe acute respiratory syndrome among close contacts in Beijing. *Chung-Hua Liu Hsing Ping Hsueh Tsa Chih [Chinese Journal of Epidemiology]* 2004;**25**(8):674-6.

Patel 2012 *{published data only}*

Patel MK, Harris JR, Juliao P, Nygren B, Were V, Kola S, et al. Impact of a hygiene curriculum and the installation of simple handwashing and drinking water stations in rural Kenyan primary schools on student health and hygiene practices. *American Journal of Tropical Medicine and Hygiene* 2012;**87**(4):594-601.

Pittet 2000 *{published data only}*

Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. Infection Control Programme (Erratum in: Lancet 2000 Dec 23-30;356(9248):2196). *Lancet* 2000;**356**(9238):1307-12.

Prasad 2004 *{published data only}*

Prasad GV, Nash MM, Zaltzman JS. Handwashing precautions taken by renal transplant recipients for severe acute respiratory syndrome. *Transplantation* 2004;**77**(12):1917.

Rabenau 2005 *{published data only}*

Rabenau HF, Kampf G, Cinatl J, Doerr HW. Efficacy of various disinfectants against SARS coronavirus. *Journal of Hospital Infection* 2005;**61**(2):107-11.

Reynolds 2008 *{published data only}*

Reynolds DL, Garay JR, Deamond SL, Moran MK, Gold W, Styra R. Understanding, compliance and psychological impact of the SARS quarantine experience. *Epidemiology and Infection* 2008;**136**(7):997-1007.

Richardson 2010 *{published data only}*

Richardson A, Hofacre K. Comparison of filtration efficiency of a N95 filtering facepiece respirator and surgical mask against viral aerosols. *American Journal of Infection Control* 2010;**38**(5):E20.

Riley 2003 *{published data only}*

Riley S, Fraser C, Donnelly CA, Ghani AC, Abu-Raddad LJ, Hedley AJ. Transmission dynamics of the etiological agent of SARS in Hong Kong: impact of public health interventions. *Science* 2003;**300**(5627):1961-6.

Rodriguez 2009 *{published data only}*

Rodriguez CV, Rietberg K, Baer A, Kwan-Gett T, Duchin J. Association between school closure and subsequent absenteeism during a seasonal influenza epidemic. *Epidemiology* 2009;**20**(6):787-92.

Rosen 2006 *{published data only}*

Rosen L, Manor O, Engelhard D, Brody D, Rosen B, Peleg H, et al. Can a handwashing intervention make a difference? Results from a randomized controlled trial in Jerusalem preschools. *Preventive Medicine* 2006;**42**(1):27-32.

Rosenthal 2005 *{published data only}*

Rosenthal VD, Guzman S, Safdar N. Reduction in nosocomial infection with improved hand hygiene in intensive care units of a tertiary care hospital in Argentina. *American Journal of Infection Control* 2005;**33**(7):392-7.

Safiulin 1972 *{published data only}*

Safiulin AA. UV sanitation of the air and surfaces for the purpose of preventing in-hospital viral respiratory infections. *Gigiena i Sanitariia* 1972;**37**(10):99-101.

Sanchez Barrueco 2022 *{published data only}*

Sánchez Barrueco Á, Mateos-Moreno MV, Martínez-Beneyto Y, García-Vázquez E, Campos González A, Zapardiel Ferrero J, et al. Effect of oral antiseptics in reducing SARS-CoV-2 infectivity: evidence from a randomized double-blind clinical trial. *Emerging Microbes & Infections* 2022;**11**(1):1833-42. [DOI: 10.1080/22221751.2022.2098059]

Sandrock 2008 *{published data only}*

Sandrock C, Stollenwerk N. Acute febrile respiratory illness in the ICU: reducing disease transmission. *Chest* 2008;**133**(5):1221-31.

Sattar 2000 *{published data only}*

Sattar SA, Abebe M, Bueti AJ, Jampani H, Newman J, Hua S. Activity of an alcohol-based hand gel against human adeno-, rhino-, and rotaviruses using the fingerpad method. *Infection Control and Hospital Epidemiology* 2000;**21**(8):516-9.

Schull 2007 *{published data only}*

Schull MJ, Stukel TA, Vermeulen MJ, Zwarenstein M, Alter DA, Manuel DG, et al. Effect of widespread restrictions on the use of hospital services during an outbreak of severe acute respiratory syndrome. *CMAJ* 2007;**176**(13):1827-32.

Seal 2010 *{published data only}*

Seal LA, Slade B, Cargill I, Aust D. Persistence factors in handwashes. *American Journal of Infection Control* 2010;**38**(5):E18-9.

Seale 2009 *{published data only}*

Seale H, Corbett S, Dwyer DE, MacIntyre CR. Feasibility exercise to evaluate the use of particulate respirators by emergency department staff during the 2007 influenza season. *Infection Control and Hospital Epidemiology* 2009;**30**(7):710-2.

Seneviratne 2021 *{published data only}*

Seneviratne C, Balan P, Ko K, Udawatte NS, Lai D, Ng D, et al. Efficacy of commercial mouth-rinses on SARS-CoV-2 viral load in saliva: randomized control trial in Singapore. *Infection* 2021;**49**:305–11. [DOI: 10.1007/s15010-020-01563-9]

Sevinc Gul 2022 *{published data only}*

Sevinç Gül SN, Dilsiz A, Sağlık İ, Aydın NN. Effect of oral antiseptics on the viral load of SARS-CoV-2: a randomized controlled trial. *Dental and Medical Problems* 2022;**59**(3):357-63.

Copyright © 2023 The Authors. Cochrane Database of Systematic Reviews published by John Wiley & Sons, Ltd. on behalf of The Cochrane Collaboration.

Sizun 1996 *{published data only}*

Sizun J, Baron R, Soupre D, Giroux JD, de Parscau L. Nosocomial infections due to syncytial respiratory virus: which hygienic measures. *Archives de Pediatrie* 1996;**3**(7):723-7.

Slayton 2016 *{published data only}*

Slayton RB, Murphy JL, Morris J, Faith SH, Oremo J, Odhiambo A, et al. A cluster randomized controlled evaluation of the health impact of a novel antimicrobial hand towel on the health of children under 2 years old in rural communities in Nyanza Province, Kenya. *American Journal of Tropical Medicine and Hygiene* 2016;**94**(2):437-44.

Stebbins 2009 *{published data only}*

Stebbins S, Downs JS, Vukotich CJ. Using nonpharmaceutical interventions to prevent influenza transmission in elementary school children: parent and teacher perspectives. *Journal of Public Health Management and Practice* 2009;**15**(2):112-7.

Stedman-Smith 2015 *{published data only}*

Stedman-Smith M, DuBois CL, Grey SF, Kingsbury DM, Shakya S, Scofield J, et al. Outcomes of a pilot hand hygiene randomized cluster trial to reduce communicable infections among US office-based employees. *Journal of Occupational and Environmental Medicine* 2015;**57**(4):374-80.

Stoner 2007 *{published data only}*

Stoner MJ, Cohen DM, Fernandez S, Bonsu BK. Physician handwashing: what do parents want? *Journal of Hospital Infection* 2007;**65**(2):112-6.

Stukel 2008 *{published data only}*

Stukel TA, Schull MJ, Guttmann A, Alter DA, Li P, Vermeulen MJ, et al. Health impact of hospital restrictions on seriously ill hospitalized patients: lessons from the Toronto SARS outbreak. *Medical Care* 2008;**46**(9):991-7.

Svoboda 2004 *{published data only}*

Svoboda T, Henry B, Shulman L, Kennedy E, Rea E, Ng W, et al. Public health measures to control the spread of the severe acute respiratory syndrome during the outbreak in Toronto. *New England Journal of Medicine* 2004;**350**(23):2353-61.

Tracht 2010 *{published data only}*

Tracht SM, Del Valle SY, Hyman JM. Mathematical modeling of the effectiveness of facemasks in reducing the spread of novel influenza a (H1N1). *PLOS One* 2010;**5**(2):e9018.

Ueno 1990 *{published data only}*

Ueno T, Saijo K. Prevention of adenovirus infection and antiviral activity of a hand disinfectant, Welpas. *Nippon Ganka Gakkai Zasshi* 1990;**94**(1):44-8.

Uhari 1999 *{published data only}*

Uhari M, Mottonen M. An open randomized controlled trial of infection prevention in child day-care centers. *Pediatric Infectious Disease Journal* 1999;**18**(8):672-7.

van der Sande 2008 *{published data only}*

van der Sande M, Teunis P, Sabel R. Professional and home-made face masks reduce exposure to respiratory infections among the general population. *PLOS One* 2008;**3**(7):e2618.

Vessey 2007 *{published data only}*

Vessey JA, Sherwood JJ, Warner D, Clark D. Comparing hand washing to hand sanitizers in reducing elementary school students' absenteeism. *Pediatric Nursing* 2007;**33**(4):368-72.

Viscusi 2009a *{published data only}*

Viscusi DJ, Bergman M, Sinkule E, Shaffer RE. Evaluation of the filtration performance of 21 N95 filtering face piece respirators after prolonged storage. *American Journal of Infection Control* 2009;**37**(5):381-6.

Viscusi 2009b *{published data only}*

Viscusi DJ, Bergman MS, Eimer BC, Shaffer RE. Evaluation of five decontamination methods for filtering facepiece respirators. *Annals of Occupational Hygiene* 2009;**53**(8):815-27.

Wang 2003 *{published data only}*

Wang JX, Feng HY, Liu D, Zhang ZL, Shan AL, Zhu XJ, et al. Epidemiological characteristics of severe acute respiratory syndrome in Tianjin and the assessment of effectiveness on measures of control. *Chung-Hua Liu Hsing Ping Hsueh Tsa Chih [Chinese Journal of Epidemiology]* 2003;**24**(7):565-9.

Wang 2005 *{published data only}*

Wang HW, He J, Zhang PH, Tang F, Wang TB, Luan YH, et al. A case-control study on the mxA polymorphisms and susceptibility to severe acute respiratory syndromes. *Chung-Hua Liu Hsing Ping Hsueh Tsa Chih [Chinese Journal of Epidemiology]* 2005;**26**(8):574-7.

Weber 2004 *{published data only}*

Weber JT, Hughes JM. Beyond Semmelweis: moving infection control into the community. *Annals of Internal Medicine* 2004;**140**(5):397-8.

Wen 2010 *{published data only}*

Wen Z, Lu J, Li J, Li N, Zhao J, Wang J, et al. Determining the filtration efficiency of half-face medical protection mask (N99) against viral aerosol. *Aerobiologia* 2010;**26**(3):245-51.

White 2005 *{published data only}*

White C, Kolble R, Carlson R, Lipson N. The impact of a health campaign on hand hygiene and upper respiratory illness among college students living in residence halls. *Journal of American College Health* 2005;**53**(4):175-81.

Wilczynski 1997 *{published data only}*

Wilczynski J, Torbicka E, Brzozowska-Binda A, Szymanska U. Breast feeding for prevention of viral acute respiratory diseases in infants. *Medycyna Doswiadczalna i Mikrobiologia* 1997;**49**(3-4):199-206.

Wilder-Smith 2003 *{published data only}*

Wilder-Smith A, Paton NI, Goh KT. Low risk of transmission of severe acute respiratory syndrome on airplanes: the

Copyright © 2023 The Authors. Cochrane Database of Systematic Reviews published by John Wiley & Sons, Ltd. on behalf of The Cochrane Collaboration.

Singapore experience. *Tropical Medicine and International Health* 2003;**8**(11):1035-7. [MEDLINE: 14629772]

Wilder-Smith 2005 *{published data only}*

Wilder-Smith A, Low JG. Risk of respiratory infections in health care workers: lessons on infection control emerge from the SARS outbreak. *Southeast Asian Journal of Tropical Medicine and Public Health* 2005;**36**(2):481-8.

Wong 2005 *{published data only}*

Wong TW, Tam WW. Handwashing practice and the use of personal protective equipment among medical students after the SARS epidemic in Hong Kong. *American Journal of Infection Control* 2005;**33**(10):580-6.

Yen 2010 *{published data only}*

Yen M-Y, Lu Y-C, Huang P-H, Chen C-M, Chen Y-C, Lin YE. Quantitative evaluation of infection control models in the prevention of nosocomial transmission of SARS virus to healthcare workers: implication to nosocomial viral infection control for healthcare workers. *Scandinavian Journal of Infectious Diseases* 2010;**42**(6-7):510-5.

Yu 2004 *{published data only}*

Yu IT, Li Y, Wong TW, Tam W, Chan AT, Lee JH, et al. Evidence of airborne transmission of the severe acute respiratory syndrome virus. *New England Journal of Medicine* 2004;**350**(17):1731-9.

Zamora 2006 *{published data only}*

Zamora JE, Murdoch J, Simchison B, Day AG. Contamination: a comparison of 2 personal protective systems. *Canadian Medical Association Journal* 2006;**175**(3):249-54.

Zhai 2007 *{published data only}*

Zhai S, Liu W, Yan B. Recent patents on treatment of severe acute respiratory syndrome (SARS). *Recent Patents on Anti-infective Drug Discovery* 2007;**2**(1):1-10.

Zhao 2003 *{published data only}*

Zhao Z, Zhang F, Xu M, Huang K, Zhong W, Cai W, et al. Description and clinical treatment of an early outbreak of severe acute respiratory syndrome (SARS) in Guangzhou, PR China. *Journal of Medical Microbiology* 2003;**52**(8):715-20.

References to studies awaiting assessment

Contreras 2022 *{published data only}*

Contreras JD, Islam M, Mertens A, Pickering AJ, Arnold BF, Benjamin-Chung J, et al. Evaluation of an on-site sanitation intervention against childhood diarrhea and acute respiratory infection 1 to 3.5 years after implementation: extended follow-up of a cluster-randomized controlled trial in rural Bangladesh. *PLOS Medicine* 2022;**19**(8):e1004041.

Croke 2022 *{published data only}*

Croke K, Coville A, Mvukiyehe E, Dohou CJ, Zibika J-P, Stanus GhibL, et al. Effects of a community-driven water, sanitation, and hygiene program on Covid-19 symptoms, vaccine acceptance,and non-Covid illnesses: a cluster-randomized controlled trial in rural Democratic Republic of Congo. *Tropical Medicine & International Health* 2022;**27**(9):795-802. [DOI: 10.1111/tmi.13799]

Delaguerre 2022 *{published data only}*

Delaugerre C, Foissac F, Abdoul H, Masson G, Choupeaux L, Dufour E, et al. Prevention of SARS-CoV-2 transmission during a large, live, indoor gathering (SPRING): a non-inferiority, randomised, controlled trial. *Lancet Infectious Diseases* 2022;**22**:341–8.

Loeb 2022 *{published data only}*

* Loeb M, Bartholomew A, Hashmi M, Tarhuni W, Hassany M, Youngster M, et al. Medical masks versus N95 respirators for preventing COVID-19 among health care workers. A randomized trial. *Annals of Internal Medicine* 2022;**0**:0. [DOI: 10.7326/M22-1966]

NCT04296643. Medical masks vs N95 respirators for COVID-19. Clinicaltrials.gov/show/NCT04296643 first received March 5, 2020.

Varela 2022 *{published data only}*

Varela AR, Gurruchaga AP, Restrepo SR, Martin JD, Landazabal YD, Tamayo-Cabeza G, et al. Effectiveness and adherence to closed face shields in the prevention of COVID-19 transmission: a non-inferiority randomized controlled trial in a middle-income setting (COVPROSHIELD). *Trials* 2022;**23**(1):698. [DOI: 10.1186/s13063-022-06606-0]

References to ongoing studies

Brass 2021 *{published data only}*

Brass A, Shoubridge A, Crotty M, Morawska L, Bell S, Qiao M, et al. Prevention of SARS-CoV-2 (COVID-19) transmission in residential aged care using ultraviolet light (PETRA): a two-arm crossover randomised controlled trial protocol. *BMC Infectious Diseases* 2021;**21**:967. [DOI: https://doi.org/10.1186/s12879-021-06659-7]

NCT03454009 *{published data only}*

NCT03454009. Kent State University / Price Chopper Wellness Promotion Study. clinicaltrials.gov/show/NCT03454009 (first date received March 5 2018).

NCT04267952 *{published data only}*

NCT04267952. Hand hygiene intervention program on primary school students' health outcomes and absenteeism in school. Clinicaltrials.gov/show/NCT04267952 (first received Feb 13 2020).

NCT04471766 *{published data only}*

NCT04471766. Locally produced cloth face mask and COVID-19 Llke illness prevention. clinicaltrials.gov/ct2/show/NCT04471766 (first received July 15, 2020). [TRIAL REGISTRY: NCT04471766]

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Additional references

Abaluck 2021a

Abaluck J, Kwong LH, Styczynski A, Haque A, Kabir MA, Bates-Jeffries E, et al. Can face masks reduce transmission of SARS-CoV-2 in Bangladesh? A cluster randomized controlled trial. osf.io/23mws/ accessed 13 June 2022.

Abaluck 2021b

Abaluck J, Kwong LH, Styczynski A, Haque A, Kabir MA, Bates-Jeffries E, et al. The impact of community masking on COVID-19: a cluster-randomized trial in Bangladesh. CEGA Working Paper Series No. WPS-179 2021 (accessed 13 June 2022). [DOI: 10.26085/C3FS3C]

ACTRN12610000887077

ACTRN12610000887077. Face masks in the protection of healthcare workers to pandemic influenza and emerging infections [Economic, social and cross cultural issues in non-pharmaceutical protection of front line responders to pandemic influenza and emerging infections]. www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=336078 (first received 18 October).

Aiello 2002

Aiello AE, Larson EL. What is the evidence for a causal link between hygiene and infections? *Lancet* 2002;**2**(2):103-10.

Ammann 2022

Ammann P, Ulyte A, Haile SR, Puhan MA, Kriemler S, Radtke T. Perceptions towards mask use in school children during the SARS-CoV-2 pandemic: the Ciao Corona Study. *Swiss Medical Weekly* 2022;**152**:w30165.

Arnold 2013

Arnold BF, Null C, Luby S, Unicomb L, Stewart CP, Dewey KG, et al. Cluster-randomised controlled trials of individual and combined water, sanitation, hygiene and nutritional interventions in rural Bangladesh and Kenya: the WASH benefits study design and rationale. *BMJ Open* 2013;**3**:e003476.

Atkins 2004

Atkins D, Best D, Briss PA, Eccles M, Falck-Ytter Y, Flottorp S, et al, GRADE Working Group. Grading quality of evidence and strength of recommendations. *BMJ* 2004;**328**(7454):1490.

Bartoszko 2020

Bartoszko JJ, Farooqi MA, Alhazzani W, Loeb M. Medical masks vs N95 respirators for preventing COVID-19 in healthcare workers: a systematic review and meta-analysis of randomized trials. *Influenza and Other Respiratory Viruses* 2020;**14**(4):365-73. [DOI: 10.1111/irv.12745] [PMID: 32246890]

Bonn 1997

Bonn D. Spared an influenza pandemic for another year? *Lancet* 1997;**349**(9044):36.

Bootsma 2007

Bootsma MC, Ferguson NM. The effect of public health measures on the 1918 influenza pandemic in U.S. cities. Proceedings of the National Academy of Sciences of the United States of America (PNAS) 2007;**E-pub ahead of print**:1-6. [DOI: 10.1073 /pnas.0611071104]

Broderick 2008

Broderick MP, Hansen CJ, Russell KL. Exploration of the effectiveness of social distancing on respiratory pathogen transmission implicates environmental contributions. *Journal of Infectious Diseases* 2008;**198**(10):1420-6. [DOI: 10.1086/592711]

Brosseau 2020

Brosseau LM, Sietsema M. Masks-for-all for COVID-19 not based on sound data. www.cidrap.umn.edu/news-perspective/2020/04/commentary-masks-all-covid-19-not-based-sound-data (accessed 20 April 2020).

Bundgaard 2020

Bundgaard H, Bundgaard JS, Raaschou-Pedersen DE, Mariager AF, Schytte N, von Buchwald C. Face masks for the prevention of COVID-19 - Rationale and design of the randomised controlled trial DANMASK-19. *Danish Medical Journal* 2020;**67**(9):A05200363.

Byambasuren 2021

Byambasuren O, Beller E, Clark J, Collignon P, Glasziou P. The effect of eye protection on SARS-CoV-2 transmission: a systematic review. *Antimicrobial Resistance & Infection Control* 2021;**10**(1):156. [DOI: 10.1186/s13756-021-01025-3]

Cassell 2006

Cassell MM, Halperin DT, Shelton JD, Stanton D. Risk compensation: the achilles' heel of innovations in HIV prevention? *BMJ* 2006;**332**:605–7.

CDC 2005a

Centers for Disease Control and Prevention. Infection control guidance for the prevention and control of influenza in acute-care facilities. www.cdc.gov/flu/professionals/infectioncontrol/healthcarefacilities.htm (accessed 3 March 2006).

CDC 2005b

Centers for Disease Control and Prevention. 2004-2005 Interim guidance for the use of masks to control influenza transmission. www.cdc.gov/flu/professionals/infectioncontrol/maskguidance.htm (accessed 3 March 2006).

Chard 2018

Chard AN, Freeman MC. Design, intervention fidelity, and behavioral outcomes of a school-based water, sanitation, and hygiene cluster-randomized trial in Laos. *International Journal of Environmental Research and Public Health* 2018;**15**(4):570.

Christensen 2015

Christensen G, Dentz HN, Pickering AJ, Bourdier T, Arnold BF, Colford JM Jr. Pilot cluster randomized controlled trials to evaluate adoption of water, sanitation, and hygiene interventions and their combination in rural western Kenya. *American Journal of Tropical Medicine and Hygiene* 2015;**92**(2):437-47.

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Chu 2020

Chu DK, Akl EA, Duda S, Solo K, Yaacoub S, Schünemann HJ. Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. *Lancet* 2020;**395**(10242):1973-87. [DOI: 10.1016/S0140-6736(20)31142-9]

Claessen 2008

Claessen J-P, Bates S, Sherlock K, Seeparsand F, Wright R. Designing interventions to improve tooth brushing. *International Dental Journal* 2008;**58**(Suppl 5):307–20.

Clark 2020

Clark JM, Sanders S, Carter M, Honeyman D, Cleo G, Auld Y, et al. Improving the translation of search strategies using the Polyglot Search Translator: a randomized controlled trial. *Journal of the Medical Library Association* 2020;**108**(2):195-207.

Coroiu 2021

Coroiu A, Moran C, Lindsay BL, Geller AC. Parent-for-child mask behavior during the COVID-19 pandemic in Canada and the United States: an investigation of attitudes, norms, and perceived control using the theory of planned behavior. *Preventive Medicine Reports* 2021;**24**:101533. [DOI: 10.1016/j.pmedr.2021.101533]

Curtis 2001

Curtis V, Biran A. Dirt, disgust, and disease: Is hygiene in our genes? *Perspectives in Biology and Medicine* 2001;**44**(1):17-31.

Demicheli 2018a

Demicheli V, Jefferson T, Ferroni E, Rivetti A, Di Pietrantonj C. Vaccines for preventing influenza in healthy adults. *Cochrane Database of Systematic Reviews* 2018, Issue 2. Art. No: CD001269. [DOI: 10.1002/14651858.CD001269.pub6]

Demicheli 2018b

Demicheli V, Jefferson T, Di Pietrantonj C, Ferroni E, Thorning S, Thomas RE, et al. Vaccines for preventing influenza in the elderly. *Cochrane Database of Systematic Reviews* 2018, Issue 2. Art. No: CD004876. [DOI: 10.1002/14651858.CD004876.pub4]

Denford 2022

Denford S, Towler L, Ali B, Treneman-Evans G, Bloomer R, Peto TE, et al. Feasibility and acceptability of daily testing at school as an alternative to self-isolation following close contact with a confirmed case of COVID-19: a qualitative analysis. *BMC Public Health* 2022;**22**:742.

Dentz 2017

Dentz H, Null C, Pickering A, Stewart C. WASH Benefits Kenya randomized controlled trial - implementation paper & documents. https://osf.io/26r59/ 2017.

Dreibelbis 2013

Dreibelbis R, Winch PJ, Leontsini E, Hulland KR, Ram PK, Unicomb L, et al. The integrated behavioural model for water, sanitation, and hygiene: a systematic review of behavioural models and a framework for designing and evaluating behaviour change interventions in infrastructure restricted settings. *BMC Public Health* 2013;**13**:1015.

Elflein 2019

Elflein J. Number of influenza cases in the United States from 2010-2017. www.statista.com/statistics/861113/estimated-number-of-flu-cases-us/ (accessed prior to 2 November 2020).

Ellis 2010

Ellis M. Evaluating strategies to prevent methicillin-resistant Staphylococcus Aureus skin and soft tissue infections in military trainees (Methicillin-resistant Staphylococcus Aureus (MRSA) skin and soft tissue infection (SSTI) prevention in military trainees]. clinicaltrials.gov/ct2/show/study/NCT01105767 April 16, 2010.

Erasmus 2011

Erasmus V, Huis A, Oenema A, Van Empelen P, Boog MC, Van Beeck EH, et al. The ACCOMPLISH study. A cluster randomised trial on the cost-effectiveness of a multicomponent intervention to improve hand hygiene compliance and reduce healthcare associated infections. *BMC Public Health [Internet]* 2011;**11**:721.

Fong 2020

Fong MW, Gao H, Wong JY, Xiao J, Shiu EY, Ryu S, et al. Nonpharmaceutical measures for pandemic influenza in nonhealthcare settings - social distancing measures. *Emerging Infectious Diseases* 2020;**26**(5):976-84.

Fretheim 2022b

Fretheim A, Elgersma IH, Helleve A, Elstrøm P, Kacelnik O, Hemkens LG. Glasses against transmission of 1 SARS-CoV-2 in the community (GLASSY): a pragmatic randomized trial. medRxiv preprint:(accessed 20 September 2022). [DOI: 10.1101/2022.07.31.22278223]

Fung 2006

Fung IC, Cairncross S. Effectiveness of handwashing in preventing SARS: a review. *Tropical Medicine and International Health* 2006;**11**(11):1749-58.

Glanz 2008

Glanz K, Rimer BK, Viswanath K, editors. Health Behavior and Health Education: Theory, Research, and Practice. 4th edition. San Francisco (CA): Jossey-Bass, 2008.

GRADEpro GDT [Computer program]

McMaster University (developed by Evidence Prime) GRADEpro GDT. Version accessed 27 April 2020. Hamilton (ON): McMaster University (developed by Evidence Prime), 2015. Available at gradepro.org.

Greenhalgh 2020

Greenhalgh T, Schmid MB, Czypionka T, Bassler D, Gruer L. Face masks for the public during the covid-19 crisis. *BMJ* 2020;**369**:m1435.

Hartinger 2011

Hartinger SM, Lanata CF, Hattendorf J, Gil AI, Verastegui H, Ochoa T, et al. A community randomised controlled trial evaluating a home-based environmental intervention package

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of improved stoves, solar water disinfection and kitchen sinks in rural Peru: Rationale, trial design and baseline findings. *Contemporary Clinical Trials* 2011;**32**(6):864–73.

Hartinger 2012

Hartinger SM, Lanata CF, Gil AI, Hattendorf J, Verastegui H, Mäusezahl D. Combining interventions: Improved chimney stoves, kitchen sinks and solar disinfection of drinking water and kitchen clothes to improve home hygiene in rural Peru. *Field Actions Science Report http://factsreports.revues.org/1627* accessed 3 May 2013;**6**:1 SPL.

Higgins 2002

Higgins JP, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Statistics in Medicine* 2002;**21**(11):1539-58.

Higgins 2003

Higgins JP, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ* 2003;**327**(7414):557-60.

Higgins 2011

Higgins JP, Green S, editor(s). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 (updated March 2011). The Cochrane Collaboration, 2011. Available from training.cochrane.org/handbook/archive/v5.1/.

Higgins 2021a

Higgins JP, Eldridge S, Li T. Chapter 23.1.5 Approximate analyses of cluster-randomized trials for a meta-analysis: inflating standard errors. In: Higgins JP, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA, editor(s). Cochrane Handbook for Systematic Reviews of Interventions Version 6.2 (updated February 2021). Cochrane, 2021. Available from training.cochrane.org/handbook.

Higgins 2021b

Higgins JP, Eldridge S, Li T. Chapter 23.3.4 How to include multiple groups from one study. In: Higgins JP, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA, editor(s). Cochrane Handbook for Systematic Reviews of Interventions Version 6.2 (updated February 2021). Cochrane, 2021. Available from training.cochrane.org/handbook.

Howard 2020

Howard J, Huang A, Li Z, Tufekci Z, Zdimal V, van der Westhuizen H, et al. Face masks against COVID-19: an evidence review. www.preprints.org/manuscript/202004.0203/v1 (accessed 20 April 2020). [DOI: 10.20944/preprints202004.0203.v1]

Huis 2013

Huis A, Schoonhoven L, Grol R, Donders R, Hulscher M, van Achterberg T. Impact of a team and leaders-directed strategy to improve nurses' adherence to hand hygiene guidelines: a cluster randomised trial. *International Journal of Nursing Studies* 2013;**50**:464-74.

Hulland 2013

Hulland KR, Leontsini E, Dreibelbis R, Unicomb L, Afroz A, Dutta NC, et al. Designing a handwashing station for infrastructure-restricted communities in Bangladesh using the integrated behavioural model for water, sanitation and hygiene interventions (IBM-WASH). *BMC Public Health* 2013;**13**(1):877.

Jefferson 2006b

Jefferson T, Demicheli V, Rivetti D, Jones M, Di Pietrantonj C, Rivetti A. Antivirals for influenza in healthy adults: systematic review. *Lancet* 2006;**367**(9507):303-13. [DOI: 10.1016/S0140-6736(06) 67970-1]

Jefferson 2014

Jefferson T, Jones M, Doshi P, Del Mar C, Hama R, Thompson M, et al. Neuraminidase inhibitors for preventing and treating influenza in adults and children. *Cochrane Database of Systematic Reviews* 2014, Issue 4. Art. No: CD008965. [DOI: 10.1002/14651858.CD008965.pub4]

Jefferson 2018

Jefferson T, Rivetti A, Di Pietrantonj C, Demicheli V. Vaccines for preventing influenza in healthy children. *Cochrane Database of Systematic Reviews* 2018, Issue 2. Art. No: CD004879. [DOI: 10.1002/14651858.CD004879.pub5]

Kaewchana 2012

Kaewchana S, Simmerman M, Somrongthong R, Suntarattiwong P, Lertmaharit S, Chotipitayasunondh T. Effect of intensive hand washing education on hand washing behaviors in Thai households with an influenza-positive child in urban Thailand. *Asia-Pacific Journal of Public Health* 2012;**24**(4):577-85.

Kendrick 1994

Kendrick AS. Training to ensure healthy child day care programs. *Pediatrics* 1994;**94**(6 II):1108-110.

Kirscht 1974

Kirscht JP. The Health Belief Model and illness behavior. *Health Education & Behavior* 1974;**2**(4):387–408.

Kitamura 2007

Kitamura T, Satomura K, Kawamura T, Yamada S, Takashima K, Suganuma N. Can we prevent influenza-like illnesses by gargling? *Japanese Society of Internal Medicine* 2007;**46**(18):1623-4. [DOI: 10.2169/internalmedicine.46.0104]

Kutter 2018

Kutter JS, Spronken MI, Fraaij PL, Fouchier RA, Herfst S. Transmission routes of respiratory viruses among humans. *Current Opinion in Virology* 2018;**28**:142-51. [DOI: 10.1016/j.coviro.2018.01.001] [ISSN 1879-6257]

Kwong 2021

Kwong L, Abaluck J, Benjamin-Chung J, Luby S. Can face masks reduce transmission of SARS-CoV-2 in Bangladesh? A cluster randomized controlled trial. osf.io/vzdh6/ 2021 (accessed 13 June 2022).

Lefebvre 2011

Lefebvre C, Manheimer E, Glanville J. Chapter 6: Searching for studies. In: Higgins JP, Green S, editor(s). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 (updated

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March 2011). The Cochrane Collaboration, 2011. Available from training.cochrane.org/handbook/archive/v5.1/.

Leung 2021

Leung NH. Transmissibility and transmission of respiratory viruses. *Nature Reviews Microbiology* 2021;**19**(8):528-45.

Lin 2022

Lin YC, Malott RJ, Ward L, Kiplagat L, Pabbaraju K, Gill K, et al. Detection and quantification of infectious severe acute respiratory coronavirus-2 in diverse clinical and environmental samples. *Scientific Reports* 2022;**12**(1):5418. [DOI: 10.1038/s41598-022-09218-5]

Long 2020

Long Y, Hu T, Liu L, Chen R, Guo Q, Yang L, et al. Effectiveness of N95 respirators versus surgical masks against influenza: a systematic review and meta-analysis. *Journal of Evidence-Based Medicine* 2020;**13**(2):93-101. [DOI: 10.1111/jebm.12381]

Luby 2018

Luby SP, Rahman M, Arnold BF, Unicomb L, Ashraf S, Winch PJ, et al. Effects of water quality, sanitation, handwashing, and nutritional interventions on diarrhoea and child growth in rural Bangladesh: a cluster randomised controlled trial. *Lancet Global Health* 2018;**6**(3):e302-e15.

Marshall 2018

Marshall IJ, A Noel-Storr A, Kuiper J, Thomas J, Wallace BD. Machine learning for identifying randomized controlled trials: an evaluation and practitioner's guide. *Research Synthesis Methods* 2018;**9**(4):602-14. [DOI: 10.1002/jrsm.1287]

Mbakaya 2017

Mbakaya BC, Lee PH, Lee RL. Hand hygiene intervention strategies to reduce diarrhoea and respiratory infections among schoolchildren in developing countries: a systematic review. *International Journal of Environmental Research and Public Health* 2017;**14**(4):371.

McKenzie 2010

McKenzie JE, Priest P, Audas R, Poore MR, Brunton CR, Reeves LM. Hand sanitisers for reducing illness absences in primary school children in New Zealand: a cluster randomised controlled trial study protocol. *Trials* 2010;**11**:7.

Meadows 2004

Meadows E, Le Saux N. A systematic review of the effectiveness of antimicrobial rinse-free hand sanitizers for prevention of illness-related absenteeism in elementary school children. *BMC Public Health* 2004;**4**:50. [DOI: 10.1186/1471-2458-4-50]

Microsoft Excel 2018

Microsoft Corporation. Microsoft Excel. Available from: https://office.microsoft.com/excel 2018.

Moncion 2019

Moncion K, Young K, Tunis M, Rempel S, Stirling R, Zhao L. Effectiveness of hand hygiene practices in preventing influenza virus infection in the community setting: a systematic review. *Canada Communicable Disease Report* 2019;**45**(1):12-23.

Monto 1969

Monto AS, Davenport FM, Napier JA, Francis T Jr. Effect of vaccination of a school-age population upon the course of an A2-Hong Kong influenza epidemic. *Bulletin of the World Health Organization* 1969;**41**(3):537-42.

Najnin 2017

Najnin N, Leder K, Qadri F, Forbes A, Unicomb L, Winch PJ, et al. Impact of adding hand-washing and water disinfection promotion to oral cholera vaccination on diarrhoea-associated hospitalization in Dhaka, Bangladesh: Evidence from a cluster randomized control trial International. *Journal of Epidemiology* 2017;**46**(6):2056-66.

Null 2018

Null C, Stewart CP, Pickering AJ, Dentz HN, Arnold BF, Arnold CD, et al. Effects of water quality, sanitation, handwashing, and nutritional interventions on diarrhoea and child growth in rural Kenya: a cluster-randomised controlled trial. *Lancet Global Health* 2018;**6**:e316–29.

Offeddu 2017

Offeddu V, Yung CF, Low MS, Tam CC. Effectiveness of masks and respirators against respiratory infections in healthcare workers: a systematic review and meta-analysis. *Clinical Infectious Diseases* 2017;**65**(11):1934-42. [DOI: 10.1093/cid/cix681]

Onakpoya 2022a

Onakpoya IJ, Heneghan CJ, Spencer EA, Brassey J, Plüddemann A, Evans DH, et al. SARS-CoV-2 and the role of close contact in transmission: a systematic review [version 3; peer review: 2 approved, 1 approved with reservations, 1 not approved]. *F1000Research* 2022;**10**:280. [DOI: 10.12688/f1000research.52439.3]

Onakpoya 2022b

Onakpoya IJ, Heneghan CJ, Spencer EA, Brassey J, Rosca EC, Maltoni S. Viral cultures for assessing fomite transmission of SARS-CoV-2: a systematic review and meta-analysis. *Journal of Hospital Infection* 2022;**130**:63-94. [DOI: 10.1016/j.jhin.2022.09.007] [PMC9473144] [PMID: 36115620]

Ong 2020

Ong SW, Tan YK, Chia PY, Lee TH, Ng OT, Wong MS, et al. Air, surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from a symptomatic patient. *JAMA* 2020;**323**(16):1610-2.

Parvez 2018

Parvez SM, Azad R, Rahman M, Unicomb L, Ram PK, Naser AM, et al. Achieving optimal technology and behavioral uptake of single and combined interventions of water, sanitation hygiene and nutrition, in an efficacy trial (WASH benefits) in rural Bangladesh. *Trials* 2018;**19**(1):358.

Perkins 2003

Perkins HW, editor. The Social Norms Approach to Preventing School and College Age Substance Abuse: a Handbook for

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Educators, Counselors, and Clinicians. San Francisco (CA): Jossey-Bass, 2003.

Pickering 2019

Pickering AJ, Null C, Winch PJ, Mangwadu G, Arnold BF, Prendergast AJ, et al. The WASH Benefits and SHINE trials: interpretation of WASH intervention effects on linear growth and diarrhoea. *Lancet Global Health* 2019;**7**(8):e1139-46.

Qadri 2015

Qadri F, Ali M, Chowdhury F, Khan AI, Saha A, Khan IA, et al. Feasibility and effectiveness of oral cholera vaccine in an urban endemic setting in Bangladesh: a cluster randomised open-label trial. *Lancet* 2015;**386**(10001):1362–71.

Rabie 2006

Rabie T, Curtis V. Handwashing and risk of respiratory infections: a quantitative systematic review. *Tropical Medicine & International Health* 2006;**11**(3):258-67.

Radonovich 2016

Radonovich LJ Jr, Bessesen MT, Cummings DA, Eagan A, Gaydos A, Gibert C, et al. The respiratory protection effectiveness clinical trial (ResPECT): a cluster-randomized comparison of respirator and medical mask effectiveness against respiratory infections in healthcare personnel. *BMC Infectious Diseases* 2016;**16**:243. [DOI: 10.1186/s12879-016-1494-2]

Rahman 2018

Rahman M, Ashraf S, Unicomb L, Mainuddin AK, Parvez SM, Begum F, et al. WASH Benefits Bangladesh trial: system for monitoring coverage and quality in an efficacy trial. *Trials* 2018;**19**:360.

Ran 2020

Ran L, Chen X, Wang Y, Wu W, Zhang L, Tan X. Risk factors of healthcare workers with corona virus disease 2019: a retrospective cohort study in a designated hospital of Wuhan in China. Clinical Infectious Diseases 2020 Mar 17 [Epub ahead of print]. [DOI: 10.1093/cid/ciaa287] [PMID: 32179890]

Rengasamy 2010

Rengasamy S, Eimer B, Shaffer RE. Simple respiratory protection - evaluation of the filtration performance of cloth masks and common fabric materials against 20-1000 nm size particles. *Annals of Occupational Hygiene* 2010;**54**(7):789-98.

RIVM 2011

RIVM. Health risks in a child daycare centre or preschool (0 to 4 year olds). Dutch National Institute for Public Health and the Environment (RIVM), Dutch National Centre for Hygiene and Safety (LCHV). Bilthoven (The Netherlands): The Institute 2011.

Saunders-Hastings 2017

Saunders-Hastings P, Crispo JA, Sikora L, Krewski D. Effectiveness of personal protective measures in reducing pandemic influenza transmission: a systematic review and meta-analysis. *Epidemics* 2017;**20**:1-20.

Savolainen-Kopra 2010

Savolainen-Kopra C, Haapakoski J, Peltola PA, Ziegler T, Korpela T, Anttila P, et al. STOPFLU: is it possible to reduce the number of days off in office work by improved hand-hygiene? *Trials* 2010;**11**:69.

Schwartz 2018

Schwartz JL. The Spanish Flu, epidemics, and the turn to biomedical responses. *American Journal of Public Health* 2018;**108**(11):1455-8.

Shen 2021

Shen M, Zeng Z, Song B, Yi H, Hu T, Zhang Y, et al. Neglected microplastics pollution in global COVID-19: disposable surgical masks. *Science of the Total Environment* 2021;**790**:148130. [DOI: 10.1016/j.scitotenv.2021.148130]

Sidibe 2003

Sidibe M. Formative Research in Schools: Review Document. London (UK): London School of Hygiene & Tropical Medicine, 2003.

Sidibe 2009

Sidibe M, Shukla N, Rustagi A. Inducing the habit of soap usage in an urban community setting. In: Proceedings of the 3rd WHO International Conference on Children's Health and the Environment. Busan (Korea), 2009.

Smith 2016

Smith JD, MacDougall CC, Johnstone J, Copes RA, Schwartz B, Garber GE. Effectiveness of N95 respirators versus surgical masks in protecting health care workers from acute respiratory infection: a systematic review and meta-analysis. *Canadian Medical Association Journal* 2016;**188**(8):567-74. [DOI: 10.1503/cmaj.150835]

Suess 2011

Suess T, Remschmidt C, Schink S, Luchtenberg M, Haas W, Krause G, et al. Facemasks and intensified hand hygiene in a German household trial during the 2009/2010 influenza A (H1N1) pandemic: adherence and tolerability in children and adults. *Epidemiology and Infection* 2011;**139**(12):1895-901.

Teesing 2020a

Teesing GR, Erasmus V, Nieboer D, Petrignani M, Koopmans MP, Vos MC, et al. Increased hand hygiene compliance in nursing homes after a multimodal intervention: a cluster randomized controlled trial (HANDSOME). *Infection Control and Hospital Epidemiology* 2020;**41**(10):1169-77.

Teesing 2020b

Teesing GR, Erasmus V, Petrignani M, Koopmans MP, de Graaf M, Vos MC, et al. Improving hand hygiene compliance in nursing homes: protocol for a cluster randomized controlled trial (HANDSOME Study). *JMIR Research Protocols* 2020;**9**(5):e17419.

Thomas 2010

Thomas RE, Jefferson T, Lasserson TJ. Influenza vaccination for healthcare workers who work with the elderly. *Cochrane Database of Systematic Reviews* 2010, Issue 2. Art. No: CD005187. [DOI: 10.1002/14651858.CD005187.pub3]

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Unicomb 2018

Unicomb L, Begum F, Leontsini E, Rahman M, Ashraf S, Naser AM, et al. WASH Benefits Bangladesh trial: management structure for achieving high coverage in an efficacy trial. *Trials* 2018;**19**:359.

Warren-Gash 2013

Warren-Gash C, Fragaszy E, Hayward AC. Hand hygiene to reduce community transmission of influenza and acute respiratory tract infection: a systematic review. *Influenza and Other Respiratory Viruses* 2013;**7**(5):738-49.

WHO 2006a

World Health Organization (WHO). WHO Guidelines on Hand Hygiene in Health Care (advanced draft). Geneva (Switzerland): WHO, 2006.

WHO 2006b

World Health Organization Writing Group. Non pharmaceutical interventions for pandemic influenza, national and community measures. *Emerging Infectious Diseases* 2006;**12**(1):88-94.

WHO 2014

World Health Organization. Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care. apps.who.int/iris/handle/10665/112656 (accessed prior to 2 November 2020).

WHO 2017

World Health Organization. The global impact of respiratory disease. www.who.int/gard/publications/The_Global_Impact_of_Respiratory_Disease.pdf (accessed 15 March 2020).

WHO 2020a

World Health Organization. Coronavirus disease (COVID-19) advice for the public. www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public (accessed 20 March 2020).

WHO 2020b

World Health Organization. Getting your workplace ready for COVID-19. www.who.int/docs/default-source/coronaviruse/getting-workplace-ready-for-covid-19.pdf?sfvrsn=359a81e7_6 (accessed 20 March 2020).

WHO 2020c

World Health Organization. Coronavirus disease (COVID-19) technical guidance: infection prevention and control/WASH. www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/infection-prevention-and-control (accessed 20 March 2020).

WHO 2021

World Health Organization. Infection prevention and control during health care when coronavirus disease (COVID-19) is suspected or confirmed. https://www.who.int/publications/i/item/WHO-2019-nCoV-IPC-2021.1 2021:accessed 26 November 2022.

WHO 2022

World Health Organization. Coronavirus disease (COVID-19) pandemic. https://www.who.int/emergencies/diseases/novel-coronavirus-2019 2022:accessed 30 November 2022.

Willmott 2016

Willmott M, Nicholson A, Busse H, MacArthur GJ, Brookes S, Campbell R. Effectiveness of hand hygiene interventions in reducing illness absence among children in educational settings: a systematic review and meta-analysis. *Archives of Disease in Childhood* 2016;**101**(1):42-50.

Wong 2014

Wong VW, Cowling BJ, Aiello AE. Hand hygiene and risk of influenza virus infections in the community: a systematic review and meta-analysis. *Epidemiology and Infection* 2014;**142**(5):922-32.

Wu 2020

Wu S, Wang Y, Jin X, Tian J, Liu J, Mao Y. Environmental contamination by SARS-CoV-2 in a designated hospital for coronavirus disease 2019. *American Journal of Infection Control* 2020;**48**(8):910-4. [DOI: 10.1016/j.ajic.2020.05.003]

Xiao 2020

Xiao J, Shiu EY, Gao H, Wong JY, Fong MW, Ryu S, et al. Nonpharmaceutical measures for pandemic influenza in nonhealthcare settings - personal protective and environmental measures. *Emerging Infectious Diseases* 2020;**26**(5):967-75. [DOI: 10.3201/eid2605.190994]

Zivich 2018

Zivich PN, Gancz AS, Aiello AE. Effect of hand hygiene on infectious diseases in the office workplace: a systematic review. *American Journal of Infection Control* 2018;**46**(4):448-55.

Zomer 2013a

Zomer TP, Erasmus V, Van Beeck EF, Tjon-A-Tsien A, Richardus JH, Voeten HA. Hand hygiene compliance and environmental determinants in child day care centers: an observational study. *American Journal of Infection Control* 2013;**41**(6):497–502.

Zomer 2013b

Zomer TP, Erasmus V, Van Empelen P, Looman C, Van Beeck EF, Tjon-A-Tsien A, et al. Sociocognitive determinants of observed and self-reported compliance to hand hygiene guidelines in child day care centers. *American Journal of Infection Control* 2013;**41**(10):862-7.

References to other published versions of this review

Jefferson 2006a

Jefferson T, Foxlee R, Del Mar C, Dooley L, Ferroni E, Hewak B, et al. Interventions for the interruption or reduction of the spread of respiratory viruses. *Cochrane Database of Systematic Reviews* 2006, Issue 6. Art. No: CD006207. [DOI: 10.1002/14651858.CD006207]

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Jefferson 2007

Jefferson T, Foxlee R, Del Mar C, Dooley L, Ferroni E, Hewak B, et al. Interventions for the interruption or reduction of the spread of respiratory viruses. *Cochrane Database of Systematic Reviews* 2007, Issue 4. Art. No: CD006207. [DOI: 10.1002/14651858.CD006207.pub2]

Jefferson 2009

Jefferson T, Del Mar C, Dooley L, Ferroni E, Al-Ansary LA, Bawazeer GA, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses: systematic review. *BMJ* 2009;**339**:b.3657. [DOI: 10.1136/bmj.b367]

Jefferson 2010

Jefferson T, Del Mar C, Dooley L, Ferroni E, Al-Ansary LA, Bawazeer GA, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database of Systematic Reviews* 2010, Issue 1. Art. No: CD006207. [DOI: 10.1002/14651858.CD006207.pub3]

Jefferson 2011

Jefferson T, Del Mar C, Dooley L, Ferroni E, Al-Ansary LA, Bawazeer GA, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database of Systematic Reviews* 2011, Issue 7. Art. No: CD006207. [DOI: 10.1002/14651858.CD006207.pub4]

Jefferson 2020

Jefferson T, Del Mar CB, Dooley L, Ferroni E, Al-Ansary LA, Bawazeer GA, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database of Systematic Reviews* 2020, Issue 11. Art. No: CD006207. [DOI: 10.1002/14651858.CD006207.pub5]

* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Abaluck 2022

Study characteristics	
Methods	Cluster-RCT Randomisation unit: villages (N = 600) Intervention duration: 8 weeks "Our intervention was designed to last 8 weeks in each village"
Participants	Inclusion criteria: community level participants Intervention = 178,322 individuals, control = 163,861 individuals (Total N = 342,183 adults)
Interventions	2 types of mask used: surgical and cloth masks PLUS a brief video of notable public figures discussing why, how, and when to wear a mask, PLUS a brochure based on WHO materials depicting proper mask-wearing. Control villages: the control group did not receive any interventions See Table 1 for details.
Outcomes	Effectiveness: primary outcome: symptomatic seroprevalence (symptomatic and seropositive) Laboratory: seropositivity was defined by having detectable IgG antibodies against SARS-CoV-2 Symptoms defined as per WHO-defined COVID-19 symptoms: (a) fever and cough; (b) 3 or more of the following symptoms (fever, cough, general weakness/fatigue, headache, myalgia, sore throat, coryza, dyspnoea, anorexia/nausea/vomiting, diarrhoea, altered mental status); or (c) loss of taste or smell. Secondary outcomes: prevalence of proper mask-wearing as wearing either a project mask or an alternative face-covering over the mouth and nose and improper mask-wearing as wearing a mask in any way that did not fully cover the mouth and nose; prevalence of physical distancing per WHO guideline that defines physical distancing as one meter of separation; prevalence of symptoms consistent with COVID-19: definition (see above) Safety not assessed. However, study mentioned that there was no adverse events reported during the study period

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Abaluck 2022 *(Continued)*

Notes	The authors conclude that: a randomised trial of community-level mask promotion in rural Bangladesh during the COVID-19 pandemic shows that the intervention increased mask usage and reduced symptomatic SARS-CoV-2 infections, demonstrating that promoting community mask-wearing can improve public health (a scalable and effective method to promote mask adoption and reduce symptomatic SARS-CoV-2 infections.) Funding: this trial was financially supported by a grant from GiveWell.org to Innovations for Poverty Action. The trial authors declare no competing interests.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number generator used
Allocation concealment (selection bias)	High risk	Significant differences in the numbers of households included in each treatment group suggestive of a lack of allocation concealment
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants, mask promoters, and mask surveillance staff were not blinded as intervention materials were clearly visible
Blinding of outcome assessment (detection bias) All outcomes	High risk	Although the pre-specified analyses and sample exclusions were made by analysts blinded to the treatment assignment, investigators dropped individuals who were missing symptom data or who did not consent to blood spot collection from the primary outcome. One of the outcomes is COVID-19 symptoms reported by participants. Mask promoters, and mask surveillance staff were not blinded
Incomplete outcome data (attrition bias) All outcomes	High risk	Laboratory testing results were only available for around 40% of the symptomatic participants
Selective reporting (reporting bias)	High risk	Primary outcome of seroconversion was not reported

Aelami 2015

Study characteristics

Methods	A prospective cross-sectional study conducted during the Hajj season 2012. Pilgrims were randomised into 2 groups. The intervention group received education on personal hygiene including a hygienic package containing alcohol-based hand rub (gel or spray), surgical masks, soap, paper handkerchiefs, and user instructions; the control group did not receive any intervention. ILI was defined as the presence of at least 2 of the following during their stay: fever, cough, and sore throat. Questionnaires including demographic and clinical information were distributed amongst trained physicians before departure from Iran.
Participants	Total enrolled: 664 Iranian pilgrims (306 in the intervention group and 358 in the control group) Inclusion criteria: not reported Exclusion criteria: not reported

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Aelami 2015 *(Continued)*

Interventions	Hygiene education and package. See Table 1 for details.
Outcomes	ILI defined as the presence of at least 2 of the following during their stay: fever, cough, and sore throat. No safety outcomes were reported.
Notes	This is an abstract, therefore few details were reported. Funding not mentioned. Disclosure of interest: none declared.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Insufficient details provided
Allocation concealment (selection bias)	Unclear risk	Insufficient details provided
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient details provided
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient details provided
Selective reporting (reporting bias)	Unclear risk	Insufficient details provided

Aiello 2010

Study characteristics

Methods	Cluster-RCT assessing the effects of hand sanitiser and masks versus masks or no intervention on ILI symptoms. The trial was conducted in university halls of residence with more than 100 student residents in a US university during the 2006 to 2007 influenza "season". The study lasted 6 weeks. The units of randomisation were 7 of the 15 halls. 1 hall was very large (1240 residents), and the 6 remaining ones, which had between 110 and 830 residents, were combined into 2 clusters roughly equivalent in size. The 3 clusters were then randomised by random extraction of the clustered halls' names out of a container. The largest hall (single-cluster) was randomised to the mask and hand sanitiser arm; the 4-halls cluster received masks; and the remaining 2 halls were assigned as controls.
Participants	A total of 1297 with completed baseline survey and at least 1 weekly survey result were analysed (face mask and hand hygiene group = 367; face mask–only group = 378; control group = 552). Inclusion criteria: aged 18 or more, willing to wear mask and use alcohol-based hand sanitiser, have a throat swab specimen collected when ill, and complete the baseline and weekly surveys over the 6-week study period

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Aiello 2010 *(Continued)*	Exclusion criteria: individuals reporting a skin allergy to alcohol were excluded Recruitment of students began in 26 November, but the trial did not go "live" with distribution of intervention materials until 22 January 2007 when the first case of influenza was confirmed on campus by laboratory tests. Enrolment continued until 16 February 2007, and the study was completed on 16 March 2007. During the study period there was a 1-week break when the majority of residents left campus. There were 1327 eligible participants, 1297 of which had a complete baseline survey and at least 1-weekly survey result. It is unclear what the ineligibility criteria were for the 30 missing (1327 minus 1297), but the explanation may be in the appendix.
Interventions	Alcohol-based hand sanitiser (62% ethyl alcohol in a gel base) in a squeeze bottle and TECNOL procedure masks with ear loops (KC Ltd) and educational material or masks and educational material or no intervention. Compliance was encouraged within halls and outside. Sleep wearing was optional. All participants received basic video-linked instruction on cough etiquette and hand sanitation. At baseline and weekly during the study, participants were asked to fill in a web-based survey collecting demographic and ILI symptom data. This was supplemented by direct observation of compliance by staff. Compliance with "optimal handwashing" (at least 20 seconds 5 or more times a day) was significantly higher in the sanitiser-and-mask arm. See Table 1 for details.
Outcomes	Laboratory details are described in appendix. Effectiveness: ILI, defined as cough and at least 1 constitutional symptom (fever/feverishness, chills, headache, myalgia). ILI cases were given contact nurses' phone numbers to record the illness and paid USD 25 to provide a throat swab. 368 participants had ILI, and 94 of these had a throat swab analysed by PCR. 10 of these were positive for influenza (7 for A and 3 for B). Safety: N/A
Notes	The authors conclude that "These findings suggest that face masks and hand hygiene may reduce respiratory illnesses in shared living settings and mitigate the impact of the influenza A (H1N1) pandemic". This conclusion is based on a significantly lower level of ILI incidence in the mask and hand sanitiser arm compared to the other 2 arms after adjustment for covariates (30% to 50% less in arm 1 compared to controls in the last 2 weeks of the study). Comparison with the ILI rate of the control arm may not be a reflection of the underlying rate of ILI because the intervention arm received instruction on hand sanitation and hand etiquette. The play of adjustments is unclear. The intracluster correlation coefficient is reported in the footer of Table 4. Its very small size suggests lack of clustering within halls. The role of spring break is mentioned in the Discussion, as are the results of this study compared to other studies included in our review (Cowling 2008 and MacIntyre 2009). The authors report that 147 of 1297 participants (11.3%) had ILI symptoms "at baseline" and were excluded from analysis. During the 6 weeks of the study, 368 of 1150 participants (32%) had ILI. This averages out at about 5% per week. It is unclear what the term "at baseline" means; presumably this means during the 2 to 3 weeks of participant enrolment. If this is so, the reason for the triggering of the interventions (tied to influenza isolation) are obscure, as the trial is supposedly about ILI, and an ILI outbreak was already under way "at baseline". This study has the same trial registration number as the Aiello 2012 study; the study was funded by government and pharmaceutical industry, i.e. this work was supported by funding from the Centers for Disease Control (CDC) and Prevention Grant U01 C1000441 (www.cdc.gov). Disclosure of interest: none declared.
Risk of bias	

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Aiello 2010 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Described as randomised, but sequence generation not reported
Allocation concealment (selection bias)	High risk	The residence hall units were randomised by blindly selecting a uniform ticket with the name of each hall out of a container (A.S.M. and A.A.) for randomisation assignment to each study arm.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessors blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition is reported as follows: 9, 11, and 19 ineligible and 26, 52, and 21 lost to follow-up (respectively by arm), for a total of 39 and 99 for each reason for attrition. In total, 1297 (97%) of 1331 participants completed a baseline and at least 1-weekly survey. The text reports an ITT analysis with only 1 ILI episode included by participant. No reasons for the attrition of participants and swab volunteers are reported (were the swabs taken from a random sample or not?).
Selective reporting (reporting bias)	High risk	There is no information on the causes of ILI other than the reporting on the 10 influenza PCR-positive swabs of 94 out of 368 students with ILI. This is a very low rate (and the Discussion confirms that the influenza season was mild), but investigation of the other known causes of ILI is not even mentioned in the text. This is especially important because stress, alcohol intake levels, and influenza vaccination were a significant predictor of ILI symptoms (Table 1). The reason for selective testing and/or reporting of influenza viruses tests over the other causes of ILI are unclear, especially as the study objective was focused on ILI. The text is also difficult to follow, weaving the reporting of ILI and influenza without a clear rationale.

Aiello 2012

Study characteristics	
Methods	During the 2007 to 2008 influenza season, 1111 students residing in university residence halls were cluster-randomised by residence house (N = 37) to either face mask and hand hygiene, face mask only, or control arms. Discrete time survival analysis using generalised models estimated rate ratios according to study arm, each week and cumulatively over the 6-week intervention period, for clinically verified ILI and laboratory-confirmed influenza A or B.
Participants	A total of 1187 young adults living in 37 residence halls, randomly assigned to 1 of 3 groups for 6 weeks: face mask use (n = 392), face masks with hand hygiene (n = 349), control (n = 370) Inclusion criteria: aged 18 or more, willing to wear mask and use alcohol-based hand sanitiser, have a throat swab specimen collected when ill, and complete the baseline and weekly surveys over the 6-week study period Exclusion criteria: individuals reporting a skin allergy to alcohol were excluded

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Aiello 2012 *(Continued)*

Interventions	Participants were assigned to face mask and hand hygiene, face mask only, or control group during the study. See Table 1 for details.
Outcomes	Clinically verified ILI: case definition (presence of cough and at least 1 or more of fever/feverishness, chills, or body aches) Laboratory-confirmed influenza A or B. Throat swab specimens were tested for influenza A or B using RT-PCR. No safety outcomes reported.
Notes	This study has the same trial registration number as the Aiello 2010 study; the study was funded by government and pharmaceutical industry, i.e. this work was supported by funding from the Centers for Disease Control (CDC) and Prevention Grant U01 C1000441 (www.cdc.gov). Disclosure of interest: none declared.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer generation of sequence described.
Allocation concealment (selection bias)	Low risk	All residence houses in each of the residence halls were randomised prior to the intervention implementation.
Blinding of participants and personnel (performance bias) All outcomes	High risk	No blinding for study participants and personnel
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessors blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low and similar in each group
Selective reporting (reporting bias)	Low risk	2 outcomes specified and reported.

Alfelali 2020

Study characteristics

Methods	Cluster open-label RCT Location: Mina, Greater Makkah, Saudi Arabia Follow up for 4 days
Participants	Arabic or English speaking Hajj pilgrims aged > 18 years from participating countries (Australia, Qatar and KSA) staying in allocated tents and able to provide signed informed consent were included.

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Alfelali 2020 *(Continued)*

Interventions	Mask wearing. See Table 1 for details.
Outcomes	Effectiveness: Laboratory: laboratory-confirmed viral respiratory infections (nasal swab on 650 participants only) Secondary outcomes: clinical respiratory infections in participants Safety reported on side effects of mask wearing The most common side effects: difficulty in breathing (26.2%); discomfort (22%); a small minority (3%) reported feeling hot, sweating, a bad smell or blurred vision with eyeglasses
Notes	The authors conclude that this trial was unable to provide conclusive evidence on facemask efficacy against viral respiratory infections most likely due to poor adherence to protocol. Funding: this report was made possible by a National Priorities Research Program grant (NPRP 6-1505-3-358) from the Qatar National Research Fund, a member of Qatar Foundation. Disclosure of interests: the other authors have no competing interests to declare.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Coin-tossing by an individual who was not a member of the research team
Allocation concealment (selection bias)	High risk	Used coin tossing which can introduce imbalance
Blinding of participants and personnel (performance bias) All outcomes	High risk	No blinding
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Laboratory staff were blinded to the assigned intervention group
Incomplete outcome data (attrition bias) All outcomes	Low risk	Reported both intention-to-treat and per-protocol analysis and participant flow chart
Selective reporting (reporting bias)	Unclear risk	Insufficient information available.

Almanza-Reyes 2021

Study characteristics

Methods	RCT randomised using a computer-generated block scheme and stratified according to duty position, work shifts and the area/department of the service FU duration: 9 weeks
Participants	Workers (doctors, nurses, administrators) in a hospital for the exclusive recruitment of patients diagnosed with COVID-19 "General Tijuana Hospital"

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Almanza-Reyes 2021 *(Continued)*

Interventions	Experimental group: mouthwash and nose rinse Silver mouth wash: 50 mL spray bottle containing AgNPs solution with 1 wt% concentration (0.6 mg/mLmetallic silver). Mix 4 to 6 spray shots (corresponding to volume ~ 0.5 mL) of this solution with 20 mL of water and to gargle with obtained solution for 15 to 30 seconds at least 3 times a day. Or use as nasal lavages on the inner part of the nasal alae and nasal passage with the same solution using a cotton swab twice a day. Mouth spray: cover evenly the oral cavity with the direct 1 to 2 spray shots of solution without its previous dilution in water. Control group: instructed to do mouth wash and nose rinse with a conventional mouthwash the way they normally did before the study See Table 1 for details.
Outcomes	Effectiveness: Laboratory: Lab-confirmed infection using RT-PCR; symptoms of respiratory tract infection (RTI) no definition given; clinical Evacuation: CT (Toshiba Aquilion 16, Japan) chest scan (random selection) Safety: done using self-reported by participants using a questionnaire. “The present study also showed that no harmful side effects were observed in the 114 participants who used AgNPs as a mouthwash and nose rinse solution for 9 weeks”
Notes	Authors conclude that the mouth and nasal rinse with AgNPs helps in the prevention of SARS-CoV-2 infection in health personnel who are exposed to patients diagnosed with COVID-19. Funding: Funded studies A. Pestryakov Development Program "Priority 2030" Tomsk Polytechnic University https://tpu.ru/en. Conflict of interest statement: the authors have declared that no competing interests exist.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated stratified block scheme
Allocation concealment (selection bias)	High risk	Unbalanced baseline prognostic factors (vaccination and frequency of handwashing)
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not blinded.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No participant flow chart reported.
Selective reporting (reporting bias)	Unclear risk	No protocol available

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Alzaher 2018

Study characteristics	
Methods	A cluster-RCT conducted amongst girls attending 4 primary schools between January and March 2018. The participants attended a hand-hygiene workshop. The schoolgirls' absences were followed up for 5 weeks. Incidence rate, percentage of absence days, and absence rate were calculated for total and upper respiratory infections absences.
Participants	A total of 496 schoolgirls aged of 6 to 12 years, attending 4 public primary girls' schools in the city of Riyadh, Saudi Arabia between January and March 2018. Students were randomised to education group (n = 234) or control group (n = 262). Exclusion criteria: not reported
Interventions	Hand hygiene workshop. See Table 1 for details.
Outcomes	Incidence rate, percentage of absence days, and absence rate were calculated for total and upper respiratory infections absences. The episode of URIs was defined as having 2 of the following symptoms for a day or 1 of the symptoms for 2 or more consecutive days: 1) a runny nose, 2) a stuffy or blocked nose or noisy breathing, 3) sneezing, 4) a cough, 5) a sore throat, and 6) feeling hot, having a fever or a chill. No safety outcomes reported.
Notes	Source of funding is unclear. Disclosure of interest: none mentioned.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Insufficient detail provided.
Allocation concealment (selection bias)	Low risk	Schools allocated prior to all schoolgirls attending selected schools were invited to participate.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study
Incomplete outcome data (attrition bias) All outcomes	Low risk	No loss to follow-up
Selective reporting (reporting bias)	Unclear risk	No protocol available

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Arbogast 2016

Study characteristics	
Methods	A 13.5-month prospective cluster-RCT executed with alcohol-based hand sanitiser in strategic workplace locations and personal use (intervention group) and brief hand hygiene education (both groups). Four years of retrospective data were collected for all participants.
Participants	Data for a total of 1183 participants were analysed (intervention group = 525, control group = 607). Inclusion criteria: all employees at 3 facilities who were 18 years of age or older, were enrolled in the company health insurance coverage, did not transfer between sites, and worked onsite full time (≥ 32 hours) were eligible for the study Exclusion criteria: not reported
Interventions	Alcohol-based hand sanitiser in strategic workplace locations and personal use (intervention group) and brief hand hygiene education (both groups). See Table 1 for details.
Outcomes	1. The number of healthcare insurance claims, for a defined set of preventable illnesses, per participant per year 2. Absenteeism, defined as the number of sick episodes per participant per year Claims based on ICD-9 codes No safety outcomes reported.
Notes	Only 2 clusters (1 per group) included, hence study data not included in meta-analysis. Industry funded. Disclosure of interest: none mentioned.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	No details provided.
Allocation concealment (selection bias)	Unclear risk	No details provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition minimal and similar in 2 groups
Selective reporting (reporting bias)	Unclear risk	No protocol available

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Ashraf 2020

Study characteristics	
Methods	Geographically pair-matched community-based cluster-randomised trial Used a random number generator to block Open-label Block randomised: unit of randomisation was a group of compounds visited by a single local promoter
Participants	1. Infants (target child) will be eligible to participate in the study if: a. they are in utero at the baseline survey. b. their parents/guardians are planning to stay in the study village for the next 12 months (if a mother is planning to give birth at her natal home and then return, she will still be a candidate for enrolment) 2. Children < 36 months old at baseline that are living in the compound of a target child will be eligible to participate in diarrhoea measurement if: a. they are < 36 months old at the baseline survey; b. their parents/guardians are planning to stay in the study village for the next 12 months. 3. Children 18 to 27 months old at baseline that are living in the compound of a target child will be eligible to participate in intestinal parasite specimen collection if: a. they are 18 to 27 months old at the baseline survey; b. their parents/guardians are planning to stay in the study village for the next 12 months.
Interventions	6 intervention arms: water quality, sanitation, hand washing, combined WSH, nutrition, nutrition + WSH Intervention was delivered at the household or the compound level See Table 1 for details.
Outcomes	Effectiveness: Primary outcome: 7-day prevalence of acute respiratory illness (ARI). Defined as: caregiver-reported symptoms of persistent cough or panting, wheezing, or difficulty breathing (1 or 2) in the 7 days before the interview. No clinical data were collected Secondary analyses: alternate combinations of the measured symptoms: 7-day prevalence of only panting, wheezing, or difficulty breathing (2) and ARI plus fever ([1 or 2] and 3) Outcomes were measured approximately 12 and 24 months following intervention roll out. Safety not assessed
Notes	The authors conclude that: single targeted water, sanitation, and hygiene interventions reduced reported respiratory illness in young children. There was no apparent respiratory health benefit from combining WASH interventions. Financial support: this research was funded by Global Development grant OPPGD759 from the Bill & Melinda Gates Foundation to the University of California, Berkeley, CA. S. P. L., S. A., M. I., B. F. A., and J. M. C. report grants from the Bill & Melinda Gates Foundation during the conduct of the study. P. K. R. reports grants from Leland Stanford University during the conduct of the study for support to the WASH Benefits project. M. R. reports grants and non financial support from the Bill & Melinda Gates Foundation (through a subcontract from UC Berkeley) during the conduct of the study. Disclosure of interest: none mentioned.

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Ashraf 2020 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number generator
Allocation concealment (selection bias)	Low risk	Random allocation by an offsite investigator
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	The research team who implemented the intervention was separate from the data collection team. The analysis was carried out masked to the allocated group.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Provided participants flow diagram showing minimal attrition.
Selective reporting (reporting bias)	Low risk	Reported the pre-specified outcomes.

Azor-Martinez 2016

Study characteristics	
Methods	Randomised, controlled, and open study with an 8-month follow-up. The experimental group washed their hands with soap and water, together with using hand sanitiser, and the control group followed their usual handwashing procedures. Absenteeism rates due to URIs were compared between the 2 groups through a multivariate Poisson regression analysis. The per cent of days missed in both groups were compared with a z test.
Participants	A sample of 1341 (intervention group = 621, control group = 720) Inclusion criteria: children 4 to 12 years old, attending 5 state schools in Almeria (Spain) whose parents/guardians had signed an informed consent document Exclusion criteria: children who had any of the following chronic illnesses that predisposed them to infection: neoplasia, primary and secondary immunodeficiencies, cystic fibrosis, chronic treatment with high doses of steroids or immunosuppressants
Interventions	Hand-washing workshops of 2-hour duration. The experimental group washed their hands with soap and water together with using hand sanitiser, whilst the control group followed usual hand-washing procedures. See Table 1 for details.
Outcomes	Absenteeism rates due to URIs Per cent of days missed Respiratory illness was defined by 2 of the following symptoms during 1 day, or 1 of the symptoms for 2 consecutive days: (1) runny nose; (2) stuffy or blocked nose or noisy breathing; (3) cough; (4) feeling hot or feverish or having chills; (5) sore throat; or (6) sneezing.

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Azor-Martinez 2016 *(Continued)*

	A school absenteeism case (episode) was defined as when a child failed to attend school due to an URI. Common infectious illnesses, such as conjunctivitis, and skin infections were not included. Other causes for absenteeism, such as doctors' appointments, family vacations, and accident injuries, were also excluded. No safety outcomes reported.
Notes	Government funded Disclosure of interest: none mentioned.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	A random number table was used.
Allocation concealment (selection bias)	Low risk	Schools/classes allocated prior to children recruited.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study
Incomplete outcome data (attrition bias) All outcomes	High risk	Attrition levels high and different in the 2 groups
Selective reporting (reporting bias)	Unclear risk	No protocol available

Azor-Martinez 2018

Study characteristics

Methods	A cluster-RCT, controlled, and open study of 911 children aged 0 to 3 years attending 24 DCCs in Almería, Spain, with an 8-month follow-up. 2 intervention groups of DCC families performed educational and hand hygiene measures, 1 with soap and water (n = 274), another with hand sanitiser (n = 339), and the control group followed usual hand-washing procedures (n = 298). Respiratory infection (RI) episode rates were compared through multilevel Poisson regression models. The percentage of days missed were compared with Poisson exact tests.
Participants	A total of 911 children attending 24 DCCs in Almería (Spain). Inclusion criteria: children between 0 and 3 years old enrolled in DCCs and attending for at least 15 hours per week whose parents or guardians had signed an informed consent Exclusion criteria: children with chronic illness or medication that could affect their likelihood of contracting an infection

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Azor-Martinez 2018 *(Continued)*

	Data were analysed for 911 participants: hand sanitiser group (n = 339), soap and water group (n = 274), and control group (n = 298).
Interventions	2 intervention groups. 1 group used soap and water, another used hand sanitiser, whilst the control group followed usual hand-washing procedures. Groups received 1-hour hand hygiene workshop. See Table 1 for details.
Outcomes	Primary: RI incidence rate Secondary: (1) the presence or absence of at least 1 antibiotic prescription for each new RI episode during the study period (topical antibiotics were excluded), and (2) the percentage of RI absenteeism days in the 3 groups calculated as the ratio of RI absenteeism days to all possible days of attendance DCC absenteeism episode was defined as when a child failed to attend a DCC because of an RI. Respiratory illness was defined as the presence of 2 of the following symptoms during 1 day or the presence of 1 of the symptoms for 2 consecutive days: (1) runny nose, (2) stuffy or blocked nose or noisy breathing, (3) cough, (4) feeling hot or feverish or having chills, (5) sore throat, or (6) sneezing. No safety outcomes reported.
Notes	Government funded. This work was supported by a grant from the Andalusia Department of Health. Competing interests: the authors have indicated they have no potential conflicts of interest to disclose.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer randomisation using statistical software for the sequence
Allocation concealment (selection bias)	Low risk	Clusters assigned prior to recruitment.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition minimal and similar in 3 groups
Selective reporting (reporting bias)	Unclear risk	No protocol available

Ban 2015

Study characteristics

Methods	Quote: "Group randomised" trial. Only 2 clusters, which were 2 kindergartens in Xiantao City, Hubei Province, China.

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Ban 2015 *(Continued)*

Participants	Data for a total of 393 participants were analysed (intervention group = 194, control group = 199). 5 classes (221 children) randomly selected from 1 kindergarten in the intervention group and 6 classes (244 children) randomly selected from another kindergarten in the control group. Children were aged 5 or under. There were 72 exclusions from the analysis.
Interventions	Intervention group: hand hygiene and surface-cleaning education and provision of products for kindergarten and home use. Control group: usual practice. See Table 1 for details.
Outcomes	Respiratory illness, defined as: 2 or more of the following: fever, cough and expectoration, runny nose and nasal congestion, collected by parental questionnaire. Axillary temperature higher than 37.3 °C or the range of temperature fluctuation is more than 1 °C. 'Cough and expectoration' were defined as 3 or more coughs in a single hour and lasting for 4 or more hours in a single day, with or without expectoration. 'Runny nose and nasal congestion' were defined as a runny nose lasting for 4 or more hours in 1 day, with or without nasal congestion.
Notes	Funding not mentioned. Disclosure of interest: none mentioned.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Method not described, and only 2 clusters.
Allocation concealment (selection bias)	Unclear risk	Method not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study
Incomplete outcome data (attrition bias) All outcomes	High risk	Parental report, and parents were aware of treatment allocation
Selective reporting (reporting bias)	High risk	Attrition reported and balanced between groups, but high rate of attrition in a trial with small numbers of participants.

Barasheed 2014

Study characteristics

Methods	Pilot, non-blinded, parallel, cluster-RCT
Participants	22 tents were randomly selected from the Australian pilgrims camped in Mina, during Hajj in 2011; 12 tents were allocated to the mask group and 10 tents to the control group. A total of 164 Australian pilgrims were recruited: 75 in the mask group (39 'cases' and 36 'contacts') and 89 in the control group (36 'cases' and 53 'contacts').

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Barasheed 2014 *(Continued)*

	Inclusion criteria for index case: 1) Australian pilgrims of any gender aged > 15 years who attend the Hajj 2011, and 2) have symptoms of respiratory infection for 3 days. For close tent contact: 1) Australian pilgrims of any gender aged 15 years or more who attend the Hajj 2011, and 2) pilgrims who share the same tent and sleep "immediately close" to the index case. Exclusion criteria: for index case: 1) pilgrims who do not suffer from symptoms of respiratory infection, 2) pilgrims who present with symptoms of respiratory infection for > 3 days, and 3) children aged less than 15 years. For close tent contact: 1) pilgrims who are symptomatic at presentation, 2) pilgrims who are not close tent contacts of an index case, and 3) children aged less than 15 years. Only 10% to 15% of potential participants took part in the study.
Interventions	"supervised mask use" versus "no supervised mask use". See Table 1 for details.
Outcomes	Laboratory: 2 nasal swabs from all ILI cases and contacts, 1 for influenza POCT using the QuickVue Influenza (A+B) assay (Quidel Corporation, San Diego, USA) and 1 for later nucleic acid testing for influenza and other respiratory viruses. However, there was a problem with getting POCT on time during Hajj. Effectiveness: to assess the effectiveness of face masks in the prevention of transmission of ILI. ILI was defined as subjective (or proven) fever plus 1 respiratory symptom (e.g. dry or productive cough, runny nose, sore throat, shortness of breath). Safety: none planned or reported
Notes	The study was conducted from 4 November 2011 to 10 November 2011. Compliance with face mask use by pilgrims was 56 of 75 (76%) in the mask group and 11 of 89 (12%) in the control group (P < 0.001). The proportion of face mask user in the 'mask' tents was 76% for both males (19/25) and females (38/50). The most often reported reason for not wearing face masks was discomfort (15%). Government funded: Qatar National Research Fund (QNRF). The other authors have declared no conflict of interest in relation to this work.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Insufficient information provided.
Allocation concealment (selection bias)	Unclear risk	Quote: "tents were randomised to either intervention group (supervised mask tent) or control group (no supervised mask tent) by an independent study coordinator who was not an investigator", but did not mention how
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote: "Because advice from the Saudi Ministry of Hajj to all pilgrims included recommending the wearing of masks, all pilgrims, both cases and controls, were asked about mask-wearing"
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Self-reported outcomes (nasal swab was performed for those who reported ILI symptoms and was not intended as systematic detection). ILI was defined as subjective (or proven) fever plus 1 respiratory symptom.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No loss to follow-up, all numbers were reported from enrolment to analysis
Selective reporting (reporting bias)	Low risk	All planned outcomes were reported.

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Biswas 2019

Study characteristics	
Methods	Cluster-RCT in 24 primary schools in Dhaka to assess the effectiveness of hand sanitiser and a respiratory hygiene education intervention in reducing ILI and laboratory-confirmed influenza during June to September 2015. 12 schools were randomly selected to receive hand sanitiser and respiratory hygiene education, and 12 schools received no intervention. Field staff actively followed children daily to monitor for new ILI episodes (cough with fever) through school visits and by phone if a child was absent. When an illness episode was identified, medical technologists collected nasal swabs to test for influenza viruses.
Participants	A total of 10,855 students were enrolled in the study (intervention schools = 5077 children; control schools = 5778 children). Children aged 5 to 10 years educated in 24 randomly selected primary schools in Dhaka, Bangladesh Exclusion: schools that offered education above grade 5 because of differences in student populations, as well as schools that had previously received a hand or respiratory hygiene intervention
Interventions	Hand sanitiser and respiratory hygiene education versus no intervention. See Table 1 for details.
Outcomes	Incidence of ILI Incidence of laboratory-confirmed influenza (RT-PCR) An ILI episode was defined as measured fever ≥ 38 °C or subjective fever and cough. If a child was absent, the field staff followed up by phone to identify the reason for absenteeism and to determine if the child met the ILI case definition. If a child in a participating school had an ILI episode, a trained medical technologist visited the child's household to obtain consent from the child's parent/guardian and collect a nasal swab from the child within 48 hours of symptom onset. If it was outside the 48-hour window, the sample was not collected. No safety outcomes reported.
Notes	Government funded. Disclosure of interest: none mentioned.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Sequence generated using a computer-based random number generator.
Allocation concealment (selection bias)	Low risk	Allocation completed prior to individuals being recruited.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study
Incomplete outcome data (attrition bias)	High risk	Information missing for 30 children (28 children in the control schools and 2 children in the intervention schools)

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Biswas 2019 *(Continued)*

All outcomes		
Selective reporting (reporting bias)	Unclear risk	No protocol available

Bundgaard 2021

Study characteristics	
Methods	Investigator-initiated, nationwide, unblinded, randomised controlled trial stratified by the 5 regions of Denmark
Participants	Inclusion criteria: community-dwelling adults aged 18 years or older without current or prior symptoms or diagnosis of COVID-19 reported being outside the home amongst others for at least 3 hours per day, and who did not wear masks during their daily work. Exclusion criteria: previously tested positive for SARS-CoV-2 and wear face masks at work
Interventions	Exposure: mask (N = 2392) Control group: no mask (N = 2470) Both groups received materials and instructions for antibody testing on receipt and at 1 month; materials and instructions for collecting an oropharyngeal/nasal swab sample for polymerase chain reaction (PCR) testing at 1 month and whenever symptoms compatible with COVID-19 occurred during follow-up. They registered symptoms and results of the antibody test in the online REDCap system. Written instructions and instructional videos guided antibody testing, oropharyngeal/nasal swabbing, and proper use of masks, and a help line was available to participants. See Table 1 for details.
Outcomes	Study duration: 1 month Effectiveness: primary outcome (composite) SARS-CoV-2 infection, defined as a positive result on an oropharyngeal/nasal swab test for SARS-CoV-2, development of a positive SARS-CoV-2 antibody test result (IgM or IgG) during the study period, or a hospital-based diagnosis of SARS-CoV-2 infection or COVID-19. Secondary outcome: PCR evidence of infection with other respiratory viruses Safety: adverse reaction: 14% in mask group (no further descriptions)
Notes	The authors conclude that inconclusive results, missing data, variable adherence, patient-reported findings on home tests, no blinding, and no assessment of whether masks could decrease disease transmission from mask wearers to others. Funding: the primary funding source was The Salling Foundations. Disclsure can be viewed at www.acponline.org /authors/icmje/ConflictOfInterestForms.do?msNum=M20-6817.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer algorithm stratified by the 5 regions of Denmark
Allocation concealment (selection bias)	Unclear risk	Insufficient information reported

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Bundgaard 2021 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	Not blinded
Blinding of outcome assessment (detection bias) All outcomes	High risk	Not blinded. Patient reported symptoms, POCT testing, patient-reported findings on home tests.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Participant flow chart showed acceptable attrition
Selective reporting (reporting bias)	Low risk	All pre-specified outcomes reported.

Canini 2010

Study characteristics	
Methods	A cluster-RCT conducted in France during the 2008 to 2009 influenza season. Households were recruited during a medical visit of a household member with a positive rapid influenza A test and symptoms lasting less than 48 hours. Households were randomised either to the mask or control group for 7 days. In the intervention arm, the index case had to wear a surgical mask from the medical visit and for a period of 5 days. The trial was initially intended to include 372 households, but was prematurely interrupted after the inclusion of 105 households (306 contacts) following the advice of an independent steering committee. Generalised estimating equations were used to test the association between the intervention and the proportion of household contacts who developed an ILI during the 7 days following the inclusion.
Participants	A total of 105 households were randomised, which represented 148 contacts in the intervention arm and 158 in the control arm. The study was conducted in 3 French regions (Ile de France, Aquitaine, and Franche-Comté) and included households of size 3 to 8. Exclusion criteria: if index patient was treated for asthma or chronic obstructive pulmonary disease or was hospitalised
Interventions	Surgical mask versus no mask. See Table 1 for details.
Outcomes	The primary endpoint was the proportion of household contacts who developed an ILI during the 7 days following inclusion. Exploratory cluster-level efficacy outcome, the proportion of households with 1 or more secondary illness in household contacts. A temperature over 37.8 °C with cough or sore throat was used as primary clinical case definition. Adverse reactions due to mask-wearing
Notes	Government funded. Competing interests: the authors have declared that no competing interests exist.
Risk of bias	

Bias	**Authors' judgement**	**Support for judgement**

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Canini 2010 *(Continued)*

Random sequence generation (selection bias)	Low risk	Randomisation lists were generated by a computerised program.
Allocation concealment (selection bias)	Low risk	Randomisation was performed centrally by the GP after written consent on an interactive voice response system dedicated to the study.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessors blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	All households included in analysis.
Selective reporting (reporting bias)	Low risk	All specified outcomes reported.

Carabin 1999

Study characteristics	
Methods	Cluster-RCT carried out in DCCs in the Canadian province of Quebec between 1 September 1996 and 30 November 1997 (15 months). The aim was to test the effects of a hygiene programme on the incidence of diarrhoea and fecal contamination (data not extracted) and on colds and URTIs. The design included before and after periods analysed to assess the Hawthorne effect of study participation on control DCCs. The unit of randomisation was DCC, but analysis was also carried out at classroom and single-child level. This is a common mistake in cluster-RCT analysis. DCCs were stratified by URTI incidence preceding the trial and randomised by location. Cluster coefficients are not reported.
Participants	A total of 1729 children aged 18 to 36 months in 47 DCCs (83 toddler classrooms) Inclusion criteria: presence of at least 1 sandbox and 1 play area and of at least 12 available toddler places For the autumn of 1997 intervention group (24 DCCs, 43 classrooms, and 414 children), control group (23 DCCs, 23 classrooms, and 374 children). It is not clear what is the distribution and data for the autumn of 1996.
Interventions	Training session (1 day) with washing of hands, toy cleaning, window opening, sand pit cleaning, and repeated exhortations to hand wash. See Table 1 for details.
Outcomes	Laboratory: N/A Effectiveness: diarrhoea and coliform contamination (data not extracted) Colds (nasal discharge with at least 1 of the following: fever, sneezing, cough, sore throat, earache, malaise, irritability) URTI (cold of at least 2 days' duration) Surveillance was carried out by educators, annotating absences or illness on calendars. Researchers also filled in a phone questionnaire with answers by DCC directors. Safety: N/A
Notes	Risk of bias: high (no description of randomisation; partial reporting of outcomes, numerators, and denominators)

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Carabin 1999 *(Continued)*

Notes: the authors conclude that the intervention reduced the incidence of colds (IRR 0.80, 95% CI 0.68 to 0.93). This was a confusingly written study with unclear interweaving of 2 study designs. For unclear reasons analysis was only carried out for the first autumn. Unclear why colds are not reported in the results. Cluster-coefficients and randomisation process were not described.

Support for the study was provided by the Rhone-Poulenc Rorer Canada Ltd.

Disclosure of interest: none mentioned.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Block randomisation of DCC according to region, but sequence generation not reported
Allocation concealment (selection bias)	Unclear risk	Not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding not possible (hygiene session plus educational material versus none)
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded
Incomplete outcome data (attrition bias) All outcomes	High risk	Originally 52 eligible DCCs with 89 classrooms agreed to take part, but 5 dropped out (2 closed, 1 was sold, 2 either did not provide data or the data were "unreliable", and 6 classrooms had insufficient data). 43 children failing to attend DCC for at least 5 days in the autumn were also excluded. ITT analysis was carried out including an additional DCC whose director refused to let staff attend the training session. No correction made for clustering.
Selective reporting (reporting bias)	High risk	Denominators unclear and not explained

Chard 2019

Study characteristics

Methods	Cluster-RCT conducted amongst 100 randomly selected primary schools lacking functional WASH facilities in Saravane Province, Lao People's Democratic Republic. Schools were randomly assigned to either the intervention (n = 50) or comparison (n = 50) arm. Intervention schools received a school water supply, sanitation facilities, hand-washing facilities, drinking water filters, and behaviour change education and promotion. Comparison schools received the intervention after research activities had ended. At unannounced visits every 6 to 8 weeks, enumerators recorded pupils' roll-call absence, enrolment, attrition, progression to the next grade, and reported illness (diarrhoea, respiratory infection, conjunctivitis), and conducted structured observations to measure intervention fidelity and adherence. Stool samples were collected annually prior to de-worming and analysed for soil-transmitted helminth (STH) infection. In addition to our primary ITT analysis, we conducted secondary analyses to quantify the role of intervention fidelity and adherence on project impacts.
Participants	100 primary schools (50 intervention, 50 comparison) with a total of 3993 pupils were enrolled throughout the study period (intervention schools = 2021 pupils, control schools = 1972 pupils). Up to 40 pupils

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Chard 2019 *(Continued)*

	selected from grades 3 to 5 in each school using systematic stratified sampling, with grade and sex as the stratification variables. Pupils selected at baseline were followed throughout the entire study period; pupils who left the school due to abandonment or transfer were replaced at the beginning of the following academic year, maintaining equal grade and sex ratios when possible. Pupils who progressed from fifth to the sixth grade were replaced with pupils from grade 3 the following academic year.
Interventions	Water supply, sanitation facilities, hand-washing facilities, drinking water filters, and behaviour change education and promotion versus control. See Table 1 for details.
Outcomes	Primary impact of interest was pupil absence, measured by school-wide roll-call at each visit. Secondary health impacts included diarrhoea, symptoms of respiratory infection, and conjunctivitis/non-vision-related eye illness collected through pupil interviews. Pupils were considered to have symptoms of respiratory infection if they reported cough, runny nose, stuffy nose, or sore throat. No safety outcomes reported.
Notes	Funded by government and pharmaceutical industry. Competing interests: all authors have completed the ICMJE uniform disclosure form at http://www.icmje.org/ coi_disclosure.pdf (available upon request from the corresponding author) and declare no conflicts of interest.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Insufficient details provided.
Allocation concealment (selection bias)	Low risk	Schools allocated prior to recruitment of individuals.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded
Incomplete outcome data (attrition bias) All outcomes	Low risk	Exclusions were due to participants leaving school, hence unlikely to cause bias.
Selective reporting (reporting bias)	Low risk	All specified outcomes reported.

Correa 2012

Study characteristics

Methods	Cluster-RCT in childcare facilities in Colombia from 16 April to 18 December 2008 (3 school terms) testing the effects of hand hygiene using an alcohol-based hand rub versus standard practice

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Correa 2012 *(Continued)*

Participants	42 childcare facilities in 6 towns in Colombia. A total of 1727 were enrolled (intervention group = 794 from 21 centres, control group = 933 from 21 centres). Inclusion criteria: licensed to care for 12 or more children aged 1 to 5 years for 8 hours a day, 5 times per week, and where availability of tap water was limited
Interventions	Intervention: alcohol-based hand wash as an addition to hand-washing Control: usual hand-washing practice See Table 1 for details.
Outcomes	ARI defined as: 2 or more of the following symptoms for at least 24 hours, lasting at least 2 days: runny, stuffy, or blocked nose or noisy breathing; cough; fever, hot sensation, or chills; and/or sore throat. Ear pain alone was considered an ARI.
Notes	This work was supported by a grant from the Global Development Network (New Delhi, India), "Fifth Global Research Project: Promoting Innovative Programs from the Developing World: Towards Realizing the Health MDG's in Africa and Asia," and the Bill and Melinda Gates Foundation (Seattle, Washington, United States). Authors declare to have no conflicts of interest.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"...using the random function in Microsoft Excel™ (Microsoft Corp., Redmond, Washington, United States), random numbers (1 or 2) were generated and allotted 1:1 within each group. Finally, a researcher flipped a coin to decide which number would correspond to either arm (heads = 1, intervention; tails = 2, control)."
Allocation concealment (selection bias)	Unclear risk	Method not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study
Incomplete outcome data (attrition bias) All outcomes	Low risk	Lost to follow-up similar in each group and not substantial
Selective reporting (reporting bias)	Unclear risk	No protocol available

Cowling 2008

Study characteristics

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Cowling 2008 *(Continued)*

Methods	Cluster-RCT carried out in Hong Kong SARS between February and September 2007. The study assessed the effects of non-pharmaceutical interventions on the household transmission of influenza over a 9-day period. ILI cases whose family contacts had been symptom-free for at least 2 weeks rapid-tested for influenza A and B were used and randomised to 3 interventions. Randomisation was carried out in 2 different schedules (2:1:1 for the first 100 households, and subsequently 8:1:1), but it is unclear why and how this was done.
Participants	A total of 350 of 944 originally enrolled participants representing 122 households were analysed (control group = 71 households with 205 household contacts, face mask = 21 households with 61 household contacts, HH = 30 households with 84 household contacts). Inclusion criteria: residents of Hong Kong aged at least 2 years, reporting at least 2 symptoms of ILI ((such as fever ≥ 38 degrees, cough, headache, coryza, sore throat, muscle aches and pains) and positive influenza A+B rapid test and living in a household with at least 2 other individuals, none of whom had ILI in the preceding 14 days Households were excluded because subsequent laboratory testing (culture) was negative. Attrition was not explained.
Interventions	Households were randomised to either wearing face masks with education (as the control group plus education about face mask use) or hand-washing with special medicated soap (with alcohol sanitiser) with education (as the control group plus education about hand-washing) or education about general healthy lifestyle and diet (control group). The soap was distributed in special containers that were weighed at the start and end of the study. Interventions visits to the households were done on average 1 day after randomisation of index case household. See Table 1 for details.
Outcomes	Laboratory: QuickVue RTI MDCK culture Samples were harvested using NTS, but the text refers to a second procedure from June 2007 onwards testing for non-influenza viruses, with no data reported. Effectiveness: secondary attack ratios (SAR): SAR is the proportion of household contacts of an index case who were subsequently ill with influenza (symptomatic contact individuals with at least 1 NTS positive for influenza by viral culture or PCR) 3 clinical definitions were used for secondary analysis: 1. Fever ≥ 38 degrees, or at least 2 of following symptoms: headache, coryza, sore throat, muscle aches and pains 2. At least 2 of the following S/S: fever ≥ 37.8 degrees, cough, headache, sore throat, muscle aches and pains 3. Fever ≥ 37.8 degrees plus cough or sore throat Safety: no harms were reported in any of the arms
Notes	The trial authors conclude that "The secondary attack ratios were lower than anticipated, and lower than reported in other countries, perhaps due to differing patterns of susceptibility, lack of significant antigenic drift in circulating influenza virus strains recently, and/or issues related to the symptomatic recruitment design. Lessons learnt from this pilot have informed changes for the main study in 2008". Although billed as a pilot study, the text is highly confusing and at times contradictory. The intervention was delivered at a home visit up to 36 hours after the index case was seen in the outpatients. This is a long time and perhaps the reason for failure of the intervention. Practically, the intervention will have to be organised before even seeking medical care, i.e. people know to do it when the child gets sick at home. This work has received financial support from the US Centers for Disease Control and Prevention (grant no. 1 U01 CI000439-01), the Research Fund for the Control of Infectious Disease, Food and Health Bu-

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Cowling 2008 *(Continued)*

reau, Government of the Hong Kong SAR, and the Area of Excellence Scheme of the Hong Kong University Grants Committee (grant no. AoE/M-12/06).

Competing Interests: the authors have declared that no competing interests exist.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was computer generated by a biostatistician. Quote:"A pre-specified table of random numbers will be used to assign one of the three interventions to the household of the index case."
Allocation concealment (selection bias)	Low risk	The households of eligible study index patients were allocated to 3 groups in a 1:1:1 ratio under a block randomisation structure with randomly permuted block sizes of 18, 24, and 30 using a random-number generator. Allocation was concealed from treating physicians and clinics and implemented by study nurses at the time of the initial household visit.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and people who administered the interventions were not blinded to the interventions, but participants were not informed of the specific nature of the interventions applied to other participating households.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded
Incomplete outcome data (attrition bias) All outcomes	High risk	Dropout was accounted for. Dropout from the randomised population was high: 32% in control group, 37.5% in hand hygiene group, and 39.4% in face mask and hand hygiene group. Reasons for dropout were distributed evenly across the 3 groups. Authors report follow-up as proportion of patients remaining in the study after initial dropout.
Selective reporting (reporting bias)	High risk	The choice of season, change in randomisation schedules, and unexplained dropouts amongst contacts; the use of QuickVue, which proved unreliable, reporting bias on non-influenza isolates resulted in a judgement of high risk of bias.

Cowling 2009

Study characteristics

Methods	Cluster-RCT
Participants	A total of 407 index cases and 794 household contacts were analysed. Of 407 enrolled households, 322 received the allocated interventions as follows: 1. control group = 112 households with 346 contacts (only 91 households analysed with 279 contacts); 2. hand hygiene = 106 households with 329 contacts (only 85 households analysed with 257 contacts); 3. face mask + hand hygiene = 104 households with 340 contacts (only 83 households analysed with 258 contacts).

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Cowling 2009 *(Continued)*

	Inclusion criteria: households in Hong Kong. Index cases from 45 outpatient clinics in both the private and public sectors across Hong Kong. They enrolled individuals who reported at least 2 symptoms of ARI (temperature 37.8 °C, cough, headache, sore throat, or myalgia); had symptom onset within 48 hours; and lived in a household with at least 2 other people, none of whom had reported ARI in the preceding 14 days. After giving informed consent, participants provided nasal and throat swab specimens. 2750 patients were eligible and tested between 2 January and 30 September 2008.
Interventions	Participants with a positive rapid-test result and their household contacts were randomly assigned to 1 of 3 study groups: control (lifestyle measures - 134 households), control plus enhanced hand hygiene only (136 households), and control plus face masks and enhanced hand hygiene (137 households) for all household members. No detailed description of the instructions was given to participants. See Table 1 for details.
Outcomes	Influenza virus infection in household contacts, as confirmed by RT-PCR or diagnosed clinically after 7 days "The primary outcome measure was the secondary attack ratio at the individual level: that is, the proportion of household contacts infected with influenza virus. We evaluated the secondary attack ratio using a laboratory definition (a household contact with a nose and throat swab specimen positive for influenza by RT-PCR) as the primary analysis and 2 secondary clinical definitions of influenza based on self-reported data from the symptom diaries as secondary analyses." Statistical analysis: adjusted for clustering Results: no statistically significant difference in secondary attack ratio between groups in total population. Statistically significant reduction in RT-PCR confirmed influenza virus infections in the household contacts in 154 households in which the intervention was applied within 36 hours of symptom onset in the index patient. Adherence to hand hygiene was between 44% and 62%. Adherence of index patient to wearing a face mask between 15% and 49%.
Notes	"In an unintentional deviation from that protocol, 49 of the 407 randomly allocated persons had a household contact with influenza symptoms at recruitment (a potential co-index patient). We also randomly assigned 6 of 407 persons who had symptoms for slightly more than 48 hours." The trial authors conclude that "Hand hygiene and face masks seemed to prevent household transmission of influenza virus when implemented within 36 hours of index patient symptom onset. These findings suggest that non-pharmaceutical interventions are important for mitigation of pandemic and interpandemic influenza". Primary funding source: Centers for Disease Control and Prevention. Potential conflicts of interest: none disclosed.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was computer generated by a biostatistician. Quote:"A pre-specified table of random numbers will be used to assign one of the three interventions to the household of the index case."
Allocation concealment (selection bias)	Low risk	The households of eligible study index patients were allocated to 3 groups in a 1:1:1 ratio under a block randomisation structure with randomly permuted block sizes of 18, 24, and 30 using a random-number generator. Allocation was concealed from treating physicians and clinics and implemented by study nurses at the time of the initial household visit.
Blinding of participants and personnel (performance bias)	High risk	Quote: "Participants and personnel administering the interventions were not blinded to group assignment."

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Cowling 2009 *(Continued)*

All outcomes		
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	It is not stated if the outcome assessor was blinded.
Incomplete outcome data (attrition bias) All outcomes	High risk	Dropout was accounted for. Dropout from the randomised population was high: 32% in control group, 37.5% in hand hygiene group, and 39.4% in face mask and hand hygiene group. Reasons for dropout were distributed evenly across the 3 groups. Trial authors report follow-up as proportion of patients remaining in the study after initial dropout.
Selective reporting (reporting bias)	Unclear risk	In general good reporting

DiVita 2011

Study characteristics	
Methods	The impact of hand-washing promotion on the risk of household transmission of influenza, ILI, and fever was tested in rural Bangladesh. ILI was defined as fever in children < 5 years old and fever with cough or sore throat in individuals > 5 years old. Households were randomised to intervention or control. The intervention group received hand-washing stations with soap and daily hand-washing motivation at critical times for pathogen transmission, such as after coughing or sneezing. Daily surveillance was conducted, and household members with fever were tested for influenza viruses by PCR. Secondary attack ratios (SAR) were calculated for influenza, ILI, and fever in each arm. Logistic regression with generalised estimating equations was used to estimate the significance of the SAR comparison whilst controlling for clustering by household.
Participants	The study included 233 patient index cases (intervention group = 100, control group 133) with 2540 household contacts (intervention group = 134, control group = 1226). Inclusion criteria: index case patients (individuals who developed ILI within the previous 2 days and were the only symptomatic person in their household) as well as their household contacts
Interventions	Hand-washing stations with soap and daily hand-washing motivation versus control. See Table 1 for details.
Outcomes	SAR were calculated for influenza, ILI, and fever. ILI was defined as fever in children < 5 years old and fever with cough or sore throat in individuals > 5 years old. No safety outcomes reported.
Notes	Funding source unknown. Disclosure of interest: none declared.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Insufficient details provided

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DiVita 2011 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	Insufficient details provided
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient details provided
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient details provided
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient details provided
Selective reporting (reporting bias)	Unclear risk	Insufficient details provided

Farr 1988a

Study characteristics	
Methods	6-month cluster-RCT, controlled, double-blind of the efficacy of virucidal nasal tissues in the prevention of natural cold, conducted in Charlottesville, Virginia, USA. Many of the families were enrolled because 1 or more family members worked at the State Farm Insurance Company; the remaining families were recruited from the Charlottesville community by advertisement in a local newspaper. Families were randomly assigned by the sponsoring company to receive boxes of treated tissues, placebo tissues, or no tissues. The randomisation was performed by computer. Study participants and investigators were unaware of the type of tissues each family was randomised to receive. Blinding efficacy was tested using a questionnaire: the mothers in each family were asked twice if she believed her family was using virucidal or placebo tissues. Participants in the treated and placebo groups were instructed to use only tissues received through the study, whilst families in the additional control group without tissues were allowed to continue their usual practice of personal hygiene. Each family member kept a daily listing of respiratory symptoms on a record card. A nurse epidemiologist visited each family monthly to encourage recording.
Participants	186 families, 58 in the active group, 59 in the placebo group, and 69 in the no-tissues group. A total of 302 families were originally recruited; 116 families who did not comply with the study protocol, lost their surveillance cards, could not complete the protocol were excluded from the analysis.
Interventions	Use of virucidal tissues versus placebo tissues versus no tissues. The treated tissues were impregnated with malic and citric acids and sodium lauryl sulphate, whilst placebo tissues contained saccharin. See Table 1 for details.
Outcomes	Laboratory: serological evidence: no Effectiveness: respiratory illness Safety: N/A
Notes	The authors concluded that virucidal tissues have only a small impact on the overall rate of natural acute respiratory illnesses. The total illness rate was lower in families using virucidal tissues than in both of the other study groups, but only the difference between active and placebo groups was statistically significant (3.4 illness per person versus 3.9 for placebo group, P = 0.04, and 3.6 for the no-tissue control group, P = 0.2, and overall 14% to 5% reduction). The questionnaire results suggest that some bias may have been present since a majority of mothers in the virucide group believed they were receiving the 'active' tissues. Another possible explanation of the low effectiveness of virucidal tissues

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Farr 1988a *(Continued)*

is poor compliance by children in use of the virucidal tissues. A well-designed and honestly reported study.

Funding source not reported.

Potential conflicts of interest: none disclosed.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote:"The randomisation was performed by computer in each trial." However, method of sequence generation is not stated.
Allocation concealment (selection bias)	Unclear risk	Quote: "In trial I, families were randomly assigned by the sponsoring company to receive boxes of treated tissues, placebo tissues or no tissues." Quote: "Families with one or two children were randomised in one stratum, and families with three or more children were randomised in a second stratum in trial I." Concealment of allocation not described
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote: "Study participants and investigators were unaware of the type of tissues which each family was randomised to receive in both trials. In trial I, the mother in each family was asked twice if she believed her family was using active or placebo tissues, first after three months and then at the end of the study."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Study participants and investigators were unaware of the type of tissues which each family was randomised to receive in both trials. In trial I, the mother in each family was asked twice if she believed her family was using active or placebo tissues, first after three months and then at the end of the study."
Incomplete outcome data (attrition bias) All outcomes	High risk	Quote: "A total of 116 of the 302 families were excluded from the analysis. Families were excluded if they lost their surveillance cards or did not conscientiously record data, did not comply with the study protocol, or simply could not complete the protocol for family reasons. It was discovered that families with five or more members had so many colds that it was not possible to distinguish primary and secondary illnesses. These large families were therefore excluded from the analysis in trial I and were excluded from enrolment in trial II."
Selective reporting (reporting bias)	Low risk	All indicated outcomes are reported.

Farr 1988b

Study characteristics

Methods	Six-month randomised, controlled, double-blind trial of the efficacy of virucidal nasal tissues in the prevention of natural cold, conducted in Charlottesville, Virginia, USA. Families were recruited from the Charlottesville community by advertisement in a local newspaper. Families were randomly assigned by the sponsoring company to receive either virucidal tissues or placebo-treated tissues. Stratified randomisation was performed by computer, and the strata were defined by total number in the family. Study participants and investigators were unaware of the type of tissues each family was randomised to receive. Each family member kept a daily listing of respiratory symptoms on a record card. A nurse

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Farr 1988b *(Continued)*

	epidemiologist visited each family monthly to encourage recording. In addition, a study monitor visited each family bimonthly to further encourage compliance and reporting of symptoms.
Participants	98 families, 58 in the active group and 40 in the placebo group. 231 families were initially recruited, 222 completed the trial, data of 98 families were analysed. The other families were excluded from the analysis because they complained of side effects (sneezing, etc.) or reported not using the tissues regularly. See Table 1 for details.
Interventions	Use of virucidal tissues versus placebo tissues. The treated tissues were impregnated with malic and citric acids and sodium lauryl sulphate, whilst the placebo tissues contained succinic acid. Participants in the treated and placebo groups were instructed to only use tissues received through the study.
Outcomes	Laboratory: serological evidence: no Effectiveness: respiratory illness Safety: N/A
Notes	The study suggests that virucidal tissues have only a small impact on the overall rate of natural acute respiratory illnesses. The total illness rate was lower in families using virucidal tissues than in the other study group, but the difference between active and placebo groups was not statistically significant. There was a small, non-significant drop in illness rates across families (5%). The tissues appeared to be ineffective as the drop was confined to primary illness unaffected by tissue use. The placebo (succinic acid) was not inert, and was associated with cough and nasal burning. This impacted on allocation concealment. A well-designed and honestly reported study marred by transparent allocation. Funding source not reported. Potential conflicts of interest: none disclosed.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"The randomisation was performed by computer in each trial." However, method of sequence generation is not stated.
Allocation concealment (selection bias)	Unclear risk	Quote: "In trial II, families were randomly assigned by the sponsor to receive either virucidal tissues or placebo treated tissues." Quote:"In trial II, stratified randomisation was again used, but this time the strata were defined by total number in the family (i.e., one stratum for two-member families, another stratum for three-member families, and a final one for four-member families)." Concealment of allocation not described
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote:"Study participants and investigators were unaware of the type of tissues which each family was randomised to receive in both trials."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote:"Study participants and investigators were unaware of the type of tissues which each family was randomised to receive in both trials."
Incomplete outcome data (attrition bias) All outcomes	High risk	Quote:"A total of 222 (of 231) families completed trial II; 9 families were terminated early (table 1). In 124 families, one or more family members reported not using the tissues regularly and/or reported having significant side effects. The data from these families were not analysed, leaving 58 families (177 persons) and 40 families (114 persons) for analysis in the virucide and placebo groups, respectively."

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Farr 1988b *(Continued)*

Selective reporting (reporting bias)	Low risk	All indicated outcomes are reported.

Feldman 2016

Study characteristics	
Methods	Prospective cluster-RCT. Ships from a single, central naval base. Ships were stratified by vessel classes (corvette, fast missile boat, and patrol boat).
Participants	All people participating in security operations, routine exercises, and patrol at a single, central naval base were eligible. The actual number of participants in the groups is not reported.
Interventions	Chlorhexidine gluconate (CHG) dispensers in addition to soap-and-water hand-washing versus soap-and-water hand-washing. See Table 1 for details.
Outcomes	Laboratory: bacterial palm cultures from 30 sailors from each group using a modified bag broth technique with sterile brain-heart broth, at 0 and 4 months (sample participants) Effectiveness: Primary outcome: incidence of infectious diseases reported by the computerised patient records system using ICD-9 diagnoses and grouped into diarrhoeal, respiratory, and skin infections; the number of sick call visits; and the number of sick leave and light-duty days incurred by the sailors Secondary outcome: subclinical morbidity (i.e. symptoms of self-reported infectious diseases) Safety: not reported
Notes	No report on adherence Study was conducted between May and September 2014 (4 months follow-up). CHG availability onboard the ships did not reduce the transmission of infectious diseases or colonisation. Government funded (Israeli Defense Force Medical Corps). Potential conflicts of interest: none disclosed.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	No description of randomisation
Allocation concealment (selection bias)	Unclear risk	No description of allocation
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded. Self-reported outcomes
Blinding of outcome assessment (detection bias)	Unclear risk	No information if personnel collecting data for ICD-9 diagnosis were blinded

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Feldman 2016 *(Continued)*

All outcomes		
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No participants flow chart, no attrition data
Selective reporting (reporting bias)	Unclear risk	No protocol to compare

Fretheim 2022a

Study characteristics	
Methods	Pragmatic RCT
Participants	3717 participants in Norway (glasses n = 1852; no glasses n = 1865) Inclusion criteria: 1. were at least 18 years of age; 2. did not regularly wear glasses; 3. owned or could borrow glasses that they could use (e.g. sun-glasses); 4. had not contracted COVID-19 in the 6 weeks prior to participation; 5. did not have COVID-19 symptoms when providing consent; 6. were willing to be randomised to wear, or not wear glasses outside their home when close to others for a 2-week period; 7. provided informed consent; and 8. contact lenses were allowed in the control group for those dependent on this visual aid. Exclusion criteria: 1. does regularly wear glasses (contact lenses are accepted); and 2. contracted COVID-19 after December 15th 2021.
Interventions	Intervention group: wearing eyeglasses (any type) when close to other people outside their home (on public transport, in shopping malls etc.), over a 14-day period. The control: encouraged not to wear glasses when close to others outside their home. See TIDieR Table (Table 1) for details.
Outcomes	Primary outcome 1. Any positive COVID-19 test result reported to the Norwegian Surveillance System for Communicable Diseases (MSIS), from day 3 to day 17 of the study period. Secondary outcomes 1. Any positive COVID-19 test result based on self-report, from day 1 to day 17 of the study period. 2. Episode of respiratory infection based on self-report of symptoms from day 1 to day 17 of the study period. Respiratory infection was defined as having 1 respiratory symptom (stuffed or runny nose, sore throat, cough, sneezing, heavy breathing) and fever, or 1 respiratory symptom and at least 2 more symptoms (body ache, muscular pain, fatigue, reduced appetite, stomach pain, headache, loss of smell). 3. Healthcare use for respiratory symptoms, self-reported, from day 1 to day 17 of the study period. 4. Healthcare use for injuries, self-reported, from day 1 to day 17 of the study period. 5. Healthcare use (all causes), self-reported, from day 1 to day 17 of the study period. 6. Healthcare use for respiratory symptoms as registered in Norwegian Patient Registry (NPR), from day 3 to day 28 of the study period.

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Fretheim 2022a *(Continued)*

7. Healthcare use for injuries (from day 1 to day 21 as registered in NPR and the Norwegian Registry for Primary Health Care (KPR), from day 3 to day 28 of the study period.
8. Healthcare use (all causes) as registered in NPR and KPR from day 1 to day 21 of the study period.

Notes	The study did not report on the latter 4 outcomes due to lack of access to this data at the time of publication. Negative experiences of using the eyeglasses were reported: fogging, feeling uncomfortable and tiring, reduced vision, fall, feeling silly when wearing glasses indoor, headache. Funding: the costs of running the trial were covered by the Centre for Epidemic Interventions Research (CEIR), Norwegian Institute of Public Health. Competing interests: all authors declare: no competing interests.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Automatically randomised after signing the consent form in the online recruitment platform (Nettskjema).
Allocation concealment (selection bias)	High risk	A digital recruitment platform (Nettskjema) was used to generate allocation. However, more participants in the intervention group wore face masks.
Blinding of participants and personnel (performance bias) All outcomes	High risk	An open-label study. Participants and investigators were not blinded.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome is self-reported positive COVID-19 test result reported to the Norwegian Surveillance System for Communicable Diseases (MSIS). However, the public policy requiring confirmatory PCR-test had changed during the study conduct which may have affected case detection.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Participants flow chart was provided.
Selective reporting (reporting bias)	Low risk	No deviation from the published protocol.

Goodall 2014

Study characteristics

Methods	A 2X2 factorial RCT with 4 treatment arms 1. Vitamin D_3 and gargling 2. Placebo and gargling 3. Vitamin D_3 and no gargling 4. Placebo and no gargling
Participants	600 students from McMaster University, Hamilton, Ontario, Canada, randomised to the following. 1. Vitamin D and gargling (N = 150, analysed 135) 2. Vitamin D and no gargling (N = 150, 123 outcomes included in analysis)

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Goodall 2014 *(Continued)*

3. Placebo and gargling (N = 150, 121 known outcomes included in analysis)
4. Placebo and no gargling (N = 150, 113 known outcomes included in analysis)

Inclusion criteria: aged ≥ 17 years and lived with at least 1 student house mate.

Exclusion criteria: students with contraindicated medical conditions (hypercalcaemia, parathyroid disorder, chronic kidney disease, use of anticonvulsants, malabsorption syndromes, sarcoidosis), who were currently or planning to become pregnant, who were taking ≥ 1000 international units (IU)/day vitamin D, or who were unable to swallow capsules

Interventions	See Table 1 for details.
Outcomes	Laboratory (influenza assessed via weekly self-collected nasal swabs; only swabs for symptomatic participants were assessed). Lab-confirmed influenza was determined by testing the Day 1 nasal swabs using an in-house enterovirus/rhinovirus PCR and, if negative, a commercial multiplex PCR able to detect 16 respiratory viruses and viral subtypes (xTAG RVP FAST, Luminex, Austin TX). Clinical URTI assessed via weekly online surveys. Clinical URTI is defined as the participant's perception of cold in conjunction with 1 or more symptoms (runny/stuffy nose, congestion, cough, sneezing, sore throat, muscle aches, or fever). When participants reported symptoms but were uncertain if they were ill, adjudication was applied by 2 clinicians. Safety: None assessed/reported by the investigators.
Notes	Study was conducted during 2 periods: September to October in 2010 and 2011. Partial governmental funding. Competing interests: the authors declare that they have no competing interests.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No description on how the randomisation sequence was generated
Allocation concealment (selection bias)	Low risk	Study used opaque, sealed, serially numbered envelopes. Envelopes were only accessed when both personnel were present.
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Due to the nature of gargling with tap water, this intervention was not blinded. However, all other aspects of the study were blinded. Self-reported symptoms were adjudicated by 2 clinicians.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Except for gargling, all other participants and study personnel were blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Study flow chart and reasons for lost to follow-up are provided, imputation used for missing outcomes.
Selective reporting (reporting bias)	Low risk	All planned study outcomes were reported and match the published study protocol.

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Gutiérrez-García 2022

Study characteristics	
Methods	Single-blind (analyst) randomised controlled trial carried out in a single centre in Mexico City during September to November 2020. Randomisation was through tokens in opaque envelopes but the trial was open to all except the data analysts. There were some imbalances in age groups post-randomisation at baseline in age and comorbidities
Participants	85 front line healthcare workers, unvaccinated and with no history of COVID infection in each arm. 6 and 1 were excluded from the analysis as they tested positive to CUVID within 14 days of recruitment. Follow-up was 2 weeks
Interventions	Neutral electrolysed water (SES) (pH 6.5 to 7.5) nasal and oral rinses 3 times daily and PPE versus PPE only for the prevention of SARS-CoV-2 infection. See Table 1 for details.
Outcomes	Laboratory RT-PCR no further described "according to the WHO guidelines", once only presumably with symptoms. Effectiveness COVID-19 disease confirmed by RT-PCR, between the 14th day since their recruitment and the 28th day of follow-up. The following are listed as COVID-19 signs and symptoms: dry cough, fever > 37.5℃, headache, myalgia, arthralgia, rhinorrhoea, conjunctivitis, pharyngodynia, odynophagia. 1 and 10 participants were positive in the intervention and control arms respectively. All 11 were nurses. Safety Local harms from SES applications – none reported
Notes	The authors conclude that quote: "the prophylactic protocol was demonstrated as a protective factor, in more than 90%, for developing the disease, and without adverse effects. Nasal and oral rinses with SES maybe an efficient alternative to reinforce the protective measures against COVID-19 disease and should be further investigated." Funding: no funding was received. Competing interests: the authors RGG, JCA and IDE declare that they have no competing interests. ACL, NMS and BPM state that they are employees at Esteripharma S.A. de C.V. company but did not participate in the decision to publish the results of the study, nor in the selection of the volunteers or in its development.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Insufficient information provided.
Allocation concealment (selection bias)	High risk	Nurse or doctor chose one of two identical tokens that were placed inside an opaque plastic container. One token was labelled 'with SES' (treatment group) and the other 'without SES' (control group).
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not blinded.
Blinding of outcome assessment (detection bias)	Low risk	Primary endpoint was the number of healthcare professionals, nurses, or physicians, with COVID-19 disease confirmed by

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Gutiérrez-García 2022 *(Continued)*

All outcomes		RT-PCR. Researchers that performed the statistical analyses were blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Minimal exclusions from the analysis.
Selective reporting (reporting bias)	Low risk	Pre-specified outcomes reported.

Gwaltney 1980

Study characteristics	
Methods	Study assessed the effectiveness of aqueous iodine applied to the fingers in blocking hand transmission of experimental infection with rhinovirus from 1 volunteer to another. Healthy, young adult volunteers were recruited from the general population at the University of Virginia, Charlottesville. Volunteers were not informed about the contents of the hand preparation until after the study. 2 experiments were conducted to evaluate the virucidal activity of aqueous iodine applied to the fingers immediately before viral contamination. Another 2 experiments were conducted to determine whether there was sufficient residual activity of aqueous iodine after 2 hours to interrupt viral spread by the hand route. Volunteers who were donors of virus for the hand exposures were challenged intranasally on 3 consecutive days with the rhinovirus strain HH. Recipients were randomly assigned to receive iodine or placebo. The donors contaminated their hands with nasal secretions by finger to nose contact before the exposure. Hand contact was made between a donor and a recipient by stroking of the fingers for 10 seconds. Donors and recipients wore masks during the exposure period.
Participants	15 and 20 volunteers in 2 experiments
Interventions	Treatment of fingers with iodine versus placebo. The virucidal preparation used was aqueous iodine (2% iodine and 4% potassium iodide). The placebo was an aqueous solution of food colours. See Table 1 for details.
Outcomes	Experimental rhinovirus infection reduced (P = 0.06) Laboratory: serological evidence Effectiveness: rhinovirus infection (based on serology, isolation, and clinical symptoms) with high-score clinical illness. Score was published elsewhere. Safety: N/A
Notes	Risk of bias: high (poor description of randomisation process, concealment, or allocation) Notes: the study suggests that aqueous iodine applied to the fingers was effective in blocking transmission by hand contact of experimental infection with rhinovirus for up to 2 hours after application (1 out 10 volunteers were infected compared to 6 out of 10 in the placebo preparation arm, P = 0.06 with Fisher's exact test). The effectiveness of iodine treatment of the fingers in interrupting viral transmission in volunteers recommends its use for attempting to block transmission of rhinovirus under natural conditions. Although the cosmetic properties of 2% aqueous iodine make it impractical for routine use, it can be used as an epidemiologic tool to study the importance of the hand transmission route and to develop an effective cosmetically acceptable hand preparation. A summarily reported study. Funding source not reported. Disclosure of interest: none mentioned.
Risk of bias	

Bias	**Authors' judgement**	**Support for judgement**

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Gwaltney 1980 *(Continued)*

Random sequence generation (selection bias)	Unclear risk	Insufficient information
Allocation concealment (selection bias)	Unclear risk	insufficient information
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote:Quote: "The viricidal preparation used was aqueous iodine... . The placebo was an aqueous solution of food colors... mixed to resemble the color of iodine. An odor of iodine was given to the placebo... . Volunteers were not informed about the contents of the hand preparation until after the study."
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	It is not stated whether the outcome assessor was blinded or not.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient information
Selective reporting (reporting bias)	Unclear risk	Insufficient information

Hartinger 2016

Study characteristics	
Methods	Communities were randomised to a comprehensive intervention was an improved solid-fuel stove, installation of a kitchen sink with running water, solar drinking water disinfection, education on handwashing, and separating animals from the kitchen environment.
Participants	534 children (267 in each group) in 51 communities (25 in intervention, 26 in control group). 250 children/households in the intervention group and 253 children/households in the control group were available for follow-up. Conducted in a rural farming area
Interventions	Environmental home-based intervention package consisting of improved solid-fuel stoves, kitchen sinks, solar disinfection of drinking water, and hygiene promotion. See Table 1 for details.
Outcomes	Laboratory: *Escherichia coli* (not relevant to this review) Effectiveness: weekly collection of daily diary data on illness. ARI was defined as child presenting cough or difficulty breathing, or both. ALRI was defined as child presenting cough or difficulty breathing, with a raised respiratory rate (> 50 per min in children aged 6 to 11 months and > 40 per min in children aged 12 months) on 2 consecutive measurements. Safety: none described in methods and none reported
Notes	The authors conclude that “combined home-based environmental interventions slightly reduced childhood diarrhoea, but the confidence interval included unity. Effects on growth and respiratory outcomes were not observed, despite high user compliance of the interventions. The absent effect on respiratory health might be due to insufficient household air quality improvements of the improved stoves and additional time needed to achieve attitudinal and behaviour change when providing composite interventions”. Well-reported trial. Age of children not reported. Funding: this work was supported by the UBS Optimus Foundation, Freiwillige Akademische Gesellschaft, Basel, Stiftung EmiliaGuggenheim-Schnurr, Basel.

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Hartinger 2016 *(Continued)*

Conflict of interest: the authors have no conflicts of interest to declare.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Covariate-constrained randomisation is mentioned, but method not described.
Allocation concealment (selection bias)	Unclear risk	Method not mentioned
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded
Blinding of outcome assessment (detection bias) All outcomes	High risk	Data collected by field worker and recorded by parent. All would be aware of allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Low attrition rate, reasons stated, balanced between groups.
Selective reporting (reporting bias)	Low risk	It is unlikely that other outcomes were measured but not reported.

Helsingen 2021

Study characteristics

Methods	Non-inferiority open randomised trial carried out in May 25 to June 15 2020 during the first lockdown in Norway. Eligible individuals were randomised 1:1 stratified by fitness centre by a computerised random number generator to no access to fitness centre or access to fitness centre with "mitigation measures"
Participants	3825 people aged 18 to 65 with no risk factors for Covid 19 (diabetes, cardiovascular disease including hypertension, age > 65). 61 randomised participants (18 and 43, respectively) withdrew consent before start of the intervention with 3764 remaining
Interventions	The intervention consisted in gym access with: avoidance of body contact; 1 m distance between individuals at all times; 2 m distance for high intensity activities; disinfection of all work stations; cleaning of all equipment after use by participant; regular cleaning of facilities and access control by facility employees to ensure distance measures and avoid overcrowding; open changing rooms with showers and saunas remained closed; staff was present during all opening hours; lids on trash cans removed; individuals were instructed to stay home if they had any Covid-19 related symptoms, participants were advised to avoid touching their eyes, nose and mouth. See Table 1 for details.
Outcomes	Laboratory Self-administered (at times facilitated by HCW) NP, saliva or OP swabs in transport medium taken at day 14 to 15 from beginning sent to central lab. RT-RPC performed. Testing of antibodies (IGG) was carried out in late June with a mailed self-administered spot slide which was then mailed and analysed centrally. Effectiveness

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Helsingen 2021 *(Continued)*

	Primary: PCR positivity in both arms Co-primary: hospital admission in the two arms at 21 days (via data linkage) Secondary: proportion of participants with SARS-CoV-2 antibodies in the 2 study arms at 30 days. Testing also carried out for gym staff. Safety NR
Notes	The authors conclude that "Provided good hygiene and physical distancing measures and low population prevalence of SARS-CoV-2infection, there was no increased infection risk of SARS-CoV-2 in fitness centres in Oslo, Norway for individuals without Covid-19-relevant comorbidities." There was low and declining incidence on C19 in the Oslo area during the time of the trial as reported by the authors. The authors call the analysis set ITT but consent withdrawal individuals were not part of the analysis. There was marked difference in PCR uptake (88.7% in the training arm; 71.4% in the no-training arm) and no cycle thresholds are reported. Funding: this study was funded by the Norwegian Research Council, grant no. 312757. The grant paid for necessary equipment, study personnel and researchers. Competing interests: Dr. Lise M. Helsingen reports grants from Norwegian Research Council (grant no. 312757), during the conduct of the study. All other authors declare no competing interests in relation to this work.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer random-number generator
Allocation concealment (selection bias)	High risk	Allocation performed by one of the study authors
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not blinded.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Not blinded.
Incomplete outcome data (attrition bias) All outcomes	High risk	More women were compliant with SARS-CoV2 testing in the training arm as compared to the no-training arm, and compliant individuals were somewhat younger in the training arm compared to the non-training arm.
Selective reporting (reporting bias)	Low risk	All pre-specified outcomes reported

Hubner 2010

Study characteristics

Methods	A prospective, controlled, intervention-control group design to assess the epidemiological and economical impact of alcohol-based hand disinfectants use at workplace. Volunteers in public administra-

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Hubner 2010 *(Continued)*

	tions in the municipality of the city of Greifswald were randomised into 2 groups. Participants in the intervention group were provided with alcoholic hand disinfection, the control group was unchanged. In all, 1230 person-months were evaluated.
Participants	Employees (n = 134) from the administration of the Ernst-Moritz-Arndt University Greifswald, the municipality of Greifswald and the state of Mecklenburg-Pomerania, were recruited for the study and randomised to intervention (N = 67) or control (N = 67). Final analysis was performed on 64 from the intervention and 65 from the control group. Inclusion criteria: all administrative officers, who did not already apply hand disinfection at work, were considered for participation and were invited by email or mail (n = 850). The 134 participants declared their written consent to participate and completed a pre-study survey with demographic, social, health, and work-related questions to provide data for randomisation. Exclusion criteria: employees that were already using hand disinfectants at work
Interventions	Alcohol-based hand disinfectants use at workplace versus usual hygiene. See Table 1 for details.
Outcomes	Respiratory and gastrointestinal symptoms and days of work were recorded based on a monthly questionnaire over 1 year.
Notes	Funding source not mentioned. Competing interests: the authors declare a financial competing interest: GK is employed by Bode Chemie GmbH, Hamburg, Germany. NOH and AK received financial support for research from Bode Chemie in the past. All other authors declare no conflict of interest.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No details provided.
Allocation concealment (selection bias)	Unclear risk	No details provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Self-reported outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	Lost to follow-up minimal and similar in 2 groups
Selective reporting (reporting bias)	Unclear risk	No protocol available

Huda 2012

Study characteristics

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Huda 2012 *(Continued)*

Methods	Poorly described cluster-RCT. Partial report of the SHEWA-B trial focused on changing 11 targeted behaviours in villages to measure the impact on diarrhoea and respiratory illness amongst children. Unit of randomisation is not clear, but was probably a village. A group of 10 to 17 households within a village were the participants, based on the household having at least 1 child under the age of 5.
Participants	A total of 1692 participants (intervention = 848, control = 844) at baseline and 1699 participants at 18 months (intervention = 849, control = 850) Households were eligible if they have a child < 5 years of age and a guardian agreed to participate.
Interventions	SHEWA-B programme targeting improved latrine coverage and usage, access to and use of arsenic-free water, and improved hygiene practices using soaps. See Table 1 for details.
Outcomes	Laboratory: none described in methods and none reported Effectiveness: ARI and diarrhoea. ARI defined as cough and fever or difficulty breathing and fever within 48 hours prior to interview. Safety: none described in methods and none reported
Notes	The authors conclude that quote: "The prevalence of childhood diarrhea and respiratory illness was similar in the intervention and control communities". Poorly reported trial. This research activity was funded by the United Kingdom's Department for International Development (DFID). Disclosure of interest: none mentioned.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Mentions random-number tables, but not clear if this was for random selection or randomisation
Allocation concealment (selection bias)	Unclear risk	Method not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded
Blinding of outcome assessment (detection bias) All outcomes	High risk	Data on illness were collected by a resident of the village, who was likely to know treatment allocation.
Incomplete outcome data (attrition bias) All outcomes	High risk	Not reported. No flow diagram
Selective reporting (reporting bias)	Unclear risk	Unlikely that other outcomes were measured and not reported

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Ibfelt 2015

Study characteristics	
Methods	Cluster-RCT in 12 daycare nurseries in Denmark. Centres in the intervention group had their linen and children's toys commercially cleaned and disinfected every 2 weeks. Control group centres had usual practice. Swabbing for bacteria and respiratory viruses was conducted at baseline and the end of the intervention period.
Participants	12 nurseries in Copenhagen (intervention = 6, control = 6) with a total of 587 children aged 6 months to 3 years Not clear how many children were in each group. Data on illness collected at the individual level, and on presence of bacteria and viruses at the cluster level.
Interventions	Washing and disinfection of toys and linen every 2 weeks for 3 months. See Table 1 for details.
Outcomes	Laboratory: counts of bacteria (not relevant to this review) and 11 respiratory viruses at baseline and end of intervention period, taken from swabs of 10 predefined locations in playroom (7 locations) and toilet area (3 locations). Viruses were influenza A and B; coronavirus NL63229E, OC43, and HKU1; parainfluenza virus 1, 2, 3, and 4; rhinovirus; RSV A/B; adenovirus; enterovirus; parechovirus; metapneumovirus; and bocavirus. Testing by PCR Effectiveness: illness counts in the children. Absence due to sickness recorded daily with reason categorised, but no definitions of illness provided. Safety: none mentioned in methods and none reported
Notes	The authors conclude that "Although cleaning and disinfection of toys every two weeks can decrease the microbial load in nurseries, it does not appear to reduce sickness absence among nursery children". The results of the disinfection are reported as follows: "The most prevalent virus was coronavirus (97% positive samples), followed by bocavirus (96%), adenovirus (73%) and rhinovirus (46%). The intervention reduced the presence of adenovirus, rhinovirus and RSV approximately two- to five-fold [odds ratio (OR) 2.4, 95% confidence interval (CI) 1.1-5.0 for adenovirus; OR 5.3, 95% CI 2.3-12.4 for rhinovirus; OR 4.1, 95% CI 1.5-11.2 for RSV] compared with the control group. On the other hand, metapneumovirus was found significantly less often in the control group than in the intervention group. The intervention had no effect on the detection of other viruses. The fomites with the highest presence of respiratory virus were pillows and sofas, followed by toys and playroom tables. When looking at the samples from the toys alone, there was a significant decrease following the intervention in the intervention group compared with the control group for rhinovirus (OR 3.8, 95% CI 1.3-10.5; P = 0.01) and RSV (OR 5.2, 95% CI 1.1-23.8; P = 0.04), but not adenovirus". This a poorly reported cluster-RCT. Its importance lies in the surface viral prevalence data (which could have been overestimated by PCR) and the finding that even in the presence of high viral prevalence, sickness was lower in the control (no surface disinfection) arm. This suggests the absence of other factors that could activate surface respiratory viruses. Funding: this work was supported by the Danish Council for Technology and Innovation under the Ministry of Science, Innovation and Higher Education as part of the Sundhed i Børneinstitutioner innovation consortium. Conflict of interest statement: Ecolab Denmark, Berendsen Denmark and 3M Denmark supplied materials and cleaning free of charge, but had no influence on the analysis of the data or the writing of the manuscript.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Method not mentioned

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Ibfelt 2015 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	Method not mentioned
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Objective measure of bacterial and viral counts. However, illness reporting is unclear.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No attrition or denominators given for results.
Selective reporting (reporting bias)	Low risk	Unlikely that other outcomes were measured but not reported

Ide 2014

Study characteristics	
Methods	Randomised, open-label, 2-group parallel study of 757 high school students (15 to 17 years of age) conducted for 90 days during the influenza epidemic season from 1 December 2011 to 28 February 2012, in 6 high schools in Shizuoka Prefecture, Japan. The green tea gargling group gargled 3 times a day with bottled green tea, and the water gargling group did the same with tap water. The water group was restricted from gargling with green tea.
Participants	A total of 747 students were enrolled (green tea gargling group = 384, water gargling group = 363) High school students (15 to 17 years of age) who attended 6 high schools in the Kakegawa and Ogasa districts of Shizuoka Prefecture, Japan
Interventions	See Table 1 for details.
Outcomes	Incidence of laboratory-confirmed influenza Incidence of clinically defined influenza infection Time for which the participant was free from clinically-defined influenza infection Clinically-defined influenza infection, specified as fever (≥ 37.8 °C) plus any 2 of the following additional symptoms: cough, sore throat, headache, or myalgia. Influenza infection with viral antigen was detected by immunochromatographic assay. No safety data reported.
Notes	Funding: this work was supported by Grants-in-Aid for Scientific Research (KAKENHI) Grant Number 23590887. Competing Interests: the authors have declared that no competing interests exist.
Risk of bias	

Bias	**Authors' judgement**	**Support for judgement**

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Ide 2014 *(Continued)*

Random sequence generation (selection bias)	Low risk	Computer-generated permuted block randomised schema
Allocation concealment (selection bias)	Low risk	Randomised at the Data Management Center of Shizuoka General Hospital in Japan
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study
Incomplete outcome data (attrition bias) All outcomes	Low risk	Minimal attrition
Selective reporting (reporting bias)	Unclear risk	Protocol not available

Ide 2016

Study characteristics	
Methods	Randomised controlled study in Japan. Participants were randomly allocated into the catechin-treated (epigallocatechin gallate-treated) or non-treated face mask groups for 60 days from January to March 2016. Incidence of laboratory-confirmed influenza infection was measured and compared between groups using Fisher's exact test. Multivariate analysis was performed to calculate adjusted ORs and associated 95% CIs.
Participants	Participants included workers in a nursing home, a rehabilitation facility, and a hospital. A total of 234 participants were eligible for the study (catechin group, n = 118; control group, n = 116).
Interventions	Catechin-treated mask versus non-treated face mask. See Table 1 for details.
Outcomes	Incidence of laboratory-confirmed influenza infection Laboratory-confirmed influenza infection with viral antigen detected by immunochromatographic assay performed when participants reported ILI. No safety outcomes reported.
Notes	Funding: this work was supported in part by a grant from the Japan Society for the Promotion of Science (JSPS), through the Grant-in-Aid for JSPS Fellows (No. 15J10190 to KI) and Grants-in-Aid for Scientific Research (C) (15K08924 to HY). Conflict of Interest: the authors declare that they have no conflicts of interest.
Risk of bias	

Bias	Authors' judgement	Support for judgement

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Ide 2016 *(Continued)*

Random sequence generation (selection bias)	Unclear risk	Computer-generated randomisation, but method not stated
Allocation concealment (selection bias)	Low risk	Central randomisation service at Data Management Centre of Shizouka General Hospital
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Double-blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Attrition minimal
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition minimal
Selective reporting (reporting bias)	Low risk	Specified outcomes reported.

Jacobs 2009

Study characteristics	
Methods	Open-RCT lasting 77 days from January 2008 to test “superiority” of face masks in preventing "URTI". This term appears as an acronym in the introduction and is not explained. It is assumed that it stands for 'upper respiratory infections', but it is preceded in the text by the term 'common cold', which is also lacking a definition. Randomisation was carried out in blocks within each of 3 professional figures (physicians, nurses, and “co-medical” personnel).
Participants	33 HCWs mainly females aged around 34 to 37 in a tertiary healthcare hospital in Tokyo, Japan. HCW with quote: “predisposing conditions” (undefined) to “URTI” and those taking antibiotics were excluded. A baseline descriptive survey was carried out including “quality of life”. 1 participant dropped out at end of week 1, but no reason is reported nor the allocation arm. Analysis was performed on 32 participants (mask = 17, no mask = 15).
Interventions	Surgical mask MA-3 (Osu Sangyo, Japan) during all phases of hospital work (n = 17) or no mask (n = 15) (except when specifically required by hospital SOPs). See Table 1 for details.
Outcomes	Laboratory: N/A Effectiveness: URTI is defined on the basis of a symptoms score, with a score > 14 being a URTI according to Jackson’s 1958 criteria (“Jackson score”). These are not explained in text, although the symptoms are listed in Table 3 (any, sore throat, runny nose, stuffy nose, sneeze, cough, headache, ear ache, feel bad) together with their mean and scores SD by intervention arm. Safety: the text does not mention or report harms. These appear to be indistinguishable from URTI symptoms (e.g. headache which is reported as of significantly longer duration in the intervention arm). Compliance is self-reported as high (84.3% of participants).

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Jacobs 2009 *(Continued)*

Notes	The authors conclude that quote: “Face mask use in healthcare workers has not been demonstrated to provide benefit in terms of cold symptoms or getting colds. A larger study is needed to definitively establish non-inferiority of no mask use”. This is a small, badly reported trial. The purpose of trials is to test hypotheses not to prove or disprove 'superiority' of interventions. There is no power calculation, and CIs are not reported (although there is a mention in Discussion). No accurate definitions of a series of important variables (e.g. URTI, runny nose, etc.) are reported, and the Jackson scores are not explained, nor their use in Japanese personnel or language validated. Intervention arm data not extracted due to the uncertainty of its meaning. Funding source not mentioned. Conflicts of interest: none to report

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Open RCT, but sequence generation not reported
Allocation concealment (selection bias)	Unclear risk	"Mask and no mask groups were formed using block randomisation of participants within their respective job categories: nurses, doctors, and co-medical personnel." Concealment of allocation not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study. Blinding not possible, as 1 group wore face masks
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study
Incomplete outcome data (attrition bias) All outcomes	Low risk	1 dropout in each group accounted for.Quote: "Analyses were performed following the principles of intention-to-treat."
Selective reporting (reporting bias)	High risk	NB: influenza vaccine coverage was 100% in mask group and only 81% in the non-mask-wearing group.

Kotch 1994

Study characteristics

Methods	Pair-matched, cluster-RCT conducted from 19 October 1988 to 23 May 1989 in 24 childcare centres in North Carolina, USA The trial tested the effects of a hand-washing and environment sterilising programme on diarrhoea (data not extracted) and ARIs. Child daycare centres had to care for 30 children or less, at least 5 of whom had to be in nappies, and intending to stay open for at least another 2 years. Randomisation is not described, nor are cluster coefficients reported.
Participants	389 children aged 3 years or less in daycare for at least 20 hours a week. There were some withdrawals, but attrition of participants is not stated, only that in the end data for 31 intervention classrooms and 36 control classrooms were available. 291 children aged up to 24 months and 80 over 24 months took part. The text is very confusing, as 371 seems to be the total of the number of families that took part.

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Kotch 1994 *(Continued)*

	No denominator breakdown by arm is reported, and numerators are only reported as new episodes per child-year.
Interventions	Structured hand-washing and environment (including surfaces, sinks, toilets, and toys) disinfecting programme with waterless disinfectant scrub. See Table 1 for details.
Outcomes	Laboratory: N/A Effectiveness: ARI (coughing, runny nose, wheezing, sore throat, or earache) Safety: N/A
Notes	Risk of bias: high (poor reporting of randomisation, outcomes, numerators and denominators) Note: the authors conclude that the fully adjusted RR for prevention of ARIs was 0.94 (−2.43 to 0.66). A poorly reported study. This study was supported in part by grant MCJ-373111 from the Maternal and Child Health Program (Title V. Social Security Act), Health Resources and Services Administration, Department of Health and Human Services. Cal Stat™ was contributed by Cal- gon Vestal Laboratories, a subsidiary of Merck and Co, Inc, St Louis, MO. Conflicts of interest: none to report.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "Pair-matched cluster-randomised, controlled trial", but sequence generation not reported
Allocation concealment (selection bias)	Unclear risk	Centres were matched in pairs and then randomly allocated to either intervention or control programmes. Allocation concealment was not reported.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not possible (intervention was training session)
Blinding of outcome assessment (detection bias) All outcomes	High risk	"The same staff who conducted the training unobtrusively recorded observations at 5-week intervals"
Incomplete outcome data (attrition bias) All outcomes	High risk	18 families were dropped, denominator not clear.
Selective reporting (reporting bias)	High risk	Denominators not clearly reported

Ladegaard 1999

Study characteristics	
Methods	RCT with cluster-randomisation to intervention or control. Of 10 institutions, 2 were excluded because they wanted institutions to be comparable in uptake area (i.e. housing and income). Interventions were administered to children, parents, and teachers at the institutions.
Participants	Children 0 to 6 years old

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Ladegaard 1999 *(Continued)*

Interventions	Multifaceted: information, t-shirts to the children with: "Clean hands - yes, thank you", performance of a fairytale "The princess who did not want to wash her hands", exercise in hand-washing, importance of clean and fresh air. The aims of the intervention were to: 1. increase the hygiene education of the daycare teachers; 2. motivate the children by practical learning to have better hand hygiene; and 3. inform the parents about better hand hygiene. See Table 1 for details.
Outcomes	34% decrease in "sickness" (probably mostly gastroenteritis)
Notes	Risk of bias: only limited data available Note: the authors conclude that there was a 34% decrease in sickness in the intervention arm; this is probably overall sickness, as gastroenteritis is part of the outcomes (data not extracted). Only limited data available from translation by Jørgen Lous. Funding was received from a local part of the Danish Health Authority (Forebyggelsesrådet för Fyns Amt).

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not described
Allocation concealment (selection bias)	Unclear risk	Randomisation by "lottery", the same as "flip the coin". Concealment not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not possible
Blinding of outcome assessment (detection bias) All outcomes	High risk	Not possible
Incomplete outcome data (attrition bias) All outcomes	High risk	Total numbers of children included in each arm Not reported.
Selective reporting (reporting bias)	High risk	Limited data reported, in particular denominators missing.

Larson 2010

Study characteristics

Methods	Cluster block-randomised, controlled trial carried out between 20 November 2006 and 20 June 2008 in an upper Manhattan immigrant Latino neighbourhood ("19 month data collection period"). The study aimed at assessing the effects of education versus education and hand sanitiser use versus education and hand sanitiser use and common mask use against upper respiratory infections over a period of under 2 years. Follow-up was through an automated telephone system with a small financial incentive (USD 20) for those with 75% or more compliance. Those reporting an ILI received a visit within 48 hours for swabbing.

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Larson 2010 *(Continued)*

	An index case was someone who at the "onset day of illness nobody else in the household had been symptomatic within the previous five days". A secondary case for each episode quote: "was any member of the household who developed symptoms within five days following the index case"; "The secondary attack rate was defined as the number of secondary cases recorded within 5 days of the onset of symptoms in the index case divided by the number of household members minus one". The text implies that the unit of observation was the episode ("study subjects contributed more than one episode in which they were considered to be the index case").
Participants	617 households were randomised to the education group (n = 211), the hand-sanitiser group (n = 205), and the hand-sanitiser and mask group (n = 201). There were 2708 participants, mostly adult Latino immigrants to the USA. Recruitment and allocation were carried out by household. There had to be at least 3 people living in the household, with at least 1 being a preschool or elementary school child, speaking English or Spanish, having a telephone, willingness to complete symptom assessments and have bimonthly home visits, and not using alcohol-based hand sanitiser routinely. Intracluster correlation coefficients are reported on page 179 of the manuscript.
Interventions	Written Spanish or English language educational materials regarding the prevention and treatment of URTIs and influenza or the same educational materials and hand sanitiser (Purell, J&J), in large (8- and 4-ounce) and small (1-ounce) containers to be carried by individual household members to work or school, or the same interventions as well as regular surgical face masks (Procedure Face Masks for adults and children, Kimberly-Clark) with instructions for both the caretaker and the ill person to wear them when an ILI occurred in any household member. Replenishment of intervention stocks was done at the bimonthly home visit. Caretakers had to wear a mask for 7 days when within 3 feet of a symptomatic case. They were also encouraged to wear masks within 3 feet of any household member. Reinforcing phone calls were made 3 times in 6 days. The text clearly reports active influenza vaccine promotion during the bimonthly visits. ("The home visit to each household was made every 2 months to minimise study dropout, reinforce adherence to the assigned intervention, replenish product supplies and record use of supplies, answer questions, and correct ongoing misconceptions. At each visit, new educational materials regarding URTI prevention and treatment and influenza vaccination were distributed." (PDF page 3). Also just before the Discussion as follows: "Influenza vaccination rates: There was an increase between the baseline and exit interview in all three groups that reported 50% of more of members receiving influenza vaccine (pre- versus post-intervention for each group: 21.1% and 40.8% in the Education group, 19.0% and 57.1% in the hand sanitiser group, and 22.4% and 43.5% in the hand sanitiser and face mask group (P = 0.001). Additionally, those in the hand sanitiser group reported a significantly greater increase than the other 2 groups, controlling for baseline rates (P = 0.002)") Coverage was unequal across groups, no information on the progressive impact of the vaccine, or indeed the nature of the vaccine(s) is reported. Apparently the first season was mild and the vaccine mismatched, compliance with the trial interventions was low in Arm 3, and a local epidemic of *Staphylococcus aureus* meant that the control group started washing hands. The trial authors report no effect on reporting rates of vaccine coverage by arms, but with so many confounders who knows? See Table 1 for details.
Outcomes	Laboratory: PCR carried out on samples from deep nasal swabs for influenza and the most common other pathogens (RSV, rhinovirus, enterovirus, parainfluenza viruses, etc.). The text describing the results of the swabbing is confusing, but in general appears to be non-random "Households reported 669 episodes of ILI (0 to 5 per individual)". Of the 234 deep nasal swabs obtained, 33.3% (n = 78) tested positive for influenza: 43.6% (n = 34) were influenza A and 56.4% (n = 44) were influenza B. Amongst the 66.7% who tested negative for influenza, 30.8% (48/156) tested positive for other viruses: 7 for respiratory syncytial virus, 9 for parainfluenza, 11 for enterovirus, 10 for rhinovirus, 6 for adenovirus, and 5 for metapneumovirus. Swabs were not obtained from the remaining 435 reported ILI episodes for the fol-

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Larson 2010 *(Continued)*

	lowing reasons: 72.0% (n = 313) did not meet the CDC definition of an ILI and were therefore included in the URTI symptom count; 21.4% of episodes (n = 93) were reported after 48 hours of ILI onset or the participant refused to be swabbed; and the research staff were unable to reach the participant in 6.7% of episodes (n = 29). As no definition of URTI is given, it is unclear what kind of biases were introduced by the non-swabbing of the 313/435 "not meeting CDC definition". Effectiveness: ILI (CDC definition): "temperature of 37.8°C or more and cough and/or sore throat in the absence of a known cause other than influenza" URTI only referred to as "Viral upper respiratory infections (URTIs)". Safety: N/A
Notes	The authors conclude that quote: "the Hand Sanitizer group was significantly more likely to report that no household member had symptoms (P,0.01), but there were no significant differences in rates of infection by intervention group in multivariate analyses. Knowledge improved significantly more in the Hand Sanitizer group (P,0.0001). The proportion of households that reported >50% of members receiving influenza vaccine increased during the study (P.0.001). Despite the fact that compliance with mask wearing was poor, mask wearing as well as increased crowding, lower education levels of caretakers, and index cases 0–5 years of age (compared with adults) were associated with significantly lower secondary transmission rates (all P,0.02). In this population, there was no detectable additional benefit of hand sanitiser or face masks over targeted education on overall rates of URTIs, but mask wearing was associated with reduced secondary transmission and should be encouraged during outbreak situations. During the study period, community concern about methicillin-resistant *Staphylococcus aureus* was occurring, perhaps contributing to the use of hand sanitiser in the Education control group, and diluting the intervention's measurable impact". The study is at high risk of bias. Randomisation and reasons for dropout are not described. Differentials in cluster characteristics across arms point to randomisation not having worked, and the confounding effects of a post randomisation staphylococcal scare are difficult to judge. Symptom-driven follow-up gives no idea of the effects on asymptomatic ILI/influenza. Poor definitions (URTI?). There are unexplained dropouts, and the analysis plan is unclear. Finally, the very small number of cases of influenza and an unclear swabbing attrition may introduce further elements of confounding. Funding: this study was funded by grant #1 U01 CI000442-01, "Stopping URIs and Flu in the Family: The Stuffy Trial." Conflicts of interest: none reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "Cluster block randomised, controlled trial", but sequence generation not reported
Allocation concealment (selection bias)	Unclear risk	Quote:"Households were block randomised into one of three groups" Allocation concealment not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of participants and personnel was not possible.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Blinding of outcome assessment is not stated.

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Larson 2010 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	High risk	In control group households (n = 211), 26 dropped out and 37 did not consent. In hand-sanitiser group households (n = 205), 21 dropped out and 36 did not consent. In hand-sanitiser and face mask group households (n = 201), 19 dropped out and 35 did not consent. Reasons for dropout were not described.
Selective reporting (reporting bias)	Unclear risk	617 of 772 eligible households were randomised.

Little 2015

Study characteristics	
Methods	Individuals sharing a household by mailed invitation through general practices in England were recruited. After consent, participants were randomised online by an automated computer-generated random-number program to receive either no access or access to a bespoke automated web-based intervention that maximised hand-washing intention, monitored hand-washing behaviour, provided tailored feedback, reinforced helpful attitudes and norms, and addressed negative beliefs. Participants were enrolled into an additional cohort (randomised to receive intervention or no intervention) to assess whether the baseline questionnaire on hand-washing would affect hand-washing behaviour. Participants were not masked to intervention allocation, but statistical analysis commands were constructed masked to group. The primary outcome was number of episodes of RTIs in index participants in a modified intention-to-treat population of randomly assigned participants who completed follow-up at 16 weeks.
Participants	344 physician offices were recruited over a wide area of England, and 20,066 participants were enrolled and randomised to intervention (N = 16,086) and control (N = 10,026). Modified ITT was performed on 16,908 participants who completed the follow-up questionnaire at 16 weeks (intervention = 8241 and control = 8667). Inclusion criteria: adult patients (aged 18 years or older) identified from computerised lists in general practitioner (GP) practices in England, for whom there was at least 1 other individual living in the household who was willing to report illness to the index person Exclusion criteria: patients with severe mental problems (e.g. major uncontrolled depression or schizophrenia, dementia, or severe mental impairment) or who were terminally ill, and those reporting a skin complaint that would restrict hand-washing
Interventions	Automated web-based intervention that maximised hand-washing intention, monitored hand-washing behaviour, provided tailored feedback, reinforced helpful attitudes and norms, and addressed negative beliefs. Control no access to intervention web pages. See Table 1 for details.
Outcomes	The primary outcome was the number of index individuals that reported 1 or more RTIs (including ILI) at 16 weeks. Secondary: duration of symptoms, transmission of respiratory infections, gastrointestinal infections, attendance at the practice, and use of health service resources Infections self-reported by participants. RTI defined as 2 symptoms of an RTI for at least 1 day or 1 symptom for 2 consecutive days. Definition of ILI was a high temperature (feeling very hot or very cold; or measured temperature > 37.5 °C), a respiratory symptom (sore throat, cough, or runny nose), and a systemic symptom (headache, severe fatigue, severe muscle aches, or severe malaise).

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Little 2015 *(Continued)*

	No safety outcomes reported.
Notes	Government funded. The study was funded by the Medical Research Council (study number 09/800/22). Declaration of interests: the authors declare no competing interests.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Participants were automatically randomly assigned by the intervention software, but sequence generation not described.
Allocation concealment (selection bias)	Low risk	Participants were automatically randomly assigned by the intervention software.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study
Incomplete outcome data (attrition bias) All outcomes	High risk	High attrition that was different in the 2 groups
Selective reporting (reporting bias)	Low risk	Specified outcomes reported.

Loeb 2009

Study characteristics

Methods	Open non-inferiority RCT carried out to compare the surgical mask with the N95 respirator in protecting healthcare workers against influenza. The trial was carried out between 2008 (enrolment started in September and follow-up on 12 January 2009) and 23 April 2009 (when all HCWs caring for febrile patients were told to wear an N95 respirator) because of the appearance of novel A/H1N1). The trial trigger was the beginning of the influenza season, defined as isolation of 2 or more viruses in a district in the same week. Following the 2003 SARS outbreak, all Ontario nurses caring for febrile patients (38 °C or more and new onset cough or SOB) had to wear surgical masks. The randomisation (carried out in blocks of 4 by centre) then consisted of either confirmation to same-maker surgical mask wear or N95 respirator wear. Investigators and laboratory staff were blind to allocation status, but for obvious reasons (the visible difference in interventions), participants were unblinded. "The criterion for non-inferiority was met if the lower limit of the 95% confidence interval (CI) for the reduction in incidence (N95 respirator minus surgical group) was greater than -9%". So this is the non-inferiority margin. It is assumed that the "minus surgical group" means minus surgical mask group.
Participants	Consenting nurses (n = 446 randomised) aged a mean of 36.2 years working full time (≥ 37 hours/week) in 23 acute units (a mix of paediatric, A&E, and acute medical units) in 8 hospitals in Ontario, Canada. 225 were randomised to the surgical mask and 221 to the N95 respirator. There were 13 and 11 dropouts, respectively from each arm (all accounted for), plus 21 and 19 lost to follow-up; 11 in each arm gave no reason, the others are accounted for. There were no deaths. The final total of 212 and 210 was included in the analysis. Table 1 reports the demographic data of participants by arm, which appear comparable.

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Loeb 2009 *(Continued)*

Interventions	Surgical masks (as standard wear by the standard distributor) or fit–tested N95 respirator. All nurses wore gloves or gowns in the presence of a febrile patient. See Table 1 for details.
Outcomes	Laboratory RT-PCR paired sera with 4-fold antibody rise from baseline (only for unvaccinated) nurses Effectiveness: follow-up (lasting a mean of around 97 days for both arms) was carried out twice-weekly on a web-based instrument. Nurses with new symptoms were asked to swab a nostril if any of the following signs or symptoms had developed: fever (temperature ≥ 38 °C), cough, nasal congestion, sore throat, headache, sinus problems, muscle aches, fatigue, earache, ear infection, or chills. The text defines influenza with laboratory confirmation, and separately reports criteria for swab triggering and a definition of ILI ("Influenza-like illness was defined as the presence of cough and fever: a temperature ≥ 38°C"). But this is not formally linked to influenza in the text, as it appears that primary focus was the detection of laboratory-confirmed influenza (either by RT-PCR or serology). Additional outcome data sought were work-related absenteeism and physician visits for respiratory illness. Secondary outcomes included detection of the following non-influenza viruses by PCR: parainfluenza virus types 1, 2, 3, and 4; respiratory syncytial virus types A and B; adenovirus; metapneumovirus; rhinovirus-enterovirus; and coronaviruses OC43, 229E, SARS, NL63, and HKU1. Audits to assess nurse compliance with the interventions were carried out in the room of each patient cared for. The text reports that 50 and 48 nurses in the surgical mask and N95 groups, respectively, had laboratory confirmation of influenza infection, indicating non-inferiority. Interestingly, non-inferiority seemed to be applicable both to seasonal viruses and nH1N1 viruses (as 8% and 11.9% were serologically positive to nH1N1). This finding is explained either by seeding or cross reaction with seasonal H1N1. Equivalent conclusions could be drawn for nurses with complete follow-up. Non-inferiority was applicable also to other ILI agents identified. None of the 52 individuals with positive isolates met the criteria for ILI. All cases of ILI were confirmed as having influenza (9 and 2 respectively). This means that all the 11 cases of ILI had influenza, but that most of those with a laboratory diagnosis of influenza did not have cough and fever. For example, the text reports that "Of the 44 nurses in each group who had influenza diagnosed by serology, 29 (65.9%) in the surgical mask group and 31 (70.5%) in the N95 respirator group had no symptoms". By implication, of the 88 nurses with antibody rises, 28 had symptoms of some kind, i.e. two-thirds were asymptomatic. Absenteeism was 1 versus 39 episodes in the mask versus respirator arms. No episodes of LRTI were recorded. The number of family contacts with ILI were the same for each arm (45 versus 47). Physician visits were similar in both groups. Safety: no AEs are reported
Notes	The authors conclude that "Among nurses in Ontario tertiary care hospitals, use of a surgical mask compared with a N95 respirator resulted in non-inferior rates of laboratory-confirmed influenza". This a well-designed and conducted trial with credible conclusions. The only comment is that the focus in the analysis on influenza (symptomatic and asymptomatic) is not well-described, although the rationale is clear (interruption of transmission). Funding/Support: this study was supported by the Public Health Agency of Canada. Financial disclosures: none reported.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"Randomisation was performed centrally ....", but method of sequence generation not described.

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Loeb 2009 *(Continued)*

Allocation concealment (selection bias)	Low risk	"...by an independent clinical trials coordinating group such that investigators were blind to the randomisation procedure and group assignment and was stratified by centre in permuted blocks of 4 participants."
Blinding of participants and personnel (performance bias) All outcomes	High risk	"It was not possible to conceal the identity of the N95 respirator or the surgical mask since manipulating these devices would interfere with their function"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessment blinded: "Laboratory personnel conducting hemagglutinin inhibition assays, polymerase chain reaction (PCR), and viral culture for influenza were blinded to allocation."
Incomplete outcome data (attrition bias) All outcomes	Low risk	21 of 225 randomised to mask group and 19 of 221 randomised to N95 group were lost to follow-up, reasons reported. Study stopped early: Quote: We had planned to stop the study at the end of influenza season. However, because of the 2009 influenza A(H1N1) pandemic, the study was stopped on April 23, 2009, when the Ontario Ministry of Health and Long-Term Care recommended N95 respirators for all healthcare workers taking care of patients with febrile respiratory illness."
Selective reporting (reporting bias)	Low risk	All outcomes reported.

Longini 1988

Study characteristics	
Methods	Cluster-controlled, double-blind, randomised trial to assess the efficacy of virucidal tissues in interrupting family transmission of rhinovirus and influenza virus. The study was carried out in the community of Tecumseh, Michigan, USA during the period of 25 November 1984 to 28 April 1985. However, the authors only report results for the period of 13 January to 23 March 1985, when a high circulation of influenza A H3N2 and rhinovirus was detected.
Participants	296 households were enrolled, but 5 households were eliminated from the analysis for "technical reasons". The analysis was carried out in households with 3 to 5 members. The authors report data on 143 households randomised to virucidal tissues and 148 to placebo tissue. The average age in households was around 22, and the difference between arms was not significant. Randomisation was carried out by the sponsor, and tissues were pre-packed in coded boxes with no other identifying features and delivered to households at the beginning of the study period.
Interventions	Disposable 3-layered virucidal tissues (citric and malic acids with sodium lauryl sulphate in the middle layer) or placebo (succinic acid in the middle layer) tissues. They were used to blow the nose and for coughing or sneezing into. Households were also stratified by level of tissue use. Tissue use was significantly higher in the intervention arm (82% versus 71%). See Table 1 for details.
Outcomes	Laboratory: yes - viral culture from nasal and throat swabs from symptomatic participants Effectiveness: ARI (with a proportion of laboratory-confirmed diagnosis in non-randomly chosen participants with symptoms lasting 2 days or more) Follow-up and surveillance was carried out using a telephone questionnaire. Safety: N/A
Notes	Risk of bias: high (inappropriate choice of placebo) Note: the authors conclude that virucidal tissues were up to 36.9% effective in preventing transmission of ARIs as measured by secondary attack rates (18.7% versus 11.8%). This finding was not statistical-

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Longini 1988 *(Continued)*

ly significant, but may well have been affected by the lack of do-nothing community controls. This a well-designed, well-written study despite the unexplained attrition of 5 families, the lack of reporting of cluster coefficients, and the differential in tissue use between the 2 arms, which raises questions about the robustness of double-blinding. Particularly notable is the discussion on the low generalisability of results from the study from the placebo arm given that even the inert barrier of the tissues is likely to have limited spread. Also, the lengths to which the authors went to obtain allocation concealment and maintenance of double-blind conditions.

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Declaration of interests: none declared.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "Treated and placebo tissues were randomly assigned ..." Sequence generation not reported
Allocation concealment (selection bias)	Low risk	Quote:"Treated and placebo tissues were randomly assigned by the sponsor to 296 participating households stratified by household size, such that roughly half the households would receive treated tissues. Thus, the investigators were unaware of the assignment of treated tissues."
Blinding of participants and personnel (performance bias) All outcomes	Low risk	"Treated and placebo tissues were randomly assigned by the sponsor to the randomly assigned 296 households stratified by household size... The type of tissue was identified by code, and the boxes in which tissues were contained were not marked with any specific identifiers. Therefore, the study was double-blinded."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote:"The investigators were unaware of the assignment of the treated tissues"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	296 households eligible. "The final sample used for analysis consisted of 143 households in the treatment group and 148 households in the placebo group."
Selective reporting (reporting bias)	High risk	Quote:"The analysis of secondary spread was restricted to households of three to five members for technical reasons, which eliminated five households." "The two groups were almost identical in composition."

Luby 2005

Study characteristics

Methods	Partly double-blind, cluster-RCT carried out during 15 April 2002 to 5 April 2003 in Karachi, Pakistan. The trial assessed the effects of mother and child hand-washing on the incidence of respiratory infections, impetigo (data not extracted), and diarrhoea (data not extracted). Randomisation took place by computer-generated random numbers in 3 phases. 1. 25 neighbourhoods were assigned to hand-washing and 11 to standard practice. 2. 300 households were assigned to using antiseptic soap. 3. 300 households were assigned to using plain soap.

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Luby 2005 *(Continued)*

4. 306 households were assigned to standard practice.
5. 1523 children younger than 15 years were assigned to using antiseptic soap.
6. 1640 children younger than 15 years were assigned to using plain soap.
7. 1528 children younger than 15 years were assigned to standard practice.

Soaps were of identical weight, colour, and smell and were packed centrally with a coded packing case matched to households containing 96 bars. Neither field workers nor participants were aware of the content. Control arm households were visited with the same frequency as intervention household but were given books and pens. Codes were held centrally by the manufacturer and broken after the end of the trial to allow analysis.

Participants	Householders of slums in Karachi. Of the 1523 children younger then 15 years assigned to using antiseptic soap, 117 dropped out (1 died, 51 were born in, and 65 aged out) = 1406; 504 were aged less than 5. Of 1640 children younger then 15 years assigned to using plain soap, 117 dropped out (3 died, 44 were born in, and 70 aged out) = 1523; 517 were aged less than 5. Of 1528 children younger then 15 years assigned to standard practice, 125 dropped out (3 died, 40 were born in, and 82 aged out) = 1403; 489 were aged less than 5.
Interventions	Instruction programme and antibacterial soap containing 1.2% triclocarban, or ordinary soap to be used throughout the day by householders, or standard procedure. See Table 1 for details.
Outcomes	Laboratory: N/A Effectiveness: 1. Number of new respiratory illness per person per week 2. Pneumonia (cough or difficulty in breathing with a respiratory rate of > 60 min in children less than 60 days old, > 50 min in those less than 1 year old, and > 40 min for those aged 1 to 5 years) Follow-up was weekly with household interview and direct observation. Children aged less than 5 were weighed, and the report presents stratification of results by child weight. Safety: N/A
Notes	Risk of bias: low (cluster coefficients and analysis by unit of randomisation provided) Note: the authors conclude that "handwashing" neighbourhoods has significantly fewer episodes of respiratory disease than controls (e.g. 50% less cough). "Handwashing" children aged less than 5 had 50% fewer episodes of pneumonia than controls (−65% to −35%). However, there was no difference in respiratory illness between types of soap. The report is confusing, with a shifting focus between children age groups. The impression reading is of an often rewritten manuscript. There is some loss of data (e.g. in the results by weight, i.e. risk group) because of lack of clarity on denominators. Despite this, the trial is a landmark. Funding: most of the funding for this study was provided by Procter and Gamble, manufacturer of Safeguard Bar Soap. The balance of the funding was provided by the Centers for Disease Control and Prevention. Conflict of interest statement: S Luby was supported by the grant from the Procter & Gamble company that funded this study. W Billhimer is an employee of the Procter & Gamble company. The other authors declare that they have no conflict of interest.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation took place by computer-generated random numbers in 3 phases.
Allocation concealment (selection bias)	Low risk	Quote:"One of the investigators (SL) who did not participate in recruiting neighbourhoods or households programmed a spreadsheet to randomly gen-

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Luby 2005 *(Continued)*

		erate the integers of a 1 or a 2. He applied the random numbers sequentially to the list of neighbourhoods. Neighbourhoods with a 1 were assigned to control, and those with a 2 were assigned to handwashing promotion. Random assignment continued until neighbourhoods consisted of at least 600 handwashing promotion households and 300 control households were assigned."
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote:"The antibacterial soap ... contained 1-2% triclocarban as an antibacterial substance. The plain soap was identical to the antibacterial soap except that it did not contain triclocarban... . Neither the fieldworkers nor the families knew whether soaps were antibacterial or plain."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote:"Neither the fieldworkers nor the families knew whether soaps were antibacterial or plain."
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	89% of the study population followed up, but no data on the clusters.
Selective reporting (reporting bias)	Low risk	Quote:"At baseline, households in the three intervention groups were similar."

MacIntyre 2009

Study characteristics	
Methods	Prospective cluster-RCT carried out in Sydney, Australia, to assess the use of surgical masks, P2 masks, and no masks in preventing ILI in households. The study was carried out during the 2 winter seasons of 2006 and 2007 (August to the end of October 2006 and June to the end of October 2007). “Gaussian random effects were incorporated in the model to account for the natural clustering of persons in households"
Participants	290 adults from 145 families. 47 households (94 enrolled adults and 180 children) were randomised to the surgical mask group, 46 (92 enrolled adults and 172 children) to the P2 mask group, and 52 (104 enrolled adults and 192 children) to the no-mask (control) group.
Interventions	Use of surgical masks and P2 mask versus no mask. The P2 mask is described as very cumbersome. See Table 1 for details.
Outcomes	Laboratory: serological evidence Effectiveness: ILI (described as fever, history of fever or feeling feverish in the past week, myalgia, arthralgia, sore throat, cough, sneezing, runny nose, nasal congestion, headache) However, a positive laboratory finding for influenza converts the ILI definition into one of influenza. Safety: N/A
Notes	The study authors conclude that adherence to mask use significantly reduced the risk for ILI-associated infection, but < 50% of participants wore masks most of the time. They concluded that household use of face masks is associated with low adherence and is ineffective for controlling seasonal respiratory disease. Compliance was by self-report, therefore likely to be an underestimate. The primary outcome was ILI or lab-positive illness. This showed no effect. Sensitivity analysis by adherence showed that under the assumption that the incubation period is equal to 1 day (the most probable value for the 2 most common viruses isolated, influenza (21) and rhinovirus (26)), adherent use of P2 or surgical masks significantly reduces the risk for ILI infection, with a hazard ratio = 0.26 (95% CI 0.09 to 0.77; P = 0.015). No other covariate was significant. Under the less likely assumption that the incubation period is equal to 2 days, the quantified effect of complying with P2 or surgical mask use remains strong, although borderline significant; hazard ratio was 0.32 (95% CI

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MacIntyre 2009 *(Continued)*

0.11 to 0.98; P = 0.046). The study was underpowered to determine if there was a difference in efficacy between P2 and surgical masks (Table 5). The study conclusion appears to be a post hoc data exploration. Regardless of this, the study message is that respirator use in a family setting is unlikely to be effective as compliance is difficult unless there is a situation of real impending risk.

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Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"Participating households were randomised to 1 of 3 arms by a secure computerised randomisation process", but sequence generation not described.
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	"Study participants and trial staff were not blinded, as it is not technically possible to blind the mask type to which participants were randomised."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"However, laboratory staff were blinded to the arm of randomisation."
Incomplete outcome data (attrition bias) All outcomes	Low risk	143 of 145 randomised families were analysed; 2 families in the control group were lost to follow-up during the study, for which no reasons were given.
Selective reporting (reporting bias)	Low risk	No differences between groups at baseline

MacIntyre 2011

Study characteristics

Methods	A cluster-RCT of 1441 HCWs in 15 Beijing hospitals was performed during the 2008 to 2009 winter. Participants wore masks or respirators during the entire work shift for 4 weeks. Outcomes included CRI, ILI, laboratory-confirmed respiratory virus infection, and influenza. A convenience no-mask/respirator group of 481 health workers from 9 hospitals was compared.
Participants	Participants (N = 1441) were hospital HCWs aged > 18 years from the emergency departments and respiratory wards of 15 hospitals. These wards were selected as high-risk settings in which repeated and multiple exposures to respiratory infections are expected.

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MacIntyre 2011 *(Continued)*

	Participants were randomised to medical mask (N = 492 staff from 5 hospitals), N95 fit-tested masks (N = 461 staff from 5 hospitals), and N95 non-fit-tested mask (N = 488 staff from 5 hospitals).
Interventions	Fit-tested N95 respirators versus non-fit-tested N95 respirators versus medical masks. See Table 1 for details.
Outcomes	Clinical respiratory illness, defined as 2 or more respiratory symptoms or 1 respiratory symptom and a systemic symptom Influenza-like illness, defined as fever ≥ 38 °C plus 1 respiratory symptom (i.e. cough, runny nose, etc.) Laboratory-confirmed viral respiratory infection (detection of adenoviruses, human metapneumovirus, coronavirus 229E/NL63, parainfluenza viruses 1, 2, and 3, influenza viruses A and B, respiratory syncytial virus A and B, rhinovirus A or B, and coronavirus OC43/HKU1 by multiplex PCR) Laboratory-confirmed influenza A or B Adherence with mask or respirator use. Reported problems associated with using the masks or respirators
Notes	Control arm not randomised so has been ignored. Funding source unknown. Conflict of interests: Raina MacIntyre receives funding from influenza vaccine manufacturers GSK and CSL Biotherapies for investigator-driven research. She has also been on advisory boards for Wyeth, GSK and Merck. Dr Simon Cauchemez received consulting fees from MacIntyre et al. 178 [a] 2011 Blackwell Publishing Ltd, Influenza and Other Respiratory Viruses, 5, 170–179 Sanofi-Pasteur MSD on the modelling of varicella zoster virus. The remaining authors declare that they have no competing interests. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication. Prior to the start of this study, NMF acted as a consultant for Roche, Novartis and GSK Biologicals (ceasing in 2007).

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Randomisation process (using a secure computerised randomisation program), but sequence generation not described
Allocation concealment (selection bias)	Low risk	Hospitals randomised prior to inclusion of participants.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study
Incomplete outcome data (attrition bias) All outcomes	Low risk	No loss to follow-up
Selective reporting (reporting bias)	Low risk	Specified outcomes reported.

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MacIntyre 2013

Study characteristics	
Methods	A cluster-RCT
Participants	A total of 1669 nurses and doctors from 68 emergency departments and respiratory wards of 19 Beijing hospitals were included. Inclusion criteria: any nurse or doctor aged 18 years or older who worked full time in the emergency or respiratory wards was eligible. Exclusion: HCWs if they (1) were unable or refused to consent; (2) had beards, long moustaches, or long facial hair stubble; (3) had a current respiratory illness, rhinitis, and/or allergy; or (4) worked part time or did not work in the aforementioned wards or departments Final analysis was performed on 572 staff and 24 wards in medical mask group, 516 staff and 20 wards in the targeted N95 mask group, and 581 staff and 24 wards in the N95 mask group.
Interventions	Quote: "Masks used in the study were the 3M Standard Tie-On Surgical Mask (catalog number mask 1817; 3M, St. Paul, MN) and the 3M Health Care N95 Particulate Respirator (catalog number 1860; 3M)... . Participants wore the mask or respirator on every shift after being shown how to fit and wear it. Participants were supplied daily with either three masks for the medical mask arm or two N95 respirators. Participants using N95 respirators underwent a fit testing procedure using a 3M FT-30 Bitrex Fit Test Kit according to the manufacturer's instructions (3M)." See Table 1 for details.
Outcomes	Laboratory: 1. Laboratory-confirmed viral respiratory infection in symptomatic participants, defined as detection of adenoviruses; human metapneumovirus; coronaviruses 229E/NL63 and OC43/HKU1; parainfluenza viruses 1, 2, and 3; influenza viruses A and B; respiratory syncytial viruses A and B; or rhinoviruses A/B by nucleic acid testing (NAT) using a commercial multiplex polymerase chain reaction (Seegen, Inc., Seoul, Korea). 2. Laboratory-confirmed influenza A or B in symptomatic participants. 3. Laboratory-confirmed bacterial colonisation in symptomatic participants, defined as detection of *Streptococcus pneumoniae*, *Legionella*, *Bordetella pertussis*, chlamydia, *Mycoplasma pneumoniae*, or *Haemophilus influenzae* type B by multiplex polymerase chain reaction (Seegen, Inc.). Effectiveness: CRI, defined as 2 or more respiratory symptoms or 1 respiratory symptom and a systemic symptom. ILI, defined as fever (38 °C) plus 1 respiratory symptom Safety: adverse effects measured using a semi-structured questionnaire. Investigators stated that there was higher reported adverse effects and discomfort of N95 respirators compared with the other 2 arms. In terms of comfort, 52% (297 of 571) of the medical mask arm reported no problems, compared with 62% (317 of 512) of the targeted arm and 38% (217 of 574) of the N95 arm (P < 0.001).
Notes	Compliance with the product was highest in the targeted N95 arm (82%; 422 of 516), then the medical mask arm (66%; 380 of 572), and the N95 arm (57%; 333 of 581); these differences were statistically significant (P < 0.001). The period study conducted: 28 December 2009 to 7 February 2010 Funding: unclear Declaration of interests: none declared.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"using a secure computerized randomization program", but sequence generation not described

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MacIntyre 2013 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	No information provided.
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Outcome was objectively assessed with lab confirmation in addition to clinical illness.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"Laboratory outcomes are reported for all subjects (with at least one respiratory symptom or fever) tested, and then for the subset meeting the CRI definition"
Incomplete outcome data (attrition bias) All outcomes	Low risk	No loss to follow-up. Flow chart and text match, investigators conducted ITT and PP analysis. All the outcomes were accounted for amongst all participants.
Selective reporting (reporting bias)	Low risk	All outcomes were reported as planned.

MacIntyre 2015

Study characteristics	
Methods	A cluster-RCT of cloth masks compared with medical masks in healthcare workers in 14 secondary-/tertiary-level hospitals in Hanoi, Vietnam. Hospital wards were randomised to: medical masks, cloth masks, or a control group (usual practice, which included mask wearing). Participants used the mask on every shift for 4 consecutive weeks.
Participants	1607 hospital HCWs aged ≥ 18 years working full time in selected high-risk wards. Medical mask group (n = 580 HCWs), cloth mask group (n = 569 HCWs), control group (n = 458 HCWs)
Interventions	Medical masks, cloth masks, or a control group. See Table 1 for details.
Outcomes	Clinical respiratory illness, influenza-like illness, and laboratory-confirmed respiratory virus infection 1. Clinical respiratory illness, defined as 2 or more respiratory symptoms or 1 respiratory symptom and a systemic symptom 2. Influenza-like illness, defined as fever ≥ 38 °C plus 1 respiratory symptom 3. Laboratory-confirmed viral respiratory infection. Laboratory confirmation was by nucleic acid detection using multiplex reverse transcriptase PCR (RT-PCR) for 17 respiratory viruses. Adverse events associated with mask use
Notes	Government funded. Competing interests: CRM has held an Australian Research Council Linkage Grant with 3M as the industry partner, for investigator-driven research. 3M has also contributed masks and respirators for investigator-driven clinical trials. CRM has received research grants and laboratory testing as in-kind support from Pfizer, GSK and Bio-CSL for investigator-driven research. HS had a NHMRC Australian-based Public Health Training Fellowship at the time of the study (1012631). She has also received funding from vaccine manufacturers GSK, bio-CSL and Sanofi Pasteur for investigator-driven research and presentations. AAC used filtration testing of masks for his PhD thesis conducted by 3M Australia.
Risk of bias	

Bias	Authors' judgement	Support for judgement

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MacIntyre 2015 *(Continued)*

Random sequence generation (selection bias)	Low risk	Epi info V.6 was used to generate a randomisation allocation.
Allocation concealment (selection bias)	Low risk	74 wards randomised prior to recruitment of individuals.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study
Incomplete outcome data (attrition bias) All outcomes	Low risk	No loss to follow-up
Selective reporting (reporting bias)	Low risk	Specified endpoints reported.

MacIntyre 2016

Study characteristics	
Methods	Cluster-RCT to examine medical mask use as source control for people with respiratory illness in 6 major hospitals in 2 districts of Beijing, China. Index cases with ILI were randomly allocated to medical mask (n = 123) and control arms (n = 122). Since 43 index cases in the control arm also used a mask during the study period, an as-treated post hoc analysis was performed by comparing outcomes amongst household members of index cases who used a mask (mask group) with household members of index cases who did not use a mask (no mask group).
Participants	245 index cases with ILI (medical mask = 123, control group = 122) and 597 household contacts (medical mask = 302, control group = 295)
Interventions	Medical mask versus no mask (control). See Table 1 for details.
Outcomes	Clinical respiratory illness, ILI, and laboratory-confirmed viral respiratory infection 1. Clinical respiratory illness, defined as 2 or more respiratory symptoms (cough, nasal congestion, runny nose, sore throat, or sneezes) or 1 respiratory symptom and a systemic symptom (chill, lethargy, loss of appetite, abdominal pain, muscle or joint aches). 2. ILI, defined as fever ≥ 38 °C plus 1 respiratory symptom. 3. Laboratory-confirmed viral respiratory infection, defined as detection of adenoviruses, human metapneumovirus, coronaviruses 229E/NL63 and OC43/HKU1, parainfluenza viruses 1, 2, and 3, influenza viruses A and B, respiratory syncytial virus A and B, or rhinovirus A/B by nucleic acid testing using a commercial multiplex PCR. No safety outcomes reported.
Notes	Government funded. Competing interests: all authors have completed the Unified Competing Interests form (available on request from the corresponding author) and declare that: CRM has held an Australian Research Council Linkage Grant with 3M as the industry partner, for investigator driven research. 3M have also contributed supplies of masks and respirators for investigator-driven clinical trials. She has received re-

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MacIntyre 2016 *(Continued)*

search grants and laboratory testing as in-kind support from Pfizer, GSK and Bio-CSL for investigator-driven research. HS had an NHMRC Australian based Public Health Training Fellowship at the time of the study (1012631). She has also received funding from vaccine manufacturers GSK, bio-CSL and Saniofi Pasteur for investigator-driven research and presentations. AAC had testing of filtration of masks by 3M for PhD.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random allocation sequence using Microsoft Excel
Allocation concealment (selection bias)	High risk	Doctors enrolled the participants randomly to intervention and control arms.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Clinical endpoints assessed unblinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No loss to follow-up
Selective reporting (reporting bias)	Low risk	Specified outcomes reported.

McConeghy 2017

Study characteristics

Methods	Pilot study of comprehensive intervention (education, cleaning of surfaces, audit and feedback) to staff of nursing homes versus usual care. Pair-matched cluster-randomised design with only 5 clusters (nursing homes) in each group
Participants	10 nursing homes in Colorado, USA Intervention group = 481 long-stay residents and control group = 380 'Long-stay' defined as resident at least 90 days prior to baseline, or recently readmitted after previous long stay.
Interventions	A multifaceted hand-washing/surface-cleaning intervention comprised of 1) 1-hour online educational module focused on how to prevent infections; 2) provided with an “essential bundle” of 7 products, ranging from hand sanitiser gel and foam to antiviral facial tissues, disinfecting spray, and hand and face wipe and recommendation to use 4 skin cream and wipe products; 3) audit and feedback system. See Table 1 for details.
Outcomes	Laboratory: surface cultures mentioned in Methods, but no results given Effectiveness: LRTI, all infections, hospitalisation, use of antibiotics (not relevant to this review)

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McConeghy 2017 *(Continued)*

	Safety: none mentioned in Methods and no results given
Notes	The authors conclude that Quote: "This multifaceted hand-washing and surface cleaning intervention was designed to reduce infection rates among nursing homes residents. In our 10-facility randomized, matched pair pilot study, we observed program compliance and satisfaction along with reductions in surface bacterial counts, but did not observe a statistically significant reduction in infection rates, antimicrobial use, or hospitalizations". Very poorly reported study with results not explained, summarised in Table 3 as RDs. Denominators and attrition are unclear. This work was supported by Kimberly-Clark Corporation (Contract # 14792008). Declaration of interests: none declared.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method not described
Allocation concealment (selection bias)	Unclear risk	Method not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded
Blinding of outcome assessment (detection bias) All outcomes	High risk	Illness and absenteeism reported by treating staff.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No attrition given. Data were collected from e-medical record at baseline, but not clear whether illness data during the study were collected by the same method.
Selective reporting (reporting bias)	High risk	Upper respiratory tract infection was mentioned in the Methods (intervention presumably would target these), but only LRTI and overall infection reported.

Millar 2016

Study characteristics

Methods	Cluster-RCT, open-label study, factorial design
Participants	Around 30,000 healthy, male army trainees aged 18 to 42 years at Fort Benning, Georgia were included. Inclusion criteria: trainees assigned to 1 of the 6 selected training battalions, trainees who present with an SSTI at the clinic or the hospital, provide informed consent. Exclusion criteria: fails to meet inclusion criteria. No denominator breakdown by arm is reported.
Interventions	Promotion of hand-washing in addition to a once-weekly application of chlorhexidine-based body wash. See Table 1 for details.
Outcomes	This study was nested in a large field-based RCT and utilised clinic-based medical records. Laboratory: none

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Millar 2016 *(Continued)*

	Effectiveness: incidence of ARI at 20 months. The case definition was any occurrence of the following ICD-9 symptom or disease-specific codes: 460 to 466, 480 to 488, and specifically 465.9, 482.9, 486, and 487.1. Safety: adverse effects neither planned nor reported by the investigators
Notes	The period study conducted: May 2010 to January 2012 Government funded. Declaration of interests: none declared.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	quote: "computer-generated random numbers to 1 of the 3 study groups"
Allocation concealment (selection bias)	Unclear risk	No information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	The study was open-label and self-reporting of ARI. It is planned as secondary objective of an original trial. Data abstractors were blinded to group assignment.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Data abstractors were blinded to group assignment.
Incomplete outcome data (attrition bias) All outcomes	High risk	There is a statistically significant difference between attrition rates in the 3 groups. The reasons for attrition are briefly reported in Table 1 of the original study (Ellis and colleagues 2014), but are unlikely to be related to the outcomes of this study. ARI cases were captured utilising clinic-based medical records, but this outcome is not prespecified in the protocol.
Selective reporting (reporting bias)	High risk	The study was conducted for another purpose. According to the study protocol, the outcomes of interest in the current report were not mentioned as outcomes when the study was planned. ARI is not prespecified as an outcome in the protocol published on ClinicalTrials.gov.

Miyaki 2011

Study characteristics

Methods	A quasi-cluster-RCT
Participants	A total of 15,134 assigned to intervention (N = 6634 workers) and control (N = 8500 workers) Inclusion criteria: all general employees (aged 19 to 72 years in 2009) of 2 sibling companies of a major car industry in Kanagawa Prefecture, Japan. All workers who regularly reported to the workplace were included, regardless of treatment for chronic diseases. All employees have the same health insurance plan and were followed up in the same way.
Interventions	Quote: "The intervention involved asking workers whose family members developed an influenza-like illness (ILI) to stay at home. If any co-habiting family members showed signs of influenza-like illness

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Miyaki 2011 *(Continued)*

	(ILI), employees ... were asked to stay at home voluntarily until 5 days has passed since the resolution of the ILS symptoms or 2 days after alleviation of fever." See Table 1 for details.
Outcomes	Workroom: influenza A test kit (rapid test) Effectiveness: assess the effectiveness of household quarantine in reducing the incidence of influenza A H1N1. ILI was defined as a body temperature greater than 38 °C or more than 1 °C above the normal temperature accompanied with more than 2 of these symptoms: nasal mucus, pharyngeal pain, cough, chills or heat sensation Safety: the incidence of influenza A H1N1 amongst workers who were told to stay home if a family member developed ILI was higher (relative risk of 2.17; P < 0.001) compared to control group. No other safety measures/harms reported. Compliance: quote: "our intervention was not compulsory; we only asked the employees to leave the workplace for a while on full pay, and we succeeded in getting all workers' agreement. In our case, explaining that the home waiting policy might be beneficial to the whole workers and help to avoid stopping the manufacturing lines (explaining it is for the benefit of the public) and guaranteeing payment during the leave (financial support) helped them to obey our request."
Notes	Period study conducted: 1 July 2009 to 19 February 2010 Unfunded There are no conflicts of interest to declare.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No information given.
Allocation concealment (selection bias)	Unclear risk	No information given.
Blinding of participants and personnel (performance bias) All outcomes	Low risk	The nature of the intervention (stay at home) was confirmed in the intervention group, where all workers agree as they were financially supported during absences due to ILI.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"Company doctors diagnosed the disease through a positive result of an influenza A test or clinical symptoms", but not clear if they were blinded to assignment; however, the diagnostic process is meticulous and objectively confirmed.
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases are included in the analysis, and none were lost to follow-up.
Selective reporting (reporting bias)	Unclear risk	Although all outcomes of interest are clearly specified, described, and followed up, and text and numbers checked out well and based on the outcome stated for the study, there is no published protocol to match the planned vs the reported outcomes.

Morton 2004

Study characteristics

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Morton 2004 *(Continued)*

Methods	Cross-over study to evaluate the effectiveness of an alcohol gel as an adjunct to regular hand-washing for decreasing absenteeism amongst elementary children by reducing specific communicable diseases such cold, flu, and conjunctivitis. The study was conducted in an elementary school in New England, USA. In the cross-over design, classrooms in each grade level were randomised to begin as the experimental group (alcohol gel) or the control group (regular hand-washing). A study protocol for hand hygiene was introduced following the germ unit education. The hand-washing product was a soap-and-water alternative that is approximately 60% ethyl alcohol. In phase 1 (46 days) children in 9 classrooms were in the experimental group, and children in 8 classrooms were in the control group. After a 1-week washout period when no children had access to the alcohol gel, phase 2 (47 days) started, and the classroom that had participated before as experimental group passed into the control group and vice versa. Data were collected by the parents, who informed the secretary or the school nurse of the reasons for a child's absence, including symptoms of any illness. Respiratory illnesses were defined by symptoms of URTI.
Participants	253 children, 120 girls and 133 boys, from kindergarten to 3rd grade. Of the eligible 285 students, 32 children dropped out (10 due to skin irritation and 22 because of lack of parental consent). No denominator breakdown by arm is reported because the study used a cross-over design.
Interventions	Use of an alcohol gel as an adjunct to regular hand-washing and educational programme versus regular hand-washing and educational programme. See Table 1 for details.
Outcomes	Laboratory: no Effectiveness: days of absences from school for respiratory illness Safety: N/A
Notes	Risk of bias: high (no description of randomisation; partial reporting of outcomes, numerators and denominators) Note: the authors conclude that significantly fewer children became ill whilst using the alcohol gel as an adjunct to regular hand-washing than when using regular hand-washing only (decreased school absenteeism of 43% with the use of alcohol gel on top of hand-washing). The authors also described, as a limitation of the study, the fact that the school nurse served as the data collector, which could be perceived as bias in measurement of the outcome variable. Randomisation and allocation are not described; no cluster coefficients were reported; and attrition was not taken into consideration during the analysis. Unit of randomisation and analysis are different. No reporting by arm. No ORs, no CIs reported. Funding: Maine Administrative School District #35 in Eliot, Maine, and South Berwick, Maine. Conlicts of interest: none declared.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Insufficient information
Allocation concealment (selection bias)	Unclear risk	Insufficient information
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Quote: "A cross-over design was used. In the crossover design, classrooms in each grade level were randomized to begin as the experimental group (regular hand washing)."
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote:"The school nurse served as the data collector for the duration of the study. This could be perceived as bias in the measurement of the outcome variable, absenteeism related to infectious illness."

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Morton 2004 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient information
Selective reporting (reporting bias)	Unclear risk	Insufficient information

Najnin 2019

Study characteristics	
Methods	Cluster-RCT, parallel assignment
Participants	Residents of the high-risk, cholera-prone study areas. Low-income communities in Mirpur area of urban Dhaka defined by low per capita income, poor sanitation, unsafe water use, sharing of water source, and poor living conditions. 90 geographic clusters were included, with 30-metre buffer zones. A total of 7842 households, with 52,237 individuals analysed Vaccine-only area: data were analysed for 1965 households consisting of 13,148 individuals Vaccine-plus-behaviour-change area: data were analysed for 3886 households consisting of 25,566 individuals Control area: data were analysed for 1991 households consisting of 13,523 individuals Study criteria from published protocol: Inclusion criteria: apparently healthy residents of selected vaccination sites, aged 1 year and above, non-pregnant women, written informed consent Exclusion criteria: age less than 1 year and pregnant women
Interventions	Hand-washing and water treatment promotion. See Table 1 for details.
Outcomes	Laboratory: none used Effectiveness: prevalence of respiratory illness. People were classified as having respiratory illness if they reported having fever plus either cough or nasal congestion or fever plus breathing difficulty in the past 2 days of unannounced home visits: in each intervention group and amongst those who had soap/soapy water with water present in the hand-washing station (35% of all groups combined) versus those without this (regardless of the intervention group). Planned secondary outcome: prevalence of reported respiratory illness during 2-year intervention period Safety: no adverse effects planned or reported
Notes	The period study conducted: 2011 to 2013 Funding: government and private Bill & Melinda Gates Foundation Conlicts of interest: none declared.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer-generated randomisation sequence was used to allocate 90 geographical clusters to 1 of 3 groups. Before randomisation, clusters were strat-

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Najnin 2019 *(Continued)*

		ified blocked into 2 categories according to the distance to the hospital. (parent article: Lancet. 2015 Oct 3;386(10001):1362-1371)
Allocation concealment (selection bias)	Unclear risk	No information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	All trial participants and investigators were aware of group assignment. Several in and out migrations across all groups before, after, and during outcome monitoring, and large number of changes in intervention areas
Blinding of outcome assessment (detection bias) All outcomes	High risk	Several in and out migrations across all groups before, after, and during outcome monitoring, and large number of changes in intervention areas
Incomplete outcome data (attrition bias) All outcomes	High risk	High migration movement. This could have distorted the baseline characteristics even more. Very hard to assess because the numbers in the index paper are different from the parent paper (Qadri 2015). In addition to that, for each intervention, data were analysed for 15% to 30% of those allocated on start date. Each group started with approximately 80,000 people; the number analysed is much lower (237,216 people were in the study area on start date of outcome monitoring, the total number analysed across all groups was 52,237). No info about data on migrated individuals or on those who changed intervention areas was dealt with? Also data for prevalence of ARI adjusted for age and wealth were not shown. The outcome is addressed in the 2 days preceding an unannounced visit. This means that if there was a respiratory illness in the past week it would not have been reported. Moreover, these monthly unannounced visits were done to a different set of participants in each group!
Selective reporting (reporting bias)	High risk	Published protocol does not include respiratory illness as an outcome.

Nicholson 2014

Study characteristics	
Methods	Cluster-RCT
Participants	70 low-income communities in Mumbai, India (35 communities per arm) were randomised to intervention arm (N = 1025) and control arm (N = 1026). Households located in low-income urban communities in west and south Mumbai, India. Each household contains 1 target child in the first year of a municipal school (typically aged 5 years).
Interventions	Combination of hand-washing promotion with provision of free soap aimed at 5-year-olds with provision of free soap. See Table 1 for details.
Outcomes	Laboratory: none reported Effectiveness: Primary outcomes: episodes of diarrhoea, ARIs, and school absences amongst target children, and episodes of diarrhoea and ARIs among their families Secondary outcomes: episodes of eye infections, vomiting, abscesses or boils, headaches, and earache

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Nicholson 2014 *(Continued)*

	Operational defiinitions for all the illnesses were taken from *Black's Medical Dictionary* (MacPherson 1999). ARIs as "pneumonia, cough, fever, chest pain and shortness of breath, cold, inflammation of any or all of the airways, that is, nose, sinuses, throat, larynx, trachea and bronchi" Safety: no safety measures planned or reported by the investigators
Notes	The period study conducted: 22 October 2007 to 2 August 2008 Funding: multinational corporate company (Unilever plc.) Conlicts of interest: none declared.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Coin tossing used, which could have led to a large imbalance.
Allocation concealment (selection bias)	Low risk	"a coin toss was used to assign one community in each pair to intervention and one to control"
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants knew to which arm they had been recruited. Households were removed from the study if they provided no data for 5 consecutive weeks.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Data collectors were independent of the behaviour change intervention. Each was assigned exclusively to either households in the intervention group or to control households. However, communities, where very low literacy levels exist, were replaced after randomisation.
Incomplete outcome data (attrition bias) All outcomes	High risk	Data for non-completers were available and similar across groups. ITT and PP were performed. However, households were removed from the study if they provided no data for 5 consecutive weeks.
Selective reporting (reporting bias)	Unclear risk	No information to judge

Pandejpong 2012

Study characteristics

Methods	Cluster-RCT, single study centre
Participants	Children (total number = 1437) were randomised to alcohol hand gel every 60 minutes (N = 452 children), every 120 minutes (N = 447 children), and once before lunch (N = 540 children). Inclusion criteria: all children in a large private school in suburban Bangkok, Thailand, all ages, both genders with parental consent to participate. Exclusion criteria: an allergy to alcohol hand gel
Interventions	3 disinfection interventions: Alcohol hand gel applied every 60 minutes vs every 120 minutes vs once before lunch (3 groups). The current school standard for hand hygiene (q lunch group). See Table 1 for details.
Outcomes	Laboratory: none

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Pandejpong 2012 *(Continued)*

	Effectiveness: Primary: rates of absenteeism from physician-confirmed ILI Secondary: rate of absenteeism caused by total reported ILI (with and without a doctor's confirmation) In case the child was sick but did not see a doctor, the parents were asked to report any of the following symptoms: runny nose or cough, fever or chills, sore throat, headache, diarrhoea, and presence of hand, foot, or mouth ulcers. If 2 or more of these symptoms were reported, then the child's illness was documented as an ILI. Safety: investigators reported that no adverse reaction to the alcohol hand gel was reported in any participants
Notes	The period study conducted: December 2009 to February 2010 Funding: Royal College of Physicians of Thailand Conflict of interest: none to report

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No information provided.
Allocation concealment (selection bias)	Unclear risk	No information provided.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Parents and teachers are aware of the assignment. Teachers were responsible for recording the absenteeism case record forms. Parents would report child sickness. No diagnostic tests, even in the case of physician-confirmed ILI
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome is physician-confirmed ILI.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "No students were lost to follow-up or discontinued the intervention during the study period."
Selective reporting (reporting bias)	Low risk	All outcomes were reported.

Priest 2014

Study characteristics

Methods	A cluster-RCT
Participants	Study included children aged 5 to 11 years at 68 primary schools in New Zealand. Schools were randomised to hand sanitiser + education session arm (34 schools and 8859 children) and education session arm (34 schools and 7386 children). Inclusion criteria:

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Priest 2014 *(Continued)*

	School-level inclusion: at least 100 children of primary school age (school years 1 to 6; children will generally range in age from 5 years to 11 years) at November 2008. Schools that are not currently using hand-sanitiser products or are willing to not use them for the period of the trial. Schools are within the City boundaries of Christchurch, Dunedin, or Invercargill in New Zealand. The principal of the school consents to the school being included in the trial. Not ''special schools'' (e.g. schools for children with deafness or disability) and either not currently using hand-sanitiser products or willing to not use them for the period of the trial if they were randomised to the control group were eligible to participate in the trial. Student-level inclusion (follow-up children): children were eligible to participate in the follow-up group, for whom more detailed information on absences was collected, if they attended a school year 1 to 6 class in 1 of the included schools at the beginning of the second school term in 2009 (the end of April), and their caregivers completed the consent form indicating that they were willing to be telephoned following their child's absences and that they were able to take part in telephone interviews in English Exclusion criteria: School-level exclusion: special needs schools Student-level exclusion (follow-up children): children of the principal investigators and study personnel of the trial. Or, children of families that the principal of the primary school directs us not to approach
Interventions	Hand sanitiser provision (in addition to hand hygiene education session also provided to control group) in schoolchildren. See Table 1 for details.
Outcomes	Laboratory: none Effectiveness: Primary outcome: the incidence rate of absence episodes from school (reported by the parents during telephone calls) due to any illness during the study period (winter term) Secondary outcomes: assessing whether hand sanitiser was effective in reducing the: 1. incidence rate of respiratory illness absence episodes, 2. incidence rate of gastrointestinal illness absence episodes, 3. incidence rate of absence for any reason, 4. length of illness episode, 5. length of illness absence episode, and 6. incidence rate of subsequent illness amongst other children or adults in the household. Definition of respiratory illness: at least 2 of the following caregiver-reported symptoms for 1 day, or 1 of the following symptoms for 2 days (but not fever alone): runny nose, stuffy or blocked nose or noisy breathing, cough, fever, sore throat, or sneezing Safety: examined whether the use of hand sanitiser was associated with an increased risk of any skin reactions during the intervention period. Skin reactions: dryness, redness, flakiness, itchiness, eczema, and any other skin reactions
Notes	The period study conducted: 27 April to 25 September 2009 Government funded: Health Research Council of New Zealand Competing Interests: the authors have declared that no competing interests exist. All authors affirm that they are not involved in any other trials on the same or a related intervention.

Risk of bias

Bias	Authors' judgement	Support for judgement

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Priest 2014 *(Continued)*

Random sequence generation (selection bias)	Low risk	Quote: "Stata/MP 10.1 for Windows was used to generate the random numbers"
Allocation concealment (selection bias)	Low risk	Done by trial statistician provided with school codes and district and randomised the schools to either "A" or "B"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Outcome assessors were blinded to the group allocation until the analysis was completed.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessors were blinded to the group allocation until the analysis was completed.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	The study flow diagram gives a clear account on follow-up, with numbers of those lost to follow-up and those who discontinued the intervention along with the reasons for doing so. No child was excluded from the analysis. Only PP analysis was reported.
Selective reporting (reporting bias)	Low risk	All outcomes stated in the published protocol were reported in the study. The exception was quote: "1 planned secondary outcome (that is irrelevant to our study) that was not collected and 2 collected secondary outcomes that were not planned in the original protocol".

Radonovich 2019

Study characteristics	
Methods	Cluster-RCT, multicentre, pragmatic effectiveness trial
Participants	Study included 280 clusters randomly assigned to N95 respirators (189 clusters and 1993 HCPs) and medical masks (191 clusters and 2058 HCPs). All participants in a cluster worked in the same outpatient clinic or outpatient setting. All participants were permitted to participate for 1 or more years and gave written consent for each year of participation. Inclusion criteria: healthcare workers in outpatient settings serving adult and paediatric patients with a high prevalence of acute respiratory illness. Participants were aged at least 18 years and employed at 1 of the 7 participating health systems, and self-identified as routinely positioned within 6 feet (1.83 m) of patients. Participants were full-time employees (defined as direct patient care for approximately ≥ 24 hours weekly) and worked primarily at the study site (defined as ≥ 75% of working hours). Exclusion criteria: medical conditions precluding safe participation or anatomic features that could interfere with respirator fit, such as facial hair or third-trimester pregnancy. Participants self-identified race and sex using fixed categories; these variables were collected because facial anthropometrics related to race and sex may influence N95 respirator fit.
Interventions	Fit-tested N95 respirators versus medical masks when near patients with respiratory illness. See Table 1 for details.
Outcomes	Laboratory. Primary outcome: the incidence of laboratory-confirmed influenza, defined as: 1. detection of influenza A or B virus by RT-PCR in an upper respiratory specimen collected within 7 days of symptom onset; 2. detection of influenza from a randomly obtained swab from an asymptomatic participant; and

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Radonovich 2019 *(Continued)*

3. influenza seroconversion (symptomatic or asymptomatic), defined as at least a 4-fold rise in haemagglutination inhibition antibody titres to influenza A or B virus between pre-season and postseason serological samples deemed not attributable to vaccination.

Effectiveness. Secondary outcomes: the incidence of 4 measures of viral respiratory illness or infection as follows:

1. acute respiratory illness with or without laboratory confirmation;
2. laboratory-detected respiratory infection, defined as detection of a respiratory pathogen by PCR or serological evidence of infection with a respiratory pathogen during the study surveillance period(s), which was added to the protocol prior to data analysis;
3. laboratory-confirmed respiratory illness, identified as previously described (defined as self-reported acute respiratory illness plus the presence of at least PCR–confirmed viral pathogen in a specimen collected from the upper respiratory tract within 7 days of the reported symptoms and/or at least a 4-fold rise from pre-intervention to postintervention serum antibody titres to influenza A or B virus; and
4. influenza-like illness, defined as temperature of at least 100 °F (37.8 °C) plus cough and/or a sore throat, with or without laboratory confirmation.

Safety: no serious study-related adverse events were reported. 19 participants reported skin irritation or worsening acne during years 3 and 4 at 1 site in the N95 respirator group.

Notes	The study was conducted from September 2011 to May 2015, with final follow-up on 28 June 2016. Compliance: adherence was reported on daily surveys 22,330 times in the N95 respirator group and 23,315 times in the medical mask group. Quote: "Always" was reported 14,566 (65.2%) times in the N95 respirator group and 15,186 (65.1%) times in the medical mask group; "sometimes" 5407 (24.2%) times in the N95 respirator group and 5853 (25.1%) times in the medical mask group; "never" 2272 (10.2%) times in the N95 respirator group and 2207 (9.5%) times in the medical mask group; and "did not recall" 85 (0.4%) times in the N95 respirator group and 69 (0.3%) times in the medical mask group. Participant-reported adherence could not be assessed in 784 participants (31.2%) in the N95 respirator group and 822 (30.8%) in the medical mask group (P = 0.84) because of lack of response to surveys or lack of adherence opportunities (i.e. participants did not encounter an individual with respiratory signs or symptoms). Analysed post hoc, participant adherence was reported as always or sometimes 89.4% of the time in the N95 respirator group and 90.2% of the time in the medical mask group. Government funded. Conflict of interest disclosures: Dr Bessesen reported receiving grants from the Department of Veterans Affairs during the conduct of the study. Dr Brown reported receiving grants from the US Department of Veterans Affairs during the conduct of the study. Dr Cummings reported receiving grants from the Centers for Disease Control and Prevention, the National Institutes of Health, and MedImmune outside the submitted work and the Biomedical Advanced Research and Development Authority during the conduct of the study. Ms Los reported receiving grants from Centers for Disease Control and Prevention, the Veterans Health Administration, and the Biodefense Advanced Research and Development Agency during the conduct of the study. Dr Gibert reported receiving financial support for the conduct of the study, including research personnel, from the Veterans Health Administration during the conduct of the study. Dr Gorse reported receiving grants from the US Department of Veterans Affairs during the conduct of the study. Dr Nyquist reported receiving grants from the Centers for Disease Control and Prevention/Division of Healthcare Quality Promotion, the National Institute for Occupational Safety and Health, and the Veterans Health Administration during the conduct of the study; personal fees and nonfinancial support from Sequirus outside the submitted work; and serving on a policy making committee regarding infectious disease for the American Academy of Pediatrics Committee on Infectious Diseases. Dr Reich reported receiving grants from Veterans Health Administration during the conduct of the study. Dr Rodriguez-Barradas reported receiving grants from Veterans Affairs Central Office during the conduct of the study. Dr Perl reported receiving grants from the Centers for Disease Control and Prevention and Biomedical Advanced Research and Development Authority during the conduct of the study and grants from Medimmune outside the submitted work. No other disclosures were reported.

Risk of bias

Bias	Authors' judgement	Support for judgement

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Radonovich 2019 *(Continued)*

Random sequence generation (selection bias)	Low risk	Computer-generated random sequences by an individual not involved in the study implementation and data analyses. Used stratified randomisation
Allocation concealment (selection bias)	Low risk	Used constrained randomisation
Blinding of participants and personnel (performance bias) All outcomes	Low risk	The participants cannot be blinded, but it seems that all the measures otherwise were the same with meticulous follow-up. Besides, the primary outcome was lab based (an objective outcome), which is unlikely to be affected by of lack of blinding. Investigators were blinded to the randomisation until completion of the study and analysis.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Primary outcome is laboratory-confirmed diagnosis.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "Missing outcomes were imputed using standard multiple imputation techniques, creating multiple imputed data sets with no missing values for each analysis"
Selective reporting (reporting bias)	Low risk	Reported study outcomes matched the published protocol. Every outcome was accounted for.

Ram 2015

Study characteristics	
Methods	RCT
Participants	377 household compounds (index cases) completed the study. Control arm has 184 compounds with 1607 contacts, and intervention group has 193 compounds with 1814 contacts. Final analysis was performed on 193 index cases and 1661 contacts in the intervention group and 184 index cases and 1498 contacts in the control group. In 2009, index case-patients with symptom onset within 7 days preceding enrolment were eligible. Eligibility criteria changed in 2010 to include index case-patient with symptom onset within 48 hours preceding enrolment. Inclusion criteria: 1. Individuals ≥ 5 years old: ILI, defined as history of fever and either cough or sore throat with fever onset within the previous 24 hours. 2. Individuals < 5 years old: any child with acute fever with onset within the previous 24 hours. 3. Return to home within 24 hours of presentation to Upazilla Health Complex, Jahurul Islam Medical College Hospital or the local pharmacies, i.e. the index case cannot be admitted for treatment. If admitted, the patient would not be eligible. 4. No fever in any bari resident during the 7 days preceding the patient's presentation to hospital (see definition below). 5. At least 2 individuals (in addition to the index case-patient) who intend to reside in the bari during the subsequent 20 days. 6. Residence within 30 minutes travel time (1-way) from the Upazilla Health Complex or Jahurul Islam Medical College Hospital or the local pharmacy. Exclusion criteria: compounds were excluded if any compound member(s) was reported to have fever within 3 days before index case-patient enrolment. At another time point, compounds were excluded

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Ram 2015 *(Continued)*

	if any primary household member was reported to have fever (fever occurring within 48 hours prior to enrolment recorded).
Interventions	Promoting intensive hand-washing in households to prevent transmission of ILI. See Table 1 for details.
Outcomes	Laboratory: PCR for influenza A and B, with further subtyping of influenza A isolates for all ILI amongst contacts Effectiveness: incidence of ILI. An age-based definition of ILI was used as follows. 1. For individuals > 5 years old, ILI was defined as history of fever with cough or sore throat. 2. For children < 5 years old, ILI was defined as fever (the authors used this relatively liberal case definition in order to include influenza cases with atypical presentations in children). Safety: no safety data planned or reported by investigators
Notes	Inclusion/exclusion criteria changed 3 times during the study conduct. The period study conducted: June 2009 to December 2010 Government funded Competing interests: the authors have declared that no competing interests exist.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Block randomisation, with a block size of 4, in order to promote random and even allocation of household compounds to the 2 treatment arms. The list of random assignments was generated by an investigator with no contact with the participants.
Allocation concealment (selection bias)	Low risk	Once baseline data collection was complete, the data collector notified the field research officer, who consulted the block randomisation list to make the assignment of the household compound to intervention or control.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Relied on symptom reporting from the head of family. Inclusion/exclusion criteria changed 3 times during the study conduct. Given the provision of a hand-washing station as part of the intervention, it was not possible to ensure blinding of participants, intervention staff, or data collectors.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Relied on symptom reporting from the head of family. Inclusion/exclusion criteria changed 3 times during the conduct of the study. Given the provision of a hand-washing station as part of the intervention, it was not possible to ensure blinding of participants, intervention staff, or data collectors.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Flow chart followed all households an individuals from recruitment to analysis.
Selective reporting (reporting bias)	Low risk	The specified outcomes are clearly accounted for Investigators report all outcomes for each modified enrolment.

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Roberts 2000

Study characteristics	
Methods	Open cluster-RCT carried out between March and November 1996 (the Southern Hemisphere winter season) in 23 childcare centres caring for a minimum of 50 children 10 hours a day, 5 days a week in Australia. The study assessed the effects of an Australian national hand-washing programme compared to standard procedure. Randomisation was according to a random-number table, and cluster coefficients are reported.
Participants	Children (299 in the intervention arm and 259 in the control arm) aged 3 or younger attending the centres at least 3 days a week. Attrition was 51 children in the intervention arm and 72 children in the control arm due mainly to staff leaving the centres.
Interventions	Hand-washing programme with training for staff and children. It is unclear whether any extra hand-cleansing agents were used, as GloGerm (?) is mentioned when it was used in a preliminary study. See Table 1 for details.
Outcomes	Laboratory: N/A Effectiveness: ARI (runny nose, cough, and blocked nose) Follow-up was via a parental phone interview every 2 weeks. Safety: N/A
Notes	Risk of bias: low (cluster coefficients and analysis by unit of randomisation) Note: the authors conclude that although there was no overall decrease in respiratory illness (RR 0.95, 95% CI 0.89 to 1.01), in children up to 24 months the decrease was statistically significant (RR 0.90, 95% CI 0.83 to 0.97). The authors speculated that this was because maximum benefits are likely from this age group due to their limited ability to wipe their nose and hands without a structured programme. Analyses by 3 compliance levels are also reported. A so-so reported and well-conducted trial. This work was supported by a grant from the Commonwealth Department of Family Services and Health, Research and Development Scheme. Conflict of interest: none to report.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was according to a random-number table.
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	It was not possible to blind the intervention.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "The observer was not informed of the content of the training sessions or the intervention status of the centres."
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Recruitment rate 88% (23 of 26 CCCs); loss to follow-up not clear, as no denominator given
Selective reporting (reporting bias)	Low risk	Centres were comparable at baseline.

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Sandora 2005

Study characteristics	
Methods	Single-blind, cluster-RCT carried around the Boston area, USA, in the period of November 2002 to April 2003. The trial tested the effects of using a hand sanitiser and a programme of instruction on the transmissions of GI infections (data not extracted) and ARIs in families. Units of randomisation were child-care centres and were carried out on enrolment by an investigator using random block size generated by computer. Assignment was single-blind (i.e. investigator blinded to the status of the centre). Cluster correlation was 0.01.
Participants	292 families with 1 or more children aged 6 months to 5 years who were in child care for 10 or more hours a week 155 children in 14 centres were allocated to the intervention arm and 137 children in 12 centres to the control arm. The mean age was 3 to 2.7 years. Attrition was respectively 15 (3 lost to follow-up and 12 who discontinued the intervention) and 19 (8 lost to follow-up and 11 who discontinued the intervention). ITT analysis was carried out.
Interventions	Alcohol-based hand sanitiser with biweekly hand hygiene educational materials over 5 months versus biweekly educational material on healthy diet. See Table 1 for details.
Outcomes	Effectiveness: ARI (2 of the following symptoms for 1 day or 1 of the following symptoms for 2 days: runny nose, cough, sneezing, stuffy or blocked nose, fever, sore throat). An illness episode had to be separated by 2 symptom-free days from a previous episode. A secondary illness was when it followed a similar illness in another family member by 2 to 7 days. Follow-up was by means of biweekly phone calls to caregivers. Safety: dry skin (71 reports), stinging (11 reports), bad smell (7 reports), dislike (2 reports), allergic reaction (2 reports), slippery feel (1 report), and irritation (20 reports).
Notes	Risk of bias: low Note: the authors conclude that although the rate of GI illnesses was significantly lower in the intervention group, the IRR was not significantly different for ARIs (0.97, 95% CI 0.72 to 1.30). Compliance and droplet route spread may account for this apparent lack of effect. A well-reported trial. Study funds and hand sanitiser were provided by GOJO Industries, Inc (Akron, OH). No conflict of interest declared.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "Random assignments were generated by computer using a permuted-blocks design with random block sizes."
Allocation concealment (selection bias)	Low risk	Low riskUnclear riskHigh risk
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "Teachers in the intervention classrooms were responsible for encouraging the use of the disinfecting wipes and hand sanitizer according to the study protocol ... Given that no placebo was provided and sanitizer use was recorded, neither families nor data collectors could be blinded as to the group assignment of the family."
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quote: "Given that no placebo was provided and sanitizer use was recorded, neither families nor data collectors could be blinded as to the group assignment of the family."

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Sandora 2005 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition was 15 in intervention arm (3 lost to follow-up and 12 who discontinued the intervention) and 19 in the control arm (8 lost to follow-up and 11 who discontinued the intervention). ITT analysis was carried out.
Selective reporting (reporting bias)	Unclear risk	Well-reported

Sandora 2008

Study characteristics	
Methods	Cluster-RCT carried out in a single elementary school system located in Avon, Ohio, USA to assess the effectiveness of a multifactorial infection-control intervention, including alcohol-based hand sanitiser and surface disinfection, in reducing absenteeism caused by gastrointestinal and respiratory illnesses amongst elementary school students. The study also aimed to describe the viral and bacterial contamination of common surfaces in the school classroom and to assess the impact of an environmental disinfectant on the presence of selected viruses and bacteria on these surfaces. Clustering was described as "teams of 3-4 classes depending on the class year".
Participants	A total of 363 students in 15 different classrooms were eligible to participate and received letters about the study. A sample of 285 of these students provided written informed consent and were randomly assigned to the intervention group (146) or to the control group (139) and contributed to final analysis. No students were lost to follow-up or discontinued the intervention during the study period. Baseline demographic characteristics were similar in the intervention and control groups. Most families were white and non-Hispanic and in excellent or very good health at baseline.
Interventions	Alcohol-based hand sanitiser to use at school and quaternary ammonium wipes to disinfect classroom surfaces daily for 8 weeks versus usual hand-washing and cleaning practices. See Table 1 for details.
Outcomes	Laboratory: Serological evidence: no Swabs for bacteria and viruses from 3 types of classroom surfaces were taken. Effectiveness: Respiratory illness defined as days absent as measured by a (blinded) school worker who routinely recorded reason for absenteeism either for gastrointestinal or respiratory causes. Safety: N/A
Notes	The authors conclude that the multifaceted intervention that included alcohol-based hand sanitiser use and disinfection of common classroom surfaces reduced absenteeism from gastrointestinal illness amongst elementary school students. The intervention did not impact on absenteeism from respiratory illness. In addition, norovirus was detected less frequently on classroom surfaces in the group receiving the intervention. The study is of good quality with low risk of bias. The authors checked compliance by counting discarded wipes. Reasons given for the apparent lack of effect against ARIs but good effect on GI illness are that disinfecting the classroom surfaces (daily at lunchtime with alkali) was important, as were the alcohol wipes. The authors measured the norovirus concentration on surfaces and found this to be reduced. Other reasons may be that droplets are not affected by this method, or that contamination of hands by respiratory infections is likely to be continuous (in orofaecal transmission is mostly at the time of defecation). Study funds, hand-sanitiser, and disinfecting wipes were provided by The Clorox Company (Oakland, CA).

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Sandora 2008 *(Continued)*

Financial disclosures: Drs Sandora and Goldmann received a consulting fee from The Clorox Company for their efforts in designing and conducting this study; Dr Shihh as indicated she has no financial relationships relevant to this article to disclose.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "The allocation sequence was generated by computer ..."
Allocation concealment (selection bias)	Unclear risk	Quote: "...and teams were assigned to study groups by a study investigator (Dr Shih)." Blinding of allocation cannot be guaranteed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not possible
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: " All of the students absences were recorded in the usual fashion by the school employee who normally answers this dedicated telephone line. This employee was blinded to the group assignment of the child."
Incomplete outcome data (attrition bias) All outcomes	Low risk	No students were lost to follow-up or discontinued the intervention during the study period.
Selective reporting (reporting bias)	Unclear risk	Well-reported

Satomura 2005

Study characteristics

Methods	RCT. Randomisation was achieved by simple computer-generated random digit. Allocation was concealed using sealed, opaque envelopes. Not clear if there was a central randomisation centre. Post hoc exchange of envelopes was prevented by writing both the name of each participant and the number on the envelope he/she drew before breaking the seal. Participants were not blinded to the intervention; however, disease incidence was determined by 1 study physician who was not informed of the results of assignment. Analysis was done based on the intention-to-treat principle. The study targeted community healthcare all over Japan and was conducted between December 2002 and March 2003 for a follow-up period of 60 days.
Participants	387 participants at 18 sites were recruited, 384 were included in the analysis: water gargling (N = 122), povidone-iodine gargling (N = 132), and control (N = 130). Follow-up was completed on 338 participants. Attrition was fully explained for URTI analysis; however, 2 participants were not accounted for in the ILI analysis. 46 participants did not complete the follow-up due to either discontinuation of diary use (n = 9) or contracting ILI (n = 37). Of the 37 participants with ILI, 11 were in the povidone-iodine group, 12 in the water group, and 14 in the control group. Analysis was performed on 35 participants (Kitamura 2007 [Kitamura 2007]).
Interventions	Participants were randomised to 1 of the following: water gargling, n = 122 (20 mL of water for about 15 seconds 3 times consecutively, at least 3 times a day); povidone-iodine gargling, n = 133 (20 mL of 15 to

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Satomura 2005 *(Continued)*

	30 times diluted 7% povidone-iodine (as indicated by the manufacturer) in the same way as water gargling); and control, n = 132 (retain their previous gargling habits). All groups were asked to fill a daily gargling diary (standardised form to record: gargling habits, hand-washing, and influenza complaints). The frequency of gargling in the water group was higher (3.6); the frequency of hand-washing was similar amongst the 3 groups. URTI symptom was classified according to Jackson methods. Diary recording was continued throughout the follow-up period and for 1 week after the onset of URTI. ILI was reported separately. See Table 1 for details.
Outcomes	Laboratory: none Effectiveness: Primary outcome: incidence of first URTI. Index cases were defined as all of the following conditions: 1. both nasal and pharyngeal symptoms, 2. severity of at least 1 symptom increased by 2 grades or more, and 3. worsening of a symptom of 1 increment or more for > 3 days. Secondary outcome: severity of URTI of the incident cases was assessed by grading each symptom during the initial 7 days after the onset of URTI in numeric scores: none = 0, mild = 1, moderate = 2, and severe = 3 ILI was defined as both developing a fever of 38 °C or higher and worsening arthralgia in addition to some respiratory symptoms (Kitamura 2007). Safety: no harm was reported. However, 2 participants in the povidone-iodine group switched to water gargling (analysed in their assignment group).
Notes	The authors concluded that simple water gargling is effective in preventing URTIs amongst healthy people. However, no statistically significant difference was observed against ILIs. The study was well-conducted; blinding would have added to the validity of the results. In addition, the study was not powered enough to detect a statistically significant preventative effect against ILI. The study demonstrates that in addition to hand-washing, simple gargling even with water can reduce URTI, but not ILI. However, during periods of endemic influenza, multiple inexpensive and simple modalities (hand-washing, masks, gargling) can be utilised together to reduce infection and transmission. Overall, the reporting of the 2 combined studies together is highly confusing. In the first study (Satomura 2005), the main outcome is URTI defined as fever and arthralgia. The second study (which is a presentation of further data from the 2005 publication in the guise of a short report) introduces the outcome ILI with a definition similar to that of URTI in the first study but referring to the earlier outcome as common cold. Also of note is reporting of significance without confidence intervals. Overall, this potentially important study should be repeated with a larger denominator. Unclear risk of bias because of confused reporting and absence of double-blinding. Partial financial support was provided by the Suzuken Memorial Foundation (2002) and Uehara Memorial Foundation (2003) (trial registry, ISRCTN67680497). No financial conflict of interest was reported by the authors of this paper.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Group assignment was based on simple computer-generated random digits..."
Allocation concealment (selection bias)	Low risk	Quote: "By an individual drawing of sealed opaque envelopes, subjects were randomly assigned to the following three groups" Quote: "allocation was completely concealed from study administrators"

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Satomura 2005 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	Not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "To prevent post hoc exchange of the envelopes, local administrators wrote down both the name of each subject and the number on the envelope he/she drew before breaking the seal."
Incomplete outcome data (attrition bias) All outcomes	Low risk	338 of 385 randomised followed up; reasons reported.
Selective reporting (reporting bias)	Unclear risk	Confusing reporting

Savolainen-Kopra 2012

Study characteristics	
Methods	Open cluster-RCT, 3-arm intervention trial
Participants	A total of 21 clusters (683 individuals) were randomised to implement hand hygiene with soap and water (257 individuals), alcohol-based hand rub (202 individuals), or control (224 individuals). The study was conducted in distinct office work units in 6 corporations in the Helsinki Region that together employed some 10,000 staff. All employees (age ≥ 18 years, both genders) were contacted by email survey. Inclusion criteria: quote: "Volunteers working in defined units" Exclusion criteria: quote:"Persons with open wounds or chronic eczema in hands" The designated 21 study clusters were identified as operationally distinct working units, each containing at least 50 people.
Interventions	Hand hygiene with soap and water and standardised instructions on how to limit the transmission of infections. Usual hand hygiene (control). See Table 1 for details.
Outcomes	Laboratory: Quote: "Between November 2008 and May 2010, the seven occupational health clinics serving the six participating corporations were advised to collect, using standard techniques, two to three respiratory samples per week from typical RTI patients and also faecal samples from a few representative patients with gastrointestinal symptoms when a GIT outbreak was suspected. The samples could originate from the study participants and also from work units not included in the study. In the laboratory, viral nucleic acids were extracted with well-characterized commercial kits and tested by validated real-time PCR methods to detect influenza A and B viruses, respiratory syncytial virus, parainfluenza virus types 1, 2, and 3, adenoviruses, human rhinoviruses and human enteroviruses from respiratory specimens, and norovirus from faecal specimens (detailed descriptions of the test procedures are available from the authors)." Effectiveness: Predefined primary endpoints: 1. Number of reported infection episodes in a cluster per total reported weeks. 2. Number of reported sick leave episodes in a cluster per total reported weeks. Secondary endpoints and outcome measures:

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Savolainen-Kopra 2012 *(Continued)*

1. Number of days with reported symptoms of RTI and/or GTI in a cluster within a time frame of 100 reporting weeks.
2. Number of days-off due to own RTI or GTI in a cluster within a time frame of 100 reporting weeks.

Safety: reported 0 adverse events

Notes	The period study conducted: January 2009 to May 2010 Government funded. Competing interests: the authors declare that they have no competing interests.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Insufficient information
Allocation concealment (selection bias)	Low risk	Quote:"clusters were matched and randomized prior to onset of the interventions"
Blinding of participants and personnel (performance bias) All outcomes	High risk	The interventions were not blinded to any party involved (i.e. the study group, participants, or the occupational health services). Subjective reporting of disease episodes
Blinding of outcome assessment (detection bias) All outcomes	High risk	Subjective reporting of disease episodes
Incomplete outcome data (attrition bias) All outcomes	High risk	24% loss to follow-up. However, new recruiting in most clusters; the total number of reporting participants at the end of the trial was 91.7% compared to that at the beginning. Attrition was reported, and 76% of volunteers who started reporting continued to do so until the end of the study. Because of new recruiting in most clusters, the total number of reporting participants at the end of the trial was 626, or 91.7%, compared to that at the beginning. This means that 15.7% of the participants were replaced during the study!!! Raw data on the effects of the interventions on the occurrence of respiratory infections and vomiting/diarrhoea diseases were not reported. Zero adverse effects were reported.
Selective reporting (reporting bias)	Low risk	All planned outcomes were reported.

Simmerman 2011

Study characteristics

Methods	Randomised controlled study
Participants	Study recruited 348 households and 885 members and randomised them as follows: 1. Control (index household = 119, with 302 family members) 2. Hand-washing (index household = 119, with 292 family members) 3. Hand-washing and face mask (index household = 110, with 291 family members)

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Simmerman 2011 *(Continued)*

	The household members of children (index cases) presenting with ILI at the outpatient department of the Queen Sirikit National Institute of Child Health (QSNICH) in Bangkok, the largest public paediatric hospital in Thailand Inclusion criteria: For index cases: children aged 1 month through 15 years, residents of the Bangkok metropolitan area, and had an onset of illness < 48 hours before respiratory specimens tested positive for influenza by an RIDT that was later confirmed by qualitative real-time RT-PCR (rRT-PCR) Eligible index cases' households must have had at least 2 other members aged ≥ 1 month who planned to sleep inside the house for a period of at least 21 days from the time of enrolment. Exclusion criteria: For index cases: children at high risk for severe influenza complications (e.g. chronic lung disease, renal disease, and long-term aspirin therapy) and those treated with influenza antiviral medications Excluded households: those with any member reporting an ILI that preceded the index case by 7 days or less and households where any member had received influenza vaccination during the preceding 12 months
Interventions	Hand-washing, or hand-washing plus paper surgical face mask, or control. See Table 1 for details.
Outcomes	Laboratory: To identify index cases: QuickVue Influenza A+B rapid diagnostic kit (Quidel Co., San Diego, CA, USA), followed by rRT-PCR for influenza viral RNA Index cases and contacts tested with nasal swab and throat swab both processed for rRT-PCR. 2 blood samples for antibody seroconversion collected on Days 1 and 21 (seroconversion defined as a fourfold rise in HI titre between paired sera for any of the antigens assayed). Effectiveness: Laboratory-confirmed secondary influenza virus infections amongst household members described as the secondary attack rate (SAR). A secondary influenza virus infection was defined as a positive rRT-PCR result on Days 3 or 7 or a fourfold rise in influenza HI antibody titres with the virus type and subtype matching the index case. SAR for ILI defined by the WHO as fever plus cough or sore throat, based on self-reported symptoms. Safety: no safety measures planned or reported by the investigators Adherence: participants in the control arm reported an average of 3.9 hand-washing episodes/day (on Day 7), whilst participants in the hand-washing arm reported an average of 4.7 hand-washing episodes/day (95% CI 4.3 to 5.0; P = 0.002 compared to controls), and participants in the hand-washing plus face mask arm reported 4.9 episodes/day (95% CI 4.5 to 5.3; P < 0.001 compared to controls). In the intervention arms, parents had the highest reported daily hand-washing frequency (5.7, 95% CI 5.3 to 6.0) followed by others (4.8, 95% CI 4.3 to 5.3), siblings (4.3, 95% CI 3.7 to 4.8), and the index cases (4.1, 95% CI 3.8 to 4.4). There was no difference in the average amount of soap used in a week in the hand-washing arm (54 mL per person) and the hand-washing plus face mask arm (58.1 mL per person) (P = 0.15). 289 participants in the hand-washing plus face mask arm used an average of 12 masks per person per week (median 11, IQR 7 to 16) and reported wearing a face mask a mean of 211 minutes/day (IQR 17 to 317 minutes/day). Parents wore their masks for a median of 153 (IQR 40 to 411) minutes per day, far more than other relations (median 59; IQR 9 to 266), the index patients themselves (median 35; IQR 4 to 197), or their siblings (median 17; IQR 6 to 107). The study authors note that differences in average usage may be an attenuated measure of appropriate use in relation to the actual unmeasured exposure risk such as proximity to the index case.
Notes	The period study conducted: April 2008 and August 2009

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Simmerman 2011 *(Continued)*

Government funded.

BJC has received research funding from MedImmune Inc. No other declarations are reported.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Randomization was achieved using a block randomization method using a list of blocks each with 12 household IDs, four of which were assigned to each of the three study arms."
Allocation concealment (selection bias)	Unclear risk	Quote: "A study coordinator assigned each household to one study arm after consent was obtained"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Recruiting clinicians were blinded to the allocation of the specific intervention. The participants were not blinded, but it is unlikely that the outcome would have been affected by lack of blinding.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	The primary outcome is a laboratory-confirmed influenza.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Household flow chart provided with reasons for exclusions, all numbers provided. Analysis was done by ITT and PP.
Selective reporting (reporting bias)	Low risk	All outcomes are accounted for in the ITT analysis of the results.

Stebbins 2011

Study characteristics	
Methods	Cluster-RCT, open-label
Participants	Study included 3360 students from 10 Pittsburgh elementary schools. Intervention arm (5 schools, 1695 people) and control arm (5 schools, 1665 people) No inclusion or exclusion criteria were provided.
Interventions	Training in hand and respiratory (cough) hygiene. Hand-sanitiser was provided and encouraged to be used regularly. See Table 1 for details.
Outcomes	Laboratory: Primary outcome: laboratory-confirmed influenza (RT-PCR) amongst children presenting with ILIs leading to their absence from school 2 nasal swabs were obtained using test manufacturer-approved sterile Dacron swabs. 1 swab was employed for influenza testing using the QuickVue Influenza A+B test (Quidel Corp, San Diego, CA). The second nasal swab was delivered on cold pack to the University of Pittsburgh Medical Center Clinical Virology Laboratory, Pittsburgh, PA for RT-PCR testing (performed within 48 hours). The RT-PCR used viral nucleic acid extract (EasyMag; bioMerieux, Durham, NC) and primer/probe sequences for influenza A, influenza B, and influenza A H1 and H3

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Stebbins 2011 *(Continued)*

	subtypes (CDC, Atlanta GA). Effectiveness: Secondary outcome: absence episodes and cumulative days of absence due to ILI, any illness, and all causes Safety: none mentioned
Notes	The period study conducted: 1 November 2007 through 24 April 2008 Funding: this research was supported by Cooperative Agreement number 5UCI000435-02 from the Centers for Disease Control and Prevention (CDC). DC and DB received support from the NIH MIDAS program (1U01-GM070708). DC holds a Career Award at the Scientific Interface from the Burroughs Welcome Fund. No other conflicts declared.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "constrained randomization algorithm"
Allocation concealment (selection bias)	Low risk	Quote: "Random allocation of schools to two arms was created by Dr. Cummings and concealed until intervention assignment". "At the beginning of the school year parents and guardians were given the opportunity to decline participation"
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	In 76% and 78% of illness in intervention and control group were laboratory confirmed. ILI is objectively defined.
Incomplete outcome data (attrition bias) All outcomes	High risk	Only episodes of identified causes were analysed. Causes of absence episodes in 66% of the study participants were not identified (2092 in the intervention group and 2232 in the control group). The parents could be contacted in only 34% cases of absence. About half of them had an illness, and in one-third of these cases the illness met the criteria of ILI (361 cases (33%)). Of these, 279 (77%) were tested for influenza.
Selective reporting (reporting bias)	Unclear risk	Insufficient information to judge

Suess 2012

Study characteristics

Methods	Cluster-RCT, open-label, parallel design
Participants	Study sample included 84 households randomised as follows: 1. 30 control (index cases = 30, household contact = 82) 2. 26 mask group (index cases = 26, household contact = 69)

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Suess 2012 *(Continued)*

	3. 28 mask and hand hygiene group (index cases = 28, household contact = 67) Inclusion criteria: patients presenting to general practitioners or family physicians at the study sites within 2 days of symptom onset; had a positive rapid antigen test for influenza (later to be confirmed by quantitative RT-PCR (qRT-PCR); and was at least 2 years old. Index cases also had to be the only household member suffering from respiratory disease within 14 days prior to symptom onset. Exclusion criteria were pregnancy, severely reduced health status, and HIV infection. 1-person households were also not eligible or inclusion.
Interventions	Quote: "facemask and practising intensified hand hygiene (MH group), wearing facemask only (M group) and none of the 2 (control group)". See Table 1 for details.
Outcomes	Primary outcomes: SAR of laboratory-confirmed (qRT-PCR) influenza infection amongst household members (secondary infection cases) presenting with ILI within the observation period (8 days from the date of onset). ILI was defined as fever (> 38.0 °C) + cough or sore throat. Nasal wash specimens (or if these were not possible, nasal swabs) from all participating household members Effectiveness: Secondary outcomes: laboratory-confirmed influenza infection in a household contact (secondary infection cases). The study authors defined a symptomatic secondary influenza virus infection as a laboratory-confirmed influenza infection in a household member who developed fever (> 38.0 °C), cough, or sore throat during the observation period. They termed all other secondary cases as subclinical. A secondary outcome measure was the occurrence of ILI as defined by WHO as fever plus cough or sore throat. Safety: study reported that the majority of participants (107/172, 62%) did not report any problems with mask-wearing. This proportion was significantly higher in the group of adults (71/100, 71%) compared to the group of children (36/72, 50%) (P = 0.005). The main problem reported by participants (adults as well as children) was "heat/humidity" (18/34, 53% of children; 10/29, 35% of adults) (P = 0.1), followed by "pain" and "shortness of breath" when wearing a face mask.
Notes	Period study conducted: November 2009 to April 2011 Adherence: in general, daily adherence was good, reaching a plateau of over 50% in nearly all groups (M and MH groups; 2009/10 and 2010/11) from the third day on (by then the intervention had been implemented in all households). A gradual decline towards lower adherence began around the sixth day of the index patient's illness. Government funded. The authors declare that they have no competing interests.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "prepared lists of random numbers with Microsoft Excel 2003 (Mircosoft™ Cooperation, Seattle, USA) which were divided between the three intervention groups. Each participating physician received a list of random numbers with the interventions represented in a 1:1:1 ratio"
Allocation concealment (selection bias)	Low risk	Quote: "the participating physician received a list of random numbers with the interventions represented in a 1:1:1 ratio. Eligible index patients were randomly assigned a number, which was then communicated to the study center. The resulting intervention was only communicated to the households with the physicians. Intervention material was given to the study sites in closed boxes marked only with the randomisation number. Recruiting physicians were not aware of the allocation of the numbers to the interventions and the boxes for the three intervention arms looked identical. After randomisation, participants were given their box by the physician's assistants"

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Suess 2012 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Outcomes are very objective and therefore unlikely to be influenced by lack of blinding. In addition, Quote: "physicians (as well as laboratory personnel) blinded from the randomisation results".
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: physicians (as well as laboratory personnel) blinded from the randomisation results". Outcomes are very objective and therefore unlikely to be influenced by lack of blinding.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No loss to follow-up. Daily follow-up home visits over the short period of data collection (8 days)
Selective reporting (reporting bias)	Low risk	The follow-up period is very short (8 days) with very good coverage, and the criteria for defining the outcome are highly objective. All planned outcomes were reported.

Swarthout 2020

Study characteristics	
Methods	Cluster randomised open-label controlled trial carried out over 18 months in Kenyan geographically near villages to test the effect of a package of measures on pregnant mothers and then on prevalence of ARIs in their young children
Participants	7246 pregnant women in 702 clusters were enrolled, with 6960 children in year 1 and 7088 in year 2 children with available ARI data. The mean ages of index children and siblings younger than 3 years were 14.2 months (SD: 6.77 months) and 22.9 months (SD: 5.70 months) for years 1 and 2, respectively. The cluster-level intra-cluster correlation coefficient for ARIs was 0.026 for both years. There were 2212 households with 2279 children lost to follow-up by year 2 for unspecified reasons
Interventions	There were 6 intervention groups: chlorinated drinking water (W), improved sanitation (S), handwashing with soap (H), combined WSH, improved nutrition (N) through counselling lipid based nutrient supplementation (LNS) combined WSHN There were 2 control groups passive control (no promotional visits), a double-sized active control (monthly visits to measure mid–upper arm circumference) All were done through health promoters with follow up 1 or 2 years after intervention. See Table 1 for details.
Outcomes	Laboratory NR Effectiveness Prevalence of ARIs in children (defined as cough or difficulty breathing, including panting or wheezing, within 7 days before the interview - in children younger than 3 years). Secondary outcomes included difficulty breathing, including panting or wheezing, in the past 7 days (a more specific indicator of respiratory infection than a cough alone); ARI symptoms presenting with fever in the past 7 days (a potentially more severe infection); and facilitator observed runny nose. As this was a rare outcome, caregiver-reported runny nose was analysed post hoc Safety NR
Notes	Quote: "The authors conclude that Water, sanitation, and handwashing interventions with behaviour change messaging did not reduce ARIs. Nutrition counselling and LNS modestly reduced ARI symptoms compared with controls in year 1 [prevalence ratio (PR): 0.87, 95% confidence interval (CI): 0.77–0.99], but no effect in the combined WSHN group weakens this finding" Financial support: this work was supported by the Bill & Melinda Gates Foundation (OPPGD759).

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Swarthout 2020 *(Continued)*

	The authors declare no further competing interests.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer random-number generator
Allocation concealment (selection bias)	Unclear risk	Insufficient information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not blinded
Blinding of outcome assessment (detection bias) All outcomes	High risk	Not blinded
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition balanced across groups and < 20%
Selective reporting (reporting bias)	High risk	None of the outcomes reported were prespecified in the trial registry

Talaat 2011

Study characteristics

Methods	Cluster-RCT
Participants	Children (N = 44,451) in the first 3 primary grades from 60 governmental elementary schools in Cairo, Egypt were included and randomised to 30 schools in the intervention arm (N = 20,882 students) and 30 control schools (N = 23,569 students). No exclusion criteria provided.
Interventions	Students were required to wash their hands at least twice during the school days for about 45 seconds, followed by proper rinsing and drying on a clean towel. Campaign material was developed, and posters were placed near sinks in the classroom and playground to encourage hand-washing with soap and water upon arriving at school, before and after meals, using the bathroom, and after coughing and sneezing. See Table 1 for details.
Outcomes	Laboratory: point-of-care influenza A and B viruses using QuickVue (QuickVue; Quidel Corp., San Diego, CA, USA). School nurses collected nasal swabs from children who visited the school clinic with ILI, and only for students who had prior written approval of a parent. Effectiveness: rates of absenteeism caused by ILI and laboratory-confirmed influenza. ILI defined as fever > 38 °C and either cough or sore throat. Safety: none planned or reported by the investigators
Notes	The period study conducted: 16 February to 12 May 2008

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Talaat 2011 *(Continued)*

Funding: this work was supported by the Centers of Diseases Prevention and Control, Work Unit no. 6000.000.000.E0016.

No interests declared.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "computer-generated random number table"
Allocation concealment (selection bias)	Unclear risk	No information given.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	The participants and study personnel were not blinded, although lack of blinding is unlikely to have influenced the outcome. Laboratory-confirmed influenza was only conducted only for students who had prior written approval of a parent.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote: “Differential interest of study teams may have contributed to the low rate of testing in students who were absent because of ILI in the control schools compared to the intervention schools (12% vs 22%)”
Incomplete outcome data (attrition bias) All outcomes	High risk	No flow chart of clusters flow during the study period. No information on withdrawal. Differential interest of study teams may have contributed to the low rate of testing in students who were absent because of ILI in the control schools compared to the intervention schools (12% vs 22%) incomplete or loss of data. The total number ILI episodes could be an underestimate, as there is no proactive method to look for symptoms of ILI amongst the students; it depends on the student being absent or in class with symptoms that are picked up by the teachers at school.
Selective reporting (reporting bias)	Unclear risk	Insufficient information to judge

Teesing 2021

Study characteristics	
Methods	Cluster - trial taking place in 66 nursing homes units (33 nursing homes) in the Netherlands during October to December 2016 with 2 follow-up periods (January to April 2017, May to October 2017). Randomisation was carried out by computer and there were some post-randomisation imbalances: the intervention arm had more small and medium-sized nursing homes (< 88 beds, 88 to 118 beds) and the control arm had more large nursing homes (> 118 beds).
Participants	Nursing home staff whose compliance was measured with direct observation according to the WHO-defined HH moments and recorded in a novel app. “The nurses were blinded by giving distinct names to the lessons (The New Way of Working) and the observations (HANDSOME), so that they appeared to be different projects. Nurses were told that the observers were registering the frequency of health care activities (in general)”. Staff worked in 66 nursing home units, 36 (976 beds, median 25 per unit) in the intervention arm, and 30 (886 beds, median 28 per unit) in the control arm. During the trial 8 (12%) units left the study during the follow-up for various reasons: 6 intervention units (four during Follow-up 1 and 2 during Follow-up 2) and 2 control units (both during Follow-up 2)

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Teesing 2021 *(Continued)*

Interventions	Hand hygiene (HH) enhancement activities versus no activities. Activities for staff were: an e-learning session, 3 live lessons, posters, and a photo competition. See Table 1 for details.
Outcomes	Laboratory NR Effectiveness Incidence of gastroenteritis*, influenza-like illness (ILI), assumed pneumonia*, urinary tract infections (UTIs)*, and infections caused MRSA* in residents *Data not extracted Safety NR
Notes	The authors conclude that quote: "This study, similarly to comparable studies, could not conclusively demonstrate the effectiveness of an HH intervention in reducing HAIs among residents of nursing homes, despite the use of clearly defined outcome measures, a standardized illness incident reporting instrument, and directly observed HH in a multicenter cluster-RCT. This could be due to an insufficient increase in HH compliance and/or other factors in the nursing home environment that need to be addressed concurrently in order to decrease illness rates" The trend of ILI incidence reflects that of the outside community at a higher level. This is probably due to ascertainment bias in the nursing homes in the trial. The trend is seasonal and could be accounted for by visitor transmission. Funding: this study was funded by the Netherlands Organization for Health Research and Development (ZonMw). Non-financial support was received from Essity during the conduct of the study. Competing interests: the authors declare that they have no competing interests.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer random-number generator
Allocation concealment (selection bias)	Unclear risk	Insufficient information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Nurses blinded but participants and other staff members not blinded.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff members of nursing homes in the intervention arm were potentially extra alert to infections and more motivated to register them.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Participant flow diagram not reported.
Selective reporting (reporting bias)	Unclear risk	Insufficient information available

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Temime 2018

Study characteristics	
Methods	2-arm cluster-RCT
Participants	All residents and staff of 27 privately held chains of nursing homes owned by Korian. 26 nursing homes (13 per arm), with an average of 80 residents per nursing home, were included in the study.
Interventions	Quote: "The intervention was based on a bundle of HH-related measures aimed at NH staff, residents, visitors, and outside care providers. These measures included facilitated access to handrub solution using pocket-sized containers and new dispensers, a campaign to promote HH with posters and event organization, the formation of local work groups in each NH to work on HH guidelines, and staff education using e-learning on infection control and HH training performed by the same nurse for all NHs." See Table 1 for details.
Outcomes	Laboratory: none used Effectiveness: Primary outcomes: incidence rate of ARIs and AGE reported in the context of episodes of clustered cases, defined as at least 5 cases within 4 days amongst nursing home residents or staff. ARIs were defined as the combination of at least 1 respiratory symptom with 1 symptom of systemic infection. AGE was defined as the sudden onset of diarrhoea or vomiting in the absence of a non-infectious aetiology. Secondary endpoints were mortality rate, hospitalisation rate, and antibiotic prescription rate (measured in defined daily doses (DDDs) per 100 resident days). Safety: no adverse event surveillance planned or reported by the investigators
Notes	The period study conducted: 1 April 2014 to 1 April 2015 Funding: private (Institute of Ageing Well Korian (Institut du bien vieillir Korian), which runs the nursing homes included in the study) Conflicts of interest: none to report.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	"simple" randomisation is used
Allocation concealment (selection bias)	Unclear risk	No information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "we suspected that underreporting occurred. The data were verified qualitatively after the end of the intervention through individual phone interviews with each participating NH. Based on these interviews, ARI clustered cases episodes had actually occurred in 12 out of 13 control NHs; however, only 1 had been notified to health authorities. No unreported clustered cases episodes were identified in the intervention NHs"
Blinding of outcome assessment (detection bias) All outcomes	High risk	Data were collected at NH level and reported to centralised by the NH group headquarters in Paris through computerised databases. There was underreporting of ARI and AGE in the control groups. The trial authors suspected that underreporting occurred. Primary outcome: high risk. Secondary outcomes: low risk

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Temime 2018 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	High risk	For the primary outcome, there was underreporting of ARI and AGE in the control groups; no study flow chart was provided; and no reporting on any exclusions. Surveillance is based on voluntary and standardised notifications to health authorities of any AGE or ARI clustered case episode.
Selective reporting (reporting bias)	Low risk	Reported outcomes match planned outcomes published in the protocol.

Turner 2004a

Study characteristics	
Methods	Double-blind RCT conducted by Hill Top Research, Inc., Winnipeg, Canada, to assess the efficacy of acids with virucidal activity for the inactivation of virus and prevention of experimental rhinovirus colds. Participants in good health, aged 18 to 60, were recruited from Winnipeg and surrounding communities for participation. Qualified participants were randomised to treatment with vehicle (62% ethanol, 1% ammonium lauryl sulphate, and 1% Klucel), vehicle containing 3.5% salicylic acid, or vehicle containing 1% salicylic acid and 3.5% pyroglutamic acid. The volunteers' hands were disinfected, and then test product was applied to both hands of participant. 15 minutes after application, the fingerprints of each hand were contaminated with rhinovirus type 39. The volunteers touched conjunctiva and the nasal mucosa only with the right hand. Viral contamination of the fingers was assessed in the left hands of the volunteers, and viral infection was assessed by culture of nasal lavage specimens and blood samples.
Participants	85 volunteers; 31 control group, 27 used vehicle with 3.5% salicylic acid, 27 used vehicle with 1% salicylic acid and 3.5% pyroglutamic acid
Interventions	Use of salicylic acid versus salicylic acid and pyroglutamic acid versus "placebo" substance. See Table 1 for details.
Outcomes	Laboratory: yes Effectiveness: rhinovirus type 39 infection Safety: N/A
Notes	Risk of bias: unclear (no description of randomisation process, concealment or allocation) Note: the authors concluded that organic acids commonly used in over-the-counter skin care and cosmetic products have substantial virucidal activity against rhinovirus. These preparations provided effective residual antiviral activity on the hands. The virucidal effect of these hand treatments resulted in a reduction in the incidence of rhinovirus infection in the treated volunteers (P = 0.025). The utility of this observation in the natural setting remains to be determined. The volunteers were not allowed to use their hands in the interval between the hand treatment and the virus challenge, so the effect of normal use of the hands on the virucidal activity of these organic acids is not known. Similarly, the virus challenge method used in these experiments may not simulate the natural setting in all aspects. The effect of nasal secretions that would be transferred with the virus in the natural setting on the activity of the acids or on the transmission of virus was not tested in the model. We are unsure as to the practical significance of this study and the generalisability of its results to the real world. Poorly reported study Funding for this study was provided by the Procter & Gamble Co., Cincinnati, Ohio. No interests declared.
Risk of bias	

Bias	**Authors' judgement**	**Support for judgement**

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Turner 2004a *(Continued)*

Random sequence generation (selection bias)	Unclear risk	Quote: "randomised" Sequence generation not described.
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Quote: "double blind", but no description
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote: "double blind", but no description
Incomplete outcome data (attrition bias) All outcomes	Low risk	All accounted for (short study).
Selective reporting (reporting bias)	High risk	Poorly reported

Turner 2004b

Study characteristics	
Methods	Double-blind RCT conducted by Hill Top Research, Inc., Winnipeg, Canada, to assess the residual virucidal activity of a skin cleanser wipe and its effectiveness in preventing experimental rhinovirus colds. Participants in good health, aged 18 to 60 years, were recruited from Winnipeg and surrounding communities for participation. The residual activity of a skin cleanser wipe containing 4% pyroglutamic acid formulated with 0.1% benzalkonium chloride was tested. The negative control treatment was 62% ethanol. Benzalkonium chloride had been previously tested and was found to have no virucidal activity. Volunteers were randomly assigned to use the control preparation or the active preparation. The study material was applied to hands with a towelette. 15 minutes later, when the fingers were completely dry, the fingertips of each hand of the control participants and the volunteers in the active treatment group were contaminated with rhinovirus type 39. An additional volunteer in the active group was challenged with virus 1 hour after application, and the final group of volunteers was challenged 3 hours after application. Viral infection was assessed by culture of nasal lavage specimens and blood samples.
Participants	122 volunteers; 30 in control group, 92 in active group (30 tested after 15 minutes, 30 after 1 hour, 32 after 2 hours)
Interventions	Use of a skin cleanser wipe containing 4% pyroglutamic acid formulated with 0.1% benzalkonium chloride versus skin cleanser wipe containing ethanol. See Table 1 for details.
Outcomes	Laboratory: yes Effectiveness: rhinovirus type 39 infection Safety: N/A
Notes	Risk of bias: unclear (no description of randomisation process, concealment or allocation) Funding for this study was provided by the Procter & Gamble Co., Cincinnati, Ohio. No interests declared.

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Turner 2004b *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "randomised" Sequence generation not described.
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Quote: "double blind", but no description given
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote: "double blind", but no description given
Incomplete outcome data (attrition bias) All outcomes	Low risk	All accounted for (short study).
Selective reporting (reporting bias)	High risk	Poorly reported

Turner 2012

Study characteristics	
Methods	Randomised controlled clinical trial
Participants	A total of 212 participants were enrolled (116 in the treatment group, 96 in the control group). Healthy adult volunteers aged > 18 years from the University of Virginia community Written informed consent was obtained, and volunteers were compensated for participation. Exclusion: individuals with skin conditions that would interfere with safety evaluations or medical conditions that could impact the person's well-being or affect study results, and those whose occupations required frequent hand-washing
Interventions	Antiviral hand treatment containing 2% citric acid, 2% malic acid, and 62% ethanol (n = 116) or to a no-treatment control group (n = 96). The hand treatment was applied every 3 hours and after hand-washing whilst the participants were awake. See Table 1 for details.
Outcomes	Laboratory: PCR using AmpliTaq Gold DNA Polymerase from Applied Biosystems Effectiveness: reduction of rhinovirus-induced common colds; comparison of the number of RV-associated illnesses per 100 participants in the control group with that in the treatment group over 9 weeks. Definitions: a common cold illness was defined as the presence of any of the symptoms of nasal obstruction, rhinorrhoea, sore throat, or cough on at least 3 consecutive days. Illnesses separated by at least 3 symptom-free days were considered to be separate illnesses. Rhinovirus infection was defined as the detection of RV in nasal lavage. All volunteers were seen weekly for nasal lavage, and specimens were assayed by PCR for the presence of RV. PCR–positive specimens separated by at least 8 days and at least 1 negative PCR specimen were considered to be separate infections. RV-associated illnesses were based on detection of RV either at the time of the illness or at the first weekly visit after the illness.

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Turner 2012 *(Continued)*

	Safety: hand irritation occurred in 11 of the 116 volunteers (9%) in the treatment group, which met protocol criteria for removal from the study. An additional 8 participants who did not meet these protocol criteria voluntarily withdrew due to hand irritation. There was no hand irritation in the control group. No other adverse effects of the study treatment were noted.
Notes	The period study conducted: August 2009 to November 2009 Funding: The Dial Corporation - a Henkel Company, Scottsdale, Arizona, USA Potential conflicts of interest: R. B. T. is a consultant to Henkel and received grant funding to conduct these studies. All other authors are current or former employees of Henkel. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "A randomization code generated using commercially available software was provided by the sponsor"
Allocation concealment (selection bias)	Low risk	Quote: "staff at the study site assigned sequential subject numbers as they enrolled volunteers into the study, and treatment assignment was determined by the subject number."
Blinding of participants and personnel (performance bias) All outcomes	Low risk	The outcomes are unlikely to be influenced by lack of blinding.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Personnel who conducted the laboratory assays were blinded to study groups and to whether the specimen was from a routine or illness related visit"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition (and reasons for it) was reported. Study outcomes reported as ITT and PP.
Selective reporting (reporting bias)	Low risk	All planned outcomes in study protocol were reported on.

White 2001

Study characteristics

Methods	Double-blind, placebo-controlled, cluster-RCT that took place in 3 schools in California during March to April 1999. The study assessed the incremental value of using an alcohol hand rub together with water-and-soap hand-washing. Both arms were administered an educational programme beginning 2 weeks prior to start of the trial. Randomisation was by classroom, and the placebo hand rub was indistinguishable from the active ingredient. Details of randomisation are not given.
Participants	Of the 72 classes originally recruited, lack of compliance (use of supplementary product at least 3 times a day) reduced the classes to 32 (16 in both arms) and a total of 769 participants aged 5 to 12 (381 students who received the sanitiser, and 388 who received the placebo).

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White 2001 *(Continued)*

Interventions	Pump-activated antiseptic hand rub with benzalkonium chloride (SAB) (Woodward Laboratories) or inert placebo that "virtually" looked the same in batches of 4 colour-coded bottles. School staff, parents, and participants were blinded. See Table 1 for details.
Outcomes	Laboratory: testing of virucidal and bactericidal activity of the active compound Effectiveness: ARI (cough, sneezing, sinus trouble, bronchitis, fever, red eye, headache, mononucleosis, acute exacerbations of asthma) Gastrointestinal and other illnesses (data not extracted) Follow-up and observation was carried out by classroom staff, and illnesses were described by parents. Safety: 7 students dropped out because of mild sensitivity to the rub
Notes	Risk of bias: high (no description of randomisation; partial reporting of outcomes, numerators and denominators) Note: the authors conclude that addition of the rub led to a 30% to 38% decrease of illness and absenteeism (RR for illness absence incidence 0.69, RR for absence duration 0.71). Very high attrition, unclear randomisation procedure, educational programme and use of placebo hand rub make generalisability of the results debatable. No confidence intervals reported. This study was supported by an Orange County School Nurses Organization Health Promotion Grant. No interests declared.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "randomised trial", but sequence generation not described
Allocation concealment (selection bias)	Unclear risk	Not described
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote: "To distinguish content, both the active and placebo formulations were distributed in four color-coded groups of 1oz spritz bottles. The content were and distribution patters were only know to the researchers and were indecipherable by the school staff or students."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Teachers were responsible for recording attendance for each day during the study"
Incomplete outcome data (attrition bias) All outcomes	High risk	Partial reporting of outcomes, numerators and denominators
Selective reporting (reporting bias)	High risk	Poor reporting

Yeung 2011

Study characteristics

Methods	Clustered-RCT of a hand hygiene intervention involving pocket-sized containers of alcohol-based hand rub for the control of infections in long-term care facilities. Staff hand hygiene adherence was directly observed, and residents' infections necessitating hospitalisation were recorded. After a 3-month pre-intervention period, long-term care facilities (LTCFs) were randomised to receive pocket-sized containers of alcohol-based gel, reminder materials, and education for all HCWs (treatment group) or to re-

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Yeung 2011 *(Continued)*

	ceive basic life support education and workshops for all HCWs (control group). A 2-week intervention period (1 to 15 April 2007) was followed by 7 months of postintervention observations.
Participants	6 out of 7 community-based, private or semiprivate, residential LTCFs in Hong Kong agreed to participate and were randomised to: 1. hand hygiene group (3 LTCFs, 73 nursing staff and 244 residents analysed); or 2. control group (3 LTCFs, 115 nursing staff and 379 residents analysed). All were nursing homes serving an elderly population. All LTCFs were situated in different regions of Hong Kong, including urban and rural areas. The targets of the intervention were all full- and part-time HCWs at these LTCFs. The LTCFs employed 3 types of HCWs: nurses, nursing assistants, and physiotherapists.
Interventions	Pocket-sized containers of alcohol-based gel, reminder materials, and education (intervention group) or basic life-support education and workshop (control group). See Table 1 for details.
Outcomes	Rates of infection (requiring hospitalisation) Outbreaks Death due to infection Diagnoses of infection coded into 6 categories, all of which were common endemic infections in LTCFs: 1. pneumonia, 2. urinary tract infection, 3. septicaemia, 4. skin or soft-tissue infection (including cellulitis or pressure sores), 5. gastroenteritis, and 6. fever. Infections recorded in death certificates were also included, regardless of whether the resident had been hospitalised. The causes of death were categorised as due to infection, not due to infection, or unknown. If the primary or the secondary diagnosis on the death certificate belonged to 1 of the 6 endemic infection categories, the death was coded as due to infection. No safety outcomes reported.
Notes	University and industry funded.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No details provided.
Allocation concealment (selection bias)	Unclear risk	No details provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unblinded study

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Yeung 2011 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	Low risk	No loss to follow-up
Selective reporting (reporting bias)	Unclear risk	No protocol available

Young 2021

Study characteristics	
Methods	Cluster-randomised, controlled trial of daily contact testing in students and staff at secondary schools and colleges in England to show whether daily contact testing increases school attendance and to assess the impact of daily contact testing on SARS-CoV-2 transmission within schools.
Participants	201 schools, of which 99 were randomly assigned to self-isolation of school-based COVID-19 contacts for 10 days (control) and 102 to voluntary daily lateral flow device (LFD) testing for 7 days with LFD-negative contacts remaining at school (intervention)
Interventions	All schools in the intervention and control groups followed the national policy of offering twice weekly asymptomatic testing with LFDs. Individuals with positive LFD results were required to self-isolate immediately and requested to obtain a confirmatory PCR test within 2 days. Those with indicator symptoms of possible COVID-19 (new cough, fever, loss or change in taste or smell) were required to self-isolate along with their household and obtain an urgent PCR test. If a student or staff member tested positive by LFD or PCR, close contacts (hereafter referred to as contacts) were identified by schools using national guidelines. Those in close contact with a case less than 48 hours before symptom onset (or a positive test if asymptomatic) were required to self-isolate for 10 days. At schools in the intervention group, contacts were offered daily contact testing as an alternative to self-isolation, provided the contact was school-based (i.e. with a staff member or student), the contact did not have indicator symptoms of COVID-19, and contacts were able to attend for on-site testing at school. See Table 1 for details.
Outcomes	Laboratory PCR confirmed infections Effectiveness COVID-19-related school absence and symptomatic PCR-confirmed COVID-19. Safety NR
Notes	The authors conclude that quote: "Daily contact testing of school-based contacts was non-inferior to self-isolation for control of COVID-19 transmission, with similar rates of symptomatic infections among students and staff with both approaches." Funding: UK Government Department of Health and Social Care. Declaration of interests: DWE reports lecture fees from Gilead outside the submitted work. VB, RO, and DC are consultants employed by Department of Health and Social Care as part of Deloitte's broader project work supporting the delivery of NHS Test and Trace. TF reports honoraria from Qatar National Research Fund outside the submitted work. All other authors declare no competing interests. Potential conflicts of interest: all authors report no conflicts of interest relevant to this article.

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer random-number generator

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Young 2021 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	Insufficient information reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not blinded.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Not blinded.
Incomplete outcome data (attrition bias) All outcomes	High risk	Participant flow diagram reported showing high attrition at different rates in the 2 groups
Selective reporting (reporting bias)	Low risk	Prespecified outcomes reported

Zomer 2015

Study characteristics	
Methods	Cluster-RCT
Participants	71 daycare centres (36 intervention DCCs, and 35 control) in Rotterdam-Rijnmond, Gouda and Leiden in the Netherlands Study enrolled 545 children (intervention = 278, control = 267). Inclusion/exclusion criteria: children who attended the DCC at least 2 days a week; were aged between 6 months and 3.5 years at start of the trial; intended to attend the DCC throughout the study period; and if their parents consented, were Dutch-speaking, and had access to email or regular post. Children were excluded if they had a chronic illness or medication that predisposed them to infection, a sibling taking part in the trial (i.e. 1 child per family could be included), or if they started attending CCC after the beginning of the trial).
Interventions	4 components: 1. HH products, paper towel dispensers, soap, alcohol-based hand sanitiser, and hand cream were provided for 6 months. 2. Training and a booklet outlining the training. 3. 2 team training sessions aimed at specific HH improvement activities. 4. Posters and stickers for caregivers and children as reminders. See Table 1 for details.
Outcomes	Laboratory: none Effectiveness: incidence of respiratory infections in children monitored by parents. The common cold was defined as a blocked or runny nose with at least 1 of the following symptoms: coughing, sneezing, fever, sore throat, or earache. Safety: none planned or reported by the investigators
Notes	The period study conducted: September 2011 to April 2012

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Zomer 2015 *(Continued)*

Funding: mixed. The Netherlands Organisation for Health Research and Development (ZonMw). Dispensers and refills were sponsored by SCA Hygiene Products, Sweden.

Declaration of interest: none.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Stratified randomization is performed by assigning each DCC to one of six strata based on size (i.e. small < 46 children per day versus large ≥ 46 children per day) and geographic location (i.e. highly urban versus urban versus slightly/non-urban). DCCs are assigned to either intervention or control group by means of computer generation with a 1:1 ratio in each of the strata"
Allocation concealment (selection bias)	Unclear risk	No information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Outcome is subjective.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Symptoms were reported by parents, no validation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Very few children were excluded or lost to follow-up (reasons for exclusions provided).
Selective reporting (reporting bias)	Low risk	All planned outcomes are reported. However, between published protocol and the paper, secondary outcomes became the primary outcome in the published paper!

AEs: adverse events
AFH: Armed Forces Hospital
AGE: acute gastroenteritis
AgNPs: ARGOVIT silver nanoparticles
ALRI: acute lower respiratory infection
ARI: acute respiratory infection
ASR: adverse skin reactions
A&E: accident and emergency
BIPAP: bilevel positive airway pressure
CCC: childcare centre
CDC: Centers for Disease Control and Prevention
CG: control group
CHG: chlorhexidine gluconate
CI: confidence interval
CMF: citric acid: malic acid: sodium lauryl sulphate (a virucidal mixture added to tissue paper)
CoV: coronavirus
cluster-RCT: cluster-randomised controlled trial
CRI: clinical respiratory illness
CXR: chest X-ray
DCC: daycare centre
EG: experimental group
FRI: febrile respiratory illness
FU: follow up
GI: gastrointestinal

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GTI: gastrointestinal infection
GP: general practitioner
HCW: healthcare worker
HFH: Hanoi French Hospital
HH: hand hygiene
HR: high risk
HSG: hand sanitiser group
ICD-9: International Classification of Disease, 9th Revision, Clinical Modification
IgG: immunoglobulin G
ICU: intensive care unit
ILI: influenza-like illness
IQR: interquartile range
IRR: incident rate ratio
ITT: intention-to-treat
KSA: Kingdom of Saudi Arabia
LFD: lateral flow device
LNS: lipid based nutrient supplementation
LRTI: lower respiratory tract infection
LTCF: long-term care facility
m: metre
MCU: medical convalescent unit
MDCK: Madin Darby canine kidney cell line
M group: face mask group
MH group: face mask and hand hygiene group
MS: monkey-derived cell line
N/A: not applicable
NAT: nucleic acid testing
NH: nursing home
NICU: neonatal intensive care unit
NOS: Newcastle-Ottawa Scales
NP: non-pharmaceutical
NR: not reported
NTS: nasal and throat swab
OR: odds ratio
PCR: polymerase chain reaction
PCU: physical conditioning unit
POCT: point-of-care testing
PP: per protocol
PPE: personal protective equipment
QNAF: Qatar National Research Fund
RCT: randomised controlled trial
RDS: respiratory distress syndrome
RI: respiratory infection
RIDT: rapid influenza diagnostic test
RNA: ribonucleic acid
RR: risk ratio
rRT-PCR: real-time reverse transcription-polymerase chain reaction
RTI: respiratory tract infection
RT-PCR: reverse-transcriptase polymerase chain reaction
RSV: respiratory syncytial virus
RV: rhinovirus
SAB: surfactant, allantoin, and benzalkonium chloride
SAR: secondary attack rate
SARS: severe acute respiratory syndrome
SCBU: special care baby unit
SD: standard deviation
SES: electrolysed water
SHEWA-B: Sanitation, Hygiene Education and Water Supply in Bangladesh
SOB: shortness of breath
SOPs: standard operating procedures
S/S: signs/symptoms
SSTI: skin and soft-tissue infection

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STH: soil-transmitted helminth
SWG: soap and water group
TIDieR: Template for Intervention Description and Replication
UHR-I: ultra high-risk infection
UHR-S: ultra high-risk SARS
URI: upper respiratory infection
URTI: upper respiratory tract infection
WBC: white blood cell
WHO: World Health Organization
WSH: water, sanitation, and handwashing (combined)

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Abou El Hassan 2004	Topic completely extraneous
Ahmadian 2022	Excluded as study is an experiment that did not measure any of our outcomes of interest.
Amirav 2005	Randomised controlled trial of aerosol treatment
Anderson 2004	Mathematical model with interesting discussion of interaction between public health measures
Anonymous 2002	News item
Anonymous 2004	News item
Anonymous 2005a	News item
Anonymous 2005b	News item
Anonymous 2005c	News item
Apisarnthanarak 2009	Intervention bundle not broken down.
Apisarnthanarak 2010	Participants took antivirals.
Aragon 2005	Descriptive paper (non-comparative). Has no viral outcomes
Azor-Martinez 2014	Results reported as respiratory and gastrointestinal infections. No extractable respiratory data
Barros 1999	Correlational study between incidence of URTI and factors such as overcrowding
Bauer 2009	Historical comparison with RSV gammaglobulin amongst interventions
Bell 2004	Has unpublished entry exit screening data and extensive references but no comparative data
Bellissimo-Rodrigues 2009	Intervention is chlorhexidine.
Ben-Abraham 2002	Exclude - bacterial illness only
Black 1981	Diarrhoea only outcome
Borkow 2010	No human beings involved.
Bouadma 2010	Hospital-based ventilator routine

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Study	Reason for exclusion
Bowen 2007	Outcomes of composite infections. Respiratory infections are not reported separately.
Breugelmans 2004	Description of risk factors in aircraft
Cai 2009	Compliance study
Cantagalli 2010	Outcome outside inclusion criteria
Carbonell-Estrany 2008	Immunoglobulin intervention and descriptive review
Carter 2002	News item
Castillo-Chavez 2003	Editorial
Cava 2005a	Survey of quarantinees' views
Cava 2005b	Personal experiences of quarantine
CDC 2003a	Case reports
CDC 2003b	No data presented.
Chai 2005	Letter - about MRSA
Chami 2012	Outcomes of composite infections. Respiratory infections are not reported separately.
Chaovavanich 2004	Case report
Chau 2003	No original retrievable data. Mathematical model fitting expected to observed cases with quarantine in the SARS of Hong Kong
Chau 2008	Audit of infection control procedures and compliance with guidelines
Chen 2007	An assessment of the impact of different hand-washing teaching methods. No clinical outcomes
Chen 2022	Not a RCT.
Cheng 2010	Confounded by antiviral use for postexposure prophylaxis
Chia 2005	Knowledge survey
Clynes 2010	Letters
Costa 2021	No clinical outcome assessed
Cowling 2007	Epidemiology, non-comparative, non-interventions study
Cyril Vitug 2021	Is a treatment for COVID-19 infection
Dalakoti 2022	Excluded as study is an experiment that did not measure any of our outcomes of interest.
Daniels 2010	Commentary
Daugherty 2008	No free data presented.

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Study	Reason for exclusion
Davies 1994	Antibody titres as outcomes with so many biases that interpretation of study is problematic
Day 1993	No acute respiratory infection outcome data
Day 2006	Mathematical model; no new data
Dell'Omodarme 2005	Probabilistic and Bayesian mathematical model of screening at entry
Denbak 2018	Outcomes of composite infections. Respiratory infections are not reported separately.
Desenclos 2004	Description of transmission
DiGiovanni 2004	Qualitative study of compliance factors in quarantine
Doebbeling 1992	RCT respiratory data not present. Only 3 viruses isolated in total with no viral typing available.
Dwosh 2003	Case series
Edmonds 2010	Lab study
Egger 2022	Excluded as study is an experiment that did not measure any of our outcomes of interest.
Fendler 2002	Cohort study badly biased with differential health profiles and healthcare workers dependency in intervention and control semi-cohorts. No attempt to adjust for confounders was made. No denominators available.
Ferrer 2021	Is a treatment (not something to interrupt transmission)
Flint 2003	Description of spread in aircraft and non-comparative data
Fung 2004	Non-comparative
Garcia 2010	Commentary
Gaydos 2001	Editorial linked to Ryan 2001. (Ryan 2001 was an included trial in a previous version of this review (2011). Non-RCTs were removed in this 2020 update).
Gensini 2004	Interesting historical review
Gharebaghi 2020	Study on the prevention of ventilator associated pneumonia in mechanical ventilatory patients
Girou 2002	Non-clinical outcomes
Giuliano 2021	Outcome is hospital aquired pneumonia which is a syndrome with multiple aetiologies, mainly bacterial and mycotic
Glass 2006	Mathematical model - no original data presented
Goel 2007	Non-comparative study
Gomersall 2006	Non-comparative study
Gore 2001	Summary of Dyer 2000. (Dyer 2000 was a prospective, cluster open-label cross-over cohort study included in the previous version of this review (2011). Non-RCTs were removed in this 2020 update).

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Study	Reason for exclusion
Gostin 2003	Not an analytical study
Gralton 2010	Review
Guinan 2002	It would appear that 9 classes took part and "acted as their own controls", but it is not clear if there was cross-over of classes or not. In addition, the outcome is combined gastrointestinal/respiratory. The clue lies in the presence of a nested economic analysis which shows considerable savings in time for staff and pupils if the soap is used: in other words this is a (covert) publicity study.
Gupta 2005	Economic model - no new data
Gwaltney 1982	No breakdown of cases given by arm.
Han 2003	Non-comparative
Hayden 1985	This is an RCT with laboratory-induced colds, small numbers, and uncertain numerators, but almost certainly because of the unique laboratory conditions (placebo tissues not being a placebo at all) of impossible generalisation. It was a pilot to the far bigger trial by Farr 1988a; Farr 1988b.
Hendley 1988	Inappropriate intervention
Hens 2009	Model
Heymann 2009	Already included in review as Heymann 2004. (Heymann 2004 was a controlled before and after study included in the previous version of this review (2011). Non-RCTs were removed in this 2020 update).
Hilburn 2003	No ARI/viral outcomes (e.g. URTIs)
Hilmarsson 2007	Animal study
Hirsch 2006	Study tested pharmacological interventions.
Ho 2003	Descriptive review
Hsieh 2007	Mathematical model
Hugonnet 2007	Letter without any data
Jiang 2003	Two papers that are probably different versions of the same paper: Jiang SP, Huang LW, Wang JF, Wu W, Yin SM, Chen WX, et al. A study of the architectural factors and the infection rates of health-care workers in isolation units for severe acute respiratory syndrome. Chung-Hua Chieh Ho Ho Hu Hsi Tsa Chih [Chinese Journal of Tuberculosis & Respiratory Diseases]. 26(10):594-7, 2003 Oct
Johnson 2009	Outcomes are non-clinical.
Jones 2005	Historical account
Karakaya 2021	Outcome is ventilator associated pneumonia which is a syndrome with multiple aetiologies, mainly bacterial and mycotic
Kawyannejad 2020	Trial on mouthwash for VAP patients with no viral infection outcomes
Kaydos-Daniels 2004	Not an analytical study
Kelso 2009	Model

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Study	Reason for exclusion
Khaw 2008	Assessing the efficacy of O_2 delivery
Kilabuko 2007	Aetiological study
Kosugi 2004	Non-comparative study
Lam 2004	Outcomes were generic (infection rates). No laboratory data available for viral diagnosis.
Lange 2004	No data presented.
Larson 2004a	Inappropriate outcomes
Larson 2004b	Inappropriate outcomes
Larson 2005	Cluster-RCT comparing the effects of 2 hand hygiene regimens on infection rates and skin condition and microbial counts of nurses' hands in neonatal intensive care units. Outcomes were generic (e.g. pneumonia and microbial counts of participants' skin). No laboratory data available for viral diagnosis.
Lau 2004	Attitude survey
Lau 2005	Herbal remedy effectiveness assessment
Lee 2005	Descriptive study of risk and protective factors of transmission in households. No assignment took place.
Lee 2010	Cohort study; unclear numbers were vaccinated against influenza
Lennell 2008	Measured absenteeism due to non-specific infection
Lim 2022	Not a RCT.
Lipsitch 2003	Mathematical model fit to evidence
Luckingham 1984	Historical report on Tucson experience during Spanish flu pandemic
Ma 2004	Case-control study of risk factors for SARS
MacIntyre 2010	Commentary on Cowling 2009
Malaczek 2022	Excluded as study is an experiment that did not measure any of our outcomes of interest.
Malone 2009	Model
Marin 1991	Viral resistance study
McSweeny 2007	Historical description
Meister 2022	Excluded as this is a treatment trial (all participants had COVID).
Mielke 2009	Review
Mikolajczyk 2008	No intervention
Mo 2022	Not a RCT.

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Study	Reason for exclusion
Monsma 1992	Non-comparative study
Montero-Vilchez 2022	Excluded as study is an experiment that did not measure any of our outcomes of interest.
Munoz-Basagoiti 2022	Excluded as this is a report of another study.
Nandrup-Bus 2009	The trial had only 2 clusters.
Nishiura 2009	Model
O'Callaghan 1993	Letter linked to Isaacs 1991. (Isaacs 1991 was a retrospective and prospective cohort study included in a previous version of this review (2011). Non-RCTs were removed in the 2020 update).
Olsen 2003	Description of transmission
Ooi 2005	Descriptive study, but with interesting organisational chart
Orellano 2010	Confounded by antiviral use
Panchabhai 2009	Pharma intervention
Pang 2004	Descriptive study of Beijing outbreak. Some duplicate data in common with Pang 2003. (Pang 2003 was an eclogical study included in a previous version of this review (2011). Non-RCTs were removed in the 2020 update).
Patel 2012	Although within each district the participating schools and households were randomly selected, the allocation of districts to the intervention and comparison arms was not randomly assigned.
Pittet 2000	Analysis of relationship between hand-washing compliance campaign and nosocomial bacterial infections (e.g. MRSA)
Prasad 2004	Letter about retrospective cohort - behavioural
Rabenau 2005	In vitro test of several disinfectants
Reynolds 2008	Describes the psychological effects of quarantine
Richardson 2010	Non-clinical study
Riley 2003	Mathematical model fit to evidence
Rodriguez 2009	A “reasonable attempt at minimizing bias” (see inclusion criteria) does not include absenteeism
Rosen 2006	Non-specific outcome. Measured absenteeism
Rosenthal 2005	Outcomes were generic (e.g. pneumonia, URTIs). No laboratory data available for viral diagnosis.
Safiulin 1972	Non-comparative set of studies with no clinical outcomes
Sanchez Barrueco 2022	Excluded as this is a treatment trial (all participants had COVID)
Sandrock 2008	Review
Sattar 2000	Experiment assessing virucidal activity of fingertip surface - no clinical outcome data

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Study	Reason for exclusion
Schull 2007	Describes the impact of SARS in a Toronto study
Seal 2010	Lab study
Seale 2009	Study looking at whether using respirators in A&E department is feasible
Seneviratne 2021	Not an intervention to reduce transmission and they did not look at ARIs or other clinically relevant outcomes
Sevinc Gul 2022	Excluded as this is a treatment trial (all participants had COVID)
Sizun 1996	This is a review; no original data presented.
Slayton 2016	Compares hand-washing plus (antibacterial) towel versus hand-washing without towel
Stebbins 2009	Attitude survey
Stedman-Smith 2015	Composite outcome. No data on separate respiratory illnesses reported.
Stoner 2007	No study data available.
Stukel 2008	Impact of the SARS disruption on care/mortality for other pathologies (e.g. acute myocardial infarction). There are no interventions, and outcomes are unrelated to acute respiratory infections.
Svoboda 2004	Descriptive study with before-and-after data but shifting denominators
Tracht 2010	Model
Ueno 1990	Experimental study. No clinical intervention
Uhari 1999	No respiratory illness data to be extracted
van der Sande 2008	Laboratory study without any clinical outcomes
Vessey 2007	Composite outcome. No data on separate respiratory illnesses reported.
Viscusi 2009a	Lab study
Viscusi 2009b	Lab study
Wang 2003	Descriptive study
Wang 2005	Case-control study of susceptibility factors
Weber 2004	Editorial linked to Larson 2004a
Wen 2010	Lab study
White 2005	Redundant publication of White 2003. (White 2003 was a prospective, open, cohort study included in a previous version of this review (2011). Non-RCTs were removed in the 2020 update).
Wilczynski 1997	Clinical trial of the effects of breastfeeding
Wilder-Smith 2003	Description of risk factors in aircraft

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Study	Reason for exclusion
Wilder-Smith 2005	Descriptive review
Wong 2005	Attitude survey
Yen 2010	Model
Yu 2004	Description of transmission
Zamora 2006	Head-to-head comparison of 2 sets of PPEs with no controls and no clinical outcomes
Zhai 2007	Non-comparative study
Zhao 2003	CCT of SARS treatment

A&E: accident and emergency
ARI: acute respiratory infection
CCT: controlled clinical trial
MRSA: methicillin-resistant *Staphylococcus aureus*
RCT: randomised controlled trial
RSV: respiratory syncytial virus
PPE: personal protective equipment
SARS: severe acute respiratory syndrome
URTI: upper respiratory tract infection
VAP: ventilator associated pneumonia

Characteristics of studies awaiting classification *[ordered by study ID]*

Contreras 2022

Methods	Follow-up of the WASH Benefits Bangladesh cluster-randomised controlled trial. Access to and reported use of latrines was high in both arms, and latrine quality was significantly improved by the intervention, while use of child faeces management tools was low. A random subset of households from the sanitation and control arms was enrolled into a longitudinal substudy, which measured child health with quarterly visits between 1 to 3.5 years after implementation.
Participants	9800 observations on children < 5 years through intention-to-treat analysis using generalised linear models with robust standard errors. 720 households (360 per arm) from the parent trial were enrolled and made 9800 child observations between June 2014 and December 2016.
Interventions	Multicomponent sanitation intervention including periods with differing intensity of behavioural promotion: water, sanitation, hygiene, and nutrition interventions. The sanitation intervention included provision of or upgrades to improved latrines, sani-scoops for faeces removal, children's potties, and in-person behavioural promotion. Promotion was intensive up to 2 years after intervention initiation, decreased in intensity between years 2 to 3, and stopped after 3 years. The study period included approximately 1 year of high-intensity promotion, 1 year of low-intensity promotion, and 6 months with no promotion.
Outcomes	Diarrhoea and ARI, at 1 to 2 years after intervention implementation to 3.5 years (follow-up). Outcomes were caregiver-reported and there were limited data collected after promotion ceased.
Notes	Trial registration: ClinicalTrials.gov; NCT01590095; https://clinicaltrials.gov/ct2/show/NCT01590095

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Croke 2022

Methods	Cluster-randomised trial assessing the effect of a national water, sanitation, and hygiene program on adherence with COVID-19 policies in Congo. The trial is a follow-up of the Villages et Ecoles Assainis programme which was running prior to the COVID-19 pandemic.
Participants	332 communities were randomly assigned to the Villages et Ecoles Assainis program or control. (590/1312; 45%) individuals who owned phones were surveyed by phone 3 times between May 2020 to August 2021.
Interventions	Large-scale water and sanitation programme not described in detail.
Outcomes	Primary outcomes were COVID symptoms, non- COVID illness symptoms, child health, psychological well-being, and vaccine acceptance. Secondary outcomes included COVID-19 preventive behaviour and knowledge, and perceptions of governmental performance, including COVID response. All outcomes were self-reported. COVID symptoms were defined as the number of household members in the past week with fever, dry cough, difficulty breathing/shortness of breath, or fatigue, while non-COVID illness variable was defined as the number of sick household members in the last 7 days (excluding those with COVID symptoms). The child health index was created using the proportion of children under 5 with fever/cough/diarrhoea in the last 2 weeks. The mental health index is a summary index of scores from answers to questions.
Notes	Cannot find NCT and unclear funders although acknowledgments list a potential load of funders. Probably public.

Delaguerre 2022

Methods	Prospective, open-label, non-inferiority randomised (2:1), controlled trial
Participants	Study included healthy individuals aged 18 to 45 years, with negative RADT test 3 days prior to concert event, with no risk factors and not living with someone with risk factors, and residing in Paris. Study excluded people with positive RADT test within 3 days before the gathering. People with clinical signs suggestive of an infectious respiratory disease, or with risk factor for severe COVID-19, or living with someone with risk factors for severe COVID-19. Persons not covered by French National Health Insurance or who cannot stand for the duration of the experiment (about 5 hours from entry line to exit) were excluded. Person under legal guardianship, pregnant woman or woman orally declaring non-use of effective contraception and breastfeeding woman were also excluded.
Interventions	Participants were randomly assigned to: 1. medical face mask wearing during an indoor concert event, or 2. not attending. Both groups had RADT test 3 days before the event Saliva samples for RT-PCR were collected from both groups on D0 and D7 using self-saliva-collection kits
Outcomes	Primary outcome: 1. the number of SARS-CoV-2-positive RT-PCR tests on self-collected saliva at day 7. Secondary outcomes: 1. the conversion rate of salivary carriage between the day 0 and day 7 visits;

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Delaguerre 2022 *(Continued)*

	2. the percentages of adequately masked (nose and mouth covered) faces over the total 4-hour period gathering.
Notes	1. French Ministry of Health. 2. ITT and PP analysis were used. Several imputation for missing data. 3. It is not clear if participants had COVID-19 in the past (in the table with baseline characteristics it is reported quote: “”declared Covid-19 history”: what does it mean? 4. Surgical masks were worn also by all attendees, regardless of study participation? 5. What is the intervention? Combined screening test + surgical mask?

Loeb 2022

Methods	Multicentre, randomised, non-inferiority trial
Participants	1009 healthcare workers who provided direct care to patients with suspected or confirmed COVID-19. Conducted in 29 healthcare facilities in Canada, Israel, Pakistan, and Egypt from 4 May 2020 to 29 March 2022.
Interventions	Use of medical masks versus fit-tested N95 respirators for 10 weeks, plus universal masking, which was the policy implemented at each site.
Outcomes	The primary outcome was confirmed COVID-19 on reverse transcriptase polymerase chain reaction (RT-PCR) test.
Notes	Financial support was given by the Canadian Institutes of Health Research, World Health Organization, and Juravinski Research Institute. Disclosures can be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M22-1966

Varela 2022

Methods	Open-label non-inferiority randomised controlled trial
Participants	Study was conducted in Colombia Inclusion criteria: people aged ≥ 18 years of both genders and who: (a) lived in a geographic area with active COVID-19 transmission and in areas with medium, medium-high, and high vulnerability index; and (b) worked outside their homes for at least 2 days during the last week. Exclusion criteria: retirement, unemployment, home-based working, history of laboratory-confirmed COVID-19, working in health care, and daily N95 mask or face shield use. In addition, during follow-up if participants reported an occupation change from work outside the home to home-based work, or became unemployed
Interventions	1. Intervention group (IG): instructed to wear closed face shields with surgical face masks 2. Active control group (ACG): instructed to wear only surgical face mask

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Varela 2022 *(Continued)*	
	PPE was sent to their home address for each day of participation All participants received a follow-up twice a week by phone All participants received recorded educational intervention via email or phone that provided recommendations about COVID-19 prevention measures, guidance to ensure adherence, and appropriate handling of the assigned PPE. Weekly short questionnaire was performed on days 7, 14, and 21 to evaluate health status SARS-CoV-2 symptoms, PPE use, and adherence.
Outcomes	Primary outcome was the composite result of positive RT-PCR or seroconversion during follow-up Secondary outcomes including PPE use and adherence
Notes	1. Study was nested within an observational study (CoVIDA project). 2. Funding was provided by donors administered by the philanthropy department at the Universidad de Los Andes, external financing from the United Nations Development Programme (UNDP), and donations of diagnostic material from the Engineering Services Laboratory S.A.S. (LABSERVING S.A.S. Colombia). Funders had no input on the study at any stage. 3. Provided analysis as ITT and PP. 4. Missing data were imputed with negative results.

ARI: acute respiratory infection
h: hours
ITT: intention-to-treat
NCT: trial register number
PPE: personal protective equipment
PP: per protocol
RADT: rapid antigen detection test
RT-PCR: reverse-transcriptase polymerase chain reaction

Characteristics of ongoing studies *[ordered by study ID]*

Brass 2021

Study name	Prevention of SARS-CoV-2 (COVID-19) transmission in residential aged care using ultraviolet light (PETRA)
Methods	A multicentre, 2-arm double-cross-over, randomised controlled trial will be conducted to determine the efficacy of GUV devices to reduce respiratory viral transmission in RACF, as an adjunct to existing infection control measures. The study will be conducted in partnership with 3 aged care providers in metropolitan and regional South Australia. RACF will be separated into paired within-site zones, then randomised to intervention order (GUV or control). The initial 6-week period will be followed by a 2-week washout before cross-over to the second 6-week period. After accounting for estimated within-zone and within-facility correlations of infection, and baseline infection rates (10 per 100 person-days), a sample size of n = 8 zones (n = 40 residents/zone) will provide 89% power to detect a 50% reduction in symptomatic infection rate.
Participants	RACF within metropolitan and regional South Australia will be considered for recruitment if they possess the ability to sub-divide communal living areas into discrete areas that enable a concurrent comparison of interventions, with the facility cohorts otherwise subject to the same facility practices (e.g. environmental cleaning, staffing, and social distancing).
Interventions	The intervention will involve the commercially available Laftech GUV appliances: UV-FLOW-C wall- and ceiling-mounted system, UV-FAN-XS wall-mounted air purifier, and UV-FAN M2/95HP air purification device (LAF Technologies, Melbourne, Australia).

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Brass 2021 *(Continued)*

Outcomes	The primary outcome will be the incidence rate ratio of combined symptomatic respiratory infections for intervention versus control. Secondary outcomes include incidence rates of hospitalisation for complications associated with respiratory infection; respiratory virus detection in facility air and fomite samples; rates of laboratory-confirmed respiratory illnesses and genomic characteristics.
Starting date	
Contact information	Andrew P. Shoubridge • The South Australian Health and Medical Research Institute (SAHMRI), Adelaide, SA, Australia • The Microbiome and Host Health Programme, College of Medicine and Public Health, Flinders University, Bedford Park, SA, Australia
Notes	

NCT03454009

Study name	Appropriate time-interval application of alcohol hand gel on reducing influenza-like illness amongst preschool children: a randomised, controlled trial
Methods	This is a comprehensive randomised cluster hand-hygiene improvement intervention to reduce self-reported ARI/ILI and GI illness, absenteeism, presenteeism and related behavioural and attitudinal change over a 90-day trial. The intervention group will receive hand hygiene supplies and a variety of educational materials, including environmental posters in common areas. The control group will perform their usual hygiene activities and will not receive an intervention. Identical weekly surveys will be administered to the intervention and control groups to measure self-reported illness, absenteeism, presenteeism, along with behaviour and attitudes measured at specified intervals during the study. The intervention and control groups were randomised by work floors before the onset of the enrolment period. It is hypothesised that employees in the intervention group will experience reduced self-reported illness, absenteeism, and presenteeism along with improved protective hygiene behaviours and related attitudes, relative to those in the control group over the 90-day trial.
Participants	Inclusion criteria 1. At least 18 years of age or older 2. No known allergies to alcohol or surface disinfecting wipes 3. Works at least 30% of office hours at the study host site 4. Consent to receiving emails from Kent State University Exclusion criteria 1. Under 18 years of age 2. Known allergies to alcohol or surface disinfecting wipes 3. Works less than 30% of office hours at the study host site 4. Does not consent to receiving emails from Kent State University
Interventions	The intervention group will receive hand hygiene supplies and a variety of educational materials, including environmental posters in common areas. The control group will perform their usual hygiene activities and will not receive an intervention.
Outcomes	Self-reported ARI/ILI and GI illness, absenteeism, presenteeism and related behavioural and attitudinal change over a 90-day trial

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NCT03454009 *(Continued)*

Starting date	5 February 2018
Contact information	Maggie Stedman-Smith, PhD, Kent State University College of Public Health
Notes	Recruitment completed. Last update in ClinicalTrials.gov was 1 May 2019. NCT03454009

NCT04267952

Study name	Hand hygiene intervention program on primary school students' health outcomes and absenteeism in school
Methods	Study Type: interventional (clinical trial) Estimated enrolment: 200 participants Allocation: randomised Intervention model: parallel assignment Masking: single (participant) Masking description: participation will not know whether they are in the experimental or control group
Participants	Inclusion criteria: primary school student (especially third- and fourth-class student) Exclusion criteria: people with chronic disease
Interventions	Experimental: first group Hand hygiene intervention programme prepared by using planned behaviour theory will be applied to the students in this group. Active comparator: second group Students in this group will be given classic hand hygiene training.
Outcomes	Primary outcome measure: children with symptoms of infection will be referred to the family physician to have a rapid antigen test and to report the result to the researcher. 10 identified upper respiratory tract symptoms (fever, sore throat, runny nose, etc.) will be recorded weekly by family of children. The researcher will receive symptom information from the family via weekly SMS. The number of days the child does not attend school due to illness and the percentage of absenteeism 1. Group A streptococcal infections in rapid antigen test (time frame: total 20 weeks) 2. Incidence of symptoms of acute upper respiratory tract infection (time frame: total 20 weeks) 3. School absenteeism (time frame: total 20 weeks) Secondary outcome measures: Glogerm gel applied hands will shine areas containing micro-organisms. Contamination rate will be calculated by taking a photo of the hands and performing brightness analysis in Adobe Photoshop program. 1. Pollution rate of hands (time frame: from date of randomisation until the date of first documented progression assessed up to 7 months)
Starting date	9 September 2019

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NCT04267952 *(Continued)*

Contact information	Contact: Uyanık +905068949969; gulcinyelten@hotmail.com
Notes	Recruitment is ongoing. Last update in ClinicalTrials.gov was 13 February 2020. NCT04267952

NCT04471766

Study name	Evaluation of locally produced cloth face mask on COVID-19 and respiratory illnesses prevention at the community level - a cluster-RCT
Methods	Study type: interventional (clinical trial) Estimated enrolment: 66,000 participants Allocation: randomised Intervention model: parallel assignment Masking: single (outcomes assessor) Primary purpose: prevention
Participants	Ages eligible for study: 10 years and older (child, adult, older adult) Sexes eligible for study: all Accepts healthy volunteers: no Criteria Inclusion criteria: 1. Household resident 2. Age 10 years and older Exclusion criteria: 1. Refusal to participate
Interventions	Experimental: certified cloth face mask plus preventive information Active comparator: information on COVID-19 prevention
Outcomes	Self-reported main symptoms of COVID-19 (3 or more of fever, cough, fatigue, shortness of breath, loss of smell/taste) Consultation for COVID-19 like illness or reported positive test, or both Self reported COVID-19 like illness plus hospitalisation or death Any death during the follow-up period: 1. Reported COVID-19 like illness (time frame: 4 months' follow-up) 2. Consultation (time frame: 4 months' follow-up) 3. Severe illness (time frame: 4 months' follow-up) 4. Mortality (time frame: 4 months' follow-up)
Starting date	Estimated study start date: July 2020
Contact information	Amabelia Rodrigues, PhD, 00245966078659; a.rodrigues@bandim.org

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NCT04471766 *(Continued)*

Notes	The number of cases of COVID-19 is still increasing, and transmission of SARS-CoV-2 seems to occur mainly through person-to-person transmission through respiratory droplets, indirect contact with infected people and surfaces. The use of face masks is recommended as a public health measure, but in many settings only domestic cloth made masks are available to the majority of the people. However, masks can be of different quality, and very little is known about the utility of cloth face masks at the community level. In Bandim Health Project's Health and Demographic Surveillance System we evaluated the effect of providing locally produced cloth face masks on the severity of COVID-19 like illness and mortality in an urban population. The locally produced cloth mask is made according to a laboratory-certified model and was provided to the intervention group alongside information of how the risk of transmission can be reduced. The control group received information alone. Follow-up will be implemented through telephone calls and post epidemic home visits.

ARI: acute respiratory tract infections
GUV: germicidal ultraviolet
ILI: influenza-like illness
GI: gastrointestinal
n: number
RACF: residential aged care facilities
RCT: randomised controlled trial
SARS: severe acute respiratory syndrome

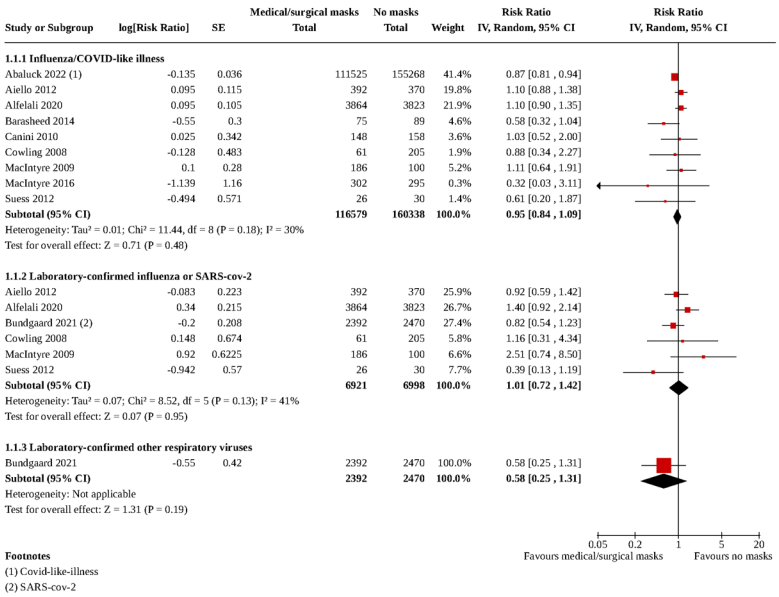
DATA AND ANALYSES

Comparison 1. Randomised trials: medical/surgical masks versus no masks

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.1 Viral illness	10		Risk Ratio (IV, Random, 95% CI)	Subtotals only
1.1.1 Influenza/COVID-like illness	9	276917	Risk Ratio (IV, Random, 95% CI)	0.95 [0.84, 1.09]
1.1.2 Laboratory-confirmed influenza or SARS-cov-2	6	13919	Risk Ratio (IV, Random, 95% CI)	1.01 [0.72, 1.42]
1.1.3 Laboratory-confirmed other respiratory viruses	1	4862	Risk Ratio (IV, Random, 95% CI)	0.58 [0.25, 1.31]

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Analysis 1.1. Comparison 1: Randomised trials: medical/surgical masks versus no masks, Outcome 1: Viral illness



Footnotes
(1) Covid-like-illness
(2) SARS-cov-2

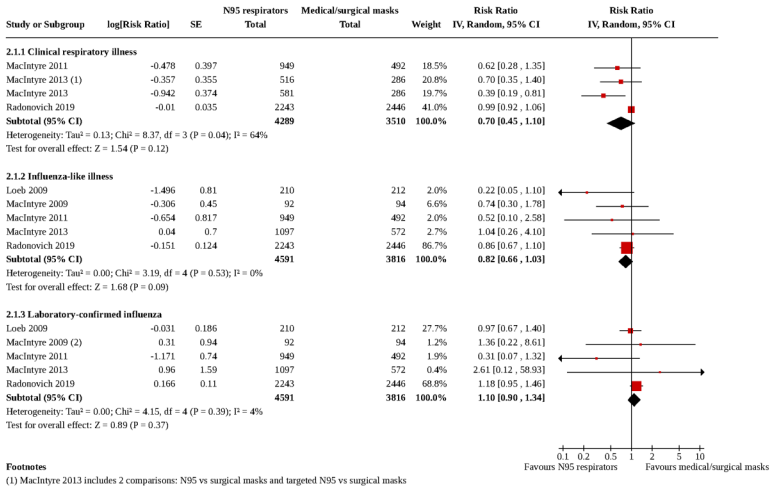
Comparison 2. Randomised trials: N95 respirators compared to medical/surgical masks

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2.1 Viral illness	5		Risk Ratio (IV, Random, 95% CI)	Subtotals only
2.1.1 Clinical respiratory illness	3	7799	Risk Ratio (IV, Random, 95% CI)	0.70 [0.45, 1.10]
2.1.2 Influenza-like illness	5	8407	Risk Ratio (IV, Random, 95% CI)	0.82 [0.66, 1.03]
2.1.3 Laboratory-confirmed influenza	5	8407	Risk Ratio (IV, Random, 95% CI)	1.10 [0.90, 1.34]
2.2 Viral illness in healthcare workers	4		Risk Ratio (IV, Random, 95% CI)	Subtotals only
2.2.1 Clinical respiratory illness	3	7799	Risk Ratio (IV, Random, 95% CI)	0.70 [0.45, 1.10]
2.2.2 Influenza-like illness	4	8221	Risk Ratio (IV, Random, 95% CI)	0.81 [0.59, 1.11]

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Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2.2.3 Laboratory-confirmed influenza	4	8221	Risk Ratio (IV, Random, 95% CI)	1.05 [0.79, 1.40]

Analysis 2.1. Comparison 2: Randomised trials: N95 respirators compared to medical/surgical masks, Outcome 1: Viral illness



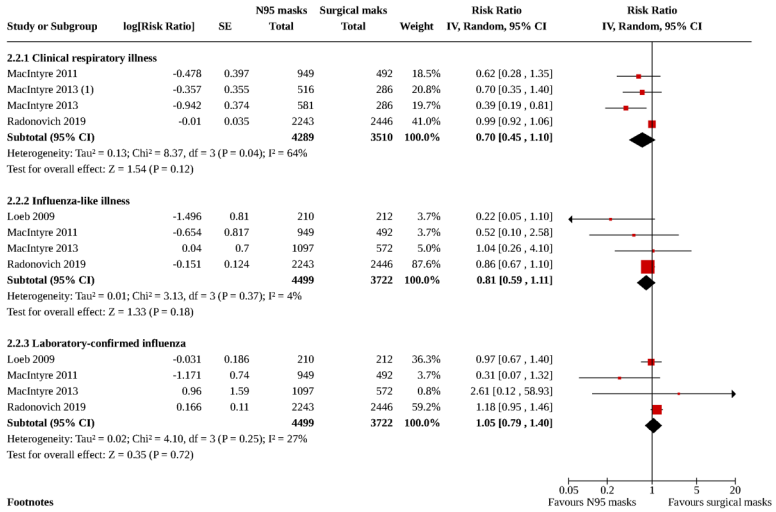
Footnotes

(1) MacIntyre 2013 includes 2 comparisons: N95 vs surgical masks and targeted N95 vs surgical masks

(2) MacIntyre 2009 reported on outcome laboratory confirmed infections

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Analysis 2.2. Comparison 2: Randomised trials: N95 respirators compared to medical/surgical masks, Outcome 2: Viral illness in healthcare workers



Footnotes

(1) MacIntyre 2013 includes 2 comparisons: N95 vs surgical masks and targeted N95 vs surgical masks

Comparison 3. Randomised trials: hand hygiene compared to control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
3.1 Viral illness	19		Risk Ratio (IV, Random, 95% CI)	Subtotals only
3.1.1 Acute respiratory illness	9	52105	Risk Ratio (IV, Random, 95% CI)	0.86 [0.81, 0.90]
3.1.2 Influenza-like illness	11	34503	Risk Ratio (IV, Random, 95% CI)	0.94 [0.81, 1.09]
3.1.3 Laboratory-confirmed influenza	8	8332	Risk Ratio (IV, Random, 95% CI)	0.91 [0.63, 1.30]
3.2 ARI or ILI or influenza (including outcome with most events from each study)	19	71210	Risk Ratio (IV, Random, 95% CI)	0.89 [0.83, 0.94]
3.3 Influenza or ILI: sensitivity analysis including outcomes with the most precise and unequivocal definitions	12	28205	Risk Ratio (IV, Random, 95% CI)	0.88 [0.77, 1.02]

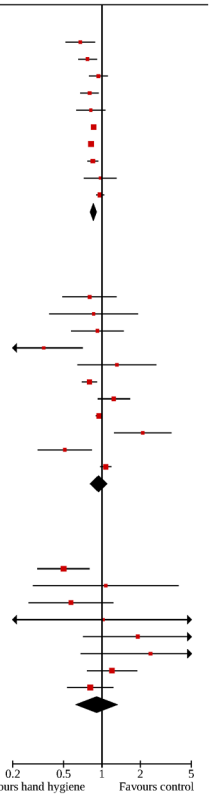
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Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
3.4 ARI or ILI or influenza: subgroup analysis	19	71210	Risk Ratio (IV, Random, 95% CI)	0.89 [0.83, 0.94]
3.4.1 Children	11	29259	Risk Ratio (IV, Random, 95% CI)	0.91 [0.84, 0.98]
3.4.2 Adults	8	41951	Risk Ratio (IV, Random, 95% CI)	0.84 [0.78, 0.91]
3.5 Absenteeism	3	3150	Risk Ratio (IV, Random, 95% CI)	0.64 [0.58, 0.71]

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Analysis 3.1. Comparison 3: Randomised trials: hand hygiene compared to control, Outcome 1: Viral illness

Study or Subgroup	log[Risk Ratio]	SE	Hand hygiene Total	Control Total	Weight	Risk Ratio IV, Random, 95% CI
3.1.1 Acute respiratory illness						
Ashraf 2020	-0.39	0.135	588	1123	3.3%	0.68 [0.52 , 0.88]
Azor-Martinez 2018 (1)	-0.261	0.086	339	149	6.7%	0.77 [0.65 , 0.91]
Azor-Martinez 2018	-0.062	0.086	274	149	6.7%	0.94 [0.79 , 1.11]
Correa 2012	-0.223	0.084	794	933	6.9%	0.80 [0.68 , 0.94]
Larson 2010	-0.199	0.134	946	904	3.3%	0.82 [0.63 , 1.07]
Little 2015	-0.151	0.02	8241	8667	20.5%	0.86 [0.83 , 0.89]
Millar 2016	-0.198	0.016	10000	10000	21.4%	0.82 [0.80 , 0.85]
Nicholson 2014	-0.163	0.05	847	833	12.6%	0.85 [0.77 , 0.94]
Sandora 2005	-0.03	0.15	602	451	2.7%	0.97 [0.72 , 1.30]
Swarthout 2020	-0.03	0.037	1496	4769	15.9%	0.97 [0.90 , 1.04]
Subtotal (95% CI)			**24127**	**27978**	**100.0%**	**0.86 [0.81 , 0.90]**
Heterogeneity: Tau² = 0.00; Chi² = 24.86, df = 9 (P = 0.003); I² = 64%						
Test for overall effect: Z = 5.93 (P < 0.00001)						
3.1.2 Influenza-like illness						
Biswas 2019	-0.223	0.249	5077	5778	6.2%	0.80 [0.49 , 1.30]
Cowling 2008	-0.151	0.408	84	205	2.8%	0.86 [0.39 , 1.91]
Cowling 2009	-0.083	0.243	257	279	6.4%	0.92 [0.57 , 1.48]
Hubner 2010	-1.05	0.36	64	65	3.5%	0.35 [0.17 , 0.71]
Larson 2010	0.271	0.363	946	904	3.5%	1.31 [0.64 , 2.67]
Little 2015	-0.223	0.07	8241	8667	17.0%	0.80 [0.70 , 0.92]
Ram 2015	0.215	0.149	193	184	11.1%	1.24 [0.93 , 1.66]
Roberts 2000	-0.051	0.03	299	259	19.4%	0.95 [0.90 , 1.01]
Simmerman 2011	0.737	0.263	292	302	5.7%	2.09 [1.25 , 3.50]
Teesing 2021	-0.67	0.248	976	886	6.2%	0.51 [0.31 , 0.83]
Zomer 2015	0.068	0.052	278	267	18.2%	1.07 [0.97 , 1.19]
Subtotal (95% CI)			**16707**	**17796**	**100.0%**	**0.94 [0.81 , 1.09]**
Heterogeneity: Tau² = 0.03; Chi² = 38.62, df = 10 (P < 0.0001); I² = 74%						
Test for overall effect: Z = 0.83 (P = 0.41)						
3.1.3 Laboratory-confirmed influenza						
Biswas 2019	-0.693	0.24	508	689	19.8%	0.50 [0.31 , 0.80]
Cowling 2008	0.07	0.671	84	205	6.0%	1.07 [0.29 , 4.00]
Cowling 2009	-0.562	0.39	257	279	12.7%	0.57 [0.27 , 1.22]
Hubner 2010	0.02	0.834	64	65	4.2%	1.02 [0.20 , 5.23]
Larson 2010	0.648	0.504	946	904	9.2%	1.91 [0.71 , 5.13]
Ram 2015	0.875	0.644	193	184	6.4%	2.40 [0.68 , 8.48]
Simmerman 2011	0.182	0.23	292	302	20.4%	1.20 [0.76 , 1.88]
Stebbins 2011	-0.211	0.212	1695	1665	21.4%	0.81 [0.53 , 1.23]
Subtotal (95% CI)			**4039**	**4293**	**100.0%**	**0.91 [0.63 , 1.30]**
Heterogeneity: Tau² = 0.11; Chi² = 13.58, df = 7 (P = 0.06); I² = 48%						
Test for overall effect: Z = 0.53 (P = 0.60)						



Footnotes

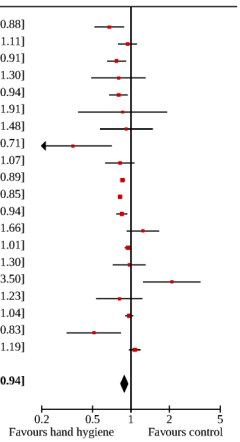
(1) Azor 2018 included 2 hand-washing groups: one using soap and water (RR 0.94) and the other using hand sanitizer (RR 0.77)

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Analysis 3.2. Comparison 3: Randomised trials: hand hygiene compared to control, Outcome 2: ARI or ILI or influenza (including outcome with most events from each study)

Study or Subgroup	log[Risk Ratio]	SE	Hand hygiene Total	Control Total	Weight	Risk Ratio IV, Random, 95% CI
Ashraf 2020	-0.39	0.135	588	1123	3.7%	0.68 [0.52 , 0.88]
Azor-Martinez 2018 (1)	-0.062	0.086	274	149	6.1%	0.94 [0.79 , 1.11]
Azor-Martinez 2018	-0.261	0.086	339	149	6.1%	0.77 [0.65 , 0.91]
Biswas 2019	-0.223	0.249	5077	5778	1.4%	0.80 [0.49 , 1.30]
Correa 2012	-0.223	0.084	794	933	6.3%	0.80 [0.68 , 0.94]
Cowling 2008	-0.151	0.408	84	205	0.6%	0.86 [0.39 , 1.91]
Cowling 2009	-0.083	0.243	257	279	1.5%	0.92 [0.57 , 1.48]
Hubner 2010	-1.05	0.36	64	65	0.7%	0.35 [0.17 , 0.71]
Larson 2010	-0.199	0.134	946	904	3.7%	0.82 [0.63 , 1.07]
Little 2015	-0.151	0.02	8241	8667	10.8%	0.86 [0.83 , 0.89]
Millar 2016	-0.198	0.016	10000	10000	11.0%	0.82 [0.80 , 0.85]
Nicholson 2014	-0.163	0.05	847	833	8.8%	0.85 [0.77 , 0.94]
Ram 2015	0.215	0.149	193	184	3.2%	1.24 [0.93 , 1.66]
Roberts 2000	-0.051	0.03	299	259	10.2%	0.95 [0.90 , 1.01]
Sandora 2005	-0.03	0.15	602	451	3.2%	0.97 [0.72 , 1.30]
Simmerman 2011	0.737	0.263	292	302	1.3%	2.09 [1.25 , 3.50]
Stebbins 2011	-0.211	0.212	1695	1665	1.8%	0.81 [0.53 , 1.23]
Swarthout 2020	-0.03	0.037	1496	4769	9.8%	0.97 [0.90 , 1.04]
Teesing 2021	-0.67	0.248	976	886	1.4%	0.51 [0.31 , 0.83]
Zomer 2015	0.068	0.052	278	267	8.6%	1.07 [0.97 , 1.19]
Total (95% CI)			**33342**	**37868**	**100.0%**	**0.89 [0.83 , 0.94]**

Heterogeneity: Tau² = 0.01; Chi² = 83.20, df = 19 (P < 0.00001); I² = 77%
Test for overall effect: Z = 3.83 (P = 0.0001)
Test for subgroup differences: Not applicable

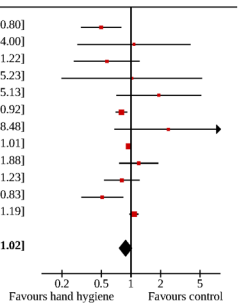


Footnotes
(1) Azor 2018 included 2 treatment groups: soap and water (RR 0.94); and hand sanitizer (RR 0.77)

Analysis 3.3. Comparison 3: Randomised trials: hand hygiene compared to control, Outcome 3: Influenza or ILI: sensitivity analysis including outcomes with the most precise and unequivocal definitions

Study or Subgroup	log[Risk Ratio]	SE	Hand hygiene Total	Control Total	Weight	Risk Ratio IV, Random, 95% CI
Biswas 2019	-0.693	0.24	508	689	6.6%	0.50 [0.31 , 0.80]
Cowling 2008	0.07	0.671	84	205	1.1%	1.07 [0.29 , 4.00]
Cowling 2009	-0.562	0.39	257	279	3.0%	0.57 [0.27 , 1.22]
Hubner 2010	0.02	0.834	64	65	0.7%	1.02 [0.20 , 5.23]
Larson 2010	0.648	0.504	946	904	1.9%	1.91 [0.71 , 5.13]
Little 2015	-0.223	0.07	8241	8667	19.7%	0.80 [0.70 , 0.92]
Ram 2015	0.875	0.644	193	184	1.2%	2.40 [0.68 , 8.48]
Roberts 2000	-0.051	0.03	299	259	23.3%	0.95 [0.90 , 1.01]
Simmerman 2011	0.182	0.23	292	302	7.0%	1.20 [0.76 , 1.88]
Stebbins 2011	-0.211	0.212	1695	1665	7.8%	0.81 [0.53 , 1.23]
Teesing 2021	-0.67	0.248	976	886	6.3%	0.51 [0.31 , 0.83]
Zomer 2015	0.068	0.052	278	267	21.5%	1.07 [0.97 , 1.19]
Total (95% CI)			**13833**	**14372**	**100.0%**	**0.88 [0.77 , 1.02]**

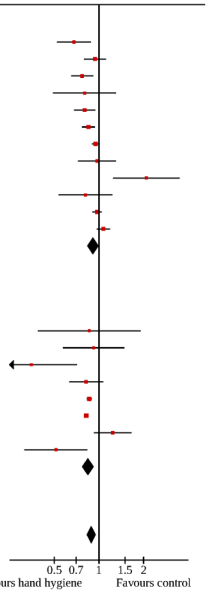
Heterogeneity: Tau² = 0.02; Chi² = 31.95, df = 11 (P = 0.0008); I² = 66%
Test for overall effect: Z = 1.75 (P = 0.08)
Test for subgroup differences: Not applicable



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Analysis 3.4. Comparison 3: Randomised trials: hand hygiene compared to control, Outcome 4: ARI or ILI or influenza: subgroup analysis

Study or Subgroup	log[Risk Ratio]	SE	Hand hygiene Total	Control Total	Weight	Risk Ratio IV, Random, 95% CI
3.4.1 Children						
Ashraf 2020	-0.39	0.135	588	1123	3.7%	0.68 [0.52 , 0.88]
Azor-Martinez 2018	-0.062	0.086	274	149	6.1%	0.94 [0.79 , 1.11]
Azor-Martinez 2018 (1)	-0.261	0.086	339	149	6.1%	0.77 [0.65 , 0.91]
Biswas 2019	-0.223	0.249	5077	5778	1.4%	0.80 [0.49 , 1.30]
Correa 2012	-0.223	0.084	794	933	6.3%	0.80 [0.68 , 0.94]
Nicholson 2014	-0.163	0.05	847	833	8.8%	0.85 [0.77 , 0.94]
Roberts 2000	-0.051	0.03	299	259	10.2%	0.95 [0.90 , 1.01]
Sandora 2005	-0.03	0.15	602	451	3.2%	0.97 [0.72 , 1.30]
Simmerman 2011	0.737	0.263	292	302	1.3%	2.09 [1.25 , 3.50]
Stebbins 2011	-0.211	0.212	1695	1665	1.8%	0.81 [0.53 , 1.23]
Swarthout 2020	-0.03	0.037	1496	4769	9.8%	0.97 [0.90 , 1.04]
Zomer 2015	0.068	0.052	278	267	8.6%	1.07 [0.97 , 1.19]
Subtotal (95% CI)			**12581**	**16678**	**67.2%**	**0.91 [0.84 , 0.98]**
Heterogeneity: Tau² = 0.01; Chi² = 36.24, df = 11 (P = 0.0002); I² = 70%						
Test for overall effect: Z = 2.36 (P = 0.02)						
3.4.2 Adults						
Cowling 2008	-0.151	0.408	84	205	0.6%	0.86 [0.39 , 1.91]
Cowling 2009	-0.083	0.243	257	279	1.5%	0.92 [0.57 , 1.48]
Hubner 2010	-1.05	0.36	64	65	0.7%	0.35 [0.17 , 0.71]
Larson 2010	-0.199	0.134	946	904	3.7%	0.82 [0.63 , 1.07]
Little 2015	-0.151	0.02	8241	8667	10.8%	0.86 [0.83 , 0.89]
Millar 2016	-0.198	0.016	10000	10000	11.0%	0.82 [0.80 , 0.85]
Ram 2015	0.215	0.149	193	184	3.2%	1.24 [0.93 , 1.66]
Teesing 2021	-0.67	0.248	976	886	1.4%	0.51 [0.31 , 0.83]
Subtotal (95% CI)			**20761**	**21190**	**32.8%**	**0.84 [0.78 , 0.91]**
Heterogeneity: Tau² = 0.00; Chi² = 20.32, df = 7 (P = 0.005); I² = 66%						
Test for overall effect: Z = 4.17 (P < 0.0001)						
Total (95% CI)			**33342**	**37868**	**100.0%**	**0.89 [0.83 , 0.94]**
Heterogeneity: Tau² = 0.01; Chi² = 83.20, df = 19 (P < 0.00001); I² = 77%						
Test for overall effect: Z = 3.83 (P = 0.0001)						
Test for subgroup differences: Chi² = 1.83, df = 1 (P = 0.18), I² = 45.2%						

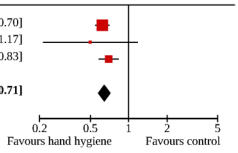


Footnotes

(1) Azor 2018 includes 2 intervnetion groups: soap and water (RR 0.94) and hand sanitizer (RR 0.77)

Analysis 3.5. Comparison 3: Randomised trials: hand hygiene compared to control, Outcome 5: Absenteeism

Study or Subgroup	log[Risk Ratio]	SE	Hand Hygiene Total	Control Total	Weight	Risk Ratio IV, Random, 95% CI
Azor-Martinez 2016	-0.478	0.065	621	720	64.8%	0.62 [0.55 , 0.70]
Hubner 2010	-0.693	0.435	64	65	1.4%	0.50 [0.21 , 1.17]
Nicholson 2014	-0.362	0.09	847	833	33.8%	0.70 [0.58 , 0.83]
Total (95% CI)			**1532**	**1618**	**100.0%**	**0.64 [0.58 , 0.71]**
Heterogeneity: Tau² = 0.00; Chi² = 1.43, df = 2 (P = 0.49); I² = 0%						
Test for overall effect: Z = 8.45 (P < 0.00001)						
Test for subgroup differences: Not applicable						

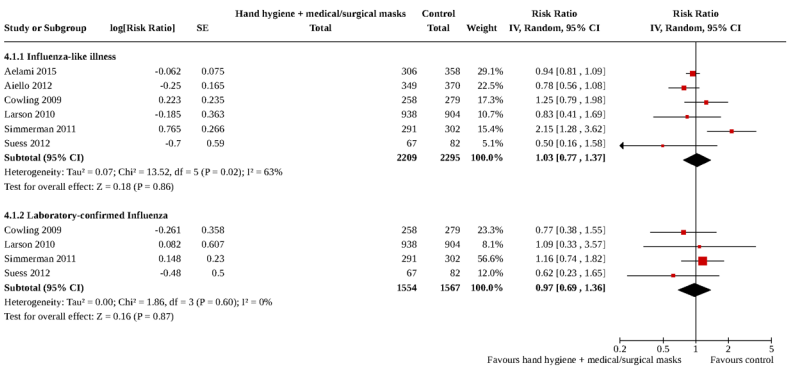


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Comparison 4. Randomised trials: hand hygiene + medical/surgical masks compared to control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
4.1 Viral illness	6		Risk Ratio (IV, Random, 95% CI)	Subtotals only
4.1.1 Influenza-like illness	6	4504	Risk Ratio (IV, Random, 95% CI)	1.03 [0.77, 1.37]
4.1.2 Laboratory-confirmed Influenza	4	3121	Risk Ratio (IV, Random, 95% CI)	0.97 [0.69, 1.36]

Analysis 4.1. Comparison 4: Randomised trials: hand hygiene + medical/surgical masks compared to control, Outcome 1: Viral illness

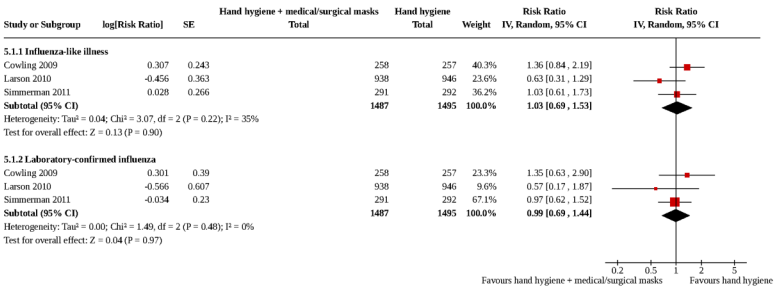


Comparison 5. Randomised trials: hand hygiene + medical/surgical masks compared to hand hygiene

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
5.1 Viral illness	3		Risk Ratio (IV, Random, 95% CI)	Subtotals only
5.1.1 Influenza-like illness	3	2982	Risk Ratio (IV, Random, 95% CI)	1.03 [0.69, 1.53]
5.1.2 Laboratory-confirmed influenza	3	2982	Risk Ratio (IV, Random, 95% CI)	0.99 [0.69, 1.44]

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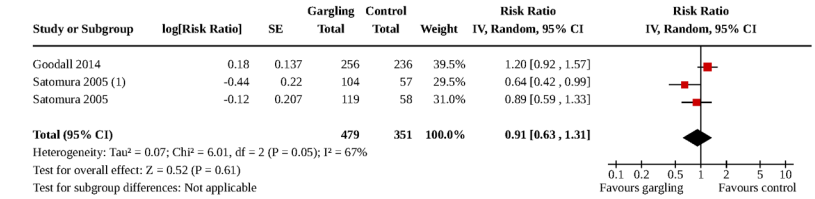
Analysis 5.1. Comparison 5: Randomised trials: hand hygiene + medical/ surgical masks compared to hand hygiene, Outcome 1: Viral illness



Comparison 6. Randomised trials: gargling compared to control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
6.1 Viral illness	2	830	Risk Ratio (IV, Random, 95% CI)	0.91 [0.63, 1.31]
6.2 SARS-CoV-2	2	394	Risk Ratio (IV, Random, 95% CI)	0.07 [0.02, 0.23]

Analysis 6.1. Comparison 6: Randomised trials: gargling compared to control, Outcome 1: Viral illness

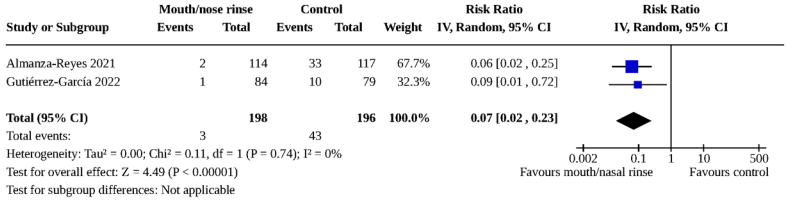


Footnotes

(1) Satomura 2005 included 2 intervention groups

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Analysis 6.2. Comparison 6: Randomised trials: gargling compared to control, Outcome 2: SARS-CoV-2



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ADDITIONAL TABLES

Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist

Author, year	Brief name	Recipient	Why	What (materials)	What (procedures)	Who provided	How	Where	When and how much	Tailoring	Modification of intervention through out trial	Strategies to improve or maintain intervention fidelity	Extent of intervention fidelity
Masks compared to either no masks or different mask types													
Abaluck 2022 (additional sources: Abaluck 2021a, Abaluck 2021b, Kwong 2021)	Community-level mask promotion and distribution of free masks. A. Cloth masks or B. Surgical masks with possible addition al village level elements: i) incentive	Leaders and adult household members of rural and peri-urban villages	Increase large-scale adoption and proper wearing of face masks to slow the spread of COVID-19 and save lives informed by research in public health, psychology, eco-	Masks colour-coded by households, either: A. cloth masks: an exterior layer of 100% non-woven polypropylene (70 grams/m2 [gsm]), 2 interior layers of 60% cotton/40% polyester interlocking knit (190 gsm), an elastic loop that goes around the head above and below the ears, and a nose bridge; filtration efficiency: 37%[1] B. 3 layers of 100% non woven polypropy-	All villages: 1. household distribution of surgical or cloth masks and showing of mask-wearing video; 2. distribution and promotion of masks at village markets; 3. mask distribution at mosques; 4. mask promotion in public spaces; 5. role modelling and advocacy by local leaders, including Imams during Friday prayers using a scripted speech. Periodic monitoring of passers-by and reminding people to put on masks	Local NGO staff and volunteers (Bangladesh NGO GreenVoice)[5] and Innovations for Poverty Action (IPA) Village Imams and police officers No "spe-	Masks and promotion delivered by Text messages delivered by	Households, markets, mosques and streets of 572 villages (in rural Bangladesh)	8 weeks per village rolled out over a 6 week period (November 2020 to January 2021) 1 day of training per village Once off mask distribution and promotion at households (4 days / village)	Periodic monitoring and then additional training of staff provided as needed Different locations and timing of observation across different days	In the first 5 weeks of the study staff found low engagement in some villages with local mask use, so mask promotion staff were re-trained by researcher part-way through the in-	Numbers of masks distributed was noted Promoters periodically monitored passers-by and reminded people to put on masks Direct surveillance of mask wearing, correct mask-	Numbers of masks distributed: A. 370,643 B. 924,849 Mask-wearing: IGs: 42.3% CG: 13.3% Increase was largest in mosques (37% points) and 25% to 29% points in

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	ii) signage	nomics, marketing, and other social sciences on product promotion and dissemination strategies	lene[2], elastic ear loops, and a nose bridge; filtration efficiency: 95%.	Some villages:	cialized skills" needed as intervention designed to be easily adopted by other NGOs or agencies	phone and individually	Mask distribution 3 to 6 days / week at markets and on 3 Friday days at mosques during the first 4 weeks	tervention "to work more closely with local leaders and set specific milestones for that partnership"	wearing (wearing either a project mask or an alternative face-covering over the mouth and nose) and physical distancing (If s/he was at least one arm's length away from the nearest person)[6]	other locations
	iii) text message reminder and household elements: i) altruism or self-protection messages		Sticker that had a logo of a mask with an outline of the Bangladeshi flag and a phrase in Bengali that noted the mask could be washed and reused[3]; filtration efficiency of 76%	village police accompanying mask promoters, providing monetary rewards or certificates to villages if mask-wearing rate improves.			Weekly or biweekly mask promotion	After 5 weeks, monitoring of mask-wearing was limited to those who appeared to be 18 years or older.		Proper mask-wearing increased by 29.0%
				Some villages:						
				public signalling of mask-wearing via signage, text message reminders, messaging emphasizing either altruistic or self-protection motives for mask-wearing, and extracting verbal commitments from households.						Physical distancing increased from 24.1% in CG villages to 29.2% in IG villages
	ii) amount of households receiving texts		Initial 3 masks per household		Training of staff provided by researchers for mask promotion		Role-modelling and leader advocacy at Friday prayers			
			Video of notable public figures[4] discussing why, how, and when to wear a mask	Modelling of safe mask wearing by study staff						No difference between IGs and CGs in number of people observed in public areas, as an indication of social distancing.
	iii) commitment to mask-wearing		Brochure based on WHO materials depicting proper mask-wearing	Detailed procedures outlined in online protocol supplement osf.io/23mws/			Periodic monitoring: 1/week on weeks 1, 2, 4, 6, 8, and 10;		Additional training	
			Scripted speeches for							

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

use by role models and local leaders at Friday prayers		daily schedule provided in Protocol – 1 hour per site for 9 sites 8am to 5pm	for mask promotion staff	
Scripted text messages			Recording of activities undertaken by intervention staff including the degree to which leaders or imams understood the script, sites observed etc (see p.9 of Protocol osf.io/23mws/)	
Monetary rewards (USD 190) or non-monetary reward (certificate) for villages		Each village observed on 2 alternating days of the week.		
Signage for household doors declaring they are a mask-wearing household		Observations occurred 7 days of the week (9 am to 7 pm)		
Smart phone for delivery and receipt of text message reminders		Detailed schedules provided in online protocol supplement via osf.io/23mws/	"consistent with the WHO guideline that defines physical distancing as one meter of separation."	
Loudspeaker for announcements in markets by research staff				

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

| | | |

Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

								mask use						could be < 24 hours)				in IG than CG
Barasheed 2014	Supervised mask use	Religious pilgrims ≥ 15 years	Prevent respiratory virus infections at mass gatherings through mask use	Plain surgical face masks (3M Standard Tie-On Surgical Mask, Cat No: 1816) manufactured by 3M company, USA; 5 masks per day Written instructions on face mask use Special polythene bags for disposal	Masks provided to index case and their contacts with advice on mask use (before prayers, in seminars, and after meals). Written instructions provided on face mask use, need to change them, and disposal.	Not described, presumably the medical researchers	Face-to-face provision of masks, instructions, and reminders	Tents of pilgrimage site (Mina Valley, Saudi Arabia)	Advice on mask use given throughout pilgrimage stay (5 days)	None reported.	Changing of mask if worn for more than 8 hours	None described	The medical researchers followed pilgrims each day to remind participants about recording their mask usage in health diary.	Face mask use: mask group: 56/75 (76%), control group: 11/89 (12%) (P < 0.001) 76% of intervention tents wore masks. 10 of 75 (13%) pilgrims in 'mask' tents wore face masks during sleep.
Bundgaard 2021 (additional source-Bundgaard 2020)	Face masks (surgical)	Community-dwelling adults aged 18 years or older with interest to reduce wearers' risk for infection outcomes from SARS-CoV-2	Reduce infection outcomes from SARS-CoV-2	Per participant: 50 x 3-layer, disposable, surgical face masks with ear loops (TYPE II EN 14683 (Abena, Denmark); filtration rate,	Supply of masks sent to home address by courier Provision of written instructions sent by courier about how and when to wear masks including	Researchers provided the masks (funded by Salling Group), in-	Individually by mail, email, online and telephone	Mask wearing: when outside the home - and in the	Mask wearing: whenever outside the home or when guests in the home,	Changing of mask if worn for more than 8 hours	None described	Face mask adherence: Self-report (Yes / Partial / No) (Suppl 4)	Face mask adherence: % Adhere: 46% Partial: 47% No: 7%

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	net access	side the home through protection of the nose and mouth from droplets or aerosols or contaminated fingers and hands	98%; made in China)	links to instructional video for face mask use	structions and follow-up support	home when they had guests (in Denmark)	up to 8 hours for 1 mask, for 1 month (April to May 2020)	If guests in the home, wear mask	Average mask use per day	Mean face masks used:	
			1 badge (saying: "I am testing face masks – for you and me")	Instruction to follow advice of local health authorities (in Denmark)					Self-assessed adherence with health authority guideline on social distancing and hygiene (Suppl)	Weekdays: 1.7 Weekends: 1.3	
			Written instructions and instructional videos for proper use of masks (See supplement 8) of published paper including link to video for proper face mask use [in Danish] vimeo.com/406952695	Provision of follow-up support by email and a phone help-line for questions	Background and training of researcher not described	Instructions and support at home and online	1 off instructions for mask use and again as needed	Individualised support as needed via email or telephone		Health authority guidance adherence not reported	
					Hotline provided medical expertise and guidance, (qualification and training needed for this support not specified)		Weekly follow-up emails				
							Hotline available at all times during study period				

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

Canini 2010	Surgical face masks	Households (over 5 years)	Limit transmission of influenza transmission by large droplets produced during coughing in households	Initial supply of 30 masks: for adults and children > 10: surgery masks with ear loops, 3 plys, anti fog (AEROKYN, LCH medical products, Paris, France) Children 5 to 10: face mask KC47127, (Kimberly-Clark, Dallas, TX, USA) Closed plastic bags for disposal	Masks given immediately on home visit by attending general practitioner with demonstration of proper use and instruction to be worn for 5 days in presence of another household member or in confined space (e.g. car) and to change every 3 hours or if damaged.	General practitioners	Face-to-face individually	Households in France	One-off provision of masks worn for 5 days	None described.	None described.	Not described, but reported mask usage was measured	34/51 (66%) wore masks > 80% of the duration. Reported mask-wearing: 11 ± 7.2 masks during 4.0 ± 1.6 days with an average use of 2.5 ± 1.3 masks per day and duration of use of 3.7 ± 2.7 hours/day
Jacobs 2009	Face masks	Hospital healthcare providers (nurses, doctors, and co-medical personnel)	Decrease risk of infection through limiting droplet spread through masks	Hospital-standard disposable surgical Mask MA-3 (Ozu Sangyo, Tokyo, Japan); quantity not specified	Provision of masks and instructions for use	Not described, presumably research team	Face-to-face	Tertiary care hospital in Tokyo, Japan Face masks worn whilst on hospital property.	77 days	None described.	None described.	Self-reported adherence	Self-reported adherence for both groups reported as good, with full adherence by 84.3% and remainder complying

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

														79.2% to 98.7%.
Loeb 2009	2 active interventions A. surgical masks B. N95 respirators	Healthcare workers (nurses)	Reduce transmission of influenza in healthcare settings through coughing or sneezing with protective masks	A. Surgical masks B. N95 respirators	Provision of masks or N95 respirators Instruction in use and proper placement of devices Fit-testing and demonstration of positioning of N95 using standard protocol and procedure (details provided) Qualitative fit-testing using saccharin or Bitrex protocol[7]	Provided by research team (not further described) Fit-testing by technician for N95	In-person face-to-face	Tertiary hospitals in Ontario, Canada	1 influenza season (12 weeks) Use of mask as required[8] when providing care to or within 1 m of patient with febrile respiratory illness, ≥ 38 °C, and new or worsening cough or shortness of breath Nurses to wear N95 when caring for patients with "febrile respira-	Fit-testing of nurses not already fit-tested	Ceased before end of season	Adherence audits during peak of season by trained auditor who stood short distance from patient isolation room	18 episodes: N95: 6/7 participants (85.7%) wearing assigned device versus 100% for masks

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

														tory illness"		
Maclntyre 2009	2 active interventions in addition to infection control guidelines A. Surgical masks (SM) B. P2 masks (P2)	Householders with a child with fever and respiratory symptoms	Prevent or reduce respiratory virus transmission in the community through non-pharmaceutical interventions	A. 3M surgical mask, catalogue no. 1820; St Paul, MN, USA for adults B. P2 masks (3M flat-fold P2 mask, catalogue no. 9320; Bracknell, Berkshire, UK) A and B: health guidelines and pamphlets about infection control	Provision of masks and pamphlets and education about infection prevention and mask use Telephone calls and exit interviews to record adherence to mask use All groups: health guidelines, pamphlets about infection control were provided	Not described, presumably research team	Face-to-face and by telephone	Households in Sydney, Australia	2 winter seasons (3 months and 6 months) 2 weeks of follow-up Masks to be worn at all times when in same room as index child, regardless of distance from child	None described.	None described.	Daily telephone calls to record mask use throughout day Exit interviews about adherence	Reported mask use: Day 1 SM: 36/94 (38%) P2: 42/92 (46%) stated wearing "most or all" of the time. Other participants were wearing face masks rarely or never. Day 5: SM: 29/94 (31%) P2: 23/92 (25%)	
Maclntyre 2011	3 active interventions A. Medical masks	Healthcare workers	Protect HCWs by preventing transmis-	Daily supply of A. 3 medical masks (3M medical mask, catalogue number 1820, St Paul, MN, USA)	Supply of masks or respirators. Instruction in when to wear it, correct fitting, and storage (in paper bag in personal locker)	Masks provided to hospitals. Training of	Masks and training provided face-	Emergency departments and respi-	Entire work shift for 4 weeks	Taken off for toilet and meal breaks and at	None described.	Mask/respirator use monitored by: (i) observed	Adherence for usage was high for all and not		

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	B. N95 respirators fit-tested C. N95 respirators non-fit-tested		sion of influenza and other respiratory viruses from patients through mask wearing	B. N95 fit-tested mask (3M flat-fold N95 respirator, catalogue number 9132) fit-tested with 3M FT-30 Bitrex Fit Test kit according to manufacturer's instructions (3M, St Paul, MN, USA) C. N95 non-fit-tested mask (3M flat-fold N95 respirator, catalogue number 9132) Diary cards for usage recording	Instruction in importance of hand hygiene before and after removal For fit-tested group: fit-testing procedure	staff provided by 1 member of research team.				end of shift		None described.	adherence by head ward nurse recorded daily; (ii) self-report diary cards carried during day recording: (i) no. hours; (ii) usage. Exit interviews	significantly different amongst arms. Medical mask: 76%, 5 hours N95 fit-tested: 74%, 5.2 hours N95 non-fit-tested: 68%, 4.9 hours
Macintyre 2013	3 active interventions A. N95 respirators at all times B. N95 respirators targeted use C. Medical masks	Healthcare workers (nurses and doctors)	Protect HCWs from respiratory infections from patients through mask use	Daily supply of: A. and B. 2 respirators (3M Health Care N95 Particulate Respirator; catalogue number 1860) 3M FT-30 Bitrex Fit Test Kit C. 3 masks 3 masks (3M Standard Tie-On Surgical Mask catalogue number mask 1817; 3M, St Paul, MN, USA) Pocket-sized diary card with	Supply of respirators Instructions in use including times and fit Fit-testing procedure according to the manufacturer's instructions (3M) For targeted N95: checklist of defined high-risk procedures, including common aerosol-generating procedures	3M supplied respirators and masks. Provider of instructions not specified.	Masks and training provided face-to-face, not described if training was individually or in groups.	Emergency departments and respiratory wards of tertiary hospitals in Beijing, China	For 4 weeks, A and B worn at all times on shift; B. targeted (intermittent) use of N95 respirators only whilst performing high-risk procedures or barrier.	None described.	None described.	Self-reported daily record of number of hours worked, mask or respirator use, number of high-risk procedures undertaken collected by study staff.	Adherence highest for targeted N95 (82%; 422/516) versus N95 (57%; 333/581) versus medical mask (66%; 380/572).

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

						tick boxes for mask use										
MacIntyre 2015	2 active interventions A. Cloth masks B. Medical masks	Hospital healthcare workers	Prevent respiratory infections in HCWs from patients through mask wearing	A. 5 cloth masks for study duration (2- layer, cotton) B. 2 medical masks daily for each 8-hour shift for study duration (3 layers, non-woven material) All masks locally manufactured. Written instructions on cleaning cloth masks	Cloth or medical masks to be worn at all times on shift. Cloth masks to be washed with soap and water daily after shifts, and the process of cleaning to be documented. Provision of written instructions for cloth mask cleaning	Researchers arranged supply of masks and instructions and any training of staff assisting the delivery.	Masks and written instructions provided face-to-face.	Hospital wards in Vietnam	4 weeks (25 days) of face mask use	Masks not worn while in the toilet or during tea or lunch breaks.	None described.	Monitored adherence with mask use by self-report diary card and exit survey and interviews with a subsample (ACTRN12610000887077)	Mask-wearing adherence: cloth mask: 56.8% medical mask: 56.6% Reported cloth mask washing: 23/25 days (92%)
MacIntyre 2016	Medical mask use	Sick household- ers with ILI (index cases) and their well contacts of the same household	Protect well people in the community from transmission of respiratory pathogens by contacts with ILI through mask use	21 medical masks (3M 1817 surgical mask) Diary cards for mask use	Supply of masks Instructions for mask wearing and handwashing protocol Provision of diary cards	Study staff member provided masks and instructions in use.	Masks and instructions provided face-to-face and individually.	Fever clinics of major hospitals in Beijing, China	3 masks/ day for 21 days Mask wearing: whenever in the same room as a household member or a visitor to the household Handwashing: before	Allowed to remove their masks during mealtimes and whilst asleep and to cease wearing once symptoms	None reported.	Self-reported daily record of mask use using diary card	Mask use: mask group: 4.4 hours; control group: 1.4 hours

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

									putting on and after taking off	resolved				
Radonovich 2019	2 active interventions A. N95 respirators (N95) B. Medical masks (MM)	Healthcare personnel of outpatient sites within medical centres	Prevent HCP from acquiring workplace viral respiratory infections and transmitting them to others by effective respiratory protection by N95 respirators which reduce aerosol exposure and inhalation of small airborne	A. N95 respirators: 3M Corporation 1860, 1860S, and 1870 (St Paul, MN, USA) or Kimberly Clark Technol Fluidshield PFR95-270, PFR95-274 (Dallas, TX, USA) B. Medical mask Precept 15320 (Arden, NC, USA) or Kimberly Clark Technol Fluidshield 47107 (Dallas, TX, USA). Reminder signs posted at each site A portable computer equipped with data recording software (HandyAudit; Toronto, Canada) to document adherence	Participants instructed to wear assigned protective devices whenever they were positioned within 6 feet (1.83 m) of patients with suspected or confirmed respiratory illness and to don a new N95/MM with each patient interaction. Hand hygiene recommended to all participants in accordance with Centers for Disease Control and Prevention guidelines. Infection prevention policies were followed at each study site. Reminder signs posted at sites and emails sent. Annual fit-testing conducted for all participants.	Centres provided device supplied by study to HCP. Study personnel posted reminder signs and emails and conducted adherence observations.	Face-to-face individual provision of devices and adherence observations Onsite posting of signs Other reminders by email	Outpatient sites within medical centres in USA	As instructed, for each new patient interaction during 12-week period of peak viral respiratory illness each year for 4 years (total of 48 weeks)	Fitting of N95 masks	None described.	Reminder signage posted at study sites, and emails sent by study personnel. Self-reported daily device wearing of "always", "sometimes", "never", or "did not recall" Observation of device-wearing behaviours as participants entered and exited care rooms conducted	Device wearing: N95: 89.4% reported "always" or "sometimes" versus MM: 90.2% "Never" N95: 10.2% MM: 9.5%

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			particles, meet filtration requirements, and fit tightly	(Radonovich 2016)	Filtration testing performed on the device models in the study. Further details in protocol (Radonovich 2016).							during unannounced, inconspicuous visits to randomly selected sites documented on portable computer
Hand hygiene													
Alzaher 2018	Hand hygiene workshop	Primary school girls	Targeted school children to improve hand hygiene to reduce school absences due to upper respiratory infection and spread of infection in	6-minute video-clip of 2 siblings that attended school-based health education about hand hygiene Short interactive lecture about: common infections in schools, methods of transmission, hand-washing procedure using soap and water including when to wash hands	Delivery of workshop and distribution of supporting materials (games and posters) to school and students	Study investigator delivered workshop.	Delivered face-to-face in group format for the workshop	2 primary girls' schools in Saudi Arabia	1-hour once-off workshop; posters and games provided to school	Not described	Not described	Posters in restrooms as reminders of handwashing hygiene during 5-week follow-up period after workshop	Not reported

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		schools and to families	Puzzle games related to hand hygiene											
			Posters with cartoon princesses' picture promoting hand-washing											
Arbogast 2016	Multimodal hand hygiene intervention protocol in addition to control of brief video	Office buildings and the employees of health insurance company	Reduce hand-to-mouth germ transmission from shared workspaces and workplace facilities and thereby healthcare claims and absenteeism through improved workplace hand	Alcohol-based hand sanitiser (PURELL Advanced, GOJO Industries Inc, Akron, OH, USA) installed as wall-mounted dispensers, stands, or free-standing bottles One 8-ounce bottle of hand sanitiser (PURELL Advanced) per cubicle One 100-count canister of hand wipes (PURELL Wipes) per cubicle	Hand hygiene supplies installed in offices. Replenishment product was made easily available to individual employees upon request via a simple process. Monitoring of product shipments into sites Physical collection and full replacement of soap, sanitiser, and wipes Intervention and control group: educational video embedded at end of baseline online knowledge survey	Not described, presumably study investigators arranged installations	Hand hygiene supplies provided in office environments and individually at staff cubicles/offices. Video provided individually via email.	High-traffic common areas of 2 US health insurance company offices (e.g. near elevators, at entrances) and appropriate public spaces (e.g. coffee area, break rooms, conference rooms, training	13.5 months overall One-off email video 11 days before study hand hygiene supplies installed. 13 months of provision of supplies 2 times evening collection and	Sanitiser installed in high-use areas of the offices.	Not described	Employee survey at 4 months included questions about hand hygiene practice adherence. Monitoring of product shipments into the sites and physical collection of the soap, sanitiser, and wipes products 2 times	Intervention group employees: reported 40% more cleaning of work area regularly; significantly more likely to keep the hand sanitiser with them and use it throughout the day; significant increases in hand sanitiser use for at-risk

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	hygiene	Replenishment products stored in supply room (in addition to existing foam hand wash (GOJO Green Certified Foam Handwash) and an alcohol-based hand sanitiser foam wall-mounted dispenser (PURELL, GOJO Industries) already provided near the restroom exits prior to intervention) Identical soap in all restrooms Intervention and control group: brief (< 1-minute educational video) about proper hand hygiene technique, for both washing and sanitising hands	rooms, lobbies, reception areas); individual staff cubicles of mostly open plan offices (average 309 square feet). Office restrooms	full replacement of products	in the study; collected samples were measured and usage rates were estimated	activities[9] Estimated use by average employee from sample collection: sanitiser 1.8 to 3.0 times/day, soap 2.1 to 4.4 times/day, wipes at their desk 1.4 to 1.5 times/week

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				"Wash Your Hands", signage promoting hand hygiene adherence, was already posted next to restroom exits at both the control and intervention sites.										
Azor-Martinez 2016	Handwashing programme	Primary school children and their parents and teachers	Prevent transmission of upper respiratory infections in schools and to families through non-pharmaceutical intervention of handwashing programme in schools	Brochure about hand-washing awareness and habits Workshop content materials Stories, songs, and classroom posters about hand hygiene and infection transmission Hand sanitiser (ALCO ALOE GEL hand sanitiser by Americo Govantes Burguete, S.L. Madrid, Spain containing 0.2% chlorhexidine digluconate, 1% phenoxyethanol,	Brochure sent to parents by mail with study information sheet. Workshop provided for pupils and teachers: frequent infections in schools, transmission and prevention, instructions on correct hand-washing (water and soap, soaping > 20 s, drying hands), use of hand sanitisers and possible side effects Classroom activities linked to hand hygiene and infection transmission	Brochure sent by school administration. Workshop and verbal and written information presumably provided by the study research assistant. Classroom	Brochure sent by mail to individual parents. Workshops and classroom activities delivered in groups face-to-face. Teacher reinforcement of hand hygiene	Primary school classes in Spain (details not provided)	8 months overall One-off brochure and installation of hand sanitiser dispensers 2-hour workshop held 1 month before study commencement Fortnightly classes	Supervision and administration of hand sanitiser as needed by teachers, especially for younger children	Not described	Daily reinforcement by teachers of hand hygiene Fortnightly support by research assistant promoting handwashing Self-reported correct handwashing procedure (water and soap, soaping	Self-reported correct handwashing included in analysis but not separately reported.

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				0.1% benzalkonium chloride, 5% aloe barbadensis, 70% denat ethyl alcohol, excipients quantity sufficient for 100 mL alcohol 70%, pH 7.0 to 7.5)	Reinforcement of hand hygiene by teachers	activities provided by research assistant and teachers.	giene provided to class face-to-face.	room activities	> than 20 s, drying hands)					
					Hand sanitiser dispensers fixed to walls with an informational poster about hand-washing		Hand sanitiser use supervision was provided individually and face-to-face.	As required, teacher supervision and administration of hand sanitiser						
				Informational poster about when and how to wash hands	Supervision of younger children when using hand sanitiser and administration of sanitiser if needed	Supervision and administration of hand sanitiser for younger children by teachers		Daily reinforcement of hand hygiene by teachers						
				Written and verbal guidance to teachers, parents, and students on properties, possible side effects, and precautionary measures for gel use and storage	Instruction of children in hand-washing procedures after toilet and when dirty and correct hand sanitiser use[10]									
Azor-Martínez 2018	Educational and hand hygiene programme 2 active in-	Day care centres and their attending children, their parents,	Prevent transmission of respiratory infections by improved hand	A. Liquid soap (no specific antibacterial components (pH = 5.5)) OR B. Hand sanitiser (70% ethyl alcohol (pH = 7.0 to 7.5)) for home use and	Installation of liquid soap or hand sanitiser dispensers in classrooms Supervision and administration of hand sanitiser if required	Workshop delivered by researchers. Research assistant	Workshops delivered face-to-face in groups to parents and staff.	Classroom of DCCs (in Spain) for child interventions	8 months overall Initial 1-hour workshop 1 month before study	Administration of hand sanitiser in the case of young children	Not described	Not described Reported that no monitoring of adherence	Families or DCC staff, or both, used 1660 L of hand sanitiser, estimated use by each child of

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ventions: A. soap and water B. hand sanitiser	and DCC staff	hygiene of children, parents, and staff through handwashing practices and use of hand sanitiser due to its bactericide and virucide properties	in dispensers for school classroom Workshop content handout Stories, songs, and posters about hand hygiene and infection transmission	3 hand hygiene workshops for parents and DCC staff: 1. Hand-washing practices, hand sanitiser use, possible side effects and precautionary measures (HSG only) 2. RIs and their treatments 3. Fever Instructions to children, parents, and DCC staff on usual hand-washing practices and protocol[11] Classroom activities (stories and songs) about hand hygiene and infection transmission	provided hand hygiene materials to DCCs and parents. Parents and staff supervised and administered sanitiser where indicated.	Workshop content emailed to attendees individually. Individual face-to-face supervision of hand sanitiser use, as indicated	Workshops provided at DCCs.	commencement 3 further identical sessions/DCC provided again 1 month apart Fortnightly classrooms and DCC activities One-off installation of dispensers As-needed supervision of hand sanitiser use Dose of sanitiser: 1 to 2	DCC staff could attend training at other DCC if unable to attend at own DCC.	through continuous observation of hand hygiene behaviours was done, but amount of hand sanitiser was measured	dose 6 to 8 times/day.

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

										mL/dis-infection			
Biswas 2019	Hand sanitiser and respiratory hygiene education	Primary schools and their students and staff	Reduce community-wide influenza virus transmission by improving handwashing and respiratory hygiene and use of sanitiser in school-children as contributors to community-wide virus transmission	Hand sanitiser (63% ethyl alcohol) in colourless, transparent 1.5-litre local plastic bottles (manufactured by a local pharmaceutical company and was available commercially in Bangladesh (price: USD 5.75/L)) Video clip on respiratory hygiene practices Behavioural change materials – 3 colour posters (see Appendix of paper) Curriculum materials for hygiene classes	Installation of hand sanitiser in wall dispensers in all classrooms and outside all toilets, refilled by field staff as needed Encouragement of use of sanitiser at 5 key times during the day[12] Hand and respiratory hygiene education provided.[13] Integration of hygiene messages into school's hygiene curriculum Delivery of video clip on respiratory hygiene practice Behaviour change materials distributed and placed around schools.	Selected teachers responsible for dissemination of intervention messages throughout were trained over 2 days in these messages, behaviour change communication, sanitiser use, and practices for preventing spread of respiratory	Hand sanitiser and education materials provided to schools. Education provided in classrooms in groups and face-to-face.	Primary schools (in Bangladesh) Sanitiser in each classroom and outside toilets Education in classroom	10 weeks Intervention messages conveyed in classrooms 3 times/week.	Refills provided as needed.	Not described	Structured field observation by 2 field staff of 5 hours/school observing handwashing and respiratory hygiene behaviours of children at 2 different locations in a classroom or outside Every other day, field staff measured the level of hand sanitiser in the morning and in the af-	Handwashing observed opportunities: IG 604/921 (66%) versus CG 171/802 (21%) Hand sanitiser used in 91% of observed handwashing events in intervention schools. Average consumption of hand sanitiser/child/day: 4.3 mL

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

					Use of sanitiser by classroom teachers after training	secretions.									ternoon to calculate amount of hand sanitiser used/day/school and enrolled children.		
					Training of selected teachers in consultation with head of school and management committee in key messages	Classroom teachers conveyed intervention messages during regular hygiene classes.											
					Communication of key messages by the selected teachers to other teachers												
						Field staff replaced supplies as needed.											
Correa 2012	Alcohol-based hand rubs	Child-care centres and their staff and children	Reduce incidence and transmission of infection in children	Dispensers of alcohol-based hand rubs with ethanol 62.0% (PURELL, GOJO Industries, Akron, OH, USA) Workshop materials[14]	ABH and training on proper use to staff and children Pre-trial ABH use workshop to teachers that followed recommended HH teaching tech-	Local representative of GOJO industries Inc.	Face-to-face training and provision of materials; group training	Child-care centres in Colombia (centres or community homes)	8 months overall 1 ABH dispenser per centre with	Refilled ABH as needed	Not described	Visual reminders and monthly refresher training Monitoring	Teachers at 7 intervention centres reported almost complete substi-				

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

dren by improved hand hygiene where water is scarce including provision of ABH and training in hand hygiene teaching techniques	Visual reminders on ABH techniques in bathrooms and next to dispensers	niques and instructed teachers to add ABH to routine HH and give preference to hand-washing with soap and water if hands visibly soiled Continuous refilling of ABH ABH technique refresher workshops (8/centre) Monitoring of safety, proper use of ABH, amount of ABH used	provided dispensers and dispenser installations free of charge. Fieldwork team delivered other components.	ABH in centres, classrooms, and common areas depending on size Visual reminders in bathrooms and next to dispensers Workshops and training pre-summably provided in centres. Monthly 30-minute ABH technique refresher training (8 per centre) Biweekly monitoring	< 14 children; 1 per classroom in larger centres; 1 per classroom + 1 for common areas in centres with > 28 children 1 workshop pre-trial to staff	of safety, proper use of ABH, amount of ABH used Semi-structured survey on completion of teachers' perceptions about changes in HH practices and use of HSW and ABH. Measurement of consumption of resources and costs related to ABH use and HSW	tution of HSW with ABH, and HSW decreased from 3 times per day to 1 per day, and ABH rose to 6 per day. Teachers at remaining 14 centres reported partial substitution of HSW with ABH. Controls reported HSW 3 times per day. Median number of ABH applications per child rose from 3.5

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

																	to 4.5 in preschools and 3.5 to 5.5 in community centres.
DiVita 2011	Household handwashing promotion	Households with index patient with ILI	Prevent influenza transmission in households in resource-poor settings through provision of handwashing facilities and use of them at critical times for pathogen transmission	Hand-washing stations with soap	Provision of handwashing stations Hand-washing motivation to wash at critical times for pathogen transmission (e.g. after coughing or sneezing)	Not specifically described, presumably the researchers	Face-to-face provision of facilities in households "Motivation" not described	Household in Bangladesh	Over 2 influenza seasons One-off provision of handwashing facilities Frequency of "motivation" not described	Not described	Not described	Not described	Not described	Not described	Not described	Not described
Feldman 2016	2 active interventions	Naval ships and	Reduced infection	Septadine solution (Floris, Misgav, Israel) 70% alcohol	Installation of CHG disinfection devices on ships alongside	Provision of CHG pre-	CHG sent to ships	Navy fast missile boats	4 months	CHG replenished	Not described	Total amount of CHG dis-	Mean volume CHG:				

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	their sailors A. Hand disinfection with chlorhexidine gluconate + hygiene education B. Hygiene education		transmission and improved hand hygiene in sailors who are at increased risk due to closed environments, contact with shared surfaces, and poor HH culture	and 0.5% CHG; inactive materials: purified water, glycerin, propylene glycol, and methylene blue	Supply and replenishment of CHG (sent to ships regardless of replenishment demands) Hygiene instruction by a naval physician (to both intervention groups and study control group)	summably by study team and funds Hygiene instruction by naval physician	directly. Mode of hygiene instruction not described.	and patrol boats of naval base in Israel Dispensers installed in key locations on-board (adjacent to heads (toilets), mess decks (dining rooms), common areas).	on demand. Unlimited supply of CHG replenished on demand for 4 to 5 months. Automatic amount dispensed: 3 mL		pensed was tallied.	8.2 mL per sailor per day (projected yearly cost USD 45 per sailor)
Gwaltney 1980	A. Virucidal hand preparation B. Placebo (no control)	Healthy young adults	Reduce infection rates by interrupting viral spread by hand	A. Virucidal hand preparation: aqueous iodine (2% iodine and 4% potassium iodide)	Immersion of each finger and thumb of both hands to proximal interphalangeal joint (interphalangeal joint of thumb) into designated preparation for 5 seconds then air-dried for 5 to 6 min	Researchers	Face-to-face and individually	US university	Exposure to donors on 3 consecutive days (days 2, 3, and 4) after initial exposure	Not described	Not described	Reported knowledge of hand preparation use as active, placebo, or don't know	Active (n = 24): 6 active 2 placebo 16 don't know Placebo (n = 22):

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

				or self-inoculation route	B. Placebo: aqueous solution of food colours (Kroger: Kroger Co., Cincinnati, OH, USA) mixed to resemble the colour of iodine with 0.01% iodine and 0.02% potassium iodide to give an odour of iodine Masks	Exposure of recipients to donors either immediately after treatment or after 2-hour delay by hand contact with donor stroking fingers for 10 s Masks worn by donors and recipients during procedure. Recipients placed in single isolation rooms after second exposure till end of experiment.							6 active 7 placebo 9 don't know
Hubner 2010	Alcoholic hand disinfection	Employees (administrative officers)	Reduce absenteism and spread of infection in administration employees with frequent customer	2 alcohol-based hand rubs (500 mL bottles) for desktop use to ensure minimal effort for use: 1. Amphisept E (Bode Chemie, Hamburg, Germany) ethanol (80% w/w) based formula with antibacterial, antifungal, and limited virus inactivating activity.		Provision of hand rub and instruction on use as needed at work only and in accordance with prevailing standard[15]; at least 5 times per day, especially after toileting, blowing nose, before eating, and after contact with ill colleagues, customers, and archive material	Presumably provided or arranged by study team	In person to staff	Administration offices in Germany Hand rubs used at desk or work (not outside of work).	12 months overall Hand rub used as much needed for complete wetting of the hands (at least 3 mL or a palmful)[16] at least	Hand rub use especially after toileting, blowing nose, before eating, and after contact with ill colleagues,	Not described	Self-reported adherence with hand hygiene measures	Reported mean hand disinfection frequency times per day: > 5: 19% 3 to 5: 59.8% 1 to 2: 20.5% < 1: 0.7%

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

			con-tact and work with paper docu-ments through im-proved hand hy-giene	2. For partici-pants with skin problems: Sterillium (Bode Chemie, Hamburg, Germany) 2-propanol (45% w/w), 1-propanol (30% w/w), and mecetro-nium etilsul-fate (0.2% w/w), with a refatting effect and has activity against bacteria, fungi and enveloped viruses. Hand cream: Baktolan balm, water-in-oil emulsion with no non-antibac-terial properties (Bode Chemie, Hamburg, Ger-many)						5 times per day.	cus-tomers, and archive mater-ial			
Lade-gaard 1999 (trans-lated from Dan-ish)	Hand hy-giene pro-gramme	Day-care centres and their staff, chil-dren, and par-ents	Re-duce risk of infec-tion in child care through in-creased hy-	Personnel guide on rec-ommendations for: hygiene, ventilation, out-of-stay care, stricter hygien-ic regulations in cases with se-lected diseases	Staff meeting in each DCC and training in microbiological cause of infection spread guided by National Board of Health and Hygiene	Re-search team pre-sum-ably pro-vided train-ing.	Face-to-face with train-ing and activi-ties by group with staff and	On-site in DCCs	2-month interven-tion peri-od 1-hour training of chil-dren	None de-scribed.	None de-scribed.	None de-scribed.	None re-ported.

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	of children	genic education of daycare professionals, motivation of daycare facilities for regular hand hygiene, and informing parents about hand hygiene		Education of children in hand-washing (about bacteria and why and when to wash hands)	children				
			Fairy tale and poster "The Princess Who Won't Wash Hands"			Information sent home to parents via children.			
				Practical hand-washing classes with 4 to 5 children at a time					
			Colouring in drawings						
				Provision of t-shirt, book, and diploma to children					
			"Wash hands" song and rhymes						
				Provision of leaflet for parents					
			T-shirt for children with the inscription "Clean hands - yes thank you"						
			Diploma for children and book "The Princess Who Won't Wash Hands" to also be used by parents with their child						
			Informational leaflet for parents in envelope						

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

Little 2015	Web-based hand-washing intervention	Householders (over 18) who were general practice patients	Prevent transmission of respiratory tract infections through improved hand hygiene to reduce spread via close contact (via droplets) and hand-to-face contact	Website-based programme: provided information about the importance of influenza and role of hand-washing; developed a plan to maximise intention formation for hand-washing; reinforced helpful attitudes and norms; addressed negative beliefs (URL provided for demonstration version no longer active; see www.lifeguideonline.org)	Provision of link to website for direct log in Automated emails prompted participants to use sessions and complete monthly questionnaires and maintain hand-washing.	Researchers delivered web-based programme and emails.	Online individually	Households in England	4 months overall 4 weekly web-based sessions Monthly email questions to maintain hand-washing over 4 months	Tailored feedback provided within web programme	None described.	Emailed questions monthly to maintain hand-washing	None reported.
Luby 2005	Handwashing promotion at neighbourhood level with 2 intervention	Neighbourhoods and their households	Improve handwashing and bathing with soap in settings where community	Slide shows, videotapes, and pamphlets illustrating health problems from contaminated hands and specific handwashing instructions	Hand-washing promotion to neighbourhoods: Neighbourhood meetings of 10 to 15 householders (mothers) from nearby homes and monthly meetings for men Soap to households	Research team in collaboration with Health Oriented Preventive Education	Face-to-face in small groups and individually	Neighbourhoods and homes in Karachi, Pakistan	1-year weekly household visits 30- to 45-minute neighbour-	Soap replaced regularly.	None described.	None described, though soap use measured.	Households' mean use of study soap per week: 3.3 bars Average use per resident

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	tions at household level A. Antibacterial soap B. Plain soap	nicable diseases are leading causes of childhood morbidity and mortality	Soaps: 90-gram white bars without brand names or symbols, same smell with identical generic white wrappers with serial numbers matched to households A. Households: 2 to 4 white bars of 90-gram antibacterial soap containing 1.2% triclocarban (Safeguard Bar Soap: Procter & Gamble Company (Cincinnati, OH, USA) B. Households: plain soap (no triclocarban)	Fieldworker home visits: discussed importance of and correct hand-washing (wet hands, lather them completely with soap, rub them together for 45 seconds, and rinse off completely) technique and promote regular hand-washing habits[17] Encouragement of daily bathing with soap and water		cation (HOPE)[18]	Fieldworkers were trained in interviewing and handwashing promotion.			hood meetings 2 to 3 times/week first 2 months then weekly for months 2 to 9, then monthly Monthly men's meetings first 3 months Weekly household visits				per day: 4.4 g
Millar 2016 additional details from Ellis 2010	Skin and soft-tissue infection prevention	Military trainees	Improve personal hygiene practices	A. Enhanced standard: supplemental materials (a pocket card and posters in the barracks) Soap packets	Provision of education and hygiene-based measures in addition to standard SSTI prevention brief upon entry:	Not described, presumably the researchers	Face-to-face and individually for body wash and	US military training base	One-off education on entry to training	None described.	None described.	None described.	None described.	None described.

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	tion intervention in addition to SSTI brief on entry also provided to control A. Enhanced standard B. Chlorhexidine	to prevent infection, especially acute respiratory infection in military trainees who are at increased risk	B. CHG: CHG-based body wash (Hibiclens, Mölnlycke Heath Care, Norcross, GA, USA)	Enhanced standard: supplemental materials CHG: as for enhanced standard group, plus a CHG-based body wash and instructions for use		pocket card Mode of education not described.		CHG: use of wash 1 per week for entire training period (14 weeks)					
Morton 2004	Healthy hands (alcohol gel as handwashing adjunct)	Elementary schools and their children and staff	Prevent infections in elementary school-age children who are particularly vulnerable through adjunct use of alcohol gel and	Alcohol gel and dispensers: AlcoSCRUB (60% ethyl alcohol) supplied by Erie Scientific Company, Portsmouth, NH, USA "Healthy Hands Rules" protocol[19] (Figure 3 in paper) Healthy Hand Resource Man-	Healthy hands protocol introduced after "Germ unit" education in classes Daily reminders to children on public address system (in first week) then weekly reminders Review of protocol in each classroom after vacation by school nurse 2 classroom visits from school nurse	Gel provided by suppliers. Research team provided education al aspects. Classroom teach-	Face-to-face training in classes and individual information giving and monitoring	Elementary schools in USA Wall-mounted near door entrance of each classroom at age-appropriate height	46 days 0.5 mL dispensed per application. Use of "special soap" according to "Healthy Hands Protocol" (Fig-	Reinforcement teaching provided if gel usage indicated that it was needed. Germ unit education tailored	1 student was concerned gel was making her sick, so school nurse provided additional classroom visit to allay concerns.	Usage of gel calculated. 1 dispenser lasted 1 month.	5 gel applications per day

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

		edu- cation based on Health Belief Model (HBM) (Kirscht 1974)	ual for school nurse, available for parents Monthly newsletters to parents "Healthy Hands" refrig- erator magnet for families (see Figure 2 in pa- per)	"Healthy Hands" magnet provid- ed to parents and guardians. "Hand Checks on Wednesdays" to identify adverse ef- fects of gel	ers re- spon- sible for en- cour- aging use of gel and rein- forcing proto- col School nurse assist- ed in mon- itor- ing and hand checks for ad- verse effects.	ure 3 in paper)	for each grade level.						
Nichol- son 2014	Hand- wash- ing with soap	House- holds with 5- year- olds and	Target- ed 5- year- old chil- dren	Initial supply of 5 bars of free soap (90-gram Lifebuoy bars) replenished on submission of	Provision of soap and social marketing programme (Sidibe 2009) (Lifebuoy branding) to edu- cate, motivate, and	Dedi- cated team of "pro- mot-	Face- to- face in groups	"Class- rooms" held in com- munity	41 weeks Weekly "class- rooms"	Moth- ers were asked to pro- vide	Tech- nical diffi- culties with "soap	Regis- ters for "class- rooms" and home	Soap con- sump- tion:			

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their mothers	and their mothers as change agents to reduce incidence of respiratory infections (and diarrhoeal disease) through handwashing using behaviour change principles (Claessen 2008), including social norms for child and mother (Perkins 2003), using using fear of cont-	empty wrappers. Environmental cue reminders (wall hangers, danglers) Rewards (e.g. stickers, coins, toy animals)	reward children for HWWS at key times Weeks 1 to 17: handwashing occasions, germ education, soap's importance in germ removal Week 18 onward: encouragement of HWWS on 5 key occasions supported by environmental cues "Classrooms" for children Home visits for mothers Parents' evenings to boost morale, build networks, and run competition for adherence, assignment completion, and folder decoration Establishment of a "Good Mums" club for sharing HWWS tips	mothers" delivered education and home visits. Mothers provided supplied rewards.	Individually by mother to child	Home visits of households in Mumbai, India	HWWS encouraged 5 key occasions: after defecation, before each of 3 meals, and during bathing. Week 18 onward: handwashing on 5 occasions for 10 consecutive days 6 weekly parents' meetings	and share handwashing tips with other mothers, competitions held for mothers.	accelleration sensors" to measure HWWS behaviours prevented successful use.	visits where 3-week gaps in attendance triggered supervisors to ask participants to resume or be withdrawn Monitoring of soap resale on open market by use of unique identifiers on soap wrappers and twice weekly checks in local shops Collection of used soap wrappers as	IG versus CG: 235 g versus 45 g

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

				ami-nation and disgust (Curtis 2001), peer pres-sure (Sidibe 2003), morale boost-ing, and net-work-ing sup-port	Rewards provided by mothers. Children encouraged to advocate HWWS within families be-fore meals. Establishment of so-cial norms for child and mother with pledges in front of peers							soap con-sump-tion measure	
Pande-jpong 2012	3 ac-tive in-terven-tions (no con-trol) differ-ent time-inter-val ap-plica-tions of al-cohol hand gel A. Every 60 min	Preschool class-es (stu-dents and teach-ers) and their par-ents	Tar-geted preschool chil-dren who can have high infec-tion rates in ILI; have close inter-action so at risk of air-borne, droplet, and	1 container of alcohol hand gel per class-room (active in-gredients: eth-yl alcohol, 70%; chlorhexidine gluconate,1%; Irgasan (tri-closan), 0.3%) Cost of hand gel every 60 minutes was USD 6.39 per child per 12-week period	Teachers instructed to: assist each child with dispensing hand gel at required time interval, store hand gel prop-erly, and refill gel as needed. Monitoring of hand gel use at specified times	Teach-ers su-per-vised, stored, and re-filled hand gel. In-struc-tions to teach-ers pre-sum-ably pro-vided	Face-to-face to schools, teach-ers and chil-dren Indi-vidual assis-tance to chil-dren with hand gel	Kinder-garten school in Bangkok, Thai-land	12 weeks overall 1 pump of gel per child per dis-infection round at 1 of 3 time in-tervals of school day: A. every 60 min B. every 120 min	None de-scribed.	Stu-dents whose fami-lies de-clined to par-tici-pate were not asked to use alcohol hand gel. These stu-dents re-	2 re-search assis-tants moni-tored hand gel use every 60 or 120 minutes for the duration of study. Class-room teachers were re-quired to co-	Report-ed that adher-ence was ensured for each interven-tion group Cost of hand gel every 60 minutes was USD 6.39 per child per 12-week period.

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

			con- tact trans- mis- sion; and are of in- creas- ingly younger ages through hand gel as a single strat- egy of conve- nient and ef- fective disin- fection	Leaflet describ- ing risk factors for ILI for each family		by re- searchers	Leaflets given to each family.	C. once only before lunch, the school standard for hand hygiene		mained in their class- rooms and con- tinued to fol- low the school stan- dard for hand hy- giene.	sign af- ter each disinfec- tion round.		
	B. Every 120 min					Leaflets distrib- uted through school.									
	C. Once before lunch					Moni- toring of use by 2 re- search assis- tants									
Priest 2014	Hand sani- tiser provi- sion (in addi- tion to hand hy- giene edu- cation session also provid- ed to control group)	Pri- mary schools and their stu- dents, teach- ers, and admin- istra- tive staff	Re- duce per- son-to- person com- munity trans- mis- sion of infec- tious dis- ease by tar- get- ing im- proved	"No touch" dis- pensers (> 60% ethanol) for each class- room that dis- pensed dose when hands were placed un- der an infrared sensor Supply of top- up sanitiser as needed	Dispensers installed into each classroom. Teachers asked to ensure that the chil- dren used sanitiser at par- ticular times and to oversee general use (McKenzie 2010). Weekly classroom visits to top-up of	School liai- son re- search assis- tants topped- up sanitis- er. Teach- ers	Instal- lation of dis- pensers to class- rooms Super- vision of chil- dren by teach- ers de- livered	City schools in New Zealand	20 weeks (2 school terms) Sanitis- er to be used by students at least after cough- ing/sneez- ing, blow- ing their nose,	Chil- dren were able to use the sani- tiser at any time they wished as well as at key times (McKen- zie 2010).	Change of sani- tiser after week 10 to flavour- less type of the same % ethanol in 41 of 396 class- rooms	Week- ly class- room visits by school li- aison re- search assis- tants who record- ed quan- tity of sanitiser used	100% dispens- ing 45 mL per child Average hand sanitis- er dis- pensed/child for 34 schools: 94 mL

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

			and addi-tional hand hy-giene of school chil-dren through super-vised hand sanitis-er pro-vision as an alter-native to im-prov-ing and main-taining bath-room facili-ties	sanitiser and mea-sure quantity used 30-minute in-class hand hygiene educa-tion session provid-ed (also to control group) plus instruc-tion in hand sanitiser use.	face-to-face indi-vidual-ly and as a class.	and as they leave for morning break and for lunch break.	Approx-imately 0.45 mL of sani-tiser dis-pensed per wash. Weekly top-up of sani-tiser	(10%) (in 9 of 34 schools) due to chil-dren tasting it when eat-ing, af-fecting use.	Total amount of sani-tiser per class-room was mea-sured. adher-ence de-fined as dispens-ing a volume equiva-lent to at least 45 mL per child of hand sanitiser solution over the trial pe-riod.	Median class-room differ-ence in sanitis-er usage between first 10 weeks and sec-ond 10 weeks amongst class-es that switched products was 220 mL.
Ram 2015	Soap and in-tensive hand-wash-ing pro-motion	House-hold com-pounds and its house-hold-ers (adults and chil-dren) that	Re-duce house-hold trans-mis-sion of ILI and in-fluenza by pro-moting hand-	Hand-washing sta-tion in each com-pound Didactic and inter-active group-level education and skills training describing influenza symptoms, transmission, and prevention, promot-	Inter-ven-tion staff arranged provi-sion of hand-wash-ing sta-tion and pre-	All ele-ments deliv-ered face-to-face but at com-pound (facil-ities), group (ed-	House-hold com-pounds in a rural area of Bangladesh consist-ing of several house-	Initiation of inter-vention within 18 hours of study enrol-ment, then dai-ly vis-its until 10 days follow-	Daily surveil-lance includ-ed ob-serva-tion of indi-vidual hand-wash-ing rein-	None de-scribed.	Daily surveil-lance of facilities and re-inforce-ment and model-ling of hand-wash-ing be-	Soap present for at least 7 days in all com-pounds and on all 10 days in 133 com-pounds (74%).
			Hand-washing station in cen-tral location of each com-pound using: large water con-tainer with a tap; plastic case for soap;									

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had a householder with ILI	washing in households with householder with ILI as well as other households with high-risk exposure due to crowded and poorly ventilated homes. Followed constructs of Social Cognitive Theory and the Health Belief Model (Glanz 2008)	bar of soap. Cue cards depicting critical times for hand-washing: after coughing or sneezing; after cleaning one's nose or child's nose, after defecation; after clearing a child who has defecated; before food preparation or serving; before eating.	ing health and non-health benefits of hand-washing with soap and identification of barriers and proposed solutions to hand-washing with soap Daily surveillance including weighing of soap and replacing if ≥ 20 g and resupply of water in container if needed Posting of cue cards Asking household-ers to demonstrate hand-washing with soap technique	sumably provided education. Intervention staff conducted daily surveillance and reinforcement visits.	ucation), and individual levels (reinforcement).	holds with common courtyard, shared latrine, water source, and cooking facilities	ing resolution of index case patient's symptoms Day 1 set up of hand-washing station	forcement and modelling as needed.	haviours including observed handwashing Cue cards in common areas of courtyard Presence or absence of soap during each of first 10 days of surveillance from 180 household compounds Patterns and amount of soap use measured.[20]	Soap and water together all 10 days in 99 compounds (55%) Soap consumption per capita: median: 2.3 g maximal: 5 g (on Day 7)	Soap and water together present 7 or more of first 10 days in 99% of compounds, with water and soap observed

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			and behaviour change communication using social marketing concepts											
Roberts 2000	Education about infection control measures, handwashing, and aseptic nose wiping	Child-care centres and their staff and children	Reduce transmission of respiratory infections in child-care centres through improved infection control procedures	GloGerm (GloGerm, Moab, UT, USA) Newsletters to staff Songs and rhymes on hand-washing Plastic bags (sandwich bags available at supermarkets) to cover hand for nose wiping	Staff training in good health (developed by Kendrick 1994) and practical exercise of hand-washing with GloGerm Fortnightly visits and newsletter to reinforce training and to communicate techniques Recommended hand-washing technique as per guidelines of the time[21] and after toileting, before eating, after changing diaper (staff and child), and after wiping nose unless barrier used Teaching of technique to children and	Training and reinforcement activities provided by 1 of the researchers. Teachers delivered training to children based on their training.	Face-to-face in groups for training and classes and individually as needed to children or staff	Child-care centres in Canberra, Australia	8 months overall 3-hour training in evening or 1-hour during lunch for new staff after study start Duration of handwashing: "count "to 10" to wash and "count to 10" to rinse	Training for new staff provided as needed.	None described.	6-weekly adherence measured by recorded observation of recommended practice for 3 hours in the morning in each centre, graded by quantiles of frequency of recommended handwashing by children.	Adherence was reported only in relation to analysis of outcomes. High adherence reported for nose wiping and child handwashing.

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

						wash hands for infants													
Sandora 2005	Healthy Hands Healthy Families	Families with an index child in out-of-home childcare	Reduce illness transmission in the home through multifactorial campaign centred on hand hygiene education and hand sanitiser	Alcohol-based hand sanitiser: active ingredient: 62% ethyl alcohol (PURELL Instant Hand Sanitiser; GOJO Industries, Inc, Akron, OH, USA) Hand hygiene educational materials at home (fact sheets, toys, games)	Supply of hand sanitiser and hand hygiene materials Biweekly telephone calls Biweekly educational materials	Study investigator	Not stated whether materials mailed or delivered in person	Homes in USA	Sanitiser use in home	5 months overall	Biweekly educational materials Sanitiser dispensed 1 mL each pump.	None described.	None described.	Recorded amount of hand sanitiser used (as reported by the primary caregiver)	Median frequency of reported times of hand sanitiser use: 5.2 per day 38% used > 2 ounces of hand sanitiser per fortnight = 4 to 5 uses per day
Savolainen-Kopra 2012 further details from Savolainen-Kopra 2010	STOPFLU Enhanced hygiene 2 active interventions IR1. Soap and	Office workers of office work units	Prevent transmission of respiratory infections in workplaces through enhanced hand hygiene IR2: in addition:	IR1: Liquid hand soap ("Erisan Non-sid" by Farmos Inc., Turku, Finland) Alcohol-based hand rub, 80% ethanol ("LV" by Berner Inc.,	Toilets equipped with liquid hand soap (all groups) or alcohol-based hand rub (IR2). Guidance on other ways to limit transmission of infections, e.g. frequent hand-washing in office and at home, coughing, sneezing into disposable handkerchief	In collaboration with occupational health clinics servicing the corporation	In-person provision of soap or hand rub Guidance and written instructions	Office work units in corporations in Helsinki, Finland		15 to 16 months overall Monthly visits by nurse throughout	Nurses assisted with any practical problems with intervention as they arose.	None described.	Adherence assessed by an electronic self-report survey of transmission-limiting habits 3 times (more	Avoiding handshaking became more common and remained high in both groups. Recorded use for per-

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	water wash IR2. Alcohol-based hand rub	giene with behavioural recommendations to reduce transmission by droplets during coughing or sneezing		Helsinki, Finland) Bottles of hand hygiene product (free of charge) to be used at home and in the office (IR2). Written instructions on hygiene for further reference	or sleeve, avoiding hand-shaking Visits to work clusters and monitoring of materials availability Monthly electronic "information spot" about viral diseases for motivation to maintain hygiene habits Adherence activities	Specially trained research nurse provided guidance and visited worker clusters throughout intervention period.	given personally.			New employees received guidance on hand hygiene and habits.		details in protocol). Use of soap (IR1) and alcohol-based disinfectant (IR2) for personal use was recorded. Study nurse checked availability of soap and alcohol rub.	sonal use smaller than predicted use based on hand hygiene instructions. Soap or disinfectant usage per participant: IR1: 6.1 IR2: 6.9	
Stebbins 2011	"WHACK the Flu" (hand sanitiser and training in hand and respiratory	Elementary schools and their students and homeroom teachers	Targeted school-aged children as important sources of influenza transmission	Hand sanitiser dispensers with 62% alcohol-based hand sanitiser from PURELL (GOJO Industries, Inc, Akron, OH, USA) automatically dispensing 1 dose	Delivery of grade-specific presentations on "WHACK the Flu" concepts and proper hand-washing technique and sanitiser use: (W)ash or sanitise your hands often; (H)ome is where you stay when you are sick; (A)void touching your eyes, nose	Project staff provided education. Home room teachers reinforced	Face-to-face at schools, presumably as a group in classes	Elementary schools (Pittsburgh, USA) Dispensers installed	Whole intervention over 1 influenza season One-off installation of hand	Encouraged to wash hands or use additional dose of hand sanitiser, or	None reported.	Monthly teacher surveys of observed NPI-related behaviour in their students before, during, and after	Teacher surveys of observed classroom NPI behaviour indicated successful adoption and maintenance	

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	ry hygiene)	through improved cough etiquette and hand hygiene in schools including sanitiser as potential inexpensive non-pharmaceutical interventions		and mouth; (C)over your coughs and sneezes; and (Keep your distance from sick people (provided URL no longer active)	forced message and monitored proper use of sanitiser.	in each classroom and all major common areas.	One-off 45-minute education presentation and one-off refresher training at onset of influenza season	both, as needed		za season	Measurement of hand sanitiser use at 2-week intervals throughout the intervention period	nance of behaviours throughout influenza season.	
			Desired frequency of hand wash use taught to student (see When and how much)										Average sanitiser use: 2.4 times per day
				Installation of hand sanitiser dispensers			Goal of use of 1 dose (0.6 mL) of sanitiser 4 times per day[22]						
				Refresher training at each school									
				Reinforcement of message and monitoring of sanitiser									
Talaat 2011	Intensive hand hygiene campaign	Schools and their students, teachers, and parents	Reduce or prevent transmission of influenza viruses amongst children	Soap supplied as needed.	Establishment of a hand hygiene team in each school	Hand hygiene team (3 teachers from social studies, arts, and	Delivered face-to-face in groups and individually	Elementary schools (grades 1 to 3) in Cairo, Egypt	12 weeks overall	Soap and hand-drying material provided by school administration if child-	None described.	Observation by social workers of hand hygiene activities, availability of soap and drying material,	About 93% of the students had soap and drying material available.
				Grade-specific student booklets each including a set of 12 games and fun activities that promoted hand-washing	Provision of hand hygiene activities: weekly exercises (e.g. games, aerobics, songs, experiments); school activities, (e.g. obliga-			In school	Weekly hand hygiene campaign activities				

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

through intensive hand hygiene intervention campaign	Hand hygiene activities materials including: games (e.g. how to escape from the germs); puzzles; soap activities (e.g. soap drawing); song specially developed to promote hand hygiene Teachers' guidebook including detailed description of the students' activities and methods to encourage students to practice these activities. Posters with messages to wash hands with soap and water upon arriving at school, before and after meals, after using the bathroom	tory hand-washing under supervision, morning broadcast, parent meetings, students-parents information transfer); specific school initiatives: (e.g. competitions and awards, hand-washing committee, school trips to soap factory and water purification plant) More details in Table 1 of paper Song played regularly. Social worker weekly visits Distribution of flyers to parents	sports and the school nurse) ensured that all pre-designed activities for the hand hygiene campaign were implemented. 6 independent social workers visited the schools.	environment and classrooms Poster near sinks in classrooms and on playground	Weekly visits by social workers Twice-daily obligatory supervised hand-washing required by students for about 45 seconds, followed by proper rinsing and drying with a clean cloth towel.	dren did not bring their own as was the custom or families could not afford it. Schools could create own motivating activities such as selecting a weekly hand hygiene champion, developing theatre plays, and launching school contests for	and students' handwashing during the day Schools created own activities to improve adherence.	All but 2 intervention schools "had a rigorous system of ensuring that schoolchildren were washing their hands at least twice daily".

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

					room, and after coughing or sneezing.						drawings and songs.		
				Informational flyers for parents reinforcing the messages delivered at the schools.									
Teesing 2021 (additional sources: Teesing 2020a and Teesing 2020b)	HANDSOME multimodal nursing intervention	HH management staff and nurses and nursing students (with or of 3 or 4-year nursing degree) and residents	Change hygiene policy and individual HH behaviour of nurses through multimodal intervention designed specifically for nursing homes based on literature, interviews at nursing	Materials for lessons about WHO-defined 5 moments for HH[23] using HANDSOME novel method: 'Room In' (moment 1), 'Room Out' (moments 4 and 5 combined), 'Before Clean' (moment 2), and 'After Dirty' (moment 3)[24] Nurse's watches and certificates earned on completion of e-learning Paint for washing hands exercise	See Table 1 of Teesing 2020a and Teesing 2020b for more details 1. Policy change: - management meeting (with senior nursing home manager, infection prevention specialist, and facilities manager), - personal hygiene rules - HH materials audit 2. Nursing staff interventions (The New Way of Working) i) 3 live lessons: a. introduction of HANDSOME/WHO HH moments; teaching and discussion re HH when handling medication, food,	Meeting and materials provided by researcher Study team member delivered 3 live lessons with involvement of senior NH manager Senior NH manager	Face to face in groups (management and nursing staff) Lessons in groups of maximums of 18/ session On-line individual e-learning	In residents' rooms or other areas of 2 units each of 33 Dutch nursing homes with ≥ 3 nurses providing intense psychogeriatric and/ or somatic care to geriatric residents	4 months (Jan to Apr 2017) Management meeting (45 to 60 min) Personal hygiene policy presentation (10 min) Live lessons: 1 (20 min) 2 (30 min)	Persuasive communication used to encourage continuing when NH wanted to stop When < 3 nurses working at the unit, either the observers continued observ-	None described, except that the process was iterative in response to feedback from individual nursing homes	Unobtrusive HH direct observation disguised as registering of frequency of health care activities recorded on computer tablet (see Figure 2 in Teesing 2020a and Table 3 of Teesing 2020b) Compliance registered if	HH compliance (12 m f/ u) IG: 36% CG: 21% (OR 2.28, CI 1.67 to 3.11) HH compliance increased more for IG than CG for each WHO-defined moment, except for moment 2

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

ing homes and intervention mapping principles, the principle of repetition and informal discussions with members of over 20 nursing home organisations in an iterative process See protocol for more details of intervention mapping process using	28 stickers representing barriers to HH in 4 themes (facilities, forgetting, choosing not to do HH, and the telephone) E-learning materials including videos modelling knowledge, guided practice and promotion of active learning 10 posters (multiple copies, new one each month) Prize for photo competition NH certificate of good HH Small bottle of hand sanitiser for lesson participants	laundry; when to use hand sanitiser/soap/gloves. Team HH goal-setting: b. make inventory and solutions for barriers to HH adherence; and c. exercise washing hands with paint to see where missed; teaching how to disinfect hands ii) e-learning: introduction and 7 lessons showing: - correct/incorrect HH behaviour - common HH actions - when to use gloves - food and medication preparation Quizzes: iii) reminder posters hung throughout NH showing large picture of hands and text: "Did you remember to wash your hands?" (in Dutch') iv) photo competition: prize for best photo of hands	agers involved in delivery of aspects, including a lesson on NH personal hygiene policy between lessons 1 and 2 Nurses and doctors in training provided adherence observation and assessment	Meetings on-site Lessons on-site and online Posters throughout NH	3 (40 min) given multiple times on 1 day E-learning; 5 to 10 min each Adherence observer training; 2 to 3 days Adherence observation: during observation hours (8 am to 1.30 pm, weekdays)	vations at an additional ward (who also received the intervention) or they stopped observing HH needed to happen in the same room as action occurred, except if a nurse brought a resident to another room, they carried something soiled or no door	HH occurred immediately before (moments 1 and 2) or after (moments 3, 4 and 5) a HH opportunity without touching another object (e.g. door handle) and only if hand sanitiser or soap, water and paper towel used Hand-related personal hygiene[28] for each nurse according to Dutch guidelines[29]1 / every	Estimated attendance at lessons: varied per unit: 23% had < 50% attending at least 1 lesson, 18% had 50% to 74% attendance at at least 1 lesson and 59% had > 75% attendance at least 1 lesson (n = 22).

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determinants and methods to develop strategies for intervention components	See website (www.zorgvoorbeter.nl/hygiene/handhygiene-verbeteren-verpleeghuis) for materials (in Dutch) used for intervention;[25] - Manual (84p) - E-learning module - PowerPoint presentation and script - Assignments - Awareness activities - Audit materials - Policy materials - Posters Adherence recording application and computer table Adherence observer training materials using method adapted	3. Arts and craft project for residents involving hands that NH displays Adherence recording procedures Provision of hand sanitiser to lesson participants Provision of good HH certificate to NH if higher than average adherence Provision of nurse's watch on completion of e-learning Provision of adherence observers training	needed to be opened before leaving the room; for these instances, HH should take place at the end of action	nurse / day Attendance at live lessons and e-learning was recorded Participants asked if HH policy information received and if posters seen	

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

Temime 2018	Multifaceted hand hygiene programme (including alcohol-based hand rub)	Nursing home staff, residents, visitors, and outside care providers	Nursing homes and their residents, staff, and visitors and external providers have an increased risk of person-to-person transmission of pathogens and HH is a simple and cost-effective tool for infection control; however, compliance with HH is poor in nursing homes in France	Dispensers and pocket-sized containers of hand rub solution Posters promoting hand hygiene Developed local HH guidelines eLearning module on infection control and HH training with online quizzes requiring sufficient performance	Facilitated access to hand rub solution Campaign to promote HH with posters and event organisation Formation of local work groups in each NH Development of local HH guidelines Staff education using eLearning Monitoring of quantity of hand rub solution used	Same nurse provided HH training for all NHs. Provision of hand rub by NH Local work group developed guideline. eLearning module and posters presumably developed by research team.	Provision of materials face-to-face Education and quizzes via eLearning	Nursing homes in France	1 year overall One-off provision of hand rub One-off eLearning repeated if unsatisfactory performance.	If staff did not score sufficiently on online quiz, they were invited to repeat the eLearning.	None described.	Estimated mean amount of hand rub solution used per resident per day assessed as proxy for HH frequency, based on quantity of hand rub solution bought by NH (which was routinely monitored in all the NHs).	Hand rub solution used: baseline quantity of consumed hand rub solution was 4.5 mL per resident per day. Over the 1 year, mean quantity consumed was significantly higher in intervention NH (7.9 mL per resident per day) than control (5.7 per resident per day).

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

			ing homes.									
Turner 2004a Clinical trial 1	3 active interventions (no control) Product: A. Ethanol B. Salicylic acid with pyroglutamic acid C. Salicylic acid	Healthy volunteers	Assess the residual virucidal activity of organic acids used in currently available over-the-counter skin products for the prevention of experimental rhinovirus colds	1.7 mL of hand products: A. 62% ethanol, 1% ammonium lauryl sulphate, and 1% Klucel) B. 3.5% salicylic acid, or vehicle containing C. 1% salicylic acid and 3.5% pyroglutamic acid	Disinfection of hands then application of test product then allowed to dry. 15 min later, fingertips of each hand contaminated with 155 $TCID_{50}$ of rhinovirus type 39 in a volume of 100 µL. Hands air-dried for 10 min. Intentional attempted inoculation with virus by contact with fingers, conjunctiva, and nasal mucosa with fingers of right hand. Left hand eluted in 2 mL of virus-collecting broth.	Researchers	Face-to-face individually	Communities in Manitoba, Canada	1.7 mL of product applied. See What for timing	Not described	Not described	Not described	Not described
Turner 2004b Clinical trial 2	2 active interventions (no control)	Healthy volunteers	Assess the residual virucidal activity of organic acids	Skin cleanser wipe containing: A. 4% pyroglutamic acid formulated with 0.1% benzalkonium chloride B. 62% ethanol	Application of product to hands with towelette then allowed to dry. 15 min later, fingertips of each hand contaminated with 106 $TCID_{50}$	Researchers	Face-to-face individually	Communities in Manitoba, Canada	Dose not reported: see What for timing Additional group	Not described	Not described	Not described

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	Skin cleaner wipe product: A. Pyroglutamic acid B. Ethanol	used in currently available over-the-counter skin products for the prevention of experimental rhinovirus colds		of rhinovirus type 39 in a volume of 100 µL. Intentional attempted inoculation with virus by contact with fingers, conjunctiva, and nasal mucosa with fingers of right hand. Left hand eluted in 2 mL of virus-collecting broth.				challenged 1 h after application; final group challenged 3 h after application (remained at study site and not allowed to use or wash hands between).				
Turner 2012	Antiviral hand lotion	Healthy adults	Reduce rhinovirus infection and illness through hand disinfection with ethanol and organic acid sanitiser	Lotion containing 62% ethanol, 2% citric acid, and 2% malic acid Daily diary	Provision of lotion and instructions for use Meetings with participants to check compliance	Staff of study site presumably supplied lotion. Study site staff met with participants.	Face-to-face and presumably individually, but not specified	Study site at university community in the USA	9 weeks Every 3 hours whilst awake and after handwashing for 9 weeks Compliance meetings	None reported.	None reported.	Self-reported daily diary of time of each product application Twice weekly for 5 weeks then weekly meetings with	"All subjects … applied at least 90% of the expected amount of hand treatment" (p. 1424)

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									twice weekly for first 5 weeks then weekly meetings with participants					participants to reinforce compliance with treatment	
Yeung 2011	Multifaceted hand hygiene programme (including alcohol-based hand rub)	Long-term care facilities and their healthcare workers	Promote use of alcohol-based hand rub by staff in LTCFs as an effective, time-, and low-irritant method of hand hygiene in a high-risk environment	Free supply of pocket-sized containers of alcohol-based antiseptic hand rub (either WHO formulation I (80% ethanol) or II (80% propanol) carried by each HCW (supplier: Vickmans Laboratories) Replacement hand rub as required Hand hygiene seminar content Reminder materials (3 to 5 posters and specially designed ball-point pens)	Provision of materials Provision of hand hygiene seminars to HCWs covering: indications, proper method, and importance of antiseptic hand rubbing and washing according to WHO 2006a) guidelines Provision of feedback session Direct, unobtrusive observation of hand hygiene adherence Training of observation staff	Study team delivered the materials, seminars, and observer training. Administrative staff of LTCF provided replacement hand rub and communicated with HCWs.	Delivered face-to-face and individually for hand rub and pens; not described if education was individually or by group, but seminar implies as a group	LTCFs in Hong Kong Posters posted in common areas. Adherence observations occurred in common rooms and resident rooms but not bathing or toilet	7 months overall Initial 2-week intervention period, then 7 months of hand rub provision and reminders 3 identical seminars at start of intervention; each staff member to attend once	Replacement of hand rub as required	As adherence dropped off in the middle months, the feedback session was delivered.	Direct observation of HCW adherence to handwashing and antiseptic hand rubbing (recorded separately and anonymously) during bedside procedures or physical contact with residents 3300 hand hygiene opportunities during	90% attendance of seminars Hand rubbing with gel increased significantly from 24.3% to 17.4%. Handwashing decreased significantly from 1.5% to 15.9%. Control: 30%

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

						let areas.								
					6 registered nurses conducted direct observation of adherence after 2-hour training (100% inter-rater reliability).		Feedback session 3 months after start of intervention 2-hour training of observers Adherence observations either 9 am to 12 pm or 3 pm to 6 pm, 1 LTCF at a time					248.5 hours of observation on 92 days	Overall hand-washing adherence increased from 25.8% to 33.3%.
Zomer 2015	Hand hygiene products and training	Day-care centres and their caregivers (staff)	Reduce infections in children attending DCCs through improved access	HH products: dispensers for paper towels, soap, alcohol-based hand sanitiser, and hand cream, with refills for 6 months	Provision of free HH products sponsored by SCA Hygiene Products, Sweden. Provision of posters and stickers for children and staff	Study team arranged supply of HH products and presumably provided	Products provided to DCCs in person for staff use.	DCCs in regions of the Netherlands	6 months overall Initial one-off supply of products	Replacement hand hygiene provided as required.	None described.	6-month follow-up observation of whether intervention dispensers and posters/stickers in use	2 DCCs did not use any HH products. Sanitiser products used in at least 1 of 2 groups

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	to HH materials (Zomer 2013a) and compliance of their DCC caregivers to hand hygiene guidelines based on socio-cognitive and environmental determinants of caregivers' HH behaviour[30] (Zomer 2013b)	Reminder posters and stickers for children and DCC caregivers	Provision of training about RIVM 2011 for mandatory HH[31]	training.	training not specified.	3 training sessions with 1-month interval			in 94%, 89%, 86%, and 45% of intervention DCCs.
							Survey of DCC caregivers		
		Training materials including booklet	Distribution of training booklet						
						2 team training sessions	HH guidelines compliance observed at 1, 3, and 6 months' follow-up: no. of HH actions/no. of opportunities	Posters used in 86%, stickers in 74%.	
			Team training sessions aimed at goal-setting and formulating HH improvement activities (Erasmus 2011; Huis 2013)						DCC survey results: 79% attended at least 1 training session; 77% received HH guidelines booklet.
									HH compliance at 6 months: IG: 59% vs CG: 44% (Zomer TP, et al,

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

														unpublished data)
														All intervention DCCs received guidelines training; all but 2 received at least 1 team training.
Hand hygiene and masks														
Aelami 2015	Hygienic education and package	Religious pilgrims	Prevent influenza-like illness by reduced infection transmission through personal hygiene measures	Hygiene package of: alcohol-based hand rub (gel or spray) surgical masks soap paper handkerchiefs user instructions	Not clearly described, but it appears that packages may have been distributed by trained physicians before departure to or on site of country of pilgrimage	Not specifically described	Not described, but it appears that packages were distributed face-to-face and individually	Not described if before departure (from Iran) or on site (in Saudi Arabia)	One-off during Hajj season	Not described	Not described	Not described	Weekly web-based	None described
Aiello 2010	2 active in-	Students living	Reduce the	7 face masks (standard medical procedure	Weekly supply of masks through student mailboxes	Not described, except	Education via email	University resi-	One-off educa- tion, 6	Mask wearing	University spring	Weekly web- based	Average mask use	

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

tervention:	in university residences	incidence of and mitigate ILI by use of non-pharmaceutical interventions of personal protection measures	masks with ear loops TECNOL procedure masks; Kimberly-Clark)	Provision of basic hand hygiene education through an email video link, the study website, and written materials; instruction to wear mask as much as possible; education in correct mask use, change of masks daily, use of provided	"Trained staff" for compliance monitoring	and study website; provision of masks and sanitiser in person to residences	dence halls in the USA	weeks (excluding spring break) of face mask and/or hand hygiene measures which commenced at "the beginning of the influenza season just after identification of the first case of influenza on campus" (p.496).	during sleep optional and encouraged outside of residence.	break occurred during weeks 4 and 5 of the study, with most students leaving campus and travelling; they were not required to continue protective measures at that time.	student survey included: self-reported average number of times hands washed/day and average duration of handwashing to obtain composite "optimal handwashing" score (at least 20 s ≥ 5/day); average no. of mask hours/day/week; average hand sanitiser use/day/week and amount used.	hours/day: FM + HH 2.99 versus FM 3.92 Average handwashing times/day: FM + HH 6.11 versus FM 8.18 vs control group 8.75 Daily washing seconds/day: FM + HH 20.65 versus FM 23.15 vs control 22.35 Hand sanitiser use times/day: Trained staff
A. Face mask (FM)			7 re-sealable plastic bags for mask storage when not in use (e.g. eating) and for disposal	re-sealable bags for mask storage and disposal										
B. Face mask and hand hygiene (FM + HH)			Alcohol-based hand sanitiser (62% ethyl alcohol in a gel base, portable 2-ounce squeeze bottle, 8-ounce pump)	Provision of replacement supplies which students signed for upon receipt	Study-affiliated residence hall staff provided replacement supplies.			Replacement supplies provided as needed.						
			Hand hygiene education (proper hand hygiene practices and cough etiquette) via emailed video, study website, written materials detailing appropriate hand sanitiser and mask use											

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

													in residence hall common areas observed silently and anonymously	FM + HH: 5.2 versus FM 2.31 vs control 2.02
Aiello 2012	2 interventions: A. Face mask (FM) B. Face mask and hand sanitiser (FM + HH)	Students living in university residences	Prevent ILI and laboratory-confirmed influenza by use of non-pharmaceutical interventions of personal protection	Packets of 7 standard medical procedure masks with ear loops (TECNOL procedure masks, Kimberly-Clark, Roswell, GA, USA) and plastic bags for storage during interruptions in mask use (e.g. whilst eating, sleeping) and for daily disposal	Intervention materials and educational video provided. Supply of masks and instructions on wearing Provision of replacement masks or sanitisers as needed on site	Trained study staff available at tables in each residence hall for surplus masks and sanitiser and for observing compliance	Hygiene packs delivered to student mailboxes; face-to-face supply also available	University residence halls in the USA	One-off educational video at start Weekly supply of hygiene packs Masks to be worn at least 6 hours/day	Students encouraged but not obliged to wear masks outside of residence hall.	1-week university spring break during the study when majority of students left campus	Weekly student survey including compliance (e.g. masks hours/day, frequency and amount of sanitiser use, number of hand washes/day, duration of hand-	Self-reported mask wearing: no significant difference Sanitiser use: significantly more in FM + HH than FM or control groups

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

			measures (e.g. face masks and hand hygiene)	Hand sanitiser (2-ounce squeeze bottle, 8-ounce pump bottle with 62% ethyl alcohol in a gel base) Replacement face masks and hand sanitiser Educational video: proper hand hygiene and use of standard medical procedure face masks					Study staff available onsite with replacement supplies as needed for duration of intervention (6 weeks, excluding spring break)				
Cowling 2009	2 active interventions in addition to control of lifestyle education: A. Enhanced hand hygiene	Households with index patient with influenza	Reduce transmission of influenza in households through personal protective measures	A. and B. Liquid soap for each kitchen and bathroom: 221 mL Ivory liquid hand soap (Proctor & Gamble, Cincinnati, OH, USA) Alcohol hand rub in individual small bottles (100 mL) WHO recom-	Home visits Provision of soap, hand rub, and masks as applicable and when to use them HH: education about efficacy of hand hygiene Demonstration of proper hand-wash-	Trained study nurse provided interventions.	Face-to-face to household members	Households in Hong Kong	Initial home visit scheduled within 2 days (ideally 12 h) of index case identification.	Not described	Not described	Monitoring of adherence during home visits Evaluation of adherence on final visit by interview or self-	Most initial visits completed within 12 h. Intervention groups *reported higher adherence …; than the

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	giene (HH)	mended formulation I, 80% ethanol, 1.45% glycerol, and 0.125% hydrogen peroxide (Vickmans Laboratories, Hong Kong, China)	ing and antisepsis techniques	visits day 3 and 6, 7-day follow-up	reported practices and counting of amount of soap and rub left in bottles and remaining masks for FM group	control group. Self-reported data were consistent with measurements of amount of soap, alcohol hand rub, and face masks used" (p.443) (see Table 6 in paper). "Adherence to the hand hygiene intervention was slightly higher in the hand hygiene group than the face mask plus hand hygiene group."
	B. Face masks and enhanced hygiene (FM + HH)	+ FM: education about efficacy of surgical face masks in reducing disease spread to household contacts if all parties wear masks B. Adults: box of 50 surgical face masks (Tecnol–The Lite One (Kimberly-Clark, Roswell, GA, USA) to each household member or C. Children 3 to 7: box of 75 paediatric masks	Demonstration of proper wearing and hygienic disposal All groups: provision of education about the importance of a healthy diet and lifestyle, both in terms of illness prevention (for household contacts) and symptom alleviation (for the index case)	HH: use of liquid soap after every washroom visit, sneezing or coughing, when their hands were soiled. Use rub when first returning home and immediately after touching any potentially contaminated surfaces FM: masks worn as often as		

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

											possible at home (except eating or sleeping) and when the index patient was with the household members outside of the household			
													Median masks used: Index: 9 Contact: 4	
													More details in paper and Appendices	
Larson 2010	2 active interventions in addition to control of URI education: A. Alcohol-based hand sanitiser (HS) B. Face masks and hand	Hispanic households with at least 1 preschool or elementary school child	Reduce incidence and secondary transmission of URIs and influenza through non-pharmaceutical household level interventions	A. and B. 2-month supply of hand sanitiser in 8-, 4-, and 1-ounce containers: PURELL (Johnson & Johnson, Morris Plains, NJ, USA) B. 2-month supply of masks: Procedure Face Masks for adults and children (Kimberly-Clark,	Provision of materials and instructions for when to use including demonstration of use and observation of return demonstration by householder A. Mask worn when householder had: "temperature of ≥37.8°C and cough and/or sore throat in the absence of a known cause other than influenza" (CDC definition of influenza-like illness at the time).	4 trained bilingual research assistants (RAs) with minimum bachelaureate degree and experience in community-based research;	Face-to-face to household members	Households in New York, USA	19-month follow-up Initial home visit, then at least every 2 months Sanitiser for use at home, work, and school	Change masks between interactions with person with ILL Householders' questions and misconceptions addressed	None described.	RA home visits for adherence with random accompaniment by project manager, who also made random calls to householders Telephone calls to reinforce within 48 hours of onset.	Sanitiser use (mean ounces/month) HH: 12.1 FM + HH: 11.6 Mask compliance was "poor": 22/44 (50%) used

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	sanitiser (FM + HS)															
	2 active interventions: A. Handwashing education and handwashing kit (HW)	Households with a febrile, influenza-positive child	Decrease influenza virus transmission in household with a febrile influenza-positive child through promoted ventions	A. and B. Hand-washing kit per household including graduated dispenser with standard unscented liquid hand soap (Teepol brand. Active ingredients: linear alkyl benzene sulfonate, potassium salt, and sodium lauryl ether sulphate)	Roswell, GA, USA)	Home visits to reinforce adherence, replenish supplies and record use, answer questions Replacement supplies at least once every 2 months B. Telephone calls to reinforce mask use Disposable thermometers All groups received URI educational materials. Educational materials about URI prevention, treatment, and vaccination (written in Spanish or English language)	A. and B. Provision of intensive hand-washing education on initial home visit to household members with 5 approaches: discussion, individual hand-washing training, self-monitoring diary, provision of soap, and provision of written materials (Kaewchana 2012) Individual hand-washing training	Study nurse conducted home visits, provided education and monitoring activities.	Education provided face-to-face as a group to household member and individually for hand-washing	In homes (in Bangkok, Thailand)	One-off provision of kits at initial home visit conducted within 24 hours of enrolment Subsequent home visits on	B. Telephone calls days 1, 3, 6 Masks worn for 7 days when within 3 feet of person with ILL or no symptoms.	B. No face masks whilst eating or sleeping as impractical and could hinder breathing in ill child	on home visits.	None described.	mask use Used bottles or face masks, or both, monitored for usage. Reinforcement	Self-monitoring diary recording hand-washing frequency > 20 s and face mask use for that group	Mask users reported mean mask use of 2. Reported average hand-washing episodes/day: HW: 4.7 HW + FM: 4.9 Parents had highest frequency (5.7), others (4.8),

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

B. Handwashing education, handwashing kit, and face masks (HW + FM)	use of handwashing or handwashing with face mask use	Replacement soap as needed	("why to wash", "when to wash", and "how to wash" in 7 hand-washing steps described in Thailand Ministry of Public Health guidelines)	training.	days 3, 7, and 21	Impromptu education and training provided by nurses as questions arose.	of messages by nurses on subsequent home visits	siblings (4.3), index cases (4.1).
		Written materials from education including pamphlets and posters attached near sinks in household.	B. Provision of education of benefits of and appropriate face mask wearing		90-day supply of handwashing supplies 30-minute education provided at initial home visit		Average soap used/week: HW: 54 mL/person HW + FM: 58.1 mL/person		
		B. Box of 50 standard paper surgical face masks and 20 paediatric face masks (Med-con company, Thailand #14IN-20AM-B-30IN)	Soap replaced as needed. More details (Kaewchana 2012)				Amount of household liquid soap and number of face masks used B. Mask use: 12/person/week Mask wearing median minutes/day: 211		Parents 153, other relations 59, index patients 35, siblings 17

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

Suess 2012	2 active interventions in addition to written information: A. Mask/hygiene (MH) B. Mask (M)	Households with an influenza-positive index case in the absence of further respiratory illness within the preceding 14 days	Prevent influenza transmission in households through easily applicable and accessible non-pharmaceutical interventions such as face masks or hand hygiene measures	A. Alcohol-based hand rub (Sterilium, Bode Chemie, Germany) A. and B. Surgical face masks in 2 different sizes: children < 14 years (Child's Face Mask, Kimberly-Clark, USA) and adults (Aérokyn Masques, LCH Medical Products, France) Written information provided on correct use of intervention and on infection prevention (Suess 2011) (tips and information on the new flu A/H1N1) (URL provided is no longer active) Digital tympanic thermometer	A. Provision of hand rub and masks A. and B. Provision of masks only Provision of thermometer and how to use it Mask fit assessed (at first household visit) Information provided by telephone and written instructions at home visit on proper use of interventions and recommendations to sleep in a different room than the index patient, not to take meals with the index patient, etc. (Suess 2011) In-person demonstration of interventions at first home visit All participating households received general written infor-	Study personnel arranged provision of materials, rang the participants, visited the homes, demonstrated and assessed fit of masks.	Provision of materials in person to households Initial telephone delivery of information Face-to-face home visits	Households in Berlin, Germany	Over 2 consecutive flu seasons Day 1 households received all necessary material instructions. Household visits no later than 2 days after symptom onset of the index case, then days 2, 3, 4, 6, 8 (5 times) or on days 3, 4, 6, 8 (4 times) depending on the day of recruitment	Adult masks worn if masks for under 14-year-olds did not fit properly. If other household members developed fever (> 38.0 °C), cough, or sore throat, they were asked to adopt the same preventive behaviour as the index patient.	In the season 2010/11 participants also recorded number of masks used per day.	Self-reported daily adherence with face masks, i.e. if they wore masks "always", "mostly", "sometimes", or "never" as instructed. Participants of the MH households additionally noted the number of hand disinfections per day. Exit questionnaire about (preventive) behaviour during	Face mask use (median/individual): MH: 12.6 M: 12.9 Daily adherence was good, reaching a plateau of over 50% in nearly all groups from the third day on. MH hand rub use (median): 87 mL (Suess 2011) MH mean frequency of daily hand

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		mation on infection prevention.							
	General written information on infection prevention		Hand rub use: after direct contact with the index patient (or other symptomatic household members), after at-risk activities or contact[31]	the past 8 days, general attitudes towards NPI, the actual amount of used intervention materials, and, if applicable, problems with wearing face masks.	See paper and Suess 2011 for more results.	disinfection: 7.6 (SD 6.4) times per day			
			Mask use: at all times when index patient and/or any other household member with respiratory symptoms were together in 1 room	Used intervention material per household member was calculated by dividing the amount used per household by the number of household members.					

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

									Regular change of face masks, not worn during the night or outside the household				See paper and Suess 2011 for more details.		
Hand hygiene and surface/object disinfection															
Ban 2015	Hand hygiene and surface cleaning or disinfection	Kindergartens and the families of their students	Reduce transmission of infection in young children from contaminated surfaces or hands through hand hygiene and surface cleaning or disinfection	Antibacterial products for hand hygiene and surface cleaning or disinfection: liquid antimicrobial soap for hand-washing (0.2% to 0.3% parachlorometaxylenol); Instant hand sanitiser for hand disinfecting (72% to 75% ethanol), antiseptic germicide (4.5% to 5.5% parachlorometaxylenol); Bleach (4.5% to 5.0% sodium hypochlorite, diluting before use).	Provision of products to kindergartens and families Instruction of parents or guardians and teachers in hand hygiene techniques and use of antibacterial products Daily cleaning of kindergartens with products At least twice/week cleaning of homes and weekly cleaning or disinfecting of items such as children's toys, house furnishings, frequently touched objects (doorknobs,	Research team provided products and instructions and monitoring.	Materials provided to kindergartens and families in person and presumably instructions in person to families and staff.	In kindergartens (hard surfaces) and families' homes (Xiantao, China)	1 year overall Daily handwashing with soap before eating, after using bathroom, nose blowing, and outdoor activities Hand sanitiser carried daily.	Families and teachers could contact study management at any time as needed. Exchange of empty bottles for new ones at any time	Not described	Close contact with teachers and families for monitoring, e.g. unscheduled parents' meetings, quarterly home visits, phone interviews, and monthly cell phone messages	Consumption of products by person (mL/person/day). Liquid soap: 7.7 Sanitiser: 1.4 Bleach: 25.0 Antiseptic-germicide: 12.5

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

				use) for surface disinfecting. Produced by Whealthfields Lohmann (Guangzhou) Company Ltd.	tables or desks), kitchen surfaces (utensils, cutlery, countertops, chopping boards, sinks, floors, etc.), bathroom surfaces (toilet, sink, floor, etc.) Monitoring activities			Kindergarten cleaning daily Home cleaning at least twice/week				Monthly survey of consumption of products by volume, total usage, person usage	
Carabin 1999	Hygiene programme	Day-care centres and their staff and children	Reduce infections in at-risk children (under 3 years old) in DCCs with inexpensive, easily implementable and practical interventions	Hygiene materials and documents, e.g. colouring books, hand-washing posters, hygiene videotapes Materials for training Reimbursement of equivalent of 1 full-time educator's salary Bleach (diluted 1:10) for toy and play area cleaning	Provision of comprehensive hygiene training session to entire DCC staff, especially the educators of participating classrooms Training in recommendations for hygiene practices: i. toy cleaning ii. hand-washing technique and schedule iii. use of creative reminder cues for hand-washing iv. open window for daily period v. sandbox and play area cleaning	Training appears to have been provided by study team.	Appears staff trained as a group, i.e. "entire DCC staff"	Day-care centres in Canada Location of training not described, except may have been off-site from DCCs since 1 DCC did not "send" staff to training.	15-month trial One-off 1-day training Toy cleaning at least every 2 days Hand-washing at least after DCC arrival, after outside play, after bathroom, before lunch	Teachers to use creative reminder cues for handwashing with children	Not described	Follow-up telephone questionnaire for DCC directors about following training recommendations	Use of materials: colouring book: 22/24 poster: 23/24 videotapes: 18/24 staff meetings: 19/24 Increased frequency of toy cleaning: 6/24 Use of rake and shovel for

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

					Payment of salary of educator for the day to encourage participation									sandpit: 17/24
								Open windows at least 30 min/ day						Frequency of cleaning sandbox: 14/24
					DCC meetings to discuss training session with all staff									
								Biweekly cleaning of sandbox/play area						
Kotch 1994	Hygiene	Caregivers at child day-care centres (CDCCs)	Develop feasible, multicomponent hygienic intervention to reduce infections in children at CDCCs who are at increased risk	Hygiene curriculum for caregivers Availability of soap, running water, and disposable towels Waterless disinfectant scrub (Cal Stat) used only if alternative was not washing at all. Handouts posted in CDCC.	Delivery of hygiene curriculum to caregivers through initial training session which required demonstration of participants' handwashing and diapering skills Local procedures: Hand-washing of children and staff Disinfection of toilet and diapering areas Physical separation of diapering areas from food preparation and serving areas Hygienic diaper disposal Daily washing and disinfection of toys,	Research team delivered training. Scrub donated by Calgon Vetal Laboratories.	Face-to-face training and follow-up group and individually	Classrooms of child day-care centres in the USA	8 months overall 3-hour initial training session Cleaning schedules as described in column What (procedures) On-site follow-up training	Follow-up sessions addressed questions and local adaptations to procedures. As required induction training	During intervention, research team encouraged directors to address physical barrier to hygiene practice, such as distance between sink and diaper-	Follow-up sessions reinforced training. Meeting with directors 5 weekly unobtrusive recorded observation by training staff	Rate of compliance to barrier modification was better in younger centres, which were more likely to have written guidelines.

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					sinks, kitchen and bathroom floors			1 week and 5 weeks later				ing areas and sink access in rooms.		
					Daily laundering of blankets, sheets, dress-up clothes									
					Hygienic preparation, serving, and clean up of food									
					Separate training of food handlers									
					As-required induction training for new staff									
					Onsite follow-up training reinforcing adaptations, demonstrations and discussion of hygiene techniques, responding to questions, and review of handouts									
					Monthly meeting with centre directors to encourage leadership and support									
McConeghy 2017	Multifaceted handwashing and surveillance	Nursing homes and their staff	Reduce exposure to pathogens	Education and launch materials	Pre-intervention: NH administrators required to:	Study personnel equipped staff with knowl-	Face-to-face interaction with staff for	Nursing homes in the USA	6 months overall: training period: 3 months	Sites could use existing comparable	2 sites retrained due to low training	Cloud-based audit and feedback system via	Online training participation rates:	

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face-cleaning intervention	and person-person transmission in high-risk facility of close environment and potentially contaminated surfaces through multifaceted intervention equipping staff to protect residents from infection with in the "culture" of care	Online module for certified nursing assistants about: infection prevention, product, and monitoring "Essential bundle" of hygiene products supplied at no cost: - hand sanitiser gel and foam - antiviral facial tissues - disinfecting spray - hand and face wipes Plus additional: - 4 skin cream and wipe products iPads for compliance audits Newsletters for support during intervention	- identify a "Heroes In Prevention" champion and team - allow all staff participation in education - iPad use for staff in each floor or community - ask staff to incorporate intervention into workflow Delivery of 3 components: - education - cleaning products - compliance audit and feedback Education: Launch event for all staff to publicise programme and explain roles Intensive training of "hygiene monitors" for data collection and compliance audit and feedback tool Training of site champion Training of select group of certified	NH staff (e.g. champion, hygiene monitors, nursing assistants) delivered aspects of intervention after specific training.	Some aspects delivered online (e.g. nursing modules, compliance auditing)	Online training	1 or 2 hygiene monitors/site 1 champion/site 1-hour online module for selected nursing assistants iPads for each community or floor Weekly teleconferences initially de-	New staff provided with education, as needed and came onboard.	Retraining of sites with low training participation rates	> 90% for 3/5 sites, 13% and 23% for 2/5 Administrators demonstrated high fidelity in reporting measures of hand-washing (> 80% of time). Hand-washing rates in Figure 1B in paper reported as "relatively constant" and "not ideal in the first few months", but improved

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						nursing assistants (online module)							creased in frequency over time.	significantly over time.
						Audit and feedback activities								
						Ongoing support during intervention:				Weekly measurement of product consumption				
						- newsletter with best practices								
						- teleconferences with each NH								
						- "onboarding" education of new staff								
Sandora 2008	Multifactorial intervention, including alcohol-based hand sanitiser and surface disinfection	Elementary school and its students	Reduce transmission of infections in school-children through improved hand hygiene and environmental disinfection	1 container of disinfecting wipes (Clorox Disinfecting Wipes (The Clorox Company, Oakland, CA, USA); active ingredient, 0.29% quaternary ammonium chloride compound) Pre-labeled 1.7-ounce containers of alcohol-based hand sanitiser (AeroFirst non-aerosol alcohol-based	Sanitiser and wipes provided to classroom/teacher with instructions for use. Teachers disinfected desks once daily. Hand sanitiser to be used: before and after lunch, after use of the restroom (on return to the classroom; hand hygiene with soap and water occurred in the restroom, because sanitisers were not placed there), after	Research team arranged supply of materials and instructed teachers on use. Teachers in-structed in use of materials and in col-	Products provided to schools. Instruction provided face-to-face to teachers and children.	Elementary schools and their classrooms in the USA	8-week period Desks disinfected once a day.	Products replenished as needed.	None described.	Individually labelled containers collected every 3 weeks from the classroom to assess adherence.	Product usage: average wipes used/week: 897 (128 wipes/classroom/week) Average bottles of hand sanitiser used per week: 8.75 (1.25 bottles/classroom/week)

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					foaming hand sanitiser (DEB SBS Inc, Stanley, NC, USA, for The Clorox Company); active ingredient, 70% ethyl alcohol) Receptacle in classrooms for empty containers	any contact with potentially infectious secretions (e.g. after exposure to other ill children or shared toys that had been mouthed)	lecting empty containers and distributing new product.						
Quarantine/Physical distancing													
Helsingen 2021	Rapid-Cycle Re-implementation of TRAining Facilities in Norway (TRAiN) hygiene and physical distancing measures	Members of health and fitness training facilities aged 18 to 64 years not at increased risk for severe COVID-19	Enable safe re-opening of fitness training facilities to maintain health and fitness by reducing the risk of SARS-CoV2 transmission	Infection mitigation measures described by "Norwegian guidelines for Hygiene and Social Distancing in Training Facilities during the COVID-19 Pandemic" (in Norwegian t-i.no/wp-content/uploads/2020/04/Bransjestandard-for-sentre.pdf) See Supplementary Appendix for "Standard for COVID-19 infection preven-	Implementation of the following during regular floor training facilities and group classes: - avoidance of body contact - 1 metre distance between individuals, - 2 metre distance for high intensity activities Provision of disinfectants at all workstations Requirement of HW and cleaning of all equipment by mem-	Facility employees controlled access and enforced implementation of guidelines and procedures at all times Staff present dur-	Face-to-face individually and as a group	5 health and fitness training facilities in Oslo, Norway	3 weeks May 22nd to June 15th, 2020 Hours of access not reported; presumably the participants had unlimited access to training facility within the procedures	Masks not required, so were optional Change rooms available Access controlled to avoid overcrowding	None described	Staff monitored access and distancing No apparent measures of fidelity	None described

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	tion measures in fitness centers during the TRAIN-study"	bers before and after use with utensils provided	ing all opening hours	for distancing	Staff monitored that distance measures were ensured
	Disinfectant readily available at workstations and strategic places (reception, booking station, changing rooms, toilets, water taps used for drinking or refilling bottles)	No physical contact between participants or participants and instructors	Not reported if training needed for facility staff		Number of people attending dependend on size of gym and associated changing rooms, showers and toilets. Facility to calculate the maximum number who could train at the
		Regular cleaning of facilities by facility employees			
		Create lists of what should be cleaned and how often			
	Rubbish cans without lids				
		Disinfection of instructor microphones			
	Washbasin with soap or hand disinfection				
		Extra cleaning of frequently touched surfaces (e.g. door handles, card readers, washbasin batteries)			
	Personal microphones for instructors (i.e. not shared)				
		Frequent refilling at all hygiene stations			
	Infection preventive measures reminders online and via posters in facilities	Avoid queuing by making sure group classes do not start and stop at same			

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

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						Advice to members to avoid touching eyes, nose and mouth										
						Closure of childcare facilities										
Miyaki 2011	Quarantine from work (stay-at-home order)	Employees	Prevent spread of influenza in workplaces by quarantining workers who had a cohabiting family member with an ILI	Full wages to employee	Non-compulsory asking of workers whose family members developed an ILI to stay at home voluntarily on full wages. Daily measuring of temperature before leaving work. Where symptoms were doubtful, industrial physician made judgement. Company doctors provided input on cancelling of stay-at-home orders as required.	Health management department oversaw the procedures and decisions.	Mode of advice to employees not described.	Car industries in Japan	Stay-at-home order for 5 days after resolution of ILI symptoms or 2 days after alleviation of fever over 7.5 months	Strict standard for cancelling of stay-at-home orders described.	None described.	Recording of compliance with stay-at-home request	100% compliance to stay at home reported.
Young 2021 (additional source: Denford 2022)	Daily contact testing (DCT) with Lateral Flow Device (LFD)	Students and staff from secondary schools and further	Provide a quicker, more convenient and alternative	SARS-CoV-2 Lateral Flow Device (LFD) (Orient Gene, Huzhou, China)[47]	In addition to twice weekly asymptomatic testing with LFD according to national policy: students and staff who were close contacts[48] of students or staff members	A study worker was funded at each school but role not	Individually and face to face	172 secondary government funded, resident ial,	March to May 2021 Daily contact testing was performed at arrival	When testing could not start immediately following identification	None reported	Daily participation rates in IG measured per day and per participant	Testing did not occur on 15.8% of person-school-days due to school or public health

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for contacts of COVID-19 cases	education colleges	testing option and policy for COVID-19 close contact testing in schools, as an alternative to self-isolation	who had a positive LFD or PCR were identified and offered daily LFD testing on arrival at school or college each morning (if asymptomatic and no household member isolating due to testing positive for COVID-19) Participants swabbed own nose (anterior nares), supervised by trained staff. Swabs tested by school staff using LFC Contacts with negative LFC attended education but were asked to self-isolate at home after school and on weekends/holidays Contacts with 5 negative tests (tests done over 7 consecutive days) including one on or after the 7th day of testing were released from self-isolation Contacts with positive test were required to self-isolate for 10 days, along with their contacts. Their school-based contacts were identified and process repeated	specified School staff tested the swabs that were taken by students Study staff trained according to national NHS Test and Trace standard process supervised LFD testing	special and independent day schools and further education colleges in England	at school each morning Day 1 of testing began the day after a case was identified Testing was done over 7 consecutive days (allowing for no testing on weekends) Schools actively participate between 19 April 2021 to 27 June 2021 (considered periods of low to moderate COVID-19 incidence)	tification of a case (e.g. due to a weekend), testing could start within 3 days of case identification	Compliance was calculated / school / week, and participant type, (= sum of all study school days of individuals eligible for DCT returning a test result or already having completed follow up each day, divided by the sum of individuals eligible for DCT. Qualitative interviews conducted to understand reasons for participation and	agency directives IG participation rate: 42.4% with marked variation between schools (range 0% to 100%). See Figure 2 for non-participation reasons breakdown (e.g. testing kit unavailable, whole cohort moved to isolation). Staff more likely to participate than students.

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

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														tors other than school type." (p. 1227) Qualitative analysis of interviews indicated daily testing may be feasible and acceptable but needs improved communication to students and parents about rationale, test interpretation and actions (Denford 2022)
Other (miscellaneous/multimodal) interventions														
Ashraf 2020 (additional of Water)	6 active interventions	Residents of households	Improve environmental	Free technologies and supplies:	Provision and delivery of supplies or installations as described in Materials column according to	540 CHW or 'promoters'	Mostly face to face in groups and in-	Households and compounds	2 years from May 2012	CHWs identified and ad-	S: latrine pits adapted	Measured by a separate trained	CHWs visited more than planned	

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sources: Arnold 2013, Luby 2018, Parvez 2018, Rahman 2018, Unicomb 2018)	of village compounds and for some interventions, particularly pregnant women and their infants and children < 5 years A. Water (W) B. Sanitation (S) C. Handwashing (H) D. Water + sanitation + handwashing (WSH) E. Nutrition F. Nutrition + WSH (WSHN	conditions to interrupt transmission of respiratory pathogens and improve child malnutrition there-by reducing childhood respiratory illness and improving childhood morbidity based on the Integrated Behavioural Model for Water Sanitation and Hy-	W: chlorine (sodium dichloroisocyanurate) tablets (Aquatabs, Medentech, Wexford, Ireland) - 10 L insulated safe storage vessel (Lion Star Plastics, Sri Lanka) with a lid and tap for drinking water per household S: Dual-pit pour flush latrines with water seals for all compound households. Each pit had 5 concrete rings 0.3 m high; - Potties[34] (RFL, Bangladesh) - Sani-scoops[35] (locally developed hand-tool made for the trial for removal of faeces from compound) for households with index children	intervention type or combination. Interventions deployed so that they were in place before index children were born In combined intervention arms, the sanitation measures were delivered first, followed by handwashing, then water treatment. Household visits and community discussions based on behaviour change strategy by CHWs (paid a monthly stipend), including interactive sessions for developing solutions to improve practice. Key recommendations per IG: W: children drink treated, safely stored water from vessel (filled vessel with added 1 33 mg tablet, wait 30 min before drinking)	who were local women and residents of study villages recruited through transparent merit-based selection methods and consultation with community leaders CHWs had completed minimum of 8 years formal education, lived within	dividually with some activities by phone	(n = 5551) of rural villages in Gazipur, Kishoreganj, Mymensingh and Tangail Districts in Bangladesh	6 to 8 households / CHW 1:12 supervisor to CHW ratio CHWs visited households 1 / week for first 6 months, then at least 1 / fortnight Households spread across 0.2 to 2.2 km radius Promoter training: Initial: W, S, HW: 4 days; N, WSH: 5 days; WSHN: 9 days	dressed any barriers that arose through ongoing dialogue with caregivers CHWs met with supervisors monthly to adapt technology and behaviour-change approaches to meet evolving conditions CHW supervisors available	when insufficient space (2% of cases) Functional water seals count was low (< 80% benchmark) in initial months which triggered a rapid response which improved uptake (Rahman 2018); households were using own latrines with broken water seals in	team (university graduates) at regular intervals using a priori benchmarks: a) surveys and spot checks in 30 to 35 households / IG / per month, over 20-month period; b) 5-hours of structured observations in 324 IG and 108 control households, approximately 15 months after interventions	(5 to 7 / month) which researchers suggest may have affected uptake Reported "high adherence to all interventions" with "marked differences in promoted behaviors from the control group at both year 1 and year 2," with over 75% adherence in the single IG and combined IGs.

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	giene[33] and 2 years of iterative testing and revision. Intervention specific behavioural objectives: W: drink treated and safely stored water S: safe faeces disposal H: HW with soap at key times N: age-appropriate nutrition birth	H: 2 HW stations, 1 water reservoir near kitchen (16 L) and 1 near latrine (40 L), each with basins for rinsing with a soapy water bottle (RFL, Bangladesh) and detergent sachets for index households[36] N: supply of lipid-based nutrient supplements (LNS, Nutriset; Malaunay, France) (for 6 to 24 months olds) 2 10g sachets per day per child; (118 kcal, 9.6g fat, 2.6g protein, 12 vitamins and 10 minerals) Cost: USD 0.08/day 18-month shelf life Stipends for CHWs (USD 20/month for 24	S: family use double pit latrines, potty train children and how to safely dispose of faeces and clean and maintain latrines H: family wash hands with soap after defecation, after cleaning a child who has defecated, before eating or before feeding a child, and before food preparation N: recommendations for exclusive breastfeeding up to 180 days and maternal and infant nutrition to mothers and index children; introduce diverse complementary food at 6 months; feed LNS from 6 to 24 months, mixed into the child's food (not intended as a replacement for breastfeeding or complementary foods). Messages adapted from the Alive & Thrive programme[37]	walking distance of IG cluster and passed a written and oral examination. They attended multiple training sessions and quarterly refreshers. Training covered active listening, strategies for developing collaborative solutions and techni-	Refresher training: 1 day each 21 day training of adherence team Monthly CHW supervisor meetings	by cell phone as needed Training of promoter varied in content and length depending on intervention type Potties provided if children < 3 years	parallel with trial latrines so pre-existing latrines were closed, visits by CHWs were increased and water-seal removal or breakage was discouraged Initial professional trainer for CHW training did not engage trainees enough so replaced with inter-	commenced. Measured: W: Presence of stored drinking water with detectable free chlorine (> 0.1 mg/L) S: a latrine with functional water seal, sanitation scoop accessibility H: presence of soap at primary HW stations N: reported con-sumption of LNS sachets	Similar adherence in single W, S, H and N IGs compared with WSH and WSHN S: observed use of latrines: 94% to 97%; child sanitation practices (37% to 54%) H: HW with soap in IG more common after toilet use (67% to 74%) versus 18% to 40% in non-IGs and after cleaning child's anus (61% to 72%) but

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	to 24 months)	months) delivered through mobile phone network to ensure timely payments	On household visits, following a structured plan, CHWs greeted targeted household members, checked presence and functionality of relevant hardware and signs of use, observed recommended practice using a guide.	cal aspects of interventions (see Table 1 of Luby 2018 for more details)	nal training resource group	See Rahman 2018 for more details (Table 1)	low before food handling W: > 65% mothers and children observed drinking chlorine-treated water from safe container N: LNS feeding > 80%
		Promoter's guide for visits for each relevant intervention including:	CHWs used discussions, video dramas, storytelling, games and songs and provided training on hardware maintenance, where applicable	CHWs were trained by 47 CHW supervisors who received direct training on intervention delivery	Due to observation of intervention fatigue reported by CHWs and sub-optimal practices observed, new behaviour change activities were developed (e.g. further technology use, increasing self-efficacy and	Continuous oversight and periodic monitoring of CHWs performance (CHW replaced within 1 month of attrition or critically low performance	33 low performing CHWs discontinued
		- visit objective, - target audience - steps and materials to be used					
		CHW ID badges	Adherence observed and measured by separate team				
		Cell phones for CHW supervisors	Supervision meetings of CHWs and periodic internal monitoring of their performance				See Luby 2018, Parvez 2018, Arnold 2013, Unicomb 2018 for more details
		Training Plan and Manual for CHW supervisors covering: i) basic training - introduction of project, CHW roles and responsibilities, introduc-	Intervention Delivery Team managed delivery through regular team phone calls, field meetings, field reports and liaison with relevant government and other stakeholders. It coordinated CHWs to	Hardware installation team (n = 18)			

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

						Training Officer and Communication Development officer						
						Adherence observed by separate team who received formal 21 day training						
Farr 1988a trial 1	2 active interventions in addition to control of no tissues:	Families	Reduce transmission of viruses from hand contamination via hand-to-hand contact or	3-ply tissues with:	Family visits to distribute tissues	Nurse epidemiologist visited families.	Face-to-face visits to families and individuals in families (especially mothers)	Communities in the USA	6 months overall	Not described	Not described	Family visits and weekly contact with mother to encourage compliance	Not described
	A. Virucidal			A. 5.1 mg/inch^2 (2.54 cm^2) of the virucidal mixture (58.8% citric acid, 29.4% malic acid, 11.8% sodium lauryl sulphate)	Weekly contact of mother				Monthly family visits				
				B. 3 mg/inch^2 (2.54 cm^2) of saccharin ap-	Families instructed to only use supplied tissues.				Weekly contact with mother				

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	nasal tissues		large-particle aerosol through tissues for nose blowing and coughs and sneezes	plied uniformly to all 3 plies of the tissue									
	B. Placebo tissues			Tissues prepared by Kimberly-Clark Corporation, Neenah, WI, USA.									
Farr 1988b trial 2	2 active interventions (no control):	Families	Reduce transmission of viruses from hand contamination via hand-to-hand contact or large-particle aerosol through tissues for nose blowing and coughs and sneezes	2-ply tissues containing: A. 4.0 mg/(inch^2 (2.54 cm^2) of antiviral mixture (53.3% citric acid, 26.7% malic acid, 20% sodium lauryl sulphate) B. 3 mg/(inch^2 (2.54 cm^2) of succinic acid, malic acid, sodium hydroxide, and polyethylene glycol Tissues prepared by Kimberly-Clark Corporation, Neenah, WI, USA.	Family visits to distribute tissues and encourage compliance Weekly contact of mother Families instructed to only use supplied tissues.	Nurse epidemiologist visited families monthly. Study monitor visited bimonthly.	Face-to-face visits to families and individuals in families (especially mothers)	Communities in the USA	6 months overall Monthly family visits Weekly contact with mother Bimonthly study monitor visit	None described.	None described.	Bimonthly study monitor visits to encourage compliance as well as monthly and weekly contact by nurse	In 124/222 families, 1 or more family members reported not using the tissues regularly and/or reported having side effects from the tissues.
	A. Virucidal nasal tissues												
	B. Placebo tissues												

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

Fretheim 2022a (additional source: Fretheim 2022b (protocol))	GLASSY (GLasses Against tranSmission of SARS-CoV-2 in the comMunitY	Adult members of the public who did not regularly wear glasses and who owned or could borrow glasses to use (e.g. sunglasses)	Provide a simple, readily available, environmentally friendly, safe and sustainable means of personal protection from infection with respiratory viruses including SARS-CoV-2	Instructions via online portal Regular eyewear, e.g. sunglasses owned by participant or that could be borrowed by participant	Request to wear sunglasses or other types of glasses when outside home and close to others in public spaces for 14 days	Research team	Individually	Outside the home, e.g. on public transport, in shopping malls (in Norway)	14 days when outside and close to others in public spaces Over 11 to 12 week period (February – April 2022)	Could borrow glasses if did not own any	None reported.	No contact was made with participants between enrolment and data collection.	Reported use of glasses often, almost always, or always: IG: 71% CG: 11% Negative experiences (especially fogging with mask use): IG: 21/76
Longini 1988	2 active interventions (no control):	Households and their families	Prevent intrafamilial transmission of viral agents in a com-	Treated tissues of 3-ply material identified with no specific identifiers (Kimberly-Clark Corporation) with inside layer containing:	Tissues delivered to households with specific instructions on use (all purposes, when blowing nose, coughing or sneezing) and to discard after use and to help young children use tissues if develop a cold.	Tissues assigned by study sponsor (Kimberly-Clark	Supply of tissues throughout 5-month trial period	Households in the USA	5 months' overall supply	Resupply of tissues as required	None described.	Reported use of tissues "not at all, some of the time, most of the time, or	Reported use "all of the time": A. versus B. 82% versus 71%

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	A. Virucidal nasal tissues	munity setting	A. citric and malic acid plus sodium lauryl sulphate; B. succinic acid.			Corporation).							all of the time"		
	B. Placebo tissues														
Chard 2019 (additional details from Chard 2018)	Water, Sanitation, and Hygiene for Health and Education in Laotian Primary Schools (WASH HELPS)	Primary schools and their students	Prevent the spread of pathogens within schools through improved water supply and hygiene facilities and improved WASH habits in children at home and throughout the life course	For each school: Water supply for school compound: (borehole, protected dug well with pump, or gravity-fed system) Water tank to supply toilet and hand-washing station School sanitation facilities (3 toilet compartments) Hand-washing facilities: 2 sinks with tapped water and supply of soap available	Provision of school: Water supply, sanitation facilities, hand-washing facilities (individual and group), drinking water filters Behaviour change education and promotion including daily group hygiene activities Daily hand-washing and cleaning schedules	UNICEF paid for materials. School and teachers conducted daily hand-washing activities with children. Students participated in daily group cleaning activities.	Facilities provided within schools. Children participated in group hand-washing and cleaning.	Primary schools and their classrooms (in Laos)	One-off provision of water and hygiene facilities Daily hand-washing activities and cleaning for 1 school year Cleaning schedules posted in at least 1 classroom near toilet.	Water supply tailored to the school requirements/environment. Sanitation facilities provided as needed and designated for boys, girls, and students with disabilities.	Rain water tank provision affected by rain water changed to tanks with motorised hand pumps or gravity-fed water supply systems. Theft and animal consumption	Unannounced visits every 6 to 8 weeks for structured observations to measure fidelity and adherence Fidelity Index score (0 to 20): for hardware provided see Table 1 in paper and protocol Adherence in-	Fidelity: 30.9% across all schools and visits Adherence: 29.4% Hardware provision: 87.8% of schools School-level adherence: 61.4% Group compound cleaning: 94.8%, toilet use: 75.5%, group toilet

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

				(1 bar of soap/ pupil) 3 group hand-washing tables with soap and water At least 1 drinking water filter per classroom Schedules of daily group hand-washing, compound and toilet cleaning Cost per school: USD 13,000 to 17,500								tion of supplied soap reduced supply.	dex: student report of behavioural outcomes index score (0 to 4)	cleaning: 68.3%, group handwashing: 48.7%, individual handwashing with soap after toilet use: 23.9%. Further details (Chard 2018)
Hartinger 2016	Integrated environmental home-based intervention package (IHIP)	Households and their household-ers including children	Reduce infections and improve child growth in households in rural communities	Per household: "OPTIMA-improved stove": improved ventilated solid-fuel stove Kitchen sink with in-kitchen water connection providing piped water	Community engagement with local and regional stakeholders in design and development Provision of stoves, kitchen sinks, and plastic bottles for solar water treatment, and hygiene education	Health promoters hired local elementary school teachers and implemented and promoted	Face-to-face and to individual households; mode of delivery of training as individual or	Households in rural communities in Peru	Stoves and sinks installed over initial 3 months. Monthly reinforcement over 12 months of	Tailored to particular household facilities and environments as needed and to local	Not described	Weekly spot-check observations of household hygiene and environmental health conditions (e.g. presence	SODIS use: 60% initially and 10% at end of study Self-reported use by mothers: 90% with

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

with limited facilities through a multi component, low-cost environmental intervention to improve drinking water, sanitation, personal hygiene, and household air quality developed in pilot (Hartinger 2011; Hartinger 2012) using a participatory approach	Point-of-use water quality intervention applying solar disinfection to drinking water	Training of mothers/caretakers in: - solar drinking-water disinfection (SODIS)[39] according to standard procedures - hand hygiene (washing own and children's hands with soap at critical times[40]) - advice to separate animals and their excreta from the kitchen environment Project-initiated repairs	4 teams of field staff conducted spot-check observations.	group not described	SODIS, child and kitchen hygiene Weekly spot checks of compliance Repairs after 9 months Environmental samples test middle and end of 12-month surveillance.	beliefs and cultural customs Repairs to stoves as needed and checked at 9 months	of SODIS bottles on the roof or kitchen) using a checklist Monthly self-report by mothers of stove and sink use	slight decrease at end Self-reported stove use: 90% daily Sink use: 66% daily 35% of stoves needed minor repairs, 1% needed major repairs. Best-functioning stoves achieved mean 45% and 27% reduction of $PM_{2.5}$ and CO, respectively, in	

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

				that addressed local beliefs and cultural views											mothers' personal exposure.
Huda 2012	Sanitation Hygiene Education and Water Supply in Bangladesh (SHEWA-B)	Villages and their households with a child < 5 years old	Reduce illness in children < 5 years by improving hygiene practices, sanitation and water supply and treatment in their household	Materials for training of community hygiene promoters and promotion activities including flip charts and flash cards with messages alerting participants to presence of unobservable "germs" and practices to minimise germs See Box 1 in paper for 11 key messages.[41]	Engaging local residents under guidance of local NGOs to develop community action plans addressing: Latrine coverage and usage Access to and use of arsenic-free water Improved hygiene practices, especially hand-washing with soap Recruitment and appointment of community hygiene promoters Household visits, courtyard meetings, and social mobilisation activities (e.g. water, sanitation and hygiene fairs, village theatre, group discussions in tea stalls (the social meet-	Community hygiene promoters (local residents with at least 10 years' schooling trained for 10 days on behaviour change communication in water, sanitation, and hygiene)	Face-to-face delivery to groups (villages and households) and individuals	Villages and households in districts of Bangladesh Community activities held in villages. Meetings held in courtyards of groups of households.	18 months overall Expected household visit and courtyard meeting every 2 months Handwashing opportunities: after own or child's defecation, prior to preparing and serving food, prior to eat-	Community action plans developed for and by local residents.	Not described	Structured observation of handwashing and child faeces disposal behaviour in households and spot checks of type of household water and sanitation facilities	HW: Food-related: No significant difference from baseline to 18 months; IG versus CG After anus cleaning: 36% versus 27% Defecation: 30% versus 23% No access to latrine decreased from

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

					ing point for village men)) by community promoters			House-hold visits	ing and feeding a child				10.3% to 6.8%.
					Structured observation in households								No significant improvement in access to improved latrines, solid waste disposal, drainage systems, and covered containers for water storage
Ibfelt 2015	Disinfection of toys	Day-care nurseries	Reduce transmission of pathogens via shared toys in day-care environment through regular disinfection	Disinfectants: Turbo Oxysan (Ecolab, Valby, Denmark) for washing machines Sirafan M, Ecolab (1% to 3% benzalkonium chloride, 1% to 3% didecyldimethylammonium chloride, and 5% to 7% alcohol ethoxylates) for immersion or wiping	Collection and commercial cleaning of toys from nurseries: - linen and toys suitable for washing machines were washed at 46 °C and subsequently disinfected - toys not suitable for washing machines immersed in disinfectant or wiped with microfibre cloth	Commercial cleaning company: Berendsen A/S, Søborg, Denmark	Cleaning companies collected the toys and linen and cleaned them offsite, then returned them.	Day-care nurseries in Denmark Commercial industrial cleaning facility	2 to 3 months overall Cleaning every 2 weeks	Staggered cleaning to ensure children had toys to play with whilst others were being cleaned	None described.	None described.	None described.

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

			treatment										
Najnin 2019 (see also Qadri 2015 for further details)	2 active interventions: A. Combined cholera vaccine and 'behaviour change communication' intervention B. Cholera vaccine-alone group	Low-income households and compounds	Prevent or reduce transmission of respiratory illness based on the Integrated Behavioural Model for Water Sanitation and Hygiene (IBM-WASH) theoretical framework (Dreibelbis 2013; Hulland 2013)	A. and B. Cholera vaccine ShanChol™ (Shantha Biotechnics-Sanofi, India) A. Following hardware per compound: a. Hand-washing hardware: (i) Bucket with a tap (provided free of charge) (ii) Soapy water bottle (mixture of a commercially available sachet of powdered detergent (~USD 0.03) with 1.5 L of water in a plastic bottle with a hole punched in the cap) supplied by participating compounds	A. and B. Provision of cholera vaccine (2 doses at least 14 days apart) Provision of handwashing hardware and behaviour change communication activities Encouragement of hand-washing after defecation, after cleaning child's anus, and before preparing food Encouragement to add chlorine to own water vessels Benefits were again explained. Follow-up visits by health promoters	Dushtha Shasthya Kendra (DSK), an NGO, delivered the hardware and behavioural intervention (through community health promoters). Separate data collectors observed soap availability.	Handwashing water treatment hardware mostly delivered at the compound level in person. Behaviour change communication messages were delivered both at compound and household levels.	Households and compounds (where several households share a common water source, kitchen, and toilets) in Bangladesh	Behaviour change communication messages delivered first (within 3 months of cholera vaccination). Point-of-use water hardware provided 3 months later. Follow-up health promoter visits 3 times in 2 months after hardware installation,	Hardware-related problems (breakage/leakage) were addressed on health promoter follow-up visits.	None described.	Unannounced home visits by data collectors who observed presence of soap/soapy water and water in most convenient place for handwashing (either reserved in a container or available at the tap) Residual chlorine was measured indicating uptake of chlorine dispenser.	Presence of soap / soapy water and water: A. Handwashing group compounds: 45% (1729 / 3886); B. Vaccine-only group compound: 22% (438 / 1965); C. Control: 28% (556 / 1991) Residual chlorine present in stored drinking water of 4% (160/3886) of house-

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

				(iii) Bowl to collect rinse water after washing hands (see photo in text or in Najnin 2017 doi.org/10.1093/ije/dyx187)									holds in the vaccine-plus-behaviour-change compound and none in the other 2 compounds.
				b. Water treatment hardware: Dispenser containing liquid sodium hypochlorite See Figure 2 in Najnin 2017 for photos of both doi.org/10.1093/ije/dyx187 and more details.									
				Participants own water vessels for water treatment									
				Print materials for behaviour change to compounds and households									
Swarthout 2020 (addi-	6 active intervention	Residents of	Improve environ-	Free technologies as appropriate to IG:	Provision and delivery of supplies or installations as de-	Community-based	Face to face in groups	8246 households	Installation and supply	Training tailored	None described	Participant reports	All interventions de-

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

tional sources: Arnold 2013, Christensen 2015, Dentinger 2017, Null 2018, Pickering 2019)	households of villages and for some interventions, particularly pregnant women (Mamas) and their infants and children < 5 years; Landowners of communal water sources and compound heads for latrine upgrades and construction	environmental conditions to interrupt transmission of respiratory pathogens and improve child malnutrition thereby reducing childhood respiratory illness and improving childhood morbidity based on a literature review, a theory-based approach (health belief,	W: water treated with sodium hypochlorite (1.25% solution / 2 mg/L) using chlorine dispensers installed at communal water source collection points or bottled chlorine (1L for 333 20–l jerry-cans worth)[45] provided to households in compounds Chlorine strips to test chlorine levels S: installation of new or improvement of existing latrines with plastic slab latrines with tight-fitting lids; plastic potties and sani-scoops H: 2 HW stations (2-foot pedal-operated jerry-cans that dispensed soapy and rinse	scribed in Materials column according to intervention type or combination Provision of study materials to promoters Community meetings Household and community visits by promoters who: - delivered intervention-specific behaviour change messaging focusing on themes of nurture, aspiration and self-efficacy, considering convenience and cultural norms to improve adherence using scripts and visual aids; - provided instructions on hardware use and consumable supplies where applicable - advocated:	health promoters nominated by their local communities and trained in the relevant intervention to be implemented Field enumerators assessed adherence in compounds Study staff trained promoters, provided pe-	(e.g. households or compounds) or individuals (mothers and their children)	and 7960 compounds of rural villages in Bungoma, Kakamega and Vihiga counties in western Kenya	of materials before community meetings Community meeting 6 weeks after enrolment Monthly visits (45 to 60 min in 1st year) by promoters over 2 years (2012 to 2014) Timing of visits detailed in procedures provided at osf.io/7j9sk/ W: 1 L bottle of chlo-	for different interventions Troubleshooting of solutions to barriers to adherence by promoter and participants as needed Nutrition messaging was tailored to be age-appropriate Material provided in both in	of visits by promoters in past month Unannounced visits by staff to a random sample of at least 20% of participants in IGs at 2, 6, 10, and 19 months after the interventions began to confirm delivery of materials and monitor availability of intervention materials and recommended behaviours after the interventions be-	livered within 3 months of enrolment Increased adherence indicators of ≥ 30% higher in all IGs relative to the control in the first year Adherence was comparable between the individual IGs compared with combined IGs. W: 5 chlorine dispensers installed / cluster

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	social cognitive theory and persuasion theory), [42],[43],[44] formative research and the WASH Benefits pilot RCT (Christensen 2015)	water), 1 near food preparation, 1 near latrine. Rinse water provided by households; bar soap for soapy water container N: 2 x 10 g sachets / day / child of lipid-based nutrient supplementation (LNS) "Mwanzobora", (Nutriset, Malaunay, France) (118 kcal/day and 12 essential vitamins and 10 minerals) See Figure 2 of Christensen 2015 for photos of examples of some of the materials Community meeting and household visit summary sheets (in Kiswahili and English) and	S: use of improved latrines for defecation and safe disposal of children's and animals' faeces and use of plastic potties by children < 3 years and sani-scoops for faeces removal H: HW with soap before food preparation and after defecating (including assisting child); helped participants identify compound members to refill taps and manage barriers to use such as running out of soap N: early initiation of breastfeeding, exclusive breastfeeding 0 to 6 months and continued till 24 months; at 6 months, introduction of appropriate and diverse complementary foods; feeding frequency and during illness; supply of LNS to children 6 to 24 months and instruction to mix it was foods twice/day Promoters used visual aids to promote messages: - cue cards provided to Mamas at initiation;	riodic observation and supervision and monthly phone calls	rine / 6 months H: bar soap provided every 3 months N: LNS introduced at 6 months of age of child Promoter training: 6 days single IGs. 7 days combined IGs. Refresher training at 6, 12 and 18 months after initial training	Kiswahili and English Chlorine dispensers located based on list of sources participants reported (at baseline) using for water collection Sanscoops and potties were to be washed by caregivers with soap and water after use	gan (Null 2018) W: monthly tests of chlorine concentration in stored water; negative results prompted discussions to address chlorination barriers	Year 1: 74% Year 2: 37% households were visited by a promoter in previous month W: Year 1: 42% Year 2: 21% had detectable total chlorine CG: 3% S: Year 1 and 2: > 80% had latrine access CG: 20%	S: participant report of access to improved latrine; field enumerators observed if latrine had plastic or cement slab or ventilation pipe;

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	list of materials provided as PDFs at osf.io/7j9sk/ Key messages and visual aids provided at osf.io/7j9sk/ Including ~6 primary key messages per intervention, each with a series of specific topics, visual aids, and engagement activities (e.g. storytelling, mottos, etc.). Visual aids included: - cue card reminders - picture sheets for use by promoters - calendars for households with key messages - stickers for LNS box depicting appropriate feeding and storage	tial visits to hang on walls for reminders - picture sheets used by promoter to explain key concepts or messages - calendars provided to households during first compound visit - stickers attached to LNS box Adherence checking unannounced visits Initial training on intervention-specific behaviour change messages and materials Refresher training Periodic observation and supportive supervision by study staff	Supervision and observation of promoter by study staff at 2, 4, 9, 14 and 21 months and monthly phone calls	and tools kept out of reach of children (see the visual aids provided to participants: osf.io/9r4kg/ for potties and osf.io/mz2c6/ for sanicoops)	caregiver report that child faeces safely disposed H: field enumerator observed if water and soap available N: report of LNS sachets consumed by child in last week / 14	HW: Year 1: 77% Year 2: 21% had HW materials CG: 9% N: Year 1: 95% Year 2: 115% of expected sachets consumed See Null 2018 for more details

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

Oral and/or nasal applications														
Almanza-Reyes 2021	Mouthwash and nose rinse with AR-GOVIT silver nanoparticles (Ag-NPs)	Healthcare personnel (doctors, nurses, administrative staff) of a metropolitan hospital caring for patients diagnosed with atypical pneumonia and/or COVID-19	Reduce morbidity in healthcare professionals exposed to SARS-Co V-2 by inhibiting virus replication	Per participant: - 50 ml bottle of RGOVIT® AgNPs mouthwash and nasal rinse [investigation and Production Center Vector-Vita Ltd., Novosibirsk, Russia] (metallic silver 0.06%, polyvinylpyrrolidone 0.63%, hydrolyzed collagen 0.31%, distilled water 99% wt.) - water - cotton swabs	Individuals provided with spray bottle containing AgNPs solution with 1 wt% concentration (0.6 mg/mL metallic silver) and instructed to do 1 of the following or a combination: a) mix 4 to 6 spray shots (~ 0.5 mL) with 20 mL of water and gargle solution for 15 to 30 seconds at least 3 times/day (gargle) or b) do not dilute with water and cover the oral cavity evenly with 1 to 2 direct spray shots (spray) c) apply the same solution to the inner part of the nasal alae and nasal passage with cotton swab twice a day (nasal rinse)	Participants self-applied the mouthwash and nasal rinse materials	Individually and face to face	General hospital in Tijuana, Mexico	Over a 9 week period (April to June 2020) 4 to 6 spray shots of AgNP solution (0.5 mL) with 20 mL of water or 1 to 2 spray shots of solution without water for 15 to 30 seconds ≥ 3 times / day and 1 nasal lavage 2 times / day	Participants could choose application method	None described	Weekly self-report of number of: daily gargles; mouthwashes with spray; mouthwashes by gargle + spray; and nasal rinses	Mean applications/day: Gargle only: IG: 2 (n = 28) CG: 2.14 Spray only: IG: 2 (n = 34). Both gargle and spray: IG: 2 gargles, 4 sprays (n = 52) Nasal rinse: IG: 0.70 (n = 64) CG: 0.25
Gutiérrez-García 2022	Nasopharyngeal and oropha-	COVID-19 frontline medical	Reduce risk of COVID-19 in	SES (pH 6.5 to 7.5; RE-DOX potential 750 – 950 mV;	Written instructions provided to follow a prophylactic rinse protocol with SES 3 times/day for 4 weeks with advice	Not clearly specified; leaders of	Individually and face to face	Mexican COVID-19 hospital	4 nasal sprays (~ 0.4 mL) and 10 mL mouth-	None described	None described	None described	None described

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	ryngeal rinses with a neutral electrolyzed water (SES)	staff (nurses and physicians, males or females)	front-line unvaccinated medical staff											
Goodall 2014	2 active interventions:	University students	Decrease the incidence	A. Vitamin D_3: container of 8 capsules of 10,000 IU (pur- | 0.0015% of active species of chlorine and oxygen) provided by Esteripharma S.A. de C.V Per participant: - 4 plastic flasks of 240 mL oral SES (ESTERICIDE® Bucofaringeo, COFEPRIS registration no. 1003C2013 SSA) with a graduated cap and - 4 plastic flasks of 30 mL nasal rinse (Esteri-Flu®, COFEPRIS registration no. 308C2015 SSA), with a valve for spraying	on correct way to use the mouthwashes and sprays and the need to report possible side effects immediately: a) nasal cavity: 4 vertical sprays in each nostril, inhaled deeply at the time of each spray b) oral cavity: mouthwash and gargle 10 mL for 60 seconds, then spit out In addition to standard COVID-19 safety protocols requiring wearing of adequate personal protection equipment at all times,[49] frequent handwashing[50] and disinfection of secondary uniform and footwear[51] and bath at end of working day	nursing and other relevant healthcare department distributed the study information and were the point of contact and monitored the protocol so they may have distributed intervention materials	A. Vitamin D: instructed to take 1 pill weekly	Not specified, presumably	Vitamin D_3 supplied individually	In university student houses	wash gargle for 60 seconds 3 times / day for 4 weeks (September to November 2020)	2 months overall	None described.	None described.	None described.	None described.

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	A. Vitamin D_3 supplementation B. Gargling water	of URTI through increased vitamin D levels (associated with greater frequency and severity of URTI) and gargling (as preventative measure against URTI)	chased from Euro-Pharm International Canada Inc.) Weekly email reminder B. Gargling: 30 mL of tap water 2/day	B. Gargling: instructed to gargle twice daily for 30 seconds All participants received general lifestyle and health advice on sleep, nutrition, hand hygiene, and exercise.	ably the researchers, including a study pharmacist	vidually, but lifestyle and health advice provision also not described.	ing (in residences or offcampus) in Canada	Vitamin D_3: weekly supplementation and email reminder Gargling: 30 mL of water for 30 seconds twice daily						
Ide 2014	2 active interventions (no control): A. Green tea gargling B. Water gargling	High school students	Prevent influenza spread and infection in high school students who are at increased	A. Bottled green tea (500 mL) containing a catechin concentration of 37 ± 0.2 mg/dL, including approximately 18% (-)-epigallocatechin gallate (manufactured by the Kakegawa Tea Merchants Association). A. Provision of green tea B. Advice to gargle with tap water and not to gargle green tea during study A. and B. Advice to gargle at least 3 times/day (after arriving at school, after lunch, and after school) Consumption of green tea and other	Materials supplied by researchers. High schools' service principals and head teachers as-	Green tea supplied individually to students. Mode of gargling advice not described.	High schools in Japan	Gargling 3 times/day for 90 days	None described.	None described.	Daily questionnaire included questions about daily adherence to gargling regimen. Adherence rate of	Gargling adherence rate: green tea group: 73.7%; water group: 67.2%

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

	risk from close interaction through gargling as a non-pharmaceutical intervention, specifically green tea containing highly bioactive catechin (-)-epigallocatechin gallate, with possible anti-influenza virus properties	Concentration measured by high-performance liquid chromatography based on the average concentration in 10 bottles from the same production lot (September 2011) used for gargling in the study. B. Tap water	tea was not restricted for either group. Safety monitoring carried out throughout the study (not further described).		sisted with safety monitoring.						gargling at or above 75%, and absence of green tea gargling when in the water gargling group.	
Satomura 2005	2 active in-	Healthy adults	Prevent URTIs	A. Water B. 15 to 30 times dilut-	Local administrators instructed participants to:	Local project admin-	Not specified,	18 healthcare	60 days overall	If diluted povi-	3 participants	Completion of gargling	9 participants did not

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Table 1. Description of interventions in included studies, using the items from the Template for Intervention Description and Replication (TIDieR) checklist *(Continued)*

terven-tions: A. Water gargling B. Povidone-iodine gargling	through gargling water alone, which may wash out pathogens from the pharynx and oral cavity through whirling water or through chlorine, or povidone-iodine for its perceived virucidal properties	ed 7% povidone-iodine (as indicated by manufacturer)	- gargle dose of water or povidone-iodine 3 times/day; - maintain hand-washing routine; - not change other hygiene habits; - not take any cold remedies; - complete gargling diary. Weekly monitoring of hygienic actions and encouragement to keep up assigned intervention every week	istrators (18 healthcare professionals) provided instructions and monitoring and encouragement.	but likely to have been face-to-face and individually, at least initially for instructions	sites in Japan (4 in northern region, 9 in central region, 5 in western region)	1. Water gargling: 20 mL for 15 s at least 3 times/day 2. Povidone-iodine gargling: 20 mL of dilution 3 times/day	done-iodine caused serious discomfort or was not available, participants were allowed to gargle with water instead.	assigned to povidone-iodine gargled with water instead as the povidone-iodine "did not agree with them".	diary: frequency of gargling and handwashing Weekly monitoring and encouragement by local administrators	complete diary. Average frequency of gargling / person / day: With water: A: 3.6 B: 0.8 Control: 0.9 With povidone-iodine: A: < 0.1 B: 2.9 Control: 0.2

ABH: alcohol-based rub
AGNPs: ARGOVIT silver nanoparticles
ARI: acute respiratory infection
CDC: Centers for Disease Control and Prevention
CG: control group
CHG: chlorhexidine gluconate
CHW: community health worker
CO: carbon monoxide
DCCs: daycare centres

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DCT: daily contact testing
FM: face masks
H: handwashing
HCP: healthcare personnel
HCW: healthcare worker
HH: hand hygiene
HSG: hand sanitiser group
HSW: hand-washing with soap and water
HW: hand-washing
HWWS: hand-washing with soap
IG: intervention group
IHIP: integrated environmental home-based intervention package
ILI: influenza-like illness
IU: international units
LFD: lateral flow device
LNS: lipid-based nutrient supplements
LTCFs: long-term care facilities
m: metre
min: minute
N: nutrition
NGOs: non-governmental organisations
NH: nursing home
NHS: National Health Service
no.: number
NPIs: non-pharmaceutical interventions
PCR: polymerase chain reaction
PM2.5: particulate matter of less than 2.5 microns
RAs: research assistants
RIs: respiratory infections
RTIs: respiratory tract infections
S: sanitation
SD: standard deviation
SES: electrolysed water
SSTI: skin and soft-tissue infection
SWG: soap-and-water group
TCID: tissue-culture infectious dose
URTI: upper respiratory tract infection
W: water
WHO: World Health Organization
wk: week
WSH: combined water, sanitation and handwashing
WSHN: combined water, sanitation, handwashing and nutrition
w/w: weight for weight

[1] Filtration efficiency testing was conducted using a Fluke 985 particle counter (volumetric sampling rate of 2.83 litres/ minute. The measurement was taken of particles 0.3–0.5 µm in diameter flowing through the material with a face velocity of 8.5 cm/s. Internal testing found that cloth masks with an external layer made of Pellon 931 polyester fusible

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interface ironed onto interlocking knit with a middle layer of interlocking knit could achieve a 60% filtration efficiency. Upon discussions with the manufacturers, the researchers learned that those materials could not be procured. Using materials that were available, the highest filtration efficiency possible was 37%.
[2] "the exterior and interiors were spunbond and the middle layer was meltblown"
[3] 10 times with bar soap and water
[4] Featured the Honorable Prime Minister of Bangladesh Sheikh Hasina, the head of the Imam Training Academy, and the national cricket star Shakib Al Hasan.
[5] A grassroots organization with a network of volunteers across the country
[6] "consistent with the WHO guideline that defines physical distancing as one meter of separation." www.who.int/westernpacific/emergencies/covid-19/information/physical-distancing (accessed 13 June 2022).
[7] Occupational Safety and Health Administration (OSHA). OSHA technical manual: section VIII: chapter 2: respiratory protection. US Department of Labor. www.osha.gov/dts/osta/otm/otm_viii/otm_viii_2.html (accessed 21 April 2020).
[8] Ministry of Health and Long-Term Care, Public Health Division, Provincial Infectious Diseases Advisory Committee. Preventing respiratory illnesses: protecting patient and staff: infection control and surveillance standards for febrile respiratory illness (FRI) in non-outbreak conditions in acute care hospitals [September 2005] http://www.health.gov.on.ca/english/providers/program/infectious/diseases/best_prac/bp_fri_080406.pdf (accessed September 11 2009). [URL inactive]
[9] Before eating, after sneezing, coughing, handling money, using restroom, returning to desk and interacting with others who may be sick
[10] after coming into classroom, before and after lunch, after break, after physical education, when they went home and after coughing, sneezing or blowing their noses
[11] after toileting and when visibly dirty plus a protocol for particular circumstances: after coming into the classroom; before and after lunch; after playing outside; when they went home; after coughing, sneezing, or blowing their noses; and after diapering
[12] 1) when entering into the classroom; 2) after sneezing, coughing, or blowing their nose; 3) after using the toilet/washroom; 4) before eating any food; and 5) when leaving the school at the end of the day
[13] what to do if hands were dirty, why students should wash their hands, benefits of washing hands and using hand sanitiser, procedure for washing hands using hand sanitiser, to cover mouth and nose with upper part of sleeve while coughing and/or sneezing
[14] Boyce JM, Pittet D, Healthcare Infection Control Practices Advisory Committee, HICPAC/ SHEA/APIC/IDSA Hand Hygiene Task Force. Guideline for hand hygiene in healthcare settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/ IDSA Hand Hygiene Task Force. MMWR Recommendations and Reports 2002;51(RR-16):1–45. www.cdc.gov/mmwr/preview/mmwrhtml/rr5116a1.htm (accessed 21 April 2020). International Bank for Reconstruction and Development/ World Bank. Bank-Netherlands Water Partnership, Water and Sanitation Program. Hand washing manual: a guide for developing a hygiene promotion program to increase handwashing with soap. http://go.worldbank.org/PJTS4A53C0 (Accessed 16 May 2007). *[URL inactive]* California State Department of Education. *Techniques for Preventing the Spread of Infectious Diseases*. Sacramento (CA): California State Department of Education, 1983. Geiger BF, Artz L, Petri CJ, Winnail SD, Mason JW. *Fun with Handwashing Education*. Birmingham (AL): University of Alabama, 2000. Roberts A, Pareja R, Shaw W, Boyd B, Booth E, Mata JI. A tool box for building health communication capacity. www.globalhealthcommunication.org/tools/29 (Accessed 10 October 2007). *[URL inactive]* Stark P. *Handwashing Technique. Instructor's Packet. Learning Activity Package*. Sacramento (CA): California State Department of Education, 1982.
[15] DIN EN 1500: Chemische Desinfektionsmittel und Antiseptika, Hygienische Händedesinfektion, Prüfverfahren und Anforderungen (Phase 2/Stufe 2). Brüssel (Belgium): CEN, European Comittee for Standardization 1997;1-20.
[16] DIN EN 12791: Chemische Desinfektionsmittel und Antiseptika, Chirugische Händedesinfektionsmittel - Prüfverfahren und Anforderungen (Phase 2/Stufe 2). Brüssel (Belgium): CEN, European Comittee for Standardization 2005;1-31.
[17] after defaecation, after cleaning an infant who had defaecated, before preparing food, before eating, and before feeding infants
[18] non-governmental organisation that supports community-based health and development initiatives
[19] "Healthy Hands" Rules (from Figure 3 in paper): Do use "special soap" when arrive to school, before lunch, after go to bathroom (only if soap and water not available), if rub nose or eyes or if fingers in mouth, if teacher asks. Do not: use "special soap" if hand dirt on them, put "special soap" on another student, play with 'special soap", put hands near eyes after using "special soap".
[20] Calculated by subtracting each day's soap weight from the previous day's weight. Maximum number of grams of soap consumed for each compound was identified and the day on which the maximum soap consumption was recorded. A per capita estimate of daily soap consumption was calculated
[21] National Health and Medical Research Council. Staying Healthy in Child Care. Canberra (Australia): Australian Government Publishing Service, 1994
[22] upon arrival, before and after lunch, and prior to departure
[23] World Health Organization. (2012). Hand hygiene in outpatient and home-based care and long-term care facilities: a guide to the application of the WHO multimodal hand hygiene improvement strategy and the "My Five Moments For Hand Hygiene" approach. World Health Organization. apps.who.int/iris/handle/10665/78060 (accessed 15 June 2022)

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[24] Moment 1 (before touching a resident) = Room In; Moment 4 (after touching a resident) and Moment 5 (after touching a resident's surroundings) = Room Out; Moment 2 (before a clean/antiseptic procedure) = Before Clean; Moment 3 (after body fluid exposure risk) – After Dirty
[25] Handsome: handhygiëne in verpleeghuizen.: Zorg voor beter; 2019 May 03. URL: www.zorgvoorbeter.nl/handsome (accessed 7 June 2022)
[26] Veiligheid en Kwaliteit: Project Handen uit de Mouwen.: Stichting Samenwerkende Rijnmond Ziekenhuizen
[27] Auditor training.: Hand Hygiene Australia URL: www.hha.org.au/audits/auditor-training (accessed 7 June 2022)
[28] no long nails, acrylic nails, or polished nails and not wearing a ring, bracelet, wristwatch, brace, or long sleeves.
[29] Persoonlijke hygiëne: Verpleeghuizen, woonzorgcentra, voorzieningen voor kleinschalig wonen voor ouderen.: Werkgroep Infectie Preventie; 2014. URL: tinyurl.com/wpfqr8p (accessed 7 June 2022)
[30] knowledge and awareness of HH guidelines, perceived importance of performing HH, perceived behavioural control (i.e. perceived ease or difficulty of performing the behaviour), and habit
[31] "According to the Dutch national guidelines, HH is mandatory for caregivers before touching/preparing food, before caregivers themselves ate or assisted children with eating, and before wound care; and after diapering, after toilet use/wiping buttocks, after caregivers themselves coughed/sneezed/wiped their own nose, after contact with body fluids (e.g. saliva, vomit, urine, blood, or mucus when wiping children's noses), after wound care, and after hands were visibly soiled." (p. 2495)
[32] Having touched household items being used by the index patients and/or other symptomatic household contacts, and after coughing/sneezing, before meals, before preparing meals and when returning home
[33] Which addresses "contextual, psychosocial, and technological factors at the societal, community, interpersonal, individual, and habitual levels". (Luby 2018)
[34] Hussain F, Luby SP, Unicomb L, Leontsini E, Naushin T, Buckland AJ, et al. Assessment of the acceptability and feasibility of child potties for safe child feces disposal in rural Bangladesh. The American Journal of Tropical Medicine and Hygiene. 2017;97:469–76.
[35] Sultana R, Mondal UK, Rimi NA, Unicomb L, Winch PJ, Nahar N, et al. An improved tool for household faeces management in rural Bangladeshi communities. Tropical Medicine & International health 2013;18:854–60.
[36] Hulland KR, Leontsini E, Dreibelbis R, Unicomb L, Afroz A, Dutta NC, et al. Designing a handwashing station for infrastructure-restricted communities in Bangladesh using the integrated behavioural model for water, sanitation and hygiene interventions (IBM-WASH). BMC Public Health 2013; 13: 877.
[37] Menon P, Nguyen PH, Saha KK, Khaled A, Sanghvi T, Baker J, et al. Combining intensive counseling by frontline workers with a nationwide mass media campaign has large differential impacts on complementary feeding practices but not on child growth: results of a cluster-randomized program evaluation in Bangladesh. The Journal of Nutrition 2016;146:2075–84.
[38] comprised of: senior program manager-intervention delivery, senior program manager-operations, Sanitation Intervention Team leader, senior field research officer, training officer, field research officers, CHW supervisors and CHWs
[39] SODIS: www.sodis.ch/index_EN.html
[40] after defecation, after changing diapers, before food preparation and before eating
[41] 1. Wash both hands with water and soap before eating/ handling food 2. Wash both hands with water and soap/ash after defecation 3. Wash both hands with water and soap/ash after cleaning baby's bottom 4. Use hygienic latrine by all family members including Children 5. Dispose of children's faeces into hygienic latrines 6. Clean and maintain latrine 7. Construct a new latrine if the existing one is full and fill the pit with soil/ash. 8. Safe collection and storage of drinking water 9. Draw drinking water from arsenic safe water point 10. Wash raw fruits and vegetables with safe water before eating and cover food properly 11. Manage menstruation period safely (p.605)
[42] Rosenstock IM, Strecher VJ, Becker MH. Social learning theory and the Health Belief Model. Health Education Quarterly 1988;15:175–83.
[43] Glanz K, Rimer BK, 2005. Theory at a Glance: A Guide for Health Promotion Practice. Washington, DC:US Department of Health and Human Services, Public Health Service, National Institutes of Health, National Cancer Institute.
[44] Hovland CI, Janis IL, Kelley HH, 1953. Communication and Persuasion; Psychological Studies of Opinion Change. New Haven, CT: Yale University Press.
[45] Based on family of five, consuming 2L of water per person per day, the bottle would last almost a year
[46] W: key concepts for water treatment and contamination, procedures for refilling dispenser and distributing bottled chlorine, chlorine testing and reporting; H: HW with soap at critical times and creating supportive environment; S: contamination pathways; N: early initiation and exclusive breastfeeding, complementary and supplementary feeding, LNS procedures for collection from health facility and delivery tracking, teaching mamas how to feed Mwanzobora to the child, cooking demonstration, age-specific messaging about nutrition
[47] Department of Health and Social Care. Lateral flow device performance data. July 7, 2021. www.gov.uk/government/publications/lateral-flow-device-performance-data (accessed 15 June 2022).
[48] "applicable to schools as defined in national guidelines were, face to face contact (within 1 metre for any length of time) or skin to skin contact or someone the case coughed on; or within 1 metre for ≥1 minute; or within 1-2 metres for >15 minutes." P.2 of Supplementary appendix

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[49] i.e., surgical uniform, N95 mask, eye-sealing glasses and plastic wallet, disposable cap, latex gloves, rubber footwear for hospital use and disposable shoe covers, while working. Additionally, third level care health professionals wore a full protective mask, Dermacare®, overalls with zipper, and an integrated hood with elastic hand and ankle cuffs, double disposable boot covers and double latex gloves.
[50] With liquid soap (2% chlorhexidine gluconate) and hand disinfection (0.05% chlorhexidine gluconate and 60–80% ethyl alcohol).
[51] With 80% ethyl alcohol

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Table 2. Results from trials of hand hygiene compared to control

Study	Comparison (see Table 1 for details of interventions)	Reported outcomes	Results
Alzaher 2018 cluster-RCT Saudi Arabia	Hand-washing workshop and posters versus usual practice	% absence days due to URI	0.39% and 0.72% in intervention group schools; 0.86% and 1.39% in control schools
Arbogast 2016 cluster-RCT USA	Hand sanitiser + wipes + hand foam versus none Both groups received education + signage about hand-washing	1. Health insurance claims for preventable illnesses per employee 2. Absences per employee	1. 0.30 claims in intervention; 0.37 in control (27% relative reduction; P = 0.03) 2. 1.45 in intervention; 1.53 in control (5.0% relative reduction in intervention; P = 0.30)
Ashraf 2020 cluster-RCT Bangladesh	6 intervention arms: water quality, sanitation, hand washing, combined WSH, nutrition, nutrition + WSH	7-day prevalence of acute respiratory illness (ARI).	Hand washing reduced ARI cases by 32% (RR 0.68, 95% CI 0.52 to 0.88)
Azor-Martinez 2016 RCT Spain	Hand-washing with soap and water plus hand sanitiser versus usual hand-washing practices	% absence days due to URI	1.15% in intervention; 1.68% in control. Significantly lower in intervention (P < 0.001)
Azor-Martinez 2018 cluster-RCT Spain	Education and hand hygiene with soap and water versus hand hygiene with sanitiser versus usual hand-washing procedures	1. URI incidence rate ratio (primary) 2. Percentage difference in absenteeism days	1. HH soap versus control 0.94 (95% CI 0.82 to 1.08); HH sanitiser versus control 0.77 (95% CI 0.68 to 0.88); HH soap versus HH sanitiser 1.21 (95% CI 1.06 to 1.39) 2. HH soap 3.9% versus control 4.2% (P < 0.001); HH sanitiser 3.25% versus control 4.2% (P = 0.026); HH soap 3.9% versus HH sanitiser 3.25% (P < 0.001)
Biswas 2019 cluster-RCT Bangladesh	Hand sanitiser and respiratory hygiene education and cough/sneeze hygiene versus no intervention	1. ILI incidence rate (at least 1 episode) 2. Laboratory-confirmed influenza	1. 22 per 1000 student-weeks in intervention; 27 per 1000 student-weeks in control, not statistically significantly different 2. 3 per 1000 student-weeks in intervention; 6 per 1000 student-weeks in control, P = 0.01
Correa 2012 cluster-RCT Colombia	Alcohol-based hand sanitiser in addition to hand-washing versus usual hand-washing practice	ARIs in 3rd trimester of follow-up	Hazard ratio for intervention to control 0.69 (95% CI 0.57 to 0.83)
Cowling 2008 cluster-RCT Hong Kong	Hand hygiene (36 households) versus face mask (mask) versus education (control)	Secondary attack rate for: 1. laboratory-confirmed influenza; 2. ILI definition 1; 3. ILI definition 2;	1. HH 0.06; mask 0.07; control 0.06 2. HH 0.18; mask 0.18; control 0.18 3. HH 0.11; mask 0.10; control 0.11 4. HH 0.04; mask 0.08; control 0.04

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Table 2. Results from trials of hand hygiene compared to control *(Continued)*

		4. ILI definition 3.	
Cowling 2009 cluster-RCT Hong Kong	Hand hygiene (HH) versus face mask + hand hygiene (HH + mask) versus education (control)	Secondary attack rate for: 1. laboratory-confirmed influenza; 2. ILI definition 1; 3. ILI definition 2.	1. HH 5; HH + mask 7; control 10 2. HH 16; HH + mask 21; control 19 3. HH 4; HH + mask 7; control 5
DiVita 2011 (conference abstract) RCT Bangladesh	Hand-washing stations with soap and motivation vs none	1. SAR for laboratory-confirmed influenza 2. SAR for ILI	1. SAR higher in intervention group (11.0% versus 7.5%) 2. SAR higher in intervention group (14.2% versus 11.9%)
Feldman 2016 cluster-RCT Israel	Hand disinfection + soap and water installed versus none	1. Number of respiratory infections 2. Number of off-duty days	1. 11 in each group 2. 112 in intervention; 104 in control
Gwaltney 1980 RCT USA	Virucidal hand wash versus placebo	1. Number with illness after immediate exposure 2. Number with illness after 2-hour delay in exposure	1. 0 of 8 in intervention; 7 of 7 in control 2. 1 of 10 in intervention; 6 of 10 in control
Hubner 2010 RCT Germany	Hand disinfection provided versus none	Odds ratios (95% CI) (intervention:control) 1. Influenza 2. Common cold 3. Sinusitis 4. Sore throat 5. Fever 6. Cough	1. 1.02 (0.20 to 5.23) 2. 0.35 (0.17 to 0.71) 3. 1.87 (0.52 to 6.74) 4. 0.62 (0.31 to 1.25) 5. 0.38 (0.14 to 0.99) 6. 0.45 (0.22 to 0.91)
Ladegaard 1999 RCT Denmark	Hand hygiene and education versus none	Sick days during the "effect period"	22 days/child in the intervention group versus 36 days/child in the control group
Larson 2010 cluster-RCT USA	Education versus education with alcohol-based hand sanitiser versus education with hand sanitiser and face masks	Incidence rate ratios (episodes per 1000 person-weeks) for: 1. URI; 2. ILI; 3. influenza. Secondary attack rates for: 4. URI/ILI/influenza; 5. ILI/influenza.	1. HS 29; HS + masks 39; control 35 2. HS 1.9; HS + masks 1.6; control 2.3 3. HS 0.6; HS + masks 0.5; control 2.3 4. HS 0.14; HS + masks 0.12; control 0.14 5. HS 0.02; HS + masks 0.02; control 0.02

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Table 2. Results from trials of hand hygiene compared to control *(Continued)*

Little 2015 RCT England	Bespoke automated web-based hand hygiene motivational intervention with tailored feedback versus none	Number of participants with 1 or more episodes of URI	Risk ratio for intervention to control 0.86 (95% CI 0.83 to 0.89; P < 0.001)
Luby 2005 RCT Pakistan	Antibacterial soap and education about hand-washing versus plain soap and education versus none	1. Cough or difficulty breathing in children < 15 yrs (episodes/100 person-weeks) 2. Congestion or coryza in children < 15 yrs (episodes/100 person-weeks) 3. Pneumonia in children < 5 yrs (episodes/100 person-weeks)	All outcomes significantly lower than control 1. 4.21 in antibacterial soap group; 4.16 in plain soap group; 8.50 in control group 2. 7.32 in antibacterial soap group; 6.87 in plain soap group; 14.78 in control group 3. 2.42 in antibacterial soap group; 2.20 in plain soap group; 4.40 in control group
Millar 2016 cluster-RCT USA	Standard educational promotion of hand-washing versus enhanced promotion versus promotion plus a once-weekly application of chlorhexidine-based body wash	Incidence rates of ARI over 20 months	37.7 enhanced + body wash; 29.3 enhanced; 35.3 standard; RR for enhanced + body wash to standard 1.07 (95% CI 1.03 to 1.11); RR for enhanced to enhanced + body wash 0.78 (95% CI 0.75 to 0.81)
Morton 2004 cluster-RCT cross-over study USA	Alcohol gel plus education versus regular hand-washing	Absence due to infectious illness	Results not stated numerically
Nicholson 2014 cluster-RCT India	Combination hand-washing promotion with provision of free soap versus none	Target children: 1. Episodes of ARI (per 100 person-weeks) 2. School absence episodes (per 100 person-days) Families: 3. Episodes of ARI	1. 16 in intervention; 19 in control 2. 1.2 in intervention; 1.7 in control 3. 10 in intervention; 11 in control
Priest 2014 cluster-RCT New Zealand	Hand hygiene education and hand sanitiser versus education alone	1. % absence days due to respiratory illness 2. % absence days due to any illness	1. 0.84% in intervention group; 0.80% in control (P = 0.44) 2. 1.21% in intervention group; 1.16% in control (P = 0.35)
Ram 2015 RCT Bangladesh	Education to promote intensive hand-washing in households plus soap provision versus none	1. Secondary attack ratio for intervention to control for ILI 2. Laboratory-confirmed influenza	1. 1.24 (95% CI 0.93 to 1.65) 2. 2.40 (95% CI 0.68 to 8.47)
Roberts 2000 cluster-RCT	Hand-washing programme with training for staff and children versus none	Incidence rate ratio for ARI	IRR 0.92 for intervention to control (95% CI 0.86 to 0.99)

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Table 2. Results from trials of hand hygiene compared to control *(Continued)*

Australia			
Sandora 2008 cluster-RCT USA	Hand sanitiser and education versus none	Incidence rates for ARI (episodes per person-month)	0.43 in intervention; 0.42 in control
Savolainen-Kopra 2012 cluster-RCT Finland	Hand hygiene with soap and water (IR1 group) versus with alcohol-based hand rub (IR2 group) versus control (none); intervention groups also received education	1. Number of respiratory infection episodes/week 2. Number of reported infection episodes/week 3. Number of reported sick leave episodes/week	1. 0.076 in IR1; 0.085 in IR2; 0.080 in control, NS 2. 0.097 in IR1; 0.107 in IR2; 0.104 in control, NS 3. 0.042 in IR1; 0.035 in IR2; 0.035 in control. Significantly higher in IR1 compared with control
Simmerman 2011 cluster-RCT Thailand	Hand-washing (HW) versus hand-washing plus paper surgical face masks (HW + FM) versus control (none)	Odds ratios for secondary attack rates for influenza	OR for HW: control 1.20 (95% CI 0.76 to 1.88) OR for HW + masks: control 1.16 (95% CI 0.74 to 1.82) OR for HW + masks: HW 0.72 (95% CI 0.21 to 2.48)
Stebbins 2011 cluster-RCT USA	Training in hand and respiratory (cough) hygiene + hand sanitiser versus none	Incidence rate ratios for intervention to control for: 1. laboratory-confirmed influenza (RT-PCR); 2. influenza-A; 3. absence.	1. IRR 0.81 (95% CI 0.54 to 1.23) 2. IRR 0.48 (95% CI 0.26 to 0.87) 3. IRR 0.74 (95% CI 0.56 to 0.97)
Swarthout 2020 cluster-RCT Kenya	There were 6 intervention groups: chlorinated drinking water (W), improved sanitation (S), handwashing with soap (H), combined WSH, improved nutrition (N) through counselling lipid based nutrient supplementation (LNS) combined WSHN There were 2 control groups passive control (no promotional visits), a double-sized active control (monthly visits to measure mid–upper arm circumference)	Prevalence of ARIs in children	No evidence of an effect: RR 0.97, 95% CI 0.90 to 1.04.
Talaat 2011 cluster-RCT Egypt	Mandatory hand-washing intervention + education versus none	1. Number of absence days due to ILI 2. Number of absence days	1. 917 in intervention; 1671 in control (P < 0.001) 2. 13,247 in intervention; 19,094 in control (P < 0.001)
Teesing 2021 cluster-RCT Netherlands	Hand hygiene enhancement activities versus no activities.	Incidence of gastroenteritis, influenza-like illness (ILI), assumed pneumonia, urinary tract infections (UTIs), and infections caused MRSA in residents	Hand hygiene reduced risk of ILI (RR 0.51, 95% CI 0.31 to 0.83)

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Table 2. Results from trials of hand hygiene compared to control *(Continued)*

Temime 2018 cluster-RCT France	Hand hygiene with alcohol-based hand rub, promotion, staff education, and local work groups versus none	Incidence rate of ARI clusters (5 or more people in same nursing home)	2 ARI clusters in intervention; 1 in control
Turner 2012 RCT USA	Antiviral hand treatment versus no treatment	1. Number of rhinovirus infections 2. Common cold infections 3. Rhinovirus-associated illnesses	1. 49 in intervention; 49 in control, NS 2. 56 in intervention; 72 in control, NS 3. 26 in intervention; 24 in control, NS
White 2001 DB-RCT USA	Hand rub with benzalkonium chloride (hand sanitiser) versus placebo	ARI symptoms Laboratory: testing of virucidal and bactericidal activity of the product	30% to 38% decrease of illness and absenteeism (RR for illness absence incidence 0.69; RR for absence duration 0.71)
Yeung 2011 cluster-RCT Hong Kong	Alcohol-based hand gel + materials + education versus control (basic life support workshop)	Difference between pre-study period and post study in pneumonia infections recorded in residents	0.63/1000 reduction in intervention group; 0.16/1000 increase in control
Zomer 2015 cluster-RCT Netherlands	4 components: 1. Hand hygiene products, paper towel dispensers, soap, alcohol-based hand sanitiser, and hand cream provided for 6 months 2. Training and booklet 3. 2 team training sessions aimed at hand hygiene improvement 4. Posters and stickers for caregivers and children as reminders. Combination versus usual practice	Incidence rate ratio for intervention to control for common cold	IRR 1.07 (95% CI 0.97 to 1.19) 8.2 episodes per child-year in intervention; 7.4 episodes per child-year in control

ARI: acute respiratory infection
CI: confidence interval
cluster-RCT: cluster-randomised controlled trial
DB-RCT: double-blind randomised controlled trial
HH: hand hygiene
HS: hand sanitiser
HW: hand-washing
ILI: influenza-like illness
IRR: incidence rate ratio
NS: non-significant
OR: odds ratio
RCT: randomised controlled trial
RR: risk ratio
RT-PCR: reverse-transcriptase polymerase chain reaction
SAR: secondary attack rate

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URI: upper respiratory infection
yrs: years

Table 3. Results from trials of hand hygiene + medical/surgical masks compared to control

Study	Comparison (see Table 1 for details of interventions)	Reported outcomes	Results
Aelami 2015 (conference abstract) RCT Saudi Arabia	Hand hygiene education + alcohol-based hand rub + soap + surgical masks vs none	Proportion with ILI (defined as presence of ≥ 2 of the following during their stay: fever, cough, and sore throat)	52% in intervention; 55.3% in control (P < 0.001)
Aiello 2010 cluster-RCT USA	Face mask use (FM) vs face masks + hand hygiene (FM + HH) vs control Note that this study is not included in meta-analysis as each treatment group included only 1 cluster.	1. ILI 2. Laboratory-confirmed influenza A or B	Significant reduction in ILI cases in both intervention groups compared with control over weeks 3 to 6 No significant differences between FM and FM + HH
Aiello 2012 cluster-RCT USA	Face mask use (FM) vs face masks + hand hygiene (FM + HH) vs control	1. Clinical ILI 2. Laboratory-confirmed influenza A or B	1. Non-significant reductions in FM group compared with control over all weeks. Significant reduction in FM + HH group compared with control in weeks 3 to 6 2. Non-significant reductions in both intervention groups compared with control
Cowling 2009 cluster-RCT Hong Kong	Hand hygiene (HH) vs hand hygiene plus face masks (HH + mask) vs control	Secondary attack ratio for: 1. laboratory-confirmed influenza; 2. ILI definition 1; 3. ILI definition 2.	1. HH 5; HH + mask 7; control 10 2. HH 16; HH + mask 21; control 19 3. HH 4; HH + mask 7; control 5
Larson 2010 cluster-RCT USA	Education (control) vs education with alcohol-based hand sanitiser (HS) vs education + HS + face masks (HS + mask)	Incidence rate ratios (episodes per 1000 person-weeks) for: 1. URI; 2. ILI; 3. influenza. Secondary attack rates for: 4. URI/ILI/influenza; 5. ILI/influenza.	1. HS 29; HS + mask 39; control 35 2. HS 1.9; HS + mask 1.6; control 2.3 3. HS 0.6; HS + mask 0.5; control 2.3 4. HS 0.14; HS + mask 0.12; control 0.14 5. HS 0.02; HS + mask 0.02; control 0.02
Simmerman 2011 cluster-RCT Thailand	Control vs hand-washing (HW) vs hand-washing + paper surgical face masks (HW + mask)	Odds ratio for secondary attack rates for influenza	OR for HW: control 1.20 (95% CI 0.76 to 1.88) OR for HW + mask: control 1.16 (95% CI 0.74 to 1.82) OR for HW + mask: HW 0.72 (95% CI 0.21 to 2.48)
Suess 2012 cluster-RCT Germany	Face mask + hand hygiene (mask + HH) vs face masks only (mask) vs none (control)	Secondary attack rates in household contacts: 1. Laboratory-confirmed influenza 2. ILI	1. Mask 9; mask + HH 15; control 23 2. Mask 9; mask + HH 9; control 17

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CI: confidence interval
cluster-RCT: cluster-randomised controlled trial
FM: face mask
HH: hand hygiene
HS: hand sanitiser
HW: hand-washing
ILI: influenza-like illness
OR: odds ratio
RCT: randomised controlled trial
URI: upper respiratory infection
vs: versus

Table 4. Results from trials of soap + water compared to hand sanitisers

Study	**Comparison** (see Table 1 for details of interventions)	**Reported outcomes**	**Results**
Azor-Martinez 2018 cluster-RCT Spain	Education and hand hygiene with soap and water (HH soap) vs hand hygiene with sanitiser (HH sanitiser) vs usual hand-washing procedures	1. URI incidence rate ratio (primary) 2. Percentage difference in absenteeism days	1: HH soap vs control 0.94 (95% CI 0.82 to 1.08); HH sanitiser vs control 0.77 (95% CI 0.68 to 0.88); HH soap vs HH sanitiser 1.21 (95% CI 1.06 to 1.39) 2: HH soap 3.9% vs control 4.2% (P < 0.001); HH sanitiser 3.25% vs control 4.2% (P = 0.026); HH soap 3.9% vs HH sanitiser 3.25% (P < 0.001)
Pandejpong 2012 cluster-RCT Thailand	Alcohol hand gel applied every 60 minutes vs every 120 minutes vs once before lunch (3 groups).	Absent days due to confirmed ILI/ present days	0.017 in every hour group; 0.025 in every 2 hours group; 0.026 in before lunch group. Statistically significant difference between every hour group and before lunch group, and between every hour and every 2 hours groups
Savolainen-Kopra 2012 cluster-RCT Finland	Hand hygiene with soap and water (IR1 group) vs with alcohol-based hand rub (IR2 group) vs control (none); intervention groups also received education	1. Number of respiratory infection episodes/week 2. Number of reported infection episodes/week 3. Number of reported sick leave episodes/week	1. 0.076 in IR1; 0.085 in IR2; 0.080 in control, NS 2: 0.097 in IR1; 0.107 in IR2; 0.104 in control, NS 3: 0.042 in IR1; 0.035 in IR2; 0.035 in control. Significantly higher in IR1 compared with control
Turner 2004a and- Turner 2004b RCT Canada	Study 1. Ethanol vs salicylic acid 3.5% vs salicylic acid 1% and pyroglutamic acid 3.5% Study 2. Skin cleanser wipe vs ethanol (control)	% of volunteers infected with rhinovirus	7% in each intervention group; 32% in control (study 1) 22% in intervention, 30% in control (study 2)

CI: confidence interval
cluster-RCT: cluster-randomised controlled trial
HH: hand hygiene
ILI: influenza-like illness
NS: non-significant
RCT: randomised controlled trial
URI: upper respiratory infection
vs: versus

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Table 5. Results from trials of surface/object disinfection (with or without hand hygiene) compared to control

Study	Comparison (see Table 1 for details of interventions)	Reported outcomes	Results
Ban 2015 cluster-RCT China	Hand hygiene products, surface cleaning and disinfection provided to families and kindergartens vs none	1. Respiratory illness 2. Cough and expectoration	1. OR 0.47 for intervention to control (95% CI 0.38 to 0.59) 2. OR 0.56 (95% CI 0.48 to 0.65)
Carabin 1999 cluster-RCT Canada	One-off hygiene education and disinfection of toys with bleach vs none	Difference in incidence rate for URTI (cluster-level result)	0.28 episodes per 100 child-days lower in intervention group (95% CI 1.65 lower to 1.08 higher); URTI incidence rate IRR 0.80 (95% CI 0.68 to 0.93)
Ibfelt 2015 cluster-RCT Denmark	Disinfectant washing of linen and toys by commercial company every 2 weeks vs usual care	Presence of respiratory viruses on surfaces	Statistically significant reduction in intervention group in adenovirus, rhinovirus, RSV, metapneumovirus, but not other viruses including coronavirus
Kotch 1994 RCT USA	Training in hand-washing and diapering and disinfection of surfaces vs none	Respiratory illness incidence rate in: 1. children < 24 months; 2. children >= 24 months.	1. 14.78 episodes per child-year in intervention; 15.66 in control 2. 12.87 in intervention; 11.77 in control
McConeghy 2017 RCT USA	Staff education, cleaning products, and audit of compliance and feedback vs none	Infection rates	Upper respiratory infections not reliably recorded or reported.
Sandora 2008 cluster-RCT USA	Hand sanitiser and disinfection of classroom surfaces vs materials about good nutrition (control)	Absence due to respiratory illness (multivariable analysis)	Rate ratio 1.10 for intervention to control (95% CI 0.97 to 1.24)

CI: confidence interval
cluster-RCT: cluster-randomised controlled trial
IRR: incident rate ratio
OR: odds ratio
RCT: randomised controlled trial
RSV: respiratory syncytial virus
URTI: upper respiratory tract infection
vs: versus

Table 6. Results from trials of complex interventions compared to control

Study	Comparison (see Table 1 for details of interventions)	Reported outcomes	Results
Complex hygiene and sanitation interventions compared to control			
Chard 2019 cluster-RCT	Complex sanitation intervention and education vs none	Pupil-reported symptoms of res-	NS difference between groups. 29% of intervention group; 32% control group; adjusted risk ratio 1.08 (95% CI 0.95 to 1.23)

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Table 6. Results from trials of complex interventions compared to control *(Continued)*

Laos		piratory infection over 1 week	
Hartinger 2016 cluster-RCT Peru	Cooking and sanitation provision and education vs none	Number of ARI episodes per child-year	NS difference between groups. Risk ratio for intervention to control 0.95 (95% CI 0.82 to 1.10)
Huda 2012 cluster-RCT Bangladesh	Sanitation provision and education vs none	Respiratory illness	12.6% in intervention group; 13.0% in control group. Not adjusted for multiple outcome measurements. No CIs reported.
Najnin 2019 cluster-RCT Bangladesh	Sanitation and behaviour change intervention (plus cholera vaccine) vs none	Respiratory illness in past 2 days	2.8% in intervention group; 2.9% in control group

ARI: acute respiratory infection
CI: confidence interval
cluster-RCT: cluster-randomised controlled trial
NS: non-significant
RCT: randomised controlled trial
vs: versus

Table 7. Results from trials of virucidal tissues compared to control

Study	Comparison	Reported outcomes	Results
Virucidal tissues compared with placebo or no tissues			
Farr 1988a and Farr 1988b cluster-RCT USA Trial 1 and Trial 2	Trial 1. Virucidal nasal tissues vs placebo vs none Trial 2. Virucidal nasal tissues vs placebo	Respiratory illnesses per person over 24 weeks Trial 1 Trial 2	Trial 1: 3.4 in tissues group; 3.9 in placebo group; 3.6 in no-tissues group Trial 2: 3.4 in tissues group; 3.6 in placebo group NS
Longini 1988 DB-PC RCT USA	Virucidal nasal tissues vs placebo	Secondary attack rate of viral infections (number of infections in household members of index case)	10.0 in intervention; 14.3 in placebo; NS

cluster-RCT: cluster-randomised controlled trial
DB-PC: double-blind, placebo-controlled
NS: non-significant
RCT: randomised controlled trial
vs: versus

Table 8. Summary of main results of the review for the primary outcomes

Interventions	RCT/cluster-RCT (N = 78)
Medical/surgical masks	**Masks (medical/surgical) compared to no masks**

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Table 8. Summary of main results of the review for the primary outcomes *(Continued)*

	9 trials in the community showed no effect on ILI (RR 0.95, 0.84 to 1.09) (Abaluck 2022; Aiello 2010; Alfelali 2020; Barasheed 2014; Canini 2010; Cowling 2008;; MacIntyre 2009;; MacIntyre 2016; Suess 2012); and 6 trials in the community showed no effect on laboratory-confirmed influenza 95% CI RR 1.01 (0.72 to 1.42) (Aiello 2012; Alfelali 2020; Bundgaard 2021; Cowling 2008; MacIntyre 2009; Suess 2012). Two trials in health care workers where the control group wore masks if they were required provided inconclusive results with very wide confidence intervals (Jacobs 2009; MacIntyre 2015). **Medical/surgical masks versus other (non-N95) masks:** 1 trial showed more ILI with cloth mask (RR 13.25, 1.74 to 100.97) (MacIntyre 2015); 1 trial showed no effect of catechin-treated masks on influenza (adjusted OR 2.35, 0.40 to 13.72) (Ide 2016).
N95 respirator	**N95 respirators compared to medical/surgical masks** 3 trials showed no difference for clinical respiratory illness (RR 0.70, 0.45 to 1.10) (MacIntyre 2011; MacIntyre 2013; Radonovich 2019); 4 trials showed no difference for ILI (95% CI RR 0.81, 0.62 to 1.05) (Loeb 2009; MacIntyre 2009; MacIntyre 2011; Radonovich 2019); and 4 trials showed no difference for laboratory-confirmed influenza (95% CI RR 1.06, 0.81 to 1.38) (Loeb 2009; MacIntyre 2009; MacIntyre 2011; Radonovich 2019). 4 trials conducted in HCWs: 3 trials showed no difference for clinical respiratory illness (RR 0.70, 0.45 to 1.10) (MacIntyre 2011; MacIntyre 2013; Radonovich 2019); 3 trials showed no difference for ILI (RR 0.64, 0.32 to 1.31) (Loeb 2009; MacIntyre 2011; Radonovich 2019); and 3 trials showed no difference for laboratory-confirmed ILI (RR 1.02, 0.73 to 1.43) (Loeb 2009; MacIntyre 2011; Radonovich 2019).
Hand hygiene	**Hand hygiene compared to control** 19 trials found an effect on combined outcome (ARI or ILI or influenza) (RR 0.89, 0.83 to 0.94) (Ashraf 2020; Azor-Martinez 2018; Biswas 2019; Correa 2012; Cowling 2008; Cowling 2009; Hubner 2010; Larson 2010; Little 2015; Millar 2016; Nicholson 2014; Ram 2015; Roberts 2000; Sandora 2005; Simmerman 2011; Stebbins 2011; Swarthout 2020; Teesing 2021; Zomer 2015); 9 trials showed an effect on ARI (RR 0.86, 0.81 to 0.90) (Ashraf 2020; Azor-Martinez 2018; Correa 2012; Larson 2010; Little 2015; Millar 2016; Nicholson 2014; Sandora 2005; Swarthout 2020); 11 trials showed no effect on ILI (RR 0.94, 0.81 to 1.09) (Biswas 2019; Cowling 2008; Cowling 2009; Hubner 2010; Larson 2010; Little 2015; Ram 2015; Roberts 2000; Simmerman 2011; Teesing 2021; Zomer 2015); and 8 trials no effect on laboratory-confirmed influenza (RR 0.91, 95% CI 0.63 to 1.30) (Biswas 2019; Cowling 2008; Cowling 2009; Hubner 2010; Larson 2010; Ram 2015; Simmerman 2011; Stebbins 2011).
Hand hygiene + medical/surgical masks	**Hand hygiene + medical/surgical masks compared to control** 7 trials showed no effect on ILI (95% CI RR 0.97, 0.80 to 1.19) (Aelami 2015; Aiello 2010; Aiello 2012; Cowling 2009; Larson 2010; Simmerman 2011; Suess 2012); and 4 trials showed no effect on laboratory-confirmed influenza (RR 0.97, 0.69 to 1.36) (Cowling 2009; Larson 2010; Simmerman 2011; Suess 2012). **Hand hygiene + medical/surgical masks compared to hand hygiene** 3 trials showed no effect on ILI (RR 1.03, 0.69 to 1.53) or laboratory-confirmed influenza (RR 0.99, 0.69 to 1.44) (Cowling 2009; Larson 2010; Simmerman 2011).
Soap + water compared to sanitiser, and comparisons of different types of sanitiser	**Soap + water compared to sanitiser, and comparisons of different types of sanitiser** 1 trial hand sanitiser was more effective than soap and water (Azor-Martinez 2018); 1 trial there was no difference (Savolainen-Kopra 2012). 2 trials in children antiseptic was more effective (Morton 2004; White 2001); 1 trial in children antiseptic = soap (Luby 2005). 1 trial hand sanitisers were better than placebo, but no difference between sanitisers (Turner 2004a); 1 trial no difference between different wipes (Turner 2004b).

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Table 8. Summary of main results of the review for the primary outcomes *(Continued)*

Surface/object disinfection (with or without hand hygiene) compared to control	**Surface/object disinfection compared to control** 2 trials were effective on ARI (Ban 2015; Carabin 1999); 1 trial was effective for viruses detected on surfaces (Ibfelt 2015); 2 trials showed no difference in ARIs (Kotch 1994; McConeghy 2017).
Disinfection of living quarters	-
Complex interventions	**Complex interventions compared to control** 4 trials in low-income countries found no effect on respiratory viral illness (Chard 2019; Hartinger 2016; Huda 2012; Najnin 2019).
Physical interventions (masks, gloves, gowns combined)	-
Gloves	-
Gowns	-
Physical distancing	**Physical distancing compared to self-isolation** 1 trial reported 1 positive SARS-CoV-2 case in the fitness centre access arm versus 0 in the no access arm (risk difference 0.05%, 95% CI − 0.05 to 0.16%) (Helsingen 2021)
Quarantine in the community	**Quarantine compared to control** 1 trial effective for influenza (Cox hazard ratio 0.799, 95% CI 0.66 to 0.97) (Miyaki 2011). **Daily contact testing compared to self-isolation** 1 trial showed non-inferiority of daily contact testing of school-based contacts compared to self-isolation for SARS-CoV-2 (RR 0.96, 95% CI 0.75 to 1.22) (Young 2021)
Eye protection	**Glasses compared to no glasses** 1 pragmatic RCT conducted in Norway wearing any type of eyeglasses when close to other people outside their home (on public transport, in shopping malls etc.), over a 14-day period. Positive COVID-19 tests based on self-reporting were 9.6% and 11.5% (RR 0.83, 95% CI 0.69 to 1.00) (Fretheim 2022a).
Gargling	**Gargling compared to control** 1 trial gargling with tap water was effective, povidone-iodine was not effective (Satomura 2005); 1 trial gargling with green tea was not more effective than tap water (Ide 2014); 1 trial gargling with water was not effective (Goodall 2014); pooling of 2 trials showed no effect of gargling (RR 0.91, 95% CI 0.63 to 1.31) (Goodall 2014; Satomura 2005). **Mouth/nose rinse compared to control** 2 trials found a large protective effect on SARS-CoV-2 (RR 0.07, 0.01 to 0.23) (Almanza-Reyes 2021; Gutiérrez-García 2022).
Virucidal tissues	**Virucidal tissues compared to control** 1 trial had a small effect (Farr 1988a) ("The study authors conclude that virucidal tissues have only a small impact upon the overall rate of natural acute respiratory illnesses"); 2 trials showed a non-significant difference (Farr 1988b; Longini 1988).
Nose wash	-

ARI: acute respiratory infection
CI: confidence interval

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HCW: healthcare worker
ILI: influenza-like illness
OR: odds ratio
RCT: randomised controlled trial
RR: risk ratio

Table 9. Trial authors' outcome definitions

Study	Outcome definitions
Masks (n = 16)	
Abaluck 2022 cluster-RCT Bangladesh	COVID-19 symptoms as per the WHO case definition of probable COVID-19 given epidemiological risk factors: (i) fever and cough; (ii) 3 or more of the following symptoms (fever, cough, general weakness and/or fatigue, headache, myalgia, sore throat, coryza, dyspnoea, anorexia, nausea, and/or vomiting, diarrhoea, and altered mental status); or (iii) loss of taste or smell. The owner of the household's primary phone completed surveys by phone or in-person at weeks 5 and 9 after the start of the intervention. They were asked to report symptoms experienced by any household member consistent with the WHO. COVID-19 case definition. Laboratory: seropositivity was defined by having detectable IgG antibodies in blood samples against SARS-CoV-2, using the SCoV-2 Detect™ IgG ELISA kit (InBios, Seattle, Washington). This assay detects IgG antibodies against the spike protein subunit (S1) of SARS-CoV-2. Safety: harms were not directly assessed in this study, but it is stated no adverse events were reported.
Alfelali 2020 cluster-RCT Haj in Makkah, Saudi Arabia	Laboratory: swabs were placed it into UTM™ (COPAN) viral transport media. Swabs labelled with the participant's unique barcode number were stored in an icebox at –20˚C before being re-stored by day's end in a –80˚C freezer at the laboratory of the Hajj Research Center at Umm Al-Qura University, Makkah. After Hajj, these swabs were shipped in refrigerated or cold containers to the Centre for Infectious Disease and Microbiology Laboratory Services, Westmead Hospital, NSW, Australia. There, nucleic acid was extracted with the Qiagen bioROBOT EZ instrument (Qiagen, Valencia, CA), and amplification was performed using the Roche LC 480 (Roche Diagnostics GmbH, Mannheim, Germany) instrument. Respiratory viruses were detected using a real-time, multiplex reverse transcription polymerase chain reaction assay targeting human coronaviruses (OC43, 229E and NL63), influenza A and B viruses, respiratory syncytial virus (RSV), parainfluenza viruses 1 to 3, human metapneumovirus, rhinovirus, enterovirus and adenovirus. Middle East respiratory syndrome coronavirus (MERS-CoV) assay targeting the upstream region of the E gene (upE) was also performed. Safety: harms of using face masks were difficulty in breathing (26.2%); discomfort (22%); and a small minority (3%) reported feeling hot, sweating, a bad smell or blurred vision with eyeglasses.
Bundgaard 2021 RCT Denmark	Laboratory: viral RNA was extracted from swab samples in DNA/RNA Shield (Zymo Research) using Quick-RNA Microprep Kit (Zymo Research) with the below modifications. 200 µl samples were incubated for 1 min with proteinase K (Qiagen) in a final concentration of 0.2 µg/µl prior to treatment with lysis buffer (Quick-RNA Microprep Kit). Only a single washing step using 400 µl RNA Wash Buffer (Quick-RNA Microprep Kit) was performed before elution in 15µl RNase free water. Participants tested for SARS-CoV-2 IgM and IgG antibodies in whole blood using a point-of-care test (Lateral Flow test [Zhuhai Livzon Diagnostics]) according to the manufacturer's recommendations. After puncturing a fingertip with a lancet, they withdrew blood into a capillary tube and placed 1 drop of blood followed by 2 drops of saline in the test chamber in each of the 2 test plates (IgM and IgG). Safety: harms were not mentioned as an outcome in the methods, but psychological adverse effects were mentioned, and 14% reported adverse reactions from other people regarding wearing a face mask.

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Table 9. Trial authors' outcome definitions *(Continued)*

Cowling 2008 cluster-RCT Hong Kong	Laboratory: QuickVue Influenza A+B rapid test Viral culture on MDCK (Madin-Darby canine kidney cells) Samples were harvested using NTS, but the text refers to a second procedure from June 2007 onwards with testing for influenza viruses on index participants with a negative QuickVue result but a fever ≥ 38 °C who were also randomised and further followed up. Data on clinical signs and symptoms were collected for all participants, and an additional NTS was collected for later confirmation of influenza infection by viral culture. It is noteworthy that dropout was higher in households of index participants who had a negative result on the rapid influenza test (25/44, 57%) compared to those who had a positive result (45/154, 29%). Effectiveness: secondary attack ratios (SAR): SAR is the proportion of household contacts of an index case who subsequently were ill with influenza (symptomatic contact individuals with at least 1 NTS positive for influenza by viral culture or PCR) 3 clinical definitions were used for secondary analysis: 1. fever ≥ 38 °C or at least 2 of the following symptoms: headache, coryza, sore throat, muscle aches and pains; 2. at least 2 of the following S/S: fever ≥ 37.8 °C, cough, headache, sore throat and muscle aches and pains; and 3. fever of ≥ 37.8 °C plus cough or sore throat. Safety: harms were not mentioned as an outcome in the methods, but it was reported in the results that there were no adverse events.
Jacobs 2009 RCT Japan	Laboratory-confirmation not reported. Effectiveness: URTI is defined on the basis of a symptom score with a score > 14 being a URTI according to Jackson's 1958 criteria ("Jackson score"). These are not explained in text, although the symptoms are listed in Table 3 (any, sore throat, runny nose, stuffy nose, sneeze, cough, headache, earache, feel bad) together with their mean and scores (SD) by intervention arm. Safety: the text does not mention or report harms. These appear to be indistinguishable from URTI symptoms (e.g. headache, which is reported as of significantly longer duration in the intervention arm). Compliance is self-reported as high (84.3% of participants).
Loeb 2009 cluster-RCT HCW Canada	Clinical respiratory illness, influenza-like illness, and laboratory-confirmed respiratory virus infection. 1. Clinical respiratory illness, defined as 2 or more respiratory symptoms or 1 respiratory symptom and a systemic symptom. 2. Influenza-like illness, defined as fever ≥ 38 °C plus 1 respiratory symptom. 3. Laboratory-confirmed viral respiratory infection. Laboratory confirmation was by nucleic acid detection using multiplex RT-PCR for 17 respiratory viruses. Safety: harms were not mentioned as an outcome in the methods, but it is stated in the results that no adverse events were reported by participants.
MacIntyre 2009 cluster-RCT Australia	Eligibility criteria were stipulated as follows: 1. the household contained > 2 adults > 16 years of age and 1 child 0 to 15 years of age; 2. the index child had fever (temperature > 37.8 °C) and either a cough or sore throat; 3. the child was the first and only person to become ill in the family in the previous 2 weeks; 4. adult caregivers consented to participate in the study; and 5. the index child was not admitted to the hospital. Definitions used for outcomes:

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Table 9. Trial authors' outcome definitions *(Continued)*

	1. ILI defined by the presence of fever (temperature > 37.8 °C), feeling feverish or a history of fever, > 2 symptoms (sore throat, cough, sneezing, runny nose, nasal congestion, headache), or 1 of the symptoms listed plus laboratory confirmation of respiratory viral infection. 2. Laboratory confirmation: multiplex RT-PCR tests to detect influenza A and B and RSV, PIV types 1 to 3, picornaviruses (enteroviruses or rhinoviruses), adenoviruses, coronaviruses 229E and OC43, and hMPV plus ≥ 1 symptom Effectiveness: presence of ILI or a laboratory diagnosis of respiratory virus infection within 1 week of enrolment. Safety: harms not mentioned as an outcome in the methods, but it is reported in the results that more than 50% of participants reported concerns with mask wearing, mainly that wearing a face mask was uncomfortable, but there were no significant differences between the P2 (N95) and surgical mask groups. Other concerns were that the child did not want the parent wearing a mask.
Aiello 2010 cluster-RCT USA	Laboratory details are described in appendix. Effectiveness: ILI, defined as cough and at least 1 constitutional symptom (fever/feverishness, chills, headache, myalgia). ILI cases were given contact nurses phone numbers to record the illness and paid USD 25 to provide a throat swab. 368 participants had ILI, 94 of which had a throat swab analysed by PCR. 10 of these were positive for influenza (7 for A and 3 for B), respectively by arm 2, 5 and 3 using PCR, 7 using cell culture. Safety: no outcomes on harms planned or reported.
Canini 2010 cluster-RCT USA	The primary endpoint was the proportion of household contacts who developed an ILI during the 7 days following inclusion. Exploratory cluster-level efficacy outcome, the proportion of households with 1 or more secondary illness in household contacts. A temperature over 37.8 °C with cough or sore throat was used as primary clinical case definition. The authors also used a more sensitive case definition based on a temperature over 37.8 °C or at least 2 of the following: sore throat, cough, runny nose, or fatigue. Safety: adverse reactions due to mask wearing were reported, with 38 (75%) participants in the intervention arm experiencing discomfort with mask use due to warmth (45%), respiratory difficulties (33%), and humidity (33%). Children wearing children face masks reported feeling pain more frequently than other participants wearing adult face masks (P = 0.036).
Aiello 2012 cluster-RCT in halls of residence in the USA	Clinically verified ILI - case definition (presence of cough and at least 1 or more of fever/feverishness, chills, or body aches) Laboratory-confirmed influenza A or B. Throat swab specimens were tested for influenza A or B using real-time PCR. Safety: no outcomes on harms planned or reported.
Barasheed 2014 cluster-RCT Saudi Arabia	Laboratory: 2 nasal swabs from all ILI cases and contacts. 1 for influenza POCT using the QuickVue Influenza (A+B) assay (Quidel Corporation, San Diego, USA) and 1 for later NAT for influenza and other respiratory viruses. However, there was a problem with getting POCT on time during Hajj. Effectiveness: to assess the effectiveness of face masks in the prevention of transmission of ILI. ILI was defined as subjective (or proven) fever plus 1 respiratory symptom (e.g. dry or productive cough, runny nose, sore throat, shortness of breath). Safety: no outcomes on harms planned or reported.
MacIntyre 2011 cluster-RCT China	Clinical respiratory illness Influenza-like illness Laboratory-confirmed viral respiratory infection

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Table 9. Trial authors' outcome definitions *(Continued)*

	Laboratory-confirmed influenza A or B 1. Clinical respiratory illness, defined as 2 or more respiratory or 1 respiratory symptom and a systemic symptom. 2. Influenza-like illness, defined as fever ≥ 38 °C plus 1 respiratory symptom (i.e. cough, runny nose, etc.). 3. Laboratory-confirmed viral respiratory infection (detection of adenoviruses, human metapneumovirus, coronavirus 229E/NL63, parainfluenza viruses 1, 2, and 3, influenza viruses A and B, respiratory syncytial virus A and B, rhinovirus A/B and coronavirus OC43/HKU1 by multiplex PCR). 4. Laboratory-confirmed influenza A or B. 5. Adherence with mask/respirator use. Safety: adherence and adverse effects of mask wearing were collected at exit interviews 4 weeks' post study. Significantly higher adverse events with N95 respirator compared to medical mask for discomfort, headache, difficulty breathing, nose pressure, trouble communicating, not wearing, and unspecified "other" side effects. Over 50% of those wearing N95 respirators reported adverse events. Of those wearing medical masks versus N95 respirators, 85.5% (420/491) versus 47.4% (447/943) reported no adverse events (P < 0.001), respectively.
MacIntyre 2013 cluster-RCT China	Laboratory: 1. Laboratory-confirmed viral respiratory infection in symptomatic participants, defined as detection of adenoviruses; human metapneumovirus; coronaviruses 229E/NL63 and OC43/HKU1; parainfluenza viruses 1, 2, and 3; influenza viruses A and B; respiratory syncytial viruses A and B; or rhinoviruses A/B by NAT using a commercial multiplex PCR (Seegen, Inc., Seoul, Korea). 2. Laboratory-confirmed influenza A or B in symptomatic participants. 3. Laboratory-confirmed bacterial colonisation in symptomatic participants, defined as detection of *Streptococcus pneumoniae*, *Legionella*, *Bordetella pertussis*, *Chlamydia*, *Mycoplasma pneumoniae*, *or Haemophilus influenzae* type B by multiplex PCR (Seegen, Inc.). Effectiveness: clinical respiratory illness defined as 2 or more respiratory symptoms or 1 respiratory symptom and a systemic symptom. ILI defined as fever (38 °C) plus 1 respiratory symptom. Safety: adverse effects measured using a semi-structured questionnaire. Investigators stated that there was higher reported adverse effects and discomfort of N95 respirators compared with the other 2 arms. In terms of comfort, 52% (297 of 571) of the medical mask arm reported no problems, compared with 62% (317 of 512) of the targeted arm and 38% (217 of 574) of the N95 arm (P < 0.001).
MacIntyre 2015 cluster-RCT Vietnam	Clinical respiratory illness, influenza-like illness, and laboratory-confirmed respiratory virus infection. 1. Clinical respiratory illness, defined as 2 or more respiratory symptoms or 1 respiratory symptom and a systemic symptom. 2. Influenza-like illness, defined as fever ≥ 38 °C plus 1 respiratory symptom. 3. Laboratory-confirmed viral respiratory infection. Laboratory confirmation was by nucleic acid detection using multiplex RT-PCR for 17 respiratory viruses. Safety: adverse events associated with face mask use were reported in 40.4% (227/562) of HCWs in the medical/surgical mask arm and 42.6% (242/568) in the cloth mask arm (P = 0.45). The most frequently reported adverse events were: general discomfort (35.1%; 397/1130) and breathing problems (18.3%; 207/1130). The rate of ILI was higher in the cloth mask arm compared to medical/surgical masks (RR 13.25, 95% CI 1.74 to 100.97).
MacIntyre 2016 cluster-RCT China	Clinical respiratory illness, influenza-like illness, and laboratory-confirmed viral respiratory infection. 1. Clinical respiratory illness, defined as 2 or more respiratory symptoms (cough, nasal congestion, runny nose, sore throat, or sneezes) or 1 respiratory symptom and a systemic symptom (chill, lethargy, loss of appetite, abdominal pain, muscle or joint aches).

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Table 9. Trial authors' outcome definitions *(Continued)*

	2. Influenza-like illness, defined as fever ≥ 38 °C plus 1 respiratory symptom. 3. Laboratory-confirmed viral respiratory infection, defined as detection of adenoviruses, human metapneumovirus, coronaviruses 229E/NL63 and OC43/HKU1, parainfluenza viruses 1, 2, and 3, influenza viruses A and B, respiratory syncytial virus A and B, or rhinovirus A/B by NAT using a commercial multiplex PCR. Safety: no outcomes on harms planned or reported.
Radonovich 2019 cluster-RCT USA	Laboratory. Primary outcome: incidence of laboratory-confirmed influenza, defined as: 1. detection of influenza A or B virus by RT-PCR in an upper respiratory specimen collected within 7 days of symptom onset; 2. detection of influenza from a randomly obtained swab from an asymptomatic participant; and 3. influenza seroconversion (symptomatic or asymptomatic), defined as at least a 4-fold rise in haemagglutination inhibition antibody titres to influenza A or B virus between pre-season and postseason serological samples deemed not attributable to vaccination. Effectiveness. Secondary outcomes: incidence of 4 measures of viral respiratory illness or infection as follows: 1. acute respiratory illness with or without laboratory confirmation; 2. laboratory-detected respiratory infection, defined as detection of a respiratory pathogen by PCR or serological evidence of infection with a respiratory pathogen during the study surveillance period(s), which was added to the protocol prior to data analysis; and 3. laboratory-confirmed respiratory illness, identified as previously described (defined as self-reported acute respiratory illness plus the presence of at least PCR–confirmed viral pathogen in a specimen collected from the upper respiratory tract within 7 days of the reported symptoms and/or at least a 4-fold rise from pre-intervention to postintervention serum antibody titres to influenza A or B virus). Influenza-like illness, defined as temperature of at least 100 °F (37.8 °C) plus cough and/or a sore throat, with or without laboratory confirmation. Safety: 19 participants reported skin irritation or worsening acne during years 3 and 4 at 1 site in the N95 respirator group.
Hand and hygiene (n = 35)	
Alzaher 2018 cluster-RCT Saudi Arabia	Episode of URI was defined as having 2 of the following symptoms for a day or 1 of the symptoms for 2 or more consecutive days: 1) a runny nose, 2) a stuffy or blocked nose or noisy breathing, 3) sneezing, 4) a cough, 5) a sore throat, and 6) feeling hot, having a fever or a chill.
Arbogast 2016 cluster-RCT USA	ICD-9 used: 46611: acute bronchiolitis due to respiratory syncytial virus, 46619: acute bronchiolitis due to other infectious organisms, 4800: pneumonia due to adenovirus, 4809: viral pneumonia, unspecified, 4870: influenza with pneumonia, 07999: unspecified viral infection, 4658: acute upper respiratory infections of other multiple sites, 4659: acute upper respiratory infections of unspecified site, 4871: influenza with other respiratory manifestations.
Ashraf 2020 cluster-RCT Bangladesh	Main outcome: 7-day prevalence of acute respiratory infection (ARI), defined as caregiver-reported symptoms of persistent cough or panting, wheezing, or difficulty breathing (1 or 2) in the 7 days before the interview.
Azor-Martinez 2016 RCT Spain	Upper respiratory illness was defined as 2 of the following symptoms during 1 day, or 1 of the symptoms for 2 consecutive days: (1) runny nose; (2) stuffy or blocked nose or noisy breathing; (3) cough; (4) feeling hot or feverish or having chills; (5) sore throat; or (6) sneezing.

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Table 9. Trial authors' outcome definitions *(Continued)*

Azor-Martinez 2018 RCT Spain	Respiratory illness (RI) was defined as the presence of 2 of the following symptoms during 1 day or the presence of 1 of the symptoms for 2 consecutive days: (1) runny nose, (2) stuffy or blocked nose or noisy breathing, (3) cough, (4) feeling hot or feverish or having chills, (5) sore throat, or (6) sneezing. ICD-10 and ICD-9 diagnosis codes used: nonspecific upper respiratory tract infection (465.9), otitis media (382.9), pharyngotonsillitis (463), lower respiratory tract infections (485 and 486), acute bronchitis (490), and bronchiolitis (466.19). Study authors combined the bronchopneumonia code (485) and pneumonia code (486) under the label "lower respiratory tract infections." If > 1 antibiotic was prescribed during an episode, they used the first prescription for analysis. The final diagnosis was done by the medical researchers on the basis of the symptoms described above and a review of the medical history of children with RIs.
Biswas 2019 cluster-RCT Bangladesh	Influenza-like illness: an ILI episode was defined as measured fever > 38 °C or subjective fever and cough. Laboratory-confirmed influenza Nasal swabs for real-time RT-PCR.
Correa 2012 cluster-RCT Colombia	Acute respiratory infection was defined as 2 or more of the following symptoms for at least 24 hours, lasting at least 2 days: runny, stuffy, or blocked nose or noisy breathing; cough; fever, hot sensation, or chills; and/or sore throat. Ear pain alone was considered ARI alternately.
Cowling 2009 cluster-RCT Hong Kong	Laboratory-confirmed of influenza virus infection by RT-PCR for influenza A and B virus. Clinical influenza-like illness: used 2 clinical definitions of influenza based on self-reported data from the symptom diaries as secondary analyses. The first definition of clinical influenza was at least 2 of the following signs and symptoms: temperature 37.8 °C or greater, cough, headache, sore throat, and myalgia; the second definition was temperature 37.8 °C or greater plus cough or sore throat.
DiVita 2011 (conference abstract) RCT Bangladesh	Influenza-like illness was defined as fever in children < 5 years old and fever with cough or sore throat in individuals > 5 years old.
Feldman 2016 cluster-RCT Israel	Infectious diseases grouped into diarrhoeal, respiratory, and skin infection. Based on ICD-9, but no supplementary material was accessible for further definition (Supplementary Material C lists all ICD-9 diagnoses tallied in this "outcome").
Gwaltney 1980 RCT USA	Viral cultures and serology if rhinovirus in laboratory-inoculation
Hubner 2010 RCT Germany	Assessing illness rates due to common cold and diarrhoea. Collecting data on illness symptoms (common cold, sinusitis, sore throat, fever, cough, bronchitis, pneumonia, influenza, diarrhoea) and associated absenteeism at the end of every month. Definitions of symptoms were given to the participants as part of the individual information at the beginning of the study. Whilst most symptoms are quite self-explanatory, "influenza" and "pneumonia" are specific diagnoses that were confirmed by professional diagnosis only. Similarly, (self-) diagnosis of "fever" required objective measurement with a thermometer.
Ladegaard 1999	Laboratory: serological evidence

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Table 9. Trial authors' outcome definitions *(Continued)*

RCT Denmark	Effectiveness: influenza-like illness (described as fever, history of fever or feeling feverish in the past week, myalgia, arthralgia, sore throat, cough, sneezing, runny nose, nasal congestion, headache). However, a positive laboratory finding for influenza converts the ILI definition into one of influenza.
Larson 2010 cluster-RCT USA	Study goals: rates of symptoms and secondary transmission of URIs, incidence of virologically confirmed influenza, knowledge of prevention and treatment strategies for influenza and URIs, and rates of influenza vaccination. 1. Laboratory-confirmed influenza: nasal swabs to test for influenza types A and B as well as other common respiratory viruses by rapid culture (R-Mix, Diagnostic Hybrids, Inc., Athens, OH, USA). PCR and subtyping of the samples was done during the second half of the second year of the study. 2. Influenza-like illness: CDC definition of ILI from the Sentinel Physicians' Network was used to determine when masks should be worn: "temperature of ≥37.8°C and cough and/or sore throat in the absence of a known cause other than influenza". 3. Episodes of URI = upper respiratory infection: not clear, no explicitly stated definition, reported that the most commonly reported URI symptoms are cough or rhinorrhoea.
Little 2015 RCT England	Respiratory tract infections defined as 2 symptoms of an RTI for at least 1 day or 1 symptom for 2 consecutive days. For reported ILI, study authors did not use WHO or CDC definitions because these definitions require measured temperature, and thus were not appropriate (participants were not included after a clinical examination), and they did not use the European Centre for Disease Prevention and Control definition (1 systemic and 1 respiratory symptom) because, according to the international influenza collaboration, this definition does not necessarily differentiate ILI from a common cold. Influenzanet suggests making high temperature a separate element. Their pragmatic definition of ILI therefore required a high temperature (feeling very hot or very cold; or measured temperature > 37.5 °C), a respiratory symptom (sore throat, cough, or runny nose), and a systemic symptom (headache, severe fatigue, severe muscle aches, or severe malaise).
Luby 2005 RCT Pakistan	Defined pneumonia in children according to the WHO clinical case definition: cough or difficulty breathing with a raised respiratory rate (> 60 per minute in individuals younger than 60 days old, > 50 per minute for those aged 60 to 364 days, and > 40 per minute for those aged 1 to 5 years)
Millar 2016 cluster-RCT USA	Medically attended, outpatient cases of acute respiratory infection in the study population. The case definition was any occurrence of the following International Classification of Disease, 9 Revision, Clinical Modification (ICD-9) symptom or disease-specific codes: 460 to 466, 480 to 488, and specifically 465.9, 482.9, 486, and 487.1. **Acute respiratory infections (460 to 466)** 460 Acute nasopharyngitis (common cold) 461 Acute sinusitis 462 Acute pharyngitis 463 Acute tonsillitis 464 Acute laryngitis and tracheitis 465 Acute upper respiratory infections of multiple or unspecified sites 466 Acute bronchitis and bronchiolitis **Pneumonia and influenza (480 to 488)** 480 Viral pneumonia 481 Pneumococcal pneumonia (*Streptococcus pneumoniae* pneumonia) 482 Other bacterial pneumonia

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Table 9. Trial authors' outcome definitions *(Continued)*

	483 Pneumonia due to other specified organism 484 Pneumonia in infectious diseases classified elsewhere 485 Bronchopneumonia, organism unspecified 486 Pneumonia, organism unspecified 487 Influenza 488 Influenza due to identified avian influenza virus 465.9 Acute upper respiratory infections of unspecified site 482.9 Bacterial pneumonia NOS 487.1 Diagnosis of influenza with other respiratory manifestations
Morton 2004 cluster-RCT Cross-over study USA	Respiratory illnesses defined by symptoms of upper respiratory infections such as nasal congestion, cough, or sore throat, in any combination, with or without fever
Nicholson 2014 cluster-RCT India	Acute respiratory infections Operational definitions for all the illnesses were taken from Black's Medical Dictionary. ARIs defined as "Pneumonia, cough, fever, chest pain and shortness of breath, cold, inflammation of any or all of the airways, that is, nose, sinuses, throat, larynx, trachea and bronchi".
Pandejpong 2012 cluster-RCT Thailand	Influenza-like illness defined if 2 or more symptoms of stuffy nose, cough, fever or chills, sore throat, headache, diarrhoea, presence of hand, foot, or mouth ulcers.
Priest 2014 cluster-RCT New Zealand	Respiratory illness was defined as an episode of illness that included at least 2 of the following caregiver-reported symptoms for 1 day, or 1 of these symptoms for 2 days (but not fever alone): runny nose, stuffy or blocked nose or noisy breathing, cough, fever, sore throat, or sneezing.
Ram 2015 RCT Bangladesh	Influenza-like illness Age-specific definitions of ILI. For individuals ≥ 5 years old, ILI was defined as history of fever with cough or sore throat. For children < 5 years old, ILI was defined as fever; study authors used this relatively liberal case definition in order to include influenza cases with atypical presentations in children. Laboratory-confirmed influenza infection Oropharyngeal swabs from index case patients for laboratory testing for influenza. All swabs were tested by PCR for influenza A and B, with further subtyping of influenza A isolates.
Roberts 2000 cluster-RCT Australia	The symptoms of acute upper respiratory illness elicited from parents were: a runny nose, a blocked nose, and cough. Study authors used a definition of colds based on a community intervention trial of virucidal impregnated tissues. A cold was defined as either 2 symptoms for 1 day or 1 of the respiratory symptoms for at least 2 consecutive days, but not including 2 consecutive days of cough alone. Study authors defined a

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Table 9. Trial authors' outcome definitions *(Continued)*

	new episode of a cold as the occurrence of respiratory symptoms after a period of 3 symptom-free days.
Sandora 2005 cluster-RCT USA	The overall rates of secondary respiratory and GI illness. Respiratory illness was defined as 2 of the following symptoms for 1 day or 1 of the symptoms for 2 consecutive days: (1) runny nose; (2) stuffy or blocked nose or noisy breathing; (3) cough; (4) fever, feels hot, or has chills; (5) sore throat; and (6) sneezing. An illness was considered new or separate when a period of at least 2 symptom-free days had elapsed since the previous illness. An illness was defined as a secondary case when it began 2 to 7 days after the onset of the same illness type (respiratory or GI) in another household member.
Savolainen-Kopra 2012 cluster-RCT Finland	Nasal and pharyngeal stick samples from participants with respiratory symptoms
Simmerman 2011 cluster-RCT Thailand	Influenza-like illness defined by WHO as fever plus cough or sore throat, based on self-reported symptoms. Laboratory-confirmed secondary influenza virus infections amongst household members described as the secondary attack rate. The secondary influenza virus infection was defined as a positive rRT-PCR result on days 3 or 7 or a four-fold rise in influenza HI antibody titres with the virus type and subtype matching the index case.
Stebbins 2011 cluster-RCT USA	The primary outcome was an absence episode associated with an influenza-like illness that was subsequently laboratory-confirmed as influenza A or B. The following CDC definition for ILI was used: fever ≥ 38 °C with sore throat or cough.
Swarthout 2020 cluster-RCT Kenya	The primary outcome in this study is ARI symptoms - defined as having caregiver-reported cough or difficulty breathing, including panting or wheezing, within 7 days before the interview - in children younger than 3 years. Prespecified secondary outcomes in this study include difficulty breathing, including panting or wheezing, in the past 7 days (a more specific indicator of respiratory infection than a cough alone); ARI symptoms presenting with fever in the past 7 days (a potentially more severe infection); and enumerator-observed runny nose (an objective outcome).
Talaat 2011 cluster-RCT Egypt	Nasal swab for QuickVue test for influenza A and B viruses. Influenza-like illness (defined as fever > 38 °C and either cough or sore throat).
Teesing 2021 cluster-RCT The Netherlands	Incidence of gastroenteritis, ILI, assumed pneumonia, UTIs using the McGeer criteria, and infections caused by MRSA.
Temime 2018 cluster-RCT France	ARIs were defined as the combination of at least 1 respiratory symptom and 1 symptom of systemic infection.
Turner 2004b RCT Canada	Virologic assays

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Table 9. Trial authors' outcome definitions *(Continued)*

Turner 2012 RCT USA	Laboratory-confirmed rhinovirus infection by PCR assay. Common cold illness was defined as the presence of any of the symptoms of nasal obstruction, rhinorrhoea, sore throat, or cough on at least 3 consecutive days. Illnesses separated by at least 3 symptom-free days were considered as separate illnesses.
Yeung 2011 cluster-RCT Hong Kong	Pneumonia
Zomer 2015 cluster-RCT Netherlands	Incidence of gastrointestinal and respiratory infections in children monitored by parents. The common cold was defined as a blocked or runny nose with at least 1 of the following symptoms: coughing, sneezing, fever, sore throat, or earache.
Hand hygiene and masks (n = 6)	
Aelami 2015 (conference abstract) RCT Saudi Arabia	Influenza-like illness was defined as the presence of at least 2 of the following during their stay: fever, cough, and sore throat. Safety: no outcomes on harms planned or reported.
Aiello 2010 cluster-RCT USA	Influenza-like illness case definition (presence of cough and at least 1 constitutional symptom (fever/feverishness, chills, or body aches). Safety: no outcomes on harms planned or reported.
Cowling 2009 cluster-RCT Hong Kong	2 clinical definitions of influenza. First definition was at least 2 of the following signs and symptoms: temperature 37.8 °C or greater, cough, headache, sore throat, and myalgia. The second was temperature 37.8 °C or greater plus cough or sore throat. Safety: no outcomes on harms planned or reported.
Larson 2010 cluster-RCT USA	Study goals: rates of symptoms and secondary transmission of URIs, incidence of virologically-confirmed influenza, knowledge of prevention and treatment strategies for influenza and URIs, and rates of influenza vaccination. 1. Laboratory-confirmed influenza: nasal swabs to test for influenza types A and B as well as other common respiratory viruses by rapid culture (R-Mix, Diagnostic Hybrids, Inc., Athens, OH, USA). PCR and subtyping of the samples was done during the second half of the second year of the study. 2. Influenza-like illness: CDC definition of ILI from the Sentinel Physicians' Network was used to determine when masks should be worn: "temperature of ≥37.8°C and cough and/or sore throat in the absence of a known cause other than influenza". 3. Episodes of URI = upper respiratory infection: not clear, no explicitly stated definition, reported that the most commonly reported URI symptoms are cough or rhinorrhoea. Safety: no outcomes on harms planned or reported.
Simmerman 2011 cluster-RCT Thailand	Laboratory-confirmed secondary influenza virus infections amongst household members described as the secondary attack rate. The secondary influenza virus infection was defined as a positive rRT-PCR result on days 3 or 7 or a four-fold rise in influenza HI antibody titres with the virus type and subtype matching the index case. Influenza-like illness defined by WHO as fever plus cough or sore throat, based on self-reported symptoms.

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Table 9. Trial authors' outcome definitions *(Continued)*

	Safety: no outcomes on harms planned or reported.
Suess 2012 cluster-RCT Germany	Quantitative RT-PCR for samples of nasal wash. Influenza virus infection as a laboratory-confirmed influenza infection in a household member who developed fever (> 38.0 °C), cough, or sore throat during the observation period. Also secondary outcome measure of the occurrence of ILI as defined by WHO as fever plus cough or sore throat. Safety: the study reported that the majority of participants (107/172, 62%) did not report any problems with mask wearing. This proportion was significantly higher in the group of adults (71/100, 71%) compared to the group of children (36/72, 50%) (P = 0.005). The main problem stated by participants (adults and children) was "heat/humidity" (18/34, 53% of children; 10/29, 35% of adults) (P = 0.1), followed by "pain" and "shortness of breath" when wearing a face mask.
Surface/object disinfection (with or without hand hygiene)(n = 8)	
Ban 2015 cluster-RCT China	Acute respiratory illness classified as the appearance of 2 or more of the following symptoms: fever, cough and expectoration, runny nose and nasal congestion.
Carabin 1999 cluster-RCT Canada	The presence of nasal discharge (runny nose) accompanied by 1 or several of the following symptoms: fever, sneezing, cough, sore throat, ear pain, malaise, irritability. A URTI was defined as a cold for 2 consecutive days.
Chard 2019 cluster-RCT Laos	Pupils were considered to have symptoms of respiratory infection if they reported cough, runny nose, stuffy nose, or sore throat.
Ibfelt 2015 cluster-RCT Denmark	Laboratory confirmation of 16 respiratory viruses: influenza A; influenza B; coronavirus NL63229E, OC43 and HKU1; parainfluenza virus 1, 2, 3, and 4; rhinovirus; RSV A/B; adenovirus; enterovirus; parechovirus; and bocavirus using quantitative PCR
Kotch 1994 RCT USA	Respiratory symptoms include coughing, runny nose, wheezing or rattling in the chest, sore throat, or earache.
McConeghy 2017 RCT USA	Classified infections as lower respiratory tract infections (i.e. pneumonia, bronchitis, or chronic obstructive pulmonary disease exacerbation) or other.
Sandora 2008 cluster-RCT USA	RI was defined as an acute illness that included > 1 of the following symptoms: runny nose, stuffy or blocked nose, cough, fever or chills, sore throat, or sneezing.
White 2001 DB-RCT USA	RI was defined as: cough, sneezing, sinus trouble, bronchitis, fever alone, pink-eye, headache, mononucleosis, and acute exacerbation of asthma.

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Table 9. Trial authors' outcome definitions *(Continued)*

Other (miscellaneous) interventions (n = 5)	
Fretheim 2022a pragmatic RCT Norway	Respiratory infection was defined as having 1 respiratory symptom (stuffed or runny nose, sore throat, cough, sneezing, heavy breathing) and fever, or 1 respiratory symptom and at least 2 more symptoms (body ache, muscular pain, fatigue, reduced appetite, stomach pain, headache, loss of smell.
Hartinger 2016 cluster-RCT Peru	ARI was defined as a child presenting cough or difficulty breathing, or both. ALRI was defined as a child presenting cough or difficulty breathing, with a raised respiratory rate > 50 per minute in children aged 6 to 11 months and > 40 per minute in children aged > 12 months on 2 consecutive measurements. An episode was defined as beginning on the first day of cough or difficulty breathing and ending with the last day of the same combination, followed by at least 7 days without those symptoms.
Huda 2012 cluster-RCT Bangladesh	Study authors classified acute respiratory illness as having cough and fever or difficulty breathing and fever within 48 h prior to interview.
Najnin 2019 cluster-RCT Bangladesh	Classified participants as having respiratory illness if they reported having fever plus either cough or nasal congestion or fever plus breathing difficult.
Satomura 2005 RCT Japan	Upper respiratory tract infection defined as all of the following conditions: 1. both nasal and pharyngeal symptoms; 2. severity of at least 1 symptom increased by 2 grades or more; and 3. worsening of a symptom of 1 increment or more for > 3 days. Because of the difference in the mode of transmission, study authors excluded influenza-like diseases featured by moderate or severe fever; anti-influenza vaccination in the preseason and arthralgia, and treated them separately. The incidence was determined by 1 study physician who was blinded to group assignment.
Virucidal tissues (n = 2)	
Farr 1988a cluster-RCT USA trial 1 and trial 2	RI defined as: occurrence of at least 2 respiratory symptoms on the same day or the occurrence of a single respiratory symptom on 2 consecutive days (except for sneezing). The respiratory symptoms were as follows: sneezing, nasal congestion, nasal discharge, sore throat, scratchy throat, hoarseness, coughing, malaise, headache, feverishness, chilliness and myalgia.
Longini 1988 DB-PC RCT USA	Respiratory illness defined as 1 or more of the following symptoms occurring during the course of acute episode: coryza, sore throat or hoarseness, earache, cough, pain on respiration, wheezy breathing or phlegm from the chest.

ALRI: acute lower respiratory infection
ARIs: acute respiratory infections
CDC: Centers for Disease Control and Prevention
CI: confidence interval
cluster-RCT: cluster-randomised controlled trial
CRI: clinical respiratory illness
DB-PC: double-blind, placebo-controlled
DB-RCT: double-blind randomised controlled trial
DNA: deoxyribonucleic acid

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ELISA: enzyme-linked immunosorbent assay
GI: gastrointestinal
h: hours
HCW: healthcare workers
HI: haemagglutinin
hMPV: human metapneumo virus
ICD-9: International Classification of Disease, 9th Revision, Clinical Modification
ICD-10: International Classification of Disease, 10th Revision, Clinical Modification
IgG: immunoglobulin G
IgM: immunoglobulin M
ILI: influenza-like illness
min: minutes
MRSA: methicillin-resistant Staphylococcus aureus
NAT: nucleic acid testing
NOS: not otherwise specified
NTS: nasal and throat swab
PCR: polymerase chain reaction
PIV: parainfluenza virus
POCT: point-of-care testing
RCT: randomised controlled trial
RI: respiratory infection
RNA: ribonucleic acid
RR: risk ratio
rRT-PCR: real-time reverse transcriptase polymerase chain reaction
RSV: respiratory syncytial virus
RTI: respiratory tract infection
RT-PCR: reverse transcriptase polymerase chain reaction
SAR: secondary attack ratios
SD: standard deviation
S/S: signs and symptoms
URI: upper respiratory infection
URTI: upper respiratory tract infection
UTI: urinary tract infection
WHO: World Health Organization

APPENDICES

Appendix 1. Cochrane Central Register of Controlled Trials (CENTRAL) search string

([mh "Influenza, Human"] OR [mh "Influenzavirus A"] OR [mh "Influenzavirus B"] OR [mh "Influenzavirus C"] OR Influenza:ti,ab OR [mh "Respiratory Tract Diseases"] OR Influenzas:ti,ab OR “Influenza-like”:ti,ab OR ILI:ti,ab OR Flu:ti,ab OR Flus:ti,ab OR [mh ^"Common Cold"] OR "common cold":ti,ab OR colds:ti,ab OR coryza:ti,ab OR [mh coronavirus] OR [mh "sars virus"] OR coronavirus:ti,ab OR Coronaviruses:ti,ab OR [mh "coronavirus infections"] OR [mh "severe acute respiratory syndrome"] OR "severe acute respiratory syndrome":ti,ab OR "severe acute respiratory syndromes":ti,ab OR sars:ti,ab OR [mh "respiratory syncytial viruses"] OR [mh "respiratory syncytial virus, human"] OR [mh "Respiratory Syncytial Virus Infections"] OR "respiratory syncytial virus":ti,ab OR "respiratory syncytial viruses":ti,ab OR rsv:ti,ab OR parainfluenza:ti,ab OR “Respiratory illness”:ti,ab OR ((Transmission) AND (Coughing OR Sneezing)) OR ((respiratory:ti,ab AND Tract) AND (infection:ti,ab OR Infections:ti,ab OR illness:ti,ab)))
AND
([mh "Hand Hygiene"] OR handwashing:ti,ab OR “hand-washing”:ti,ab OR ((Hand:ti,ab OR Alcohol:ti,ab) AND (wash:ti,ab OR Washing:ti,ab OR Cleansing:ti,ab OR Rinses:ti,ab OR hygiene:ti,ab OR rub:ti,ab OR Rubbing:ti,ab OR sanitizer:ti,ab OR sanitiser:ti,ab OR cleanser:ti,ab OR disinfected:ti,ab OR Disinfectant:ti,ab OR Disinfect:ti,ab OR antiseptic:ti,ab OR virucid:ti,ab)) OR [mh "gloves, protective"] OR Glove:ti,ab OR Gloves:ti,ab OR [mh Masks] OR [mh "respiratory protective devices"] OR facemask:ti,ab OR Facemasks:ti,ab OR mask:ti,ab OR Masks:ti,ab OR respirator:ti,ab OR respirators:ti,ab OR [mh ^"Protective Clothing"] OR [mh "Protective Devices"] OR "patient isolation":ti,ab OR ((school:ti,ab OR Schools:ti,ab) AND (Closure:ti,ab OR Closures:ti,ab OR Closed:ti,ab)) OR [mh Quarantine] OR quarantine:ti,ab OR "Hygiene intervention":ti,ab OR [mh Mouthwashes] OR gargling:ti,ab OR "nasal tissues":ti,ab OR [mh "Eye Protective Devices"] OR Glasses:ti,ab OR Goggle:ti,ab OR "Eye protection":ti,ab OR Faceshield:ti,ab OR Faceshields:ti,ab OR Goggles:ti,ab OR "Face shield":ti,ab OR "Face shields":ti,ab OR Visors:ti,ab)
AND

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([mh "Communicable Disease Control"] OR [mh "Disease Outbreaks"] OR [mh "Disease Transmission, Infectious"] OR [mh "Infection Control"] OR "Communicable Disease Control":ti,ab OR "Secondary transmission":ti,ab OR ((Reduced:ti,ab OR Reduce:ti,ab OR Reduction:ti,ab OR Reducing:ti,ab OR Lower:ti,ab) AND (Incidence:ti,ab OR Occurrence:ti,ab OR Transmission:ti,ab OR Secondary:ti,ab))

Appendix 2. PubMed search string

("Influenza, Human"[Mesh] OR "Influenzavirus A"[Mesh] OR "Influenzavirus B"[Mesh] OR "Influenzavirus C"[Mesh] OR Influenza[tiab] OR "Respiratory Tract Diseases"[Mesh] OR "Bacterial Infections/transmission"[Mesh] OR Influenzas[tiab] OR “Influenza-like”[tiab] OR ILI[tiab] OR Flu[tiab] OR Flus[tiab] OR "Common Cold"[Mesh:NoExp] OR "common cold"[tiab] OR colds[tiab] OR coryza[tiab] OR coronavirus[Mesh] OR "sars virus"[Mesh] OR coronavirus[tiab] OR Coronaviruses[tiab] OR "coronavirus infections"[Mesh] OR "severe acute respiratory syndrome"[Mesh] OR "severe acute respiratory syndrome"[tiab] OR "severe acute respiratory syndromes"[tiab] OR sars[tiab] OR "respiratory syncytial viruses"[Mesh] OR "respiratory syncytial virus, human"[Mesh] OR "Respiratory Syncytial Virus Infections"[Mesh] OR "respiratory syncytial virus"[tiab] OR "respiratory syncytial viruses"[tiab] OR rsv[tiab] OR parainfluenza[tiab] OR “Respiratory illness”[tiab] OR ((Transmission[tiab]) AND (Coughing[tiab] OR Sneezing[tiab])) OR ((respiratory[tiab] AND Tract[tiab]) AND (infection[tiab] OR Infections[tiab] OR illness[tiab])))
AND
("Hand Hygiene"[Mesh] OR handwashing[tiab] OR hand-washing[tiab] OR ((Hand[tiab] OR Alcohol[tiab]) AND (wash[tiab] OR Washing[tiab] OR Cleansing[tiab] OR Rinses[tiab] OR hygiene[tiab] OR rub[tiab] OR Rubbing[tiab] OR sanitizer[tiab] OR sanitiser[tiab] OR cleanser[tiab] OR disinfected[tiab] OR Disinfectant[tiab] OR Disinfect[tiab] OR antiseptic[tiab] OR virucid[tiab])) OR "gloves, protective"[Mesh] OR Glove[tiab] OR Gloves[tiab] OR Masks[Mesh] OR "respiratory protective devices"[Mesh] OR facemask[tiab] OR Facemasks[tiab] OR mask[tiab] OR Masks[tiab] OR respirator[tiab] OR respirators[tiab] OR "Protective Clothing"[Mesh:NoExp] OR "Protective Devices"[Mesh] OR "patient isolation"[tiab] OR ((school[tiab] OR Schools[tiab]) AND (Closure[tiab] OR Closures[tiab] OR Closed[tiab])) OR Quarantine[Mesh] OR quarantine[tiab] OR “Hygiene intervention”[tiab] OR "Mouthwashes"[Mesh] OR gargling[tiab] OR “nasal tissues”[tiab] OR "Eye Protective Devices"[Mesh] OR Glasses[tiab] OR Goggle[tiab] OR “Eye protection”[tiab] OR Faceshield[tiab] OR Faceshields[tiab] OR Goggles[tiab] OR “Face shield”[tiab] OR “Face shields”[tiab] OR Visors[tiab])
AND
("Communicable Disease Control"[Mesh] OR "Disease Outbreaks"[Mesh] OR "Disease Transmission, Infectious"[Mesh] OR "Infection Control"[Mesh] OR Transmission[sh] OR “Prevention and control”[sh] OR "Communicable Disease Control"[tiab] OR “Secondary transmission”[tiab] OR ((Reduced[tiab] OR Reduce[tiab] OR Reduction[tiab] OR Reducing[tiab] OR Lower[tiab]) AND (Incidence[tiab] OR Occurrence[tiab] OR Transmission[tiab] OR Secondary[tiab])))
AND
(Randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR randomised[tiab] OR placebo[tiab] OR "drug therapy"[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab])
NOT
(Animals[Mesh] not (Animals[Mesh] and Humans[Mesh]))
NOT
(“Case Reports”[pt] OR Editorial[pt] OR Letter[pt] OR Meta-Analysis[pt] OR “Observational Study”[pt] OR “Systematic Review”[pt] OR “Case Report”[ti] OR “Case series”[ti] OR Meta-Analysis[ti] OR “Meta Analysis”[ti] OR “Systematic Review”[ti])

Appendix 3. Embase (Elsevier) search string

('influenza'/exp OR Influenza:ti,ab OR 'Respiratory Tract Disease'/exp OR Influenzas:ti,ab OR Influenza-like:ti,ab OR ILI:ti,ab OR Flu:ti,ab OR Flus:ti,ab OR 'Common Cold'/de OR "common cold":ti,ab OR colds:ti,ab OR coryza:ti,ab OR 'coronavirus'/exp OR 'SARS coronavirus'/exp OR coronavirus:ti,ab OR Coronaviruses:ti,ab OR 'coronavirus infection'/exp OR 'severe acute respiratory syndrome'/exp OR "severe acute respiratory syndrome":ti,ab OR "severe acute respiratory syndromes":ti,ab OR sars:ti,ab OR 'Pneumovirus'/exp OR 'Human respiratory syncytial virus'/exp OR "respiratory syncytial virus":ti,ab OR "respiratory syncytial viruses":ti,ab OR rsv:ti,ab OR parainfluenza:ti,ab OR “Respiratory illness”:ti,ab OR ((Transmission) AND (Coughing OR Sneezing)) OR ((respiratory:ti,ab AND Tract) AND (infection:ti,ab OR Infections:ti,ab OR illness:ti,ab)))
AND
('hand washing'/exp OR handwashing:ti,ab OR hand-washing:ti,ab OR ((Hand:ti,ab OR Alcohol:ti,ab) AND (wash:ti,ab OR Washing:ti,ab OR Cleansing:ti,ab OR Rinses:ti,ab OR hygiene:ti,ab OR rub:ti,ab OR Rubbing:ti,ab OR sanitizer:ti,ab OR sanitiser:ti,ab OR cleanser:ti,ab OR disinfected:ti,ab OR Disinfectant:ti,ab OR Disinfect:ti,ab OR antiseptic:ti,ab OR virucid:ti,ab)) OR 'protective glove'/exp OR Glove:ti,ab OR Gloves:ti,ab OR 'mask'/exp OR 'gas mask'/exp OR facemask:ti,ab OR Facemasks:ti,ab OR mask:ti,ab OR Masks:ti,ab OR respirator:ti,ab OR respirators:ti,ab OR 'protective clothing'/de OR 'protective equipment'/exp OR "patient isolation":ti,ab OR ((school:ti,ab OR Schools:ti,ab) AND (Closure:ti,ab OR Closures:ti,ab OR Closed:ti,ab)) OR 'Quarantine'/exp OR quarantine:ti,ab OR "Hygiene intervention":ti,ab OR 'mouthwash'/exp OR gargling:ti,ab OR "nasal tissues":ti,ab OR ‘eye protective device’/exp OR Glasses:ti,ab OR Goggle:ti,ab OR "Eye protection":ti,ab OR Faceshield:ti,ab OR Faceshields:ti,ab OR Goggles:ti,ab OR "Face shield":ti,ab OR "Face shields":ti,ab OR Visors:ti,ab)
AND
('Communicable Disease Control'/exp OR 'epidemic'/exp OR 'disease transmission'/exp OR 'Infection Control'/exp OR "Communicable Disease Control":ti,ab OR "Secondary transmission":ti,ab OR ((Reduced:ti,ab OR Reduce:ti,ab OR Reduction:ti,ab OR Reducing:ti,ab OR Lower:ti,ab) AND (Incidence:ti,ab OR Occurrence:ti,ab OR Transmission:ti,ab OR Secondary:ti,ab)))
AND

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(random* OR factorial OR crossover OR placebo OR blind OR blinded OR assign OR assigned OR allocate OR allocated OR 'crossover procedure'/exp OR 'double-blind procedure'/exp OR 'randomized controlled trial'/exp OR 'single-blind procedure'/exp NOT ('animal'/exp NOT ('animal'/exp AND 'human'/exp)))

Appendix 4. CINAHL (EBSCO) search string

((MH "Influenza, Human+") OR (MH "Orthomyxoviridae+") OR TI Influenza OR AB Influenza OR (MH "Respiratory Tract Diseases+") OR TI Influenzas OR AB Influenzas OR TI Influenza-like OR AB Influenza-like OR TI ILI OR AB ILI OR TI Flu OR AB Flu OR TI Flus OR AB Flus OR (MH "Common Cold+") OR TI "common cold" OR AB "common cold" OR TI colds OR AB colds OR TI coryza OR AB coryza OR (MH "coronavirus+") OR (MH "sars virus+") OR TI coronavirus OR AB coronavirus OR TI Coronaviruses OR AB Coronaviruses OR (MH "coronavirus infections+") OR (MH "severe acute respiratory syndrome+") OR TI "severe acute respiratory syndrome" OR AB "severe acute respiratory syndrome" OR TI "severe acute respiratory syndromes" OR AB "severe acute respiratory syndromes" OR TI sars OR AB sars OR (MH "respiratory syncytial viruses+") OR TI "respiratory syncytial virus" OR AB "respiratory syncytial virus" OR TI "respiratory syncytial viruses" OR AB "respiratory syncytial viruses" OR TI rsv OR AB rsv OR TI parainfluenza OR AB parainfluenza OR TI “Respiratory illness” OR AB “Respiratory illness” OR ((Transmission) AND (Coughing OR Sneezing)) OR ((TI respiratory OR AB respiratory AND Tract) AND (TI infection OR AB infection OR TI Infections OR AB Infections OR TI illness OR AB illness)))
AND
((MH "Handwashing+") OR TI handwashing OR AB handwashing OR TI hand-washing OR AB hand-washing OR ((TI Hand OR AB Hand OR TI Alcohol OR AB Alcohol) AND (TI wash OR AB wash OR TI Washing OR AB Washing OR TI Cleansing OR AB Cleansing OR TI Rinses OR AB Rinses OR TI hygiene OR AB hygiene OR TI rub OR AB rub OR TI Rubbing OR AB Rubbing OR TI sanitizer OR AB sanitiser OR TI sanitizer OR AB sanitiser OR TI cleanser OR AB cleanser OR TI disinfected OR AB disinfected OR TI Disinfectant OR AB Disinfectant OR TI Disinfect OR AB Disinfect OR TI antiseptic OR AB antiseptic OR TI virucid OR AB virucid)) OR (MH "gloves+") OR TI Glove OR AB Glove OR Gloves OR (MH "Masks+") OR (MH "respiratory protective devices+") OR TI facemask OR AB facemask OR TI Facemasks OR AB Facemasks OR TI mask OR AB mask OR TI Masks OR AB Masks OR TI respirator OR AB respirator OR TI respirators OR AB respirators OR (MH "Protective Clothing") OR (MH "Protective Devices+") OR TI "patient isolation" OR AB "patient isolation" OR ((TI school OR AB school OR TI Schools OR AB Schools) AND (TI Closure OR AB Closure OR TI Closures OR AB Closures OR TI Closed OR AB Closed)) OR (MH "Quarantine+") OR TI quarantine OR AB quarantine OR TI "Hygiene intervention" OR AB "Hygiene intervention" OR (MH "Mouthwashes+") OR TI gargling OR AB gargling OR TI "nasal tissues" OR AB "nasal tissues" OR (MH "Eye Protective Devices+") OR TI Glasses OR AB Glasses OR TI Goggle OR AB Goggle OR TI "Eye protection" OR AB "Eye protection" OR TI Faceshield OR AB Faceshield OR TI Faceshields OR AB Faceshields OR TI Goggles OR AB Goggles OR TI "Face shield" OR AB "Face shield" OR TI "Face shields" OR AB "Face shields" OR TI Visors OR AB Visors)
AND
((MH "Infection Control+") OR (MH "Disease Outbreaks+") OR (MH "Infection Control+") OR TI "Communicable Disease Control" OR AB "Communicable Disease Control" OR TI "Secondary transmission" OR AB "Secondary transmission" OR ((TI Reduced OR AB Reduced OR TI Reduce OR AB Reduce OR TI Reduction OR AB Reduction OR TI Reducing OR AB Reducing OR TI Lower OR AB Lower) AND (TI Incidence OR AB Incidence OR TI Occurrence OR AB Occurrence OR TI Transmission OR AB Transmission OR TI Secondary OR AB Secondary)))
AND
((MH "Clinical Trials+") OR (MH "Quantitative Studies") OR TI placebo* OR AB placebo* OR (MH "Placebos") OR (MH "Random Assignment") OR TI random* OR AB random* OR TI ((singl* or doubl* or tripl* or trebl*) W1 (blind* or mask*)) OR AB ((singl* or doubl* or tripl* or trebl*) W1 (blind* or mask*)) OR TI clinic* trial* OR AB clinic* trial* OR PT clinical trial)

Appendix 5. Previous search strategies (pre-2010)

Details of the 2010 update and the search strategy used in the original review and the 2009 search strategy updates for MEDLINE, CENTRAL, EMBASE and CINAHL

In the 2010 update we searched, as we have done previously, the Cochrane Central Register of Controlled Trials (CENTRAL) 2010, Issue 3, which includes the Acute Respiratory Infections Group's Specialised Register, MEDLINE (April 2009 to October week 2, 2010), EMBASE (April 2009 to October 2010) and CINAHL (January 2009 to October 2010). Details of previous searches are in Appendix 1. In addition, to include more of the literature of low-income countries in this update, we ran searches in LILACS (2008 to October 2010), Indian MEDLARS (2008 to October 2010) and IMSEAR (2008 to October 2010).

We used the following search strategy (updated to include new and emerging respiratory viruses) to search MEDLINE and CENTRAL. We combined the MEDLINE search strategy with the Cochrane Highly Sensitive Search Strategy for identifying randomised trials in MEDLINE: sensitivity- and precision-maximising version (2008 revision) (Ovid format) (Lefebvre 2011). We also included an additional search strategy based on the work of Fraser, Murray and Burr (Fraser 2006) to identify observational studies.

1 Influenza, Human/
2 exp Influenzavirus A/
3 exp Influenzavirus B/
4 Influenzavirus C/
5 (influenza* or flu).tw.
6 Common Cold/
7 common cold*.tw.

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8 Rhinovirus/
9 rhinovir*.tw.
10 adenoviridae/ or mastadenovirus/ or adenoviruses, human/
11 adenoviridae infections/ or adenovirus infections, human/
12 adenovir*.tw.
13 coronavirus/ or coronavirus 229e, human/ or coronavirus oc43, human/ or infectious bronchitis virus/ or sars virus/
14 coronavir*.tw.
15 coronavirus infections/ or severe acute respiratory syndrome/
16 (severe acute respiratory syndrome* or sars).tw.
17 respiratory syncytial viruses/ or respiratory syncytial virus, human/
18 Respiratory Syncytial Virus Infections/
19 (respiratory syncytial virus* or rsv).tw.
20 Pneumovirus Infections/
21 parainfluenza virus 1, human/ or parainfluenza virus 3, human/
22 parainfluenza virus 2, human/ or parainfluenza virus 4, human/
23 (parainfluenza* or para-influenza* or para influenza).tw.
24 enterovirus a, human/ or exp enterovirus b, human/ or enterovirus c, human/ or enterovirus d, human/
25 Enterovirus Infections/
26 enterovir*.tw.
27 Human bocavirus/
28 bocavirus*.tw.
29 Metapneumovirus/
30 metapneumovir*.tw.
31 Parvovirus B19, Human/
32 parvoviridae infections/ or erythema infectiosum/
33 parvovirus*.tw.
34 Parechovirus/
35 parechovirus*.tw.
36 acute respiratory tract infection*.tw.
37 acute respiratory infection*.tw.
38 or/1-37
39 Handwashing/
40 (handwashing or hand washing or hand-washing).tw.
41 hand hygiene.tw.
42 (sanitizer* or sanitiser*).tw.
43 (cleanser* or disinfectant*).tw.
44 gloves, protective/ or gloves, surgical/
45 glov*.tw.
46 masks/ or respiratory protective devices/
47 (mask or masks or respirator or respirators).tw.
48 Protective Clothing/
49 Protective Devices/
50 Patient Isolators/
51 Patient Isolation/
52 patient isolat*.tw.
53 (barrier* or curtain* or partition*).tw.
54 negative pressure room*.tw.
55 ((reverse barrier or reverse-barrier) adj3 (nurs* or unit or isolation)).tw.
56 Cross Infection/pc [Prevention & Control]
57 (cross infection* adj2 prevent*).tw.
58 Communicable Disease Control/
59 Infection Control/
60 (school* adj3 (clos* or dismissal*)).tw.
61 temporary closur*.tw.
62 mass gathering*.tw.
63 (public adj2 (gathering* or event*)).tw.
64 (bans or banning or banned or ban).tw.
65 (outbreak adj3 control*).tw.
66 distancing*.tw.
67 Quarantine/
68 quarantine*.tw.
69 (protective adj2 (cloth* or garment* or device* or equipment)).tw.

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70 ((protective or preventive) adj2 (procedure* or behaviour* or behavior*)).tw.
71 personal protect*.tw.
72 (isolation room* or isolation strateg*).tw.
73 (distance adj2 patient*).tw.
74 ((spatial or patient) adj separation).tw.
75 cohorting.tw.
76 or/39-75
77 38 and 76
78 (animals not (animals and humans)).sh.
79 77 not 78

Ovid MEDLINE

1 Influenza, Human/
2 exp Influenzavirus A/
3 exp Influenzavirus B/
4 Influenzavirus C/
5 (influenza* or flu).tw.
6 Common Cold/
7 common cold*.tw.
8 Rhinovirus/
9 rhinovir*.tw.
10 adenoviridae/ or mastadenovirus/ or adenoviruses, human/
11 adenoviridae infections/ or adenovirus infections, human/
12 adenovir*.tw.
13 coronavirus/ or coronavirus 229e, human/ or coronavirus oc43, human/ or infectious bronchitis virus/ or sars virus/
14 coronavir*.tw.
15 coronavirus infections/ or severe acute respiratory syndrome/
16 (severe acute respiratory syndrome* or sars).tw.
17 respiratory syncytial viruses/ or respiratory syncytial virus, human/
18 Respiratory Syncytial Virus Infections/
19 (respiratory syncytial virus* or rsv).tw.
20 Pneumovirus Infections/
21 parainfluenza virus 1, human/ or parainfluenza virus 3, human/
22 parainfluenza virus 2, human/ or parainfluenza virus 4, human/
23 (parainfluenza* or para-influenza* or para influenza).tw.
24 enterovirus a, human/ or exp enterovirus b, human/ or enterovirus c, human/ or enterovirus d, human/
25 Enterovirus Infections/
26 enterovir*.tw.
27 Human bocavirus/
28 bocavirus*.tw.
29 Metapneumovirus/
30 metapneumovir*.tw.
31 Parvovirus B19, Human/
32 parvoviridae infections/ or erythema infectiosum/
33 parvovirus*.tw.
34 Parechovirus/
35 parechovirus*.tw.
36 acute respiratory tract infection*.tw.
37 acute respiratory infection*.tw.
38 or/1-37
39 Handwashing/
40 (handwashing or hand washing or hand-washing).tw.
41 hand hygiene.tw.
42 (sanitizer* or sanitiser*).tw.
43 (cleanser* or disinfectant*).tw.
44 gloves, protective/ or gloves, surgical/
45 glov*.tw.
46 masks/ or respiratory protective devices/
47 (mask or masks or respirator or respirators).tw.
48 Protective Clothing/
49 Protective Devices/

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50 Patient Isolators/
51 Patient Isolation/
52 patient isolat*.tw.
53 (barrier* or curtain* or partition*).tw.
54 negative pressure room*.tw.
55 ((reverse barrier or reverse-barrier) adj3 (nurs* or unit or isolation)).tw.
56 Cross Infection/pc [Prevention & Control]
57 (cross infection* adj2 prevent*).tw.
58 Communicable Disease Control/
59 Infection Control/
60 (school* adj3 (clos* or dismissal*)).tw.
61 temporary closur*.tw.
62 mass gathering*.tw.
63 (public adj2 (gathering* or event*)).tw.
64 (bans or banning or banned or ban).tw.
65 (outbreak adj3 control*).tw.
66 distancing*.tw.
67 Quarantine/
68 quarantine*.tw.
69 (protective adj2 (cloth* or garment* or device* or equipment)).tw.
70 ((protective or preventive) adj2 (procedure* or behaviour* or behavior*)).tw.
71 personal protect*.tw.
72 (isolation room* or isolation strateg*).tw.
73 (distance adj2 patient*).tw.
74 ((spatial or patient) adj separation).tw.
75 cohorting.tw.
76 or/39-75
77 38 and 76
78 (animals not (animals and humans)).sh.
79 77 not 78

Embase.com search strategy, October 2010
The search strategy was broadened in 2010 to be more inclusive of new and emerging viruses.

#3 #1 AND #25899
#2 766172
#2.8 #2.3 NOT #2.7766172
#2.7 #2.4 NOT #2.6
#2.6 #2.4 AND #2.5
#2.5 'human'/de AND [embase]/lim
#2.4 'animal'/de OR 'nonhuman'/de OR 'animal experiment'/de AND [embase]/lim
#2.3 #2.1 OR #2.2
#2.2 random*:ab,ti OR placebo*:ab,ti OR crossover*:ab,ti OR 'cross over':ab,ti OR allocat*:ab,ti OR trial:ti OR (doubl* NEXT/1 blind*):ab,ti AND [embase]/lim
#2.1 'randomized controlled trial'/exp OR 'single blind procedure'/exp OR 'double blind procedure'/exp OR 'crossover procedure'/exp AND [embase]/lim

#1 74545
#1.65 #1.28 AND #1.6474545
#1.64 #1.29 OR #1.30 OR #1.31 OR #1.32 OR #1.33 OR #1.34 OR #1.35 OR #1.36 OR #1.37 OR #1.38 OR #1.39 OR #1.40 OR #1.41 OR #1.42 OR #1.43 OR #1.44 OR #1.45 OR #1.46 OR #1.47 OR #1.48 OR #1.49 OR #1.50 OR #1.51 OR #1.52 OR #1.53 OR #1.54 OR #1.55 OR #1.56 OR #1.57 OR #1.58 OR #1.59 OR #1.60 OR #1.61 OR #1.62 OR #1.63
#1.63 cohorting:ab,ti OR 'cohort isolation':ab,ti AND [embase]/lim
#1.62 ((spatial OR patient*) NEAR/2 separation):ab,ti AND [embase]/lim
#1.61 (distance NEAR/2 patient*):ab,ti AND [embase]/lim
#1.60 (isolation NEXT/1 (room* OR strateg*)):ab,ti AND [embase]/lim
#1.59 'personal protection':ab,ti AND [embase]/lim
#1.58 ((protective OR preventive) NEAR/2 (procedure* OR behaviour* OR behavior*)):ab,ti AND [embase]/lim
#1.57 (protective NEAR/2 (cloth* OR garment* OR device* OR equipment)):ab,ti AND [embase]/lim
#1.56 quarantin*:ab,ti AND [embase]/lim

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#1.55 distancing:ab,ti AND [embase]/lim
#1.54 ((outbreak* OR transmission OR infection*) NEAR/2 control):ab,ti AND [embase]/lim
#1.53 bans:ab,ti OR banning:ab,ti OR banned:ab,ti OR ban:ab,ti AND [embase]/lim
#1.52 (public NEAR/2 (gathering* OR event*)):ab,ti AND [embase]/lim
#1.51 'mass gathering':ab,ti OR 'mass gatherings':ab,ti AND [embase]/lim
#1.50 (temporar* NEAR/2 closur*):ab,ti AND [embase]/lim
#1.49 (school* NEAR/3 (clos* OR dismissal*)):ab,ti AND [embase]/lim
#1.48 'infection control'/de AND [embase]/lim
#1.47 'epidemic'/dm_pc AND [embase]/lim
#1.46 (('cross infection' OR 'cross infections') NEAR/2 prevent*):ab,ti AND [embase]/lim
#1.45 'cross infection'/dm_pc AND [embase]/lim
#1.44 (('reverse barrier' OR 'reverse-barrier') NEAR/3 (nurs* OR unit OR isolat*)):ab,ti AND [embase]/lim
#1.43 'negative pressure room':ab,ti OR 'negative pressure rooms':ab,ti AND [embase]/lim
#1.42 barrier*:ab,ti OR curtain*:ab,ti OR partition*:ab,ti AND [embase]/lim
#1.41 (patient* NEAR/2 isolat*):ab,ti AND [embase]/lim
#1.40 'patient isolator'/de AND [embase]/lim
#1.39 'protective equipment'/de AND [embase]/lim
#1.38 'protective clothing'/de AND [embase]/lim
#1.37 facemask*:ab,ti OR mask:ab,ti OR masks:ab,ti OR goggles:ab,ti
OR respirator*:ab,ti OR respirators:ab,ti AND [embase]/lim
#1.36 'face mask'/exp OR 'mask'/de OR 'surgical mask'/de AND [embase]/lim
#1.35 glov*:ab,ti AND [embase]/lim
#1.34 'surgical glove'/de AND [embase]/lim
#1.33 cleanser*:ab,ti OR disinfect*:ab,ti OR antiseptic*:ab,ti OR virucid*:ab,ti AND [embase]/lim
#1.32 sanitizer*:ab,ti OR sanitiser*:ab,ti AND [embase]/lim
#1.31 (alcohol NEAR/2 rub*):ab,ti AND [embase]/lim
#1.30 handwash*:ab,ti OR (hand* NEAR/2 (wash* OR cleans* OR hygiene)):ab,ti AND [embase]/lim
#1.29 'hand washing'/de AND [embase]/lim
#1.28 #1.1 OR #1.2 OR #1.3 OR #1.4 OR #1.5 OR #1.6 OR #1.7 OR #1.8 OR #1.9 OR #1.10 OR #1.11 OR #1.12 OR #1.13 OR #1.14 OR #1.15 OR
#1.16 OR #1.17 OR #1.18 OR #1.19 OR #1.20 OR #1.21 OR #1.22 OR #1.23
OR #1.24 OR #1.25 OR #1.26 OR #1.27
#1.27 (respiratory NEAR/2 (infect* OR illness* OR virus* OR pathogen* OR acute)):ab,ti AND [embase]/lim
#1.26 parechovirus*:ab,ti AND [embase]/lim
#1.25 'parechovirus'/de AND [embase]/lim
#1.24 parvovirus*:ab,ti AND [embase]/lim
#1.23 'parvovirus infection'/de OR 'erythema infectiosum'/exp AND [embase]/lim
#1.22 'parvovirus'/de OR 'human parvovirus b19'/de AND [embase]/lim
#1.21 'human metapneumovirus'/de OR 'human metapneumovirus infection'/de AND [embase]/lim
#1.20 'bocavirus'/de OR 'bocavirus infection'/de AND [embase]/lim
#1.19 enterovir*:ab,ti AND [embase]/lim
#1.18 'enterovirus infection'/de OR 'coxsackie virus infection'/de OR 'echovirus infection'/de AND [embase]/lim
#1.17 'enterovirus'/de OR 'coxsackie virus'/exp OR 'echo virus'/de AND [embase]/lim
#1.16 parainfluenza:ab,ti OR 'para influenza':ab,ti OR 'para-influenza':ab,ti AND [embase]/lim
#1.15 'parainfluenza virus'/exp AND [embase]/lim
#1.14 'pneumovirus infection'/de AND [embase]/lim
#1.13 'respiratory syncytial virus':ab,ti OR 'respiratory syncytial viruses':ab,ti OR rsv:ab,ti AND [embase]/lim
#1.12 'respiratory syncytial pneumovirus'/de OR 'respiratory syncytial virus infection'/exp AND [embase]/lim
#1.11 coronavir*:ab,ti OR sars:ab,ti OR 'severe acute respiratory syndrome':ab,ti AND [embase]/lim
#1.10 'coronavirus infection'/de OR 'severe acute respiratory syndrome'/de AND [embase]/lim
#1.9 'coronavirus'/de OR 'human coronavirus nl63'/de OR 'sars coronavirus'/de OR 'transmissible gastroenteritis virus'/de
#1.8 adenovir*:ab,ti AND [embase]/lim
#1.7 'adenovirus infection'/de OR 'human adenovirus infection'/de OR 'human adenovirus'/exp AND [embase]/lim
#1.6 rhinovir*:ab,ti AND [embase]/lim
#1.5 'rhinovirus infection'/de OR 'human rhinovirus'/de AND [embase]/lim
#1.4 'common cold':ab,ti OR 'common colds':ab,ti OR coryza:ab,ti OR colds:ab,ti AND [embase]/lim
#1.3 'common cold'/de OR 'common cold symptom'/de AND [embase]/lim
#1.2 influenza*:ab,ti OR flu:ab,ti AND [embase]/lim
#1.1 'influenza'/exp AND [embase]/lim

CINAHL (EBSCO) search strategy, October 2010
The search strategy was broadened in 2010 to be more inclusive of new and emerging viruses.

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S54 S32 and S53
S53 S44 or S52
S52 S45 or S46 or S47 or S48 or S49 or S50 or S51
S51 TI observational stud* or AB observational stud*
S50 TI cohort stud* or AB cohort stud*
S49 (MH "Cross Sectional Studies")
S48 (MH "Nonconcurrent Prospective Studies")
S47 (MH "Correlational Studies")
S46 (MH "Case Control Studies+")
S45 (MH "Prospective Studies")
S44 S33 or S34 or S35 or S36 or S37 or S38 or S39 or S40 or S41 or S42 or S43
S43 TI allocat* N1 random* or AB allocat* N1 random*
S42 (MH "Quantitative Studies")
S41 TI placebo* or AB placebo*
S40 (MH "Placebos")
S39 TI random* allocation* or AB random* allocation*
S38 (MH "Random Assignment")
S37 TI (randomised control* trial* or randomized control* trial*) or AB (randomised control* trial* or randomized control* trial)
S36 TI ((singl* W1 blind*) or (singl* W1 mask*) or (doubl* W1 blind*) or (doubl* W1 mask*) or (trebl* W1 blind*) or (trebl* W1 mask*) or (tripl* W1 blind*) or (tripl* W1 mask*)) or AB ((singl* W1 blind*) or (singl* W1 mask*) or (doubl* W1 blind*) or (doubl* W1 mask*) or (trebl* W1 blind*) or (trebl* W1 mask*) or (tripl* W1 blind*) or (tripl* W1 mask*))
S35 TI clinic* W1 trial* or AB clinic* W1 trial*
S34 PT clinical trial
S33 (MH "Clinical Trials+")
S32 S15 and S31
S31 S16 or S17 or S18 or S19 or S20 or S21 or S22 or S23 or S24 or S25 or S26 or S27 or S28 or S29 or S30
S30 TI (bans or banning or banned or ban or "outbreak control" or "outbreak controls" or distancing* or quarantine* or "protective clothing" or "protective garment" or "protective garments" or "protective gown" or "protective gowns" or "protective device" or "protective devices" or "protective equipment" or "protective behaviour" or "protective behavior" or "protective behaviours" or "protective behaviors" or "protective procedure" or "protective procedures" or "preventive behaviours" or "preventive behaviour" or "preventive behavior" or "preventive behaviors" or "preventive procedure" or "preventive procedures" or "personal protective" or "isolation room" or "isolation rooms" or "isolation strategy" or "isolation strategies" or "patient distance" or "patient distancing" or "patient separation" or "spatial separation") or AB (handwashing or "hand washing" or hand-washing or "hand hygiene" or sanitizer or sanitiser or cleanser* or disinfectant* or glov* or mask or masks or respirator or respirators or "patient isolation" or "patient isolators" or barrier* or curtain* or partition* or "negative pressure room" or "negative pressure rooms" or "reverse barrier nursing" or "reverse barrier unit" or "reverse barrier isolation" or "cross infection" or "infection control" or "disease control" or "school closure" or "school closures" or "school dismissal" or "school dismissals" or "temporary closure" or "temporary closures" or "mass gathering" or "mass gatherings" or "public gathering" or "public gatherings" or "public event" or "public events")
S29 TI (handwashing or "hand washing" or hand-washing or "hand hygiene" or sanitizer or sanitiser or cleanser* or disinfectant* or glov* or mask or masks or respirator or respirators or "patient isolation" or "patient isolators" or barrier* or curtain* or partition* or "negative pressure room" or "negative pressure rooms" or "reverse barrier nursing" or "reverse barrier unit" or "reverse barrier isolation" or "cross infection" or "infection control" or "disease control" or "school closure" or "school closures" or "school dismissal" or "school dismissals" or "temporary closure" or "temporary closures" or "mass gathering" or "mass gatherings" or "public gathering" or "public gatherings" or "public event" or "public events") or AB (handwashing or "hand washing" or hand-washing or "hand hygiene" or sanitizer or sanitiser or cleanser* or disinfectant* or glov* or mask or masks or respirator or respirators or "patient isolation" or "patient isolators" or barrier* or curtain* or partition* or "negative pressure room" or "negative pressure rooms" or "reverse barrier nursing" or "reverse barrier unit" or "reverse barrier isolation" or "cross infection" or "infection control" or "disease control" or "school closure" or "school closures" or "school dismissal" or "school dismissals" or "temporary closure" or "temporary closures" or "mass gathering" or "mass gatherings" or "public gathering" or "public gatherings" or "public event" or "public events")
S28 (MH "Sterilization and Disinfection")
S27 (MH "Quarantine")
S26 (MH "Area Restriction (Iowa NIC)") OR (MH "Infection Protection (IowaNIC)")
S25 (MH "Infection Control")
S24 (MH "Cross Infection/PC")
S23 (MH "Isolation, Reverse")
S22 (MH "Patient Isolation")
S21 (MH "Protective Devices")
S20 (MH "Protective Clothing")
S19 (MH "Respiratory Protective Devices")
S18 (MH "Masks")
S17 (MH "Gloves")
S16 (MH "Handwashing+")

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S15 S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9 or S10 or S11 or S12 or S13 or S14
S14 TI ("acute respiratory tract infection" or "acute respiratory tract infections" or "acute respiratory infection" or "acute respiratory infections") or AB (influenza* or flu or "common cold" or "common colds" or rhinovir* or adenovir* or coronavir* or sars or "severe acute respiratory syndrome" or "respiratory syncytial virus" or "respiratory syncytial viruses" or rsv or pneumovir* or parainfluenza* or "para influenza" or para-influenza or enterovir* or bocavir* or metapneumovir* or parvovir* or parechovir*)
S13 TI (influenza* or flu or "common cold" or "common colds" or rhinovir* or adenovir* or coronavir* or sars or "severe acute respiratory syndrome" or "respiratory syncytial virus" or "respiratory syncytial viruses" or rsv or pneumovir* or parainfluenza* or "para influenza" or para-influenza or enterovir* or bocavir* or metapneumovir* or parvovir* or parechovir*) or AB (influenza* or flu or "common cold" or "common colds" or rhinovir* or adenovir* or coronavir* or sars or "severe acute respiratory syndrome" or "respiratory syncytial virus" or "respiratory syncytial viruses" or rsv or pneumovir* or parainfluenza* or "para influenza" or para-influenza or enterovir* or bocavir* or metapneumovir* or parvovir* or parechovir*)
S12 (MH "Respiratory Tract Infections+")
S11 (MH "Parvovirus Infections+")
S10 (MH "Enterovirus Infections+")
S9 (MH "Enteroviruses+")
S8 (MH "Respiratory Syncytial Virus Infections")
S7 (MH "Respiratory Syncytial Viruses")
S6 (MH "SARS Virus")
S5 (MH "Severe Acute Respiratory Syndrome")
S4 (MH "Coronavirus Infections+")
S3 (MH "Coronavirus+") OR (MH "Coronavirus Infections")
S2 (MH "Common Cold")
S1 (MH "Influenza+") OR (MH "Influenza A H5N1") OR (MH "Influenza A

LILACS (Latin America and Caribbean) search strategy
(mh:"Influenza, Human" OR "Gripe Humana" OR "Influenza Humana" OR influenza* OR flu OR grippe OR gripe OR mh:"Influenzavirus A" OR mh:b04.820.545.405* OR mh:b04.909.777.545.405* OR mh:"Influenzavirus B" OR mh:b04.820.545.407* OR mh:b04.909.777.545.407* OR "influenzavirus B" OR mh:"Influenzavirus C" OR "Influenzavirus C" OR mh:"Common Cold" OR "common cold" OR "common colds" OR "Resfriado Común" OR "Resfriado Comum" OR coryza OR "Coriza Aguda") AND (mh:handwashing OR "Lavado de Manos" OR "Lavagem de Mãos" OR "Desinfección de Manos" OR "Desinfecção de Mãos" OR "Higienização de Mãos Pré-Cirúrgica" OR handwash* OR "hand washing" OR "hand hygiene" OR "hand cleaning" OR "hand cleanse" OR "hand cleansing" OR higiene OR sanitizer* OR sanitiser* OR cleanser* OR disinfect* OR esteriliza* OR desinfectar* OR virucid* OR antiseptic* OR mh:"Gloves, Protective" OR "protective glove" OR "protective gloves" OR "Guantes Protectores" OR "Luvas Protetoras" OR mh:e07.700.600.400* OR mh:j01.637.215.600.400* OR mh:j01.637.708.600.400* OR glov* OR guantes OR luvas OR mh:masks OR mask* OR máscaras OR mascarillas OR facemask* OR goggles OR respirator* OR mh:"Respiratory Protective Devices" OR "Dispositivos de Protección Respiratoria" OR "Dispositivos de Proteção Respiratória" OR mh:"Protective Clothing" OR "Ropa de Protección" OR "Roupa de Proteção" OR mh:e07.700.600* OR mh:j01.637.215.600* OR mh:j01.637.708.600* OR mh:"Protective Devices" OR "Equipos de Seguridad" OR "Equipamentos de Proteção" OR mh:e07.700* OR mh:j01.637.708* OR mh:vs2.006.001.001* OR mh:vs4.002.001.001.007.002.002* OR mh:"Patient Isolation" OR "patient isolation" OR "Aislamiento de Pacientes" OR "Isolamento de Pacientes" OR mh:"Patient Isolators" OR "patient isolators" OR "Aisladores de Pacientes" OR "Isoladores de Pacientes" OR barrier* OR curtain* OR partition* OR barrera OR barreira OR cortina OR tabique OR mh:"Cross Infection" OR "cross infection" OR "Infección Hospitalaria" OR "Infecção Hospitalar" OR "Infecciones en Hospitales" OR "Infecciones Nosocomiales" OR "Infecções Nosocomiais" OR mh:"Infection Control" OR mh:n06.850.780.200.450* OR "Control de Infecciones" OR "Controle de Infecções" OR mh:"Communicable Disease Control" OR "Control de Enfermedades Transmisibles" OR "Controle de Doenças Transmissíveis" OR mh:n06.850.780.200* OR mh:sp8.946.819.811* OR mh:"Disease Outbreaks/prevention & control" OR mh:quarantine OR cuarentena OR quarentena OR "personal protection" OR "isolation room" OR "sala de aislamiento" OR "quarto de isolamento" OR "patient distance" OR "distancia del paciente" OR "spatial separation" OR cohort* OR ban OR bans OR banning OR banned OR prohibici* OR proibi* OR "outbreak control" OR distanc* OR "school closure" OR "school closures" OR "temporary closure" OR "temporary closures" OR "cierre de la escuela" OR "fechamento da escola" OR "public gathering" OR "public gatherings" OR "reunion publica" OR "reverse barrier nursing" OR "reverse barrier unit" OR "reverse barrier isolation" OR "negative pressure room" OR "negative pressure rooms" OR "patient separation") AND db:("LILACS") AND type_of_study:("clinical_trials" OR "cohort" OR "case_control")

Indian MEDLARS search strategy
(influenza$ or flu or common cold$ or rhinovir$ or coronavir$ or adenovir$ or severe acute respiratory syndrome$ or sars or respiratory syncytial virus$ or rsv or parainfluenza$ or enterovir$ or metapneumovir$ or parvovir$ or bocavir$ or parechovir$) and (handwashing or hand washing or mask$ or glov$ or protect$ or isolat$ or barrier$ or curtain$ or partition$ or cross infection$ or infection control$ or disease control$ or school$ or quarantine$ or ban$ or cohort$ or distanc$ or spatial separation$)
IMSEAR (Index Medicus for the South East Asia Region) search strategy
(influenza or flu or common cold or rhinovirus or coronavirus or adenovirus or severe acute respiratory syndrome or sars or respiratory syncytial virus or rsv or parainfluenza or enterovirus or bocavirus or metapneumovirus or parvovirus or parechovirus) and (handwashing or hand washing or hand hygiene or sanitizer or sanitiser or cleanser or disinfectant or gloves or masks or mask or protective clothing or protective devices or patient isolation or barrier or curtain or partition or cross infection or disease control or infection control or school or schools or bans or banning or banned or ban or distancing or quarantine or isolation or spatial separation or cohorting or cohort isolation)

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In the first publication of this review we searched the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2006, issue 4); MEDLINE (1966 to November 2006); OLDMEDLINE (1950 to 1965); EMBASE (1990 to November 2006) and CINAHL (1982 to November 2006). The MEDLINE search terms were modified for OLDMEDLINE, EMBASE and CINAHL.

In this 2009 update we searched the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2009, issue 2); Ovid MEDLINE (2006 to May Week 1 2009); OLDMEDLINE (1950 to 1965); Ovid EMBASE (2006 to Week 18, 2009) and Ovid CINAHL (2006 to May Week 1 2009).

Ovid MEDLINE
1 exp Influenza/
2 influenza.tw.
3 flu.tw.
4 exp Common Cold/
5 common cold.tw.
6 exp Rhinovirus/
7 rhinovirus*.tw.
8 exp Adenoviridae/
9 adenovirus*.tw.
10 exp Coronavirus/
11 exp Coronavirus Infections/
12 coronavirus*.tw.
13 exp Respiratory Syncytial Viruses/
14 exp Respiratory Syncytial Virus Infections/
15 respiratory syncytial virus*.tw.
16 respiratory syncythial virus.tw.
17 exp Parainfluenza Virus 1, Human/
18 exp Parainfluenza Virus 2, Human/
19 exp Parainfluenza Virus 3, Human/
20 exp Parainfluenza Virus 4, Human/
21 (parainfluenza or para-influenza or para influenza).tw.
22 exp Severe Acute Respiratory Syndrome/
23 (severe acute respiratory syndrome or SARS).tw.
24 acute respiratory infection*.tw.
25 acute respiratory tract infection*.tw.
26 or/1-25 (59810)
27 exp Hand Washing/
28 (handwashing or hand washing or hand-washing).tw.
29 hand hygiene.tw.
30 (sanitizer* or sanitiser*).tw.
31 (cleanser* or disinfectant*).tw.
32 exp Gloves, Protective/
33 exp Gloves, Surgical/
34 glov*.tw.
35 exp Masks/
36 mask*1.tw.
37 exp Patient Isolators/
38 exp Patient Isolation/
39 patient isolat*.tw.
40 (barrier* or curtain* or partition*).tw.
41 negative pressure room*.tw.
42 reverse barrier nursing.tw.
43 Cross Infection/pc [Prevention]
44 school closure*.tw.
45 (clos* adj3 school*).tw.
46 mass gathering*.tw.
47 public gathering*.tw.
48 (ban or bans or banned or banning).tw.
49 (outbreak* adj3 control*).tw.
50 distancing.tw.
51 exp Quarantine/
52 quarantine*.tw.
53 or/27-49

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54 26 and 53
55 (animals not (humans and animals)).sh.
56 54 not 55

CENTRAL search strategy
#1 MeSH descriptor Influenza, Human explode all trees
#2 influenza:ti,ab,kw
#3 flu:ti,ab,kw
#4 MeSH descriptor Common Cold explode all trees
#5 "common cold":ti,ab,kw
#6 MeSH descriptor Rhinovirus explode all trees
#7 rhinovirus*:ti,ab,kw
#8 MeSH descriptor Adenoviridae explode all trees
#9 adenovirus*:ti,ab,kw
#10 MeSH descriptor Coronavirus explode all trees
#11 MeSH descriptor Coronavirus Infections explode all trees
#12 coronavirus*:ti,ab,kw
#13 MeSH descriptor Respiratory Syncytial Viruses explode all trees
#14 MeSH descriptor Respiratory Syncytial Virus Infections explode all trees
#15 respiratory syncytial virus*:ti,ab,kw
#16 respiratory syncythial virus*:ti,ab,kw
#17 MeSH descriptor Parainfluenza Virus 1, Human explode all trees
#18 MeSH descriptor Parainfluenza Virus 2, Human explode all trees
#19 MeSH descriptor Parainfluenza Virus 3, Human explode all trees
#20 MeSH descriptor Parainfluenza Virus 4, Human explode all trees
#21 (parainfluenza or para-influenza or para influenza):ti,ab,kw
#22 MeSH descriptor Severe Acute Respiratory Syndrome explode all trees
#23 (severe acute respiratory syndrome or SARS):ti,ab,kw
#24 acute respiratory infection*:ti,ab,kw
#25 acute respiratory tract infection*:ti,ab,kw
#26 (#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)
#27 MeSH descriptor Handwashing explode all trees
#28 (handwashing or hand washing or hand-washing):ti,ab,kw
#29 hand hygiene:ti,ab,kw
#30 (sanitizer* or sanitiser*):ti,ab,kw
#31 (cleanser* or disinfectant*):ti,ab,kw
#32 MeSH descriptor Gloves, Protective explode all trees
#33 MeSH descriptor Gloves, Surgical explode all trees
#34 glov*:ti,ab,kw
#35 MeSH descriptor Masks explode all trees
#36 mask*:ti,ab,kw
#37 MeSH descriptor Patient Isolators explode all trees
#38 MeSH descriptor Patient Isolation explode all trees
#39 (barrier* or curtain* or partition*):ti,ab,kw
#40 negative NEXT pressure NEXT room*:ti,ab,kw
#41 "reverse barrier nursing":ti,ab,kw
#42 MeSH descriptor Cross Infection explode all trees with qualifier: PC
#43 school NEXT closure*:ti,ab,kw
#44 (clos* NEAR/3 school*):ti,ab,kw
#45 mass NEXT gathering*:ti,ab,kw
#46 public NEXT gathering*:ti,ab,kw
#47 ("ban" or "bans" or banned or banning):ti,ab,kw
#48 (outbreak* NEAR/3 control*):ti,ab,kw
#49 distancing:ti,ab,kw
#50 MeSH descriptor Quarantine explode all trees
#51 quarantine*:ti,ab,kw
#52 (#27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47 OR #48 OR #49 OR #50 OR #51)
#53 (#26 AND #52)

Ovid Embase search strategy

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1 exp Influenza/
2 influenza.tw.
3 flu.tw.
4 exp Common Cold/
5 common cold.tw.
6 exp Human Rhinovirus/
7 rhinovirus*.tw.
8 exp Adenovirus/
9 adenovirus*.tw.
10 exp Coronavirus/
11 coronavirus*.tw.
12 exp Respiratory Syncytial Pneumovirus/
13 respiratory syncytial virus*.tw.
14 respiratory syncythial virus.tw.
15 (parainfluenza or para-influenza or para influenza).tw.
16 exp Severe Acute Respiratory Syndrome/
17 (severe acute respiratory syndrome or SARS).tw.
18 acute respiratory infection*.tw.
19 acute respiratory tract infection*.tw.
20 or/1-19
21 exp Hand Washing/
22 (handwashing or hand washing or hand-washing).tw.
23 hand hygiene.tw.
24 (sanitizer$ or sanitiser$).tw.
25 (cleanser$ or disinfectant$).tw.
26 exp Glove/
27 exp Surgical Glove/
28 glov*.tw.
29 exp Mask/
30 mask*1.tw.
31 patient isolat*.tw.
32 (barrier* or curtain* or partition*).tw.
33 negative pressure room*.tw.
34 reverse barrier nursing.tw.
35 Cross Infection/pc [Prevention]
36 school closure*.tw.
37 (clos* adj3 school*).tw.
38 mass gathering*.tw.
39 public gathering*.tw. (5)
40 (ban or bans or banned or banning).tw.
41 (outbreak* adj3 control*).tw.
42 distancing.tw.
43 quarantine*.tw.
44 or/21-43
45 20 and 44

EBSCO CINAHL search strategy

S26 S10 and S24
S25 S10 and S24
S24 S11 or S12 or S13 or S14 or S15 or S16 or S17 or S18 or S19 or S20 or S21 or S22 or 23 or S24
S23 TI outbreak* N3 control* or AB outbreak* N3 control*
S22 TI (school closure* or mass gathering* or public gathering* or ban or bans or banned or banning or distancing or quarantine*) or AB (school closure* or mass gathering* or public gathering* or ban or bans or banned or banning or distancing or quarantine*)
S21 TI (patient isolat* or barrier* or curtain* or partition* or negative pressure room* or reverse barrier nursing) or AB (patient isolat* or barrier* or curtain* or partition* or negative pressure room* or reverse barrier nursing)
S20 TI (glov* or mask*) or AB (glov* or mask*)
S19 TI (handwashing or hand washing or hand-washing or hand hygiene) or AB (handwashing or hand washing or hand-washing or hand hygiene)
S18 (MH "Quarantine")
S17 (MM "Cross Infection")
S16 (MH "Isolation, Reverse")
S15 (MH "Patient Isolation+")

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S14 (MH "Respiratory Protective Devices")
S13 (MH "Masks")
S12 (MH "Gloves")
S11 (MH "Handwashing+")
S10 S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9
S9 TI (influenza or flu or rhinovirus* or adenovirus* or coronavirus* or respiratory syncytial virus* or respiratory syncythial virus* or parainfluenza or para-influenza or para influenza or severe acute respiratory syndrome or SARS or respiratory viral infection* or viral respiratory infection*) or AB (influenza or flu or rhinovirus* or adenovirus* or coronavirus* or respiratory syncytial virus* or respiratory syncythial virus* or parainfluenza or para-influenza or para influenza or severe acute respiratory syndrome or SARS or respiratory viral infection* or viral respiratory
infection*)TI (influenza or flu or rhinovirus* or adenovirus* or coronavirus* or respiratory syncytial virus* or respiratory syncythial virus* or parainfluenza or para-influenza or para influenza or severe acute respiratory (syndrome or SARS or respiratory viral infection* or viral respiratory infection*) or AB (influenza or flu or rhinovirus* or adenovirus* or coronavirus* or respiratory syncytial virus* or respiratory syncythial virus* or parainfluenza or para-influenza or para influenza or severe acute respiratory syndrome or SARS or respiratory viral infection* or viral
respiratory infection*)
S8 (MH "SARS Virus")
S7 (MH "Severe Acute Respiratory Syndrome")
S6 (MH "Respiratory Syncytial Virus Infections")
S5 (MH "Respiratory Syncytial Viruses")
S4 (MH "Coronavirus+")
S3 (MH "Coronavirus Infections+")
S2 (MH "Common Cold")
S1 (MH "Influenza+")

WHAT'S NEW

Date	Event	Description
4 April 2023	Amended	John Conly's declaration of interest statement has been clarified in response to a feedback comment.

HISTORY

Protocol first published: Issue 4, 2006
Review first published: Issue 4, 2007

Date	Event	Description
27 January 2023	New citation required but conclusions have not changed	Our conclusions remain unchanged.
27 January 2023	New search has been performed	Searches updated. We included 11 new trials (Abaluck 2022; Alfelali 2020; Almanza-Reyes 2021; Ashraf 2020; Bundgaard 2021; Fretheim 2022a; Gutiérrez-García 2022; Helsingen 2021; Swarthout 2020; Teesing 2021; Young 2021), and excluded 20 new trials (Ahmadian 2022; Chen 2022; Costa 2021; Cyril Vitug 2021; Dalakoti 2022; Egger 2022; Ferrer 2021; Gharebaghi 2020; Giuliano 2021; Karakaya 2021; Kawyannejad 2020; Lim 2022; Malaczek 2022; Meister 2022; Mo 2022; Montero-Vilchez 2022; Munoz-Basagoiti 2022; Sanchez Barrueco 2022; Seneviratne 2021; Sevinc Gul 2022). We identified two new ongoing trials (Brass 2021; NCT04471766), and five trials awaiting classification (Contreras 2022; Croke 2022; Delaguerre 2022; Loeb 2022; Varela 2022).

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Date	Event	Description
1 April 2020	New search has been performed	Searches updated. In this 2020 update we only searched for RCTs and cluster-RCTs. We included 44 new trials (Aelami 2015; Aiello 2012; Alzaher 2018; Arbogast 2016; Azor-Martinez 2016; Azor-Martinez 2018; Ban 2015; Barasheed 2014; Biswas 2019; Canini 2010; Chard 2019; Correa 2012; DiVita 2011; Feldman 2016; Goodall 2014; Hartinger 2016; Hubner 2010; Huda 2012; Ibfelt 2015; Ide 2014; Ide 2016; Little 2015; MacIntyre 2011; MacIntyre 2013; MacIntyre 2015; MacIntyre 2016; McConeghy 2017; Millar 2016; Miyaki 2011; Najnin 2019; Nicholson 2014; Pandejpong 2012; Priest 2014; Radonovich 2019; Ram 2015; Savolainen-Kopra 2012; Simmerman 2011; Stebbins 2011; Suess 2012; Talaat 2011; Temime 2018; Turner 2012; Yeung 2011; Zomer 2015). We excluded 12 new trials (Azor-Martinez 2014; Bowen 2007; Chami 2012; Denbak 2018; Lennell 2008; Nandrup-Bus 2009; Patel 2012; Rosen 2006; Slayton 2016; Stedman-Smith 2015; Uhari 1999; Vessey 2007). We identified 5 new ongoing trials (NCT03454009; NCT04267952; NCT04296643; NCT04337541; Wang 2015) one of which – NCT04337541 - published as this review was going to press. We focused on RCTs and cluster-RCTs only and removed observational studies from this update.
1 April 2020	New citation required and conclusions have changed	There is now sufficient randomised controlled trial (RCT) evidence to show that hand hygiene is likely to provide a modest benefit. Uncertainty remains for the other interventions. Further RCT evidence is needed.
22 October 2010	New citation required but conclusions have not changed	We updated the review again at the behest of the World Health Organization (WHO). External sources of support amended. External support from the WHO. The WHO interim guidelines document on 'Infection Prevention and Control of Epidemic and Pandemic Prone Acute Respiratory Diseases in Health Care' was published in 2007 to provide infection control guidance to help prevent the transmission of acute respiratory diseases in health care. The update of these guidelines will be evidence-based, and an update of this review was requested to assist in informing the evidence base for the revision of the WHO guidelines. Dr John Conly, Dr Mark Jones, and Sarah Thorning joined the review team.
22 October 2010	New search has been performed	Searches conducted. We included 7 new trials: 4 randomised controlled trials and 3 non-randomised comparative studies. We excluded 36 new trials.
7 May 2009	New search has been performed	For the 2009 update, we included 3 cluster-randomised controlled trials, Cowling 2009; MacIntyre 2009; Sandora 2008, and 1 individual randomised controlled trial (Satomura 2005, with its linked publication Kitamura 2007). We also included 1 retrospective cohort study (Foo 2006), 1 case-control study (Yu 2007), and 2 prospective cohort studies (Wang 2007; Broderick 2008). The content and conclusions of the 2007 review changed little, but the additional 8 studies add more information and certainty. Our meta-analysis remains unchanged as there were no new studies for pooling.

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Date	Event	Description
30 April 2009	New citation required but conclusions have not changed	New author joined the review team.
8 July 2008	Amended	Converted to new review format.
20 August 2007	Amended	Review first published Issue 4, 2007.

CONTRIBUTIONS OF AUTHORS

For this 2022 update:
Co-ordinated the update: LD
Updated Background section: LD, MJ, LA
Updated searches: JC
Excluded irrelevant citations and disputed resolutions for trial registry searches: GB, LA
Screened titles and abstracts: EB, GB, LA, TJ
Selected studies: PG, GB, JMC
Extracted study data: MJ, TH, GB, JMC, EF, TJ
Adjudicated data extraction: PG, JMC
Assessed of risk of bias: MJ, GB, EF
Analysed data: MJ
Contributed to writing the update: PG, MJ, LD, TH, GB, JMC, JC, EF, MVD, LA, TJ
Approved final draft: EB, LD, PG, MJ, TH, GB, JMC, JC, EF, MVD, LA, TJ

DECLARATIONS OF INTEREST

LAA: has declared that they have no conflict of interest.
GAB: reports working at King Saud University, Medical City, Riyadh, Saudi Arabia as clinical faculty in the College of Pharmacy, collaborating with pharmacy services to provide clinical pharmacy services in primary care clinics (non-paid).
EMB: has declared that they have no conflict of interest.
JC: is an Information Specialist at the Cochrane Acute Respiratory Infections Group but was not involved in the editorial process for this review.
JMC: has held or holds peer reviewed grants from the Canadian Institutes for Health Research (CIHR) on acute and primary care preparedness for COVID-19 in Alberta, Canada and has received components of funding from a CIHR funded study via McMaster University for a randomised trial of medical masks versus N95 respirators for preventing COVID-19 amongst healthcare workers. He has also been engaged in WHO funded studies using integrated human factors and ethnography approaches to identify and scale innovative IPC guidance implementation supports in primary care with a focus on low-resource settings and using drone aerial systems to deliver medical supplies and PPE to remote First Nations communities during the COVID-19 pandemic and was the primary local Investigator for a *Staphylococcus aureus* vaccine study funded by Pfizer for which all funding was provided only to the University of Calgary. He has received travel support from the Centers for Disease Control and Prevention (CDC) to attend an Infection Control Think Tank Meeting and from bioMerieux Canada to speak at a symposium on antimicrobial resistance co-hosted by the University of Toronto and bioMerieux Canada. He also reports being a member and Chair of the WHO Infection Prevention and Control Research and Development Expert Group for COVID-19 and reports being a member of the WHO Health Emergencies Programme (WHE) Ad-hoc COVID-19 IPC Guidance Development Group, both of which provide multidisciplinary advice to the WHO, for which no funding is received and from which no funding recommendations are made for any WHO contracts or grants. He reports declaring an opinion on topics in this review in *Clinical Microbiology and Infection* and *Antimicrobial Resistance and Infection Control*; reports being engaged as a co-author on a randomised trial of medical masks versus N95 respirators for preventing COVID-19 amongst healthcare workers published in the *Annals of Internal Medicine* in 2022 and mentioned in this current Cochrane Review, but no extraction or risk of bias assessment or data pooling or other assessment was undertaken by him nor will it be in any future updates. He has also been a member of the W21C since 2004 and served as its Medical Director from 2012-2022. W21C is a not-for-profit healthcare systems research and innovation initiative based in the University of Calgary's O'Brien Institute for Public Health and the Calgary Zone of Alberta Health Services. He reports working as an Infectious Diseases Consultant at Alberta Health Services, Calgary, Canada.
LD: is a Managing Editor at the Cochrane Acute Respiratory Infections Group but was not involved in the editorial process for this review.
EF: has declared that they have no conflict of interest.
PG: reports a grant from the National Health and Medical Research Council, Australia.
TH: is a member of the Cochrane Stroke Group Editorial Board but was not involved in the editorial process for this review.

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TJ: reports declaring an opinion on the topic of the review in articles for popular media. TJ is an Editor at the Cochrane Acute Respiratory Infections Group but was not involved in the editorial process for this review. See full statement here: https://restoringtrials.org/competing-interests-tom-jefferson/
MAJ: reports a grant from the National Institute for Health Research, UK. MAJ is Co-ordinating Editor at the Cochrane Acute Respiratory Infections Group but was not involved in the editorial process for this review.
MLvD: reports being a primary care panel member for the National COVID-19 Clinical Evidence Taskforce, Australia. MLvD is Deputy Co-ordinating Editor at the Cochrane Acute Respiratory Infections Group but was not involved in the editorial process for this review.

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DIFFERENCES BETWEEN PROTOCOL AND REVIEW

We changed the title of the review in 2010 (see Published notes below).
For the 2020 update, we added one additional outcome: adverse events related to the intervention, and we split the outcomes into primary and secondary outcomes. We also focused only on randomised controlled trials (RCTs) and cluster-RCTs and removed observational studies.

NOTES

In Issue 1, 2010, the title of the review was changed from 'Interventions for the interruption or reduction of the spread of respiratory viruses' to 'Physical interventions to interrupt or reduce the spread of respiratory viruses'.

The original review was subsequently published as Jefferson T, Foxlee R, Del Mar C, Dooley L, Ferroni E, Hewak B, Prabhala A, Nair S, Rivetti A. Physical interventions to interrupt or reduce the spread of respiratory viruses: systematic review. BMJ 2008;336:77-80 and Jefferson T, Del Mar C, Dooley L, Ferroni E, Al-Ansary LA, Bawazeer GA, van Driel ML, Foxlee R, Rivetti A. Physical interventions to interrupt or reduce the spread of respiratory viruses: systematic review. BMJ 2009;339:b3675. DOI: 10.1136/bmj.b3675.

INDEX TERMS

Medical Subject Headings (MeSH)

*Communicable Disease Control [methods]; COVID-19 [epidemiology] [prevention & control]; Global Health [statistics & numerical data]; Influenza A Virus, H1N1 Subtype; Influenza, Human [epidemiology] [prevention & control]; Randomized Controlled Trials as Topic; *Respiratory Tract Infections [epidemiology] [prevention & control]; SARS-CoV-2

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MeSH check words

Aged; Child, Preschool; Humans

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Chairman SMITH. Representative from New York, Ms. Tenney, is recognized.

Ms. TENNEY. Thank you, Chairman Smith and Ranking Member Neal, for holding this important meeting.

And thank you, Mr. Secretary, for testifying before the committee.

Over the past couple of years, many of us have shared numerous concerns about the Department of Health and Human Services prioritizing politics over its duty to promote and protect the health and welfare of the American people. This has included HHS' insistence to keep the unscientific CMS health care workforce COVID–19 vaccine mandate, referenced by my colleague from New York, Mr. Higgins, which has exacerbated health care staffing shortages, especially in rural districts like my own in Upstate New York.

The department has also spent time altering Medicare payments to re-incentivize doctors to develop anti-racism plans, for example, instead of boosting health quality care or health care quality for all patients.

At the same time, HHS has failed to properly implement bipartisan surprise medical billing provisions passed by Congress or reform its guidance to allow seniors to access new, innovative treatment for Alzheimer's disease, as my colleagues have referenced.

But I want to jump right into this issue about vaccine mandates if I could, Mr. Secretary. Over the past few years, multiple scientific studies have found that the COVID–19 vaccines do not reduce transmission of the virus. In fact, our own CDC Director, Dr. Rochelle Walensky, she is a Doctor of Medicine, unlike you and I who are doctor of laws.

She said in referencing the COVID–19 vaccine, what they cannot do anymore is prevent transmission.

So you just stated in your testimony today that the reason we are extending this vaccine mandate, especially on health care workers, until November of 2024 is because of the transmission of the disease.

This is causing huge problems in Upstate New York in terms of staffing, as I indicated. In the Finger Lakes Region and Buffalo Region, which I share with Mr. Higgins, hospitals have had a 375 percent increase in contract labor costs due partly because of the vaccine mandate, having to hire visiting nurses, which are much more costly.

There have been protests, and a lot of objections to this vaccine mandate, particularly among nurses and those heroes who served when we did not have a vaccine, who now have been laid off and lost their jobs.

And we think this is unsustainable. What are your plans under CMS—and I know you have indicated to my colleague, Mrs. Miller from West Virginia; what are your plans in dealing with this vaccine mandate now that we know that this is not transmissionable by Dr. Rochelle Walensky, our CDC Director?

Would you be willing to overturn this vaccine mandate earlier so that we could get people back to work in New York and really provide the health care we owe to our patients?

Secretary BECERRA. Congressman, thank you for the question.

And as has always been the case, and you can——

Ms. TENNEY. Can you just answer would you be willing to do that? Because I want to also add a New York judge actually just struck down the vaccine mandate in January.

So is this something you are willing to do to override this based on the law and also based on science?

Secretary BECERRA. The actions are taken based on science and the evidence, and that will continue to be the case.

Ms. TENNEY. So Dr. Walensky is not accurate as a doctor in determining that these vaccines do not transmit the disease?

Secretary BECERRA. So I am not sure about the quote that you attribute to her, but what I could tell you is that Dr. Walensky, like all of those who are working on COVID within the Department of Health and Human Services, base their actions on science and the evidence.

Ms. TENNEY. Would you be willing to waive Novak Djokovic's entry into the United States to play in the U.S. Open, tennis.

Secretary BECERRA. So you give me more power than I have, authority than I have. Those are not——

Ms. TENNEY. You oversee the CDC?

Secretary BECERRA. CDC does not make the decision about who can come in and cannot come in. Those are issues that——

Ms. TENNEY. They could issue the waiver.

Secretary BECERRA. I'm sorry?

Ms. TENNEY. The waiver could be issued.

Secretary BECERRA. A waiver for one individual?

Ms. TENNEY. For anyone, anyone that is coming in. I mean, we have illegal immigrants crossing our border every single day who do not actually take the vaccine.

Secretary BECERRA. We provide the vaccine to those unaccompanied migrant children who do come into the country, yes.

Ms. TENNEY. And what about American citizens who choose to play in these sports that do not take the vaccine? They are waived from coming in.

Are they dangerous to the——

Secretary BECERRA. American citizens are able——

Ms. TENNEY. Is that science?

I mean, I am just saying, I mean, we allow American citizens unvaccinated to play in the U.S. Open. So is that scientific? Should we mandate that they are vaccinated in order to play in sporting events, for example?

Secretary BECERRA. The actions that our Administration has taken with regard to American citizens is to protect them as best possible against COVID. The actions we take with regard to those trying to enter the country are somewhat similar, but there are some differences because these are folks who are asking for permission to come into the U.S.

Ms. TENNEY. Would you not say that the decisions are political at this point?

Secretary BECERRA. The decision is based on science and the evidence.

Chairman SMITH. We need to move on.

Ms. TENNEY. My time is up. My time has expired.

Thank you very much.

Chairman SMITH. Thank you.

The gentleman from Michigan, Mr. Kildee, is recognized.

Mr. KILDEE. Thank you, Chairman Smith and Ranking Member Neal, for holding this hearing.

And thank you, Secretary Becerra, for being here this morning and, in particular, for discussing the proposed 2024 budget. You and I served together here in this body. I consider you a friend, and I am glad to have you here with us, and I appreciate you addressing some of these issues.

I am pleased with the priorities that I—have seen come forth in the aspect of the budget that you have responsibility for. I am particularly pleased that the budget includes $5 million for the Flint lead registry, which as you know is a powerful tool to help improve the lives of kids and families that I represent in my hometown of Flint that have been exposed to lead contaminated water, and I do appreciate this being a priority for the department.

Because Mr. Kustoff raised it, I want to give you an opportunity to address some of the work that you are doing on this issue of child labor violations.

I know that you most recently have stood up a task force to address this issue. It is a serious issue. It is one that we have to take seriously, and you know, Mr. Kustoff raised this issue as I have with you privately in the past.

We do know that this is really a question of your authority, but even to the extent that you do have some authority, it is also an issue of resources. And that is why I am happy to see $39.4 billion for the Department of Health and Human Services, Administration for Children and Families in the President's budget.

It is ATF that works to protect the wellbeing of unaccompanied children by assessing the placements that they will be placed in connection with the other resources that they will be provided.

And because a budget decision affects what you are able to do, I wonder if you might just tell us how cuts, which I do believe some would advocate for, cuts to the Department of Health and Human Services Department's Administration for Children and Families would impact your ability, even given the authority that you have to protect children from exploitation.

Secretary BECERRA. Well, Congressman, that is a broad question, but what I can tell you is if we lose some of the funding we have within the Administration for Children and Families, we would have less opportunity to provide the child care services support, the Head Start services support, to be able to with regard specifically to the refugee program and within that the Unaccompanied Migrant Kids Program, be able to provide the level of custody care that we provide.

And so you impact kids in so many different ways, and as I say, children are children, and whether they are your children, my children, in this country we should let children be treated as children.

Mr. KILDEE. Thank you, and I ask finally do you know, and I hope you do, that the Administration would support my efforts to increase the civil and criminal penalties for employers?

Because look. We need to hold people responsible for this. You know, you have some regulatory authority, but employers have a responsibility. Those employers who are illegally hiring children in dangerous jobs need to face stiffer criminal and civil penalties.

And I ask if the Administration would support our effort to do just that.

Secretary BECERRA. You hit it right on the money, Congressman. If an employer, if a company was not willing to hire against the law these children, we would not see the type of exploitation, and that is the heart of this. We should not be allowing this to happen right in front of us.

Mr. KILDEE. Thank you, Mr. Secretary.

And thank you, Mr. Chairman. I yield back.

Chairman SMITH. Thank you.

The gentleman from Utah is recognized.

Mr. MOORE of Utah. Thank you, Mr. Chairman and the Ranking Member.

Secretary Becerra, thank you for being here today and putting in the time to dialogue with us on these issues.

This is it. This is the most crucial, most important matters of our Nation, is getting things related to health care figured out. This is something in every single district across the board. So incredibly important.

According to a recent estimate, 250,000 Americans die each year due to medical error. This is an issue Congress and CMS have tried to address for decades through quality measure activities.

However, a 2019 GAO report noted that CMS failed to properly track its spending on quality measurement activities and how its spending is or is not helping it achieve its strategic objectives, such as lowering administrative burdens.

We talk a lot about administrative burdens, but sincerely, this is an area that we could truly lower administrative burdens. My team and I think that this could be a significant win and a bipartisan win in the 118th Congress.

I sent you a letter yesterday asking five detailed questions on this topic.

Will you commit to answering these questions in my letter by the end of April? Will that be enough time for you to consider this?

Secretary BECERRA. So——

Mr. MOORE of Utah. You have not seen the questions, but——

Secretary BECERRA. Yes, I have not seen the questions, but I commit we will respond and we will try to do it as best we can as quickly as we can.

Mr. MOORE of Utah. And we will follow up, and once you have had a chance to look at them, I have got a copy of it here today. We would love a sense for just when you will have time to get to them.

We are going to drive this this Congress, and you know, time is running out. We want to get this going.

Secretary BECERRA. Having sat where you sit today, I know how important it is to get the answers.

Mr. MOORE of Utah. Some more context on that, if you will commit to working with us to make these quality measures outcome oriented and transparent, would you be willing to, you know, without seeing the exact questions, making this outcome oriented and transparent we think is a significant bipartisan win here so that they are indicative of the quality of care patients actually receive

and that patients are not in some cases forced to shop around for their health care in the dark?

Secretary BECERRA. Congressman, looking forward to working with you and reading this letter.

Mr. MOORE of Utah. Thank you.

Finally, the last piece here on the budget, your budget claims to extend Medicare solvency by 25 years. I looked at this. My team looked at this, and your plan, the way we view it does this primarily by funneling existing general tax revenues to the Medicare Hospital Insurance Trust Fund.

The trust fund, general, it is just funneling them over into the trust fund to extend that solvency.

According to CBO data, if Medicare is allowed to run its course and we merely finance it by borrowing against our children's future, Medicare will add over $17 trillion to the national debt over the next 25 years just in additional interest payments.

When you and the President formulated your budget, did you consider the cost, the specific cost, of additional interest payments caused by borrowing?

Secretary BECERRA. And, Congressman, again, I do not understand that math because the President's budget, as opposed to what you have described, the President's budget actually reduces deficits. It not only extends the life of Medicare and strengthens it, but it reduces deficits moving forward into the future.

It makes some painful decisions that some folks may not like, but it does protect Medicare, those benefits, and it does continue to make it available not just for today's seniors but the next generation.

Mr. MOORE of Utah. We had an opportunity to dig into this in the Budgetary Committee, and there is argument over whether that truly does reduce deficits here.

Secretary BECERRA. I would love to go through those numbers.

Mr. MOORE of Utah. You are taking from one pot and just pushing it into the other. We are not truly going after the solvency here.

Secretary BECERRA. Again, I disagree with that, and I am more than willing to sit down and go number to number, mano to mano on that one because the President made a commitment. It is real.

Secretary BECERRA. We will gladly sit down and go mano to mano at any time on this, on these details.

Thank you.

Secretary BECERRA. Thank you.

Chairman SMITH. Mrs. Steel from California is recognized.

Mrs. STEEL. Thank you, Chairman Smith.

And thank you, Secretary Becerra, your coming out and you know how many hours you have been here for testifying. So I really appreciate that.

You know, I am concerned about Center for Medicare and Medicaid Services' oversight of new Hospices and home health agencies. This is particularly an issue in California, which instituted a moratorium on State licensures January 1st, 2022.

Despite this moratorium, Hospices in California that previously received State licenses are still being certified by Medicare. In fact, 443 California-based Hospices received Medicare certification in

2022. Three hundred seventy-five out of 443 were issued in L.A. County only.

Considering the moratorium in California and the State Auditor's Report highlighting these bad actors, why is Medicare still certifying Hospices that are likely engaged in fraud?

Secretary BECERRA. Congressman, that is a great question. I am not totally abreast of what the State of California, my State, is doing, but as you will recognize, the laws that guide us on Medicare and Hospice care are different from what guides the State of California.

What the State can do is not necessarily what we can do and vice versa. If someone applies to provide Hospice care, we have to make sure that what they are doing is fulfilling the criteria that by Federal law they must achieve. If they do, we do not have the luxury of saying, "No, we will not because your State is saying you may not be a good actor."

We have to base it on the information they provide to us, and if they meet the criteria to qualify for funding under Medicare.

Mrs. STEEL. So who does the audit?

Secretary BECERRA. Who does what audit?

Mrs. STEEL. These Hospice cares, especially caretakers.

Secretary BECERRA. If you are talking about the work that the State has done to suspend further licensing, then it is the State who would do some of those audits.

If you are talking about the Medicare Program, that is a Federal program. The State does not operate Medicare.

Mrs. STEEL. So Medicare certifications they were just still giving out to these fraud cases.

Secretary BECERRA. Medicare would not give out a certificate for operation of a Hospice Care Program if it was doing it fraudulently. Those programs would have to be able to show that they meet the criteria.

If they subsequently commit fraud——

Mrs. STEEL. So who finds out that they are fraudulent, such is the case or not? Who find out? Because it is the Medicare certificate that we are talking about here.

Secretary BECERRA. That is where you rely on the surveyors, the investigators who periodically go in to see how those programs are operating.

The State might have some folks who are doing it. When I was Attorney General of California, we had the authority to go in and look at all of these different facilities for how they were caring for folks. That is why we expanded the program that actually looks into nursing homes.

That is different from what the Federal Government does.

Mrs. STEEL. So you know what? Let me just change the issue. I am going to go a little more deeply, and I am going to work with you about this.

Secretary BECERRA. Of course.

Mrs. STEEL. Fraudulent certificates.

But lastly, constituents of mine from Fullerton and Placentia rallied on Capitol Hill about CMS decisions to deny senior access to vital Alzheimer's treatments.

What do you expect me to tell my constituents about not having access to care? Because USC, Stanford, UCLA, UC-Irvine, UC-Berkeley, UC-San Diego, these are just really good universities. They all say it is a breakthrough medication.

So why not?

Secretary BECERRA. Congresswoman, I would tell you to tell them that you will advocate as hard as you can to make sure that where possible, we will make access to those medicines and service that help them with their particular condition or disease.

And if they probe even further, you might want to make sure you can tell them the distinction, the difference between the work that the FDA does to make a drug available and the work that CMS does within the Medicare system to make those drugs available for reimbursement within the Medicare Program.

Mrs. STEEL. So how are we going to do that though because they are not reimbursing it? They have been denying those coverages.

Secretary BECERRA. That is what I am saying. People have to understand how CMS and Medicare operate so they can understand the decisions, the determinations that are made by CMS.

CMS did provide some coverage for some of those Alzheimer's drugs, but under limited conditions.

Mrs. STEEL. You know what? My time is up. I am going to do it in writing and I will ask all of these questions. Actually I have more than ten questions here that I want to ask you, but I just do not have time.

So I yield back.

Secretary BECERRA. Thank you, Representative.

Chairman SMITH. The Representative from Virginia, Mr. Beyer.

Mr. BEYER. Mr. Chairman, thank you to you and Ranking Member Neal for having this hearing.

Mr. Secretary, welcome back to Ways and Means. It is great to have you back.

I want to praise the work that you have done and CDC and SAMHSA on suicide prevention. There is always a lot more work to be done, but I am really proud of this Administration's budget, your intent to take suicide seriously.

The $80 million directed just for the Suicide Prevention Program for CDC for fiscal year 2024 is just wonderful.

You know one of the biggest pieces has been the transition to the lifeline, to the 988 number, and you mentioned it in your opening statement.

Thanks, by the way, to Mr. Moulton, a Democrat, and Mr. Stewart, a Republican, and their leadership on this issue.

And we successfully secured funding to help that transition last year, but it only went into effect in July. There was a huge surge in August in that number, and right now I think SAMHSA expects calls to double in this next year as word is getting out about the 988.

And one of the pieces of this conversation is trying to get an awareness of the campaign going for the new number and for suicide resources broadly because how we treat it today is much different than when we were kids.

And this, by the way, was something that Governor Gianforte and Mr. Kinzinger have both partnered with me on, and I was encouraged to see this year's President's budget called for an awareness campaign similar to the bill we had last year, the Campaign to Prevent Suicide Act.

Can you just speak to us as the leading health care official in this country about why this is so important?

Secretary BECERRA. Congressman, I do not know if there is anyone in America who has not lost a loved one at some point because of suicide or drug overdose, and it is amazing to see the age of some of the people who are calling in to 988, children, pre-teens.

You hear the stories from parents about how they are not sure what to do, that their kids are suffering. You hear the stories directly from the children. America is hurting.

COVID did not create it. It just really exposed some of what is going on, and the President is very committed to 988 because it is a way to say to people who are hurting we are here, we are listening, and we are here to catch you.

And thank God working with all the States we were able to stand up a program that actually works, and now the President wants to continue to double down, do even more, and I hope you will help us with that because we want to do six million additional contacts.

Mr. BEYER. Great. Thank you.

One more question. I am intensely interested in looking at how we can decrease costs within the health care system, and AHRQ, a foundational agency that helps tackle much of this work, and I have been particularly interested in the role of all payer claims databases.

You know, State after State have picked this up, and it is wonderful how all of the data is pulled together State by State, but what we really need is a Federal all payer claims database to bring this all together.

And I know your budget looks at supporting this work within AHRQ. Can you speak to what you might see as the benefits of an all-payer claims database on a national level?

Secretary BECERRA. Well, we will get to see what every country is doing better, and we will get to pass along the best practices to every part of the country because by collecting data and having it from all parts of the country, we can let folks see what is working and what is not.

But if you are never seeing the data, you will never know the success stories or the failures and will continue to make the same mistakes.

And so we are hoping that we can do a far better job of collecting that data nationally because there is so much data out there now. It is just that we do not have in some cases the authority or in some cases the capacity to collect it, but, boy, if we were able to collect it, Congressman, the stories we could tell and the improvements we could make in the health care system.

Mr. BEYER. Thank you, Mr. Secretary, very much.

And I yield back.

Chairman SMITH. Thank you.

Mrs. Fischbach from Minnesota is recognized.

Mrs. FISCHBACH. Thank you, Mr. Chair. I appreciate the opportunity.

You know, I am going to just power through these because I have got a few questions.

Secretary, throughout my district and across the Nation nursing homes are already struggling to maintain current staffing levels and have an even more difficult time finding new staff members to fill vacancies.

And I know there was some discussion about nursing homes, but President Biden's additional staff ratios requirements on top of the ongoing workforce shortages would greatly reduce the number of patients served in facilities.

Secretary, do you agree that long-term care facilities are facing labor shortages?

Secretary BECERRA. Congressman, without a doubt the whole health care system is facing shortages.

Mrs. FISCHBACH. And I agree with that, Mr. Secretary.

Could the President's new staffing ratios force nursing homes to reduce the number of patients they can serve or, worse, even close their doors entirely?

Secretary BECERRA. Ah, here is where we probably diverge because I would say the most important thing about any nursing home facility is that they offer quality care, and if you cannot offer quality care, maybe you should not have your doors open.

And that is why we want to make sure that if you are open, first and foremost, you care about the people that you are serving, which means you have to have the level of services required for the people that are needed.

Mrs. FISCHBACH. Well, Mr. Secretary, are staffing ratios the only measurement of care?

Secretary BECERRA. Oh, no, no, no.

Mrs. FISCHBACH. Quality care?

Secretary BECERRA. No. There are many measures.

Mrs. FISCHBACH. Okay.

Secretary BECERRA. But staffing levels make a difference.

Mrs. FISCHBACH. But potentially you could close nursing homes, I think, is what you said.

Secretary BECERRA. By themselves, they should not be the reason you close. If you have the correct number of staff——

Mrs. FISCHBACH. Well, if they cannot get enough, Mr. Secretary, if they cannot get enough nurses or nursing staff——

Secretary BECERRA. What if they do not provide enough nurses? Is that good?

Mrs. FISCHBACH. That is not the issue here because it is ratios and you are going to increase those and make it already more difficult. It is difficult to get nurses, and I think you agreed with that.

Secretary BECERRA. Obtaining nurses, and they will tell you they cannot have them doing everything for everyone. You need to have enough nurses in a facility. You are right.

Mrs. FISCHBACH. Nurse and CNAs and LPNs, nursing staff.

Secretary BECERRA. Absolutely.

Mrs. FISCHBACH. And you know, Mr. Secretary, I do not know who you are talking to, but I do think maybe you should talk to some of the rural folks that are struggling to keep nursing homes

open under the already tight ratios and provide people care close to their families and close to their homes.

But I have got to move on.

Secretary BECERRA. I just want to assure you we have been talking to folks in rural America about this.

Mrs. FISCHBACH. Reclaiming my time, Secretary, the Hyde Amendment protects taxpayers by prohibiting taxpayer funding of abortion, and as you well know, this language, this vital language, has been included in appropriations bills every time since 1977, with strong bipartisan support.

Does the President's budget request include the Hyde Amendment language?

Secretary BECERRA. The President's budget does everything possible to make sure that women are entitled or afforded——

Mrs. FISCHBACH. I am asking you a direct question, Mr. Secretary. I think it is a yes or no.

Does the President's budget request include the Hyde Amendment?

Secretary BECERRA. The Hyde Amendment is something that Congress has added, and it is up to Congress to determine whether it will add the Hyde Amendment.

Mrs. FISCHBACH. Well, does the President want the Hyde Amendment included in that budget request?

Secretary BECERRA. The President's budget does everything possible to protect the reproductive health care rights of all——

Mrs. FISCHBACH. Mr. Secretary, with all due respect, I am going to take that as a no.

And the Dornan Amendment, I am assuming that is also a no, that that is not included in the language in the legislation either.

And I do not know. I should at some point find out for sure. I know we have been looking for language on the budget, if we have gotten that, but I am going to assume that neither of those are included because you did not answer with a yes or no.

But this is something since 1977 that has been included with bipartisan support, and it really does leave Americans vulnerable to being forced to pay for elective abortions, even though the majority of Americans are opposed to tax dollars going towards abortion funding.

But I understand that under this budget the Democrats would rather appease their extremist base that want Federal funding for abortion on demand, and I just say it will be very, very sad that the left is forcing this onto Americans.

With that I yield back.

Chairman SMITH. The gentleman from Pennsylvania is recognized.

Mr. EVANS. Mr. Secretary, it is a pleasure to have you come back before this committee. I have enjoyed listening to you.

This year, no one on Medicaid will pay more than $35 a month for insulin. The question I would ask you, Mr. Secretary, can you please explain and discuss how the change helps constituents in Philadelphia and across the country?

Secretary BECERRA. Congressman, the benefits are immediate. I cannot tell you how many folks have come up to me and said, "I cannot believe it. In December, I was paying"—I think this one

woman was paying $117 for her insulin for a month, and she said, "I got charged $35 in January. I went back to the provider and said I think you underbilled me, and they said, no, that is the new price." She was ecstatic.

And that is something that is being repeated over and over because the savings are not just real, but they are current, and I will tell you that in your State of Pennsylvania, the savings on average this year for Americans who are on Medicare and need insulin will be somewhere around close to $550. That is $550 in their pocket that they would have had to otherwise spend to buy their insulin.

That is the average. That means some people are saving a little less, but it means there are a whole bunch of folks who are saving a lot more.

Mr. EVANS. I want to thank you.

I yield back. I thank you very much.

Chairman SMITH. The gentlemen from Iowa, Mr. Feenstra, is recognized.

Mr. FEENSTRA. Thank you, Chairman Smith and Ranking Member Neal.

And thank you, Secretary Becerra, for being in front of us today.

I have just got a quick question. Do you support a single payer system?

Secretary BECERRA. Congressman, I have worked for many, many years to make universal health care available to all Americans, and now as the Secretary I put into place the President's proposals which include lowering cost——

Mr. FEENSTRA. So you are simply saying you are not going to answer the question and you are going to dodge the question.

Secretary BECERRA. I have always been for universal health care, to make sure everybody——

Mr. FEENSTRA. Well, here is why I asked that. I listen to all of my colleagues, and the responses I have got it seems like we are going down that path very quickly.

When you start capping obviously pharmaceuticals, that crushes the research and development. When you do not update, you know, your reimbursements, that obviously dramatically hurts rural hospitals, rural clinics, doctors, and so forth.

And then the elimination of 2,200 codes is an actual crusher. So my question to you is this. If you dramatically increase taxes on a business, do you think that business will pass those increased costs onto the consumer?

Secretary BECERRA. You are asking me a question which is speculation.

Mr. FEENSTRA. All right. You are not going to answer that.

Let me say this. Cutting payment to health plans in the end, it will be the patient that bears the cost. We have seen this time and time again. It happens.

And a recent analysis suggests that this will be about $540 per month per member per year. So the Biden Administration highlights its desire to lower cost on health coverage and provide better benefit. Yet the 30 million seniors and people with disabilities who choose to enroll in Medicare Advantage, which is close to 50 percent of them, will see either the benefits reduced or the costs go up.

So how is the Administration and yourself, how do you explain that to the customers?

Secretary BECERRA. Because, Congressman, there is nothing in our proposals that would cut Medicare benefits. I defy you to find me something in our proposal.

That is what the commercials say that are paid for by the——

Mr. FEENSTRA. Okay. So this is you singularly saying this, but do you want to know something? A hundred and fifty groups that represent patient, providers, and plans—I yield back—150 groups representing patients, providers, and plans are saying that this will happen, and including the American Medical Association.

So who is right, yourself or 150 other groups that are saying that this is what is going to happen?

Secretary BECERRA. Take a look at the proposal. It makes——

Mr. FEENSTRA. Your proposal is arbitrary, and if I had to guess, if I look at the real nuts and bolts of it, it is wrong.

Now we are arguing.

Secretary BECERRA. We are not arguing, Congressman. It is just a fact. We are not getting paid money to do those commercials. They——

Mr. FEENSTRA. I have not just fallen off a turnip truck. I have my Ph.D. in health care administration. I see what is going on here. All right? I see what is going on.

And if we were here next year at this time when all the Med. Advantage plans go up or their benefits are lost, I would love to hear what you have to say.

Secretary BECERRA. Congressman——

Mr. FEENSTRA. And I yield back.

Secretary BECERRA. They cannot cut those benefits.

Mr. FEENSTRA. I yield back.

Secretary BECERRA. That is the deception that is going on. They cannot cut Medicare benefits. They can tell people that, but they cannot cut those benefits.

Chairman SMITH. The gentleman from Illinois, Mr. Schneider, is recognized.

Mr. SCHNEIDER. Thank you, Mr. Chairman.

It is always good to see you and thank you for making the time to be here, and your patience.

You know, it is critically important that we continue to make the progress we have made on expanding affordable access to health care. As you talked to, it has been a lifetime devotion for you, and I appreciate your work and will continue to do so.

I take great pride in the fact that in the decade since ACA became law, the number of Americans without health insurance has dropped by almost half. Preexisting conditions are no longer a barrier to getting health insurance. Kids are able to stay on their parents' program until age 26, and lifetime caps are history, and those are just a few of the highlights of ACA.

I want to focus on telemedicine. According to the CDC, just in 2021, more than one-third of Americans made use of telemedicine in the previous year. Prior to the pandemic, I do not want to speak for everyone, but I would suggest that this panel ran the spectrum from curious to skeptical on telehealth.

Post-pandemic, I can promise you that this is a roomful of evangelists singing the benefits of telehealth.

Telemedicine has improved access for virtually every American, including those who live far from medical facilities, those who do not have ready access to transportation, folks in need of mental health who cannot find a provider with an open appointment near them, or maybe they are just too shy to go in public because of the perceived stigma.

So with the emergency coming to an end in May and the pandemic winding down, we have to consider how we are going to take the lessons learned from telehealth and make sure that they stay strong.

I will soon introduce my bill, the Primary and Virtual Care Affordability Act. This bill would extend the temporary provision that allowed HSA eligible, high deductible plans to waive the deductible for telehealth services.

I am also joining with my colleague, Mrs. Steel, as co-lead on her bill, Telehealth Expansion Act, that is being introduced today, may have already been introduced, to make telehealth flexibility permanent.

My question for you in the last minute is can you speak to the Administration's other actions to expand telehealth services, and how do we build on this progress to make sure telehealth is something that is part of our future?

Secretary BECERRA. I will mention one thing that actually is not within HHS' jurisdiction which is crucial if you are going to get your bill passed and deployed, and that is that broadband has to be made accessible to all communities because you can do telehealth if you have got good broadband, but if you do not have good broadband, you cannot do the connection.

And so we want to make sure all communities have decent broadband so they can take full advantage of telehealth.

The other thing we want to make sure we do is get people trained up. So especially places like rural America, we get providers, physicians who are ready to use telehealth because in some of those communities, that is where it is going to have the greatest advantage. And so we want to make sure folks are ready for this time.

And then finally, we are going to need to work with you because the end of 2024 will come soon. Those extensions for telehealth will be upon us before you know it, and what we do not want is for a whole bunch of providers to be wondering can we or can we not continue to do this. The clock is ticking.

Better we take care of it early to give predictability to those providers of how we will do telehealth.

Mr. SCHNEIDER. My hope is we can extend telehealth long before we get to the deadline in 2024.

Thank you. I yield back.

Chairman SMITH. The gentlelady from New York, Ms. Malliotakis.

Ms. MALLIOTAKIS. Thank you, Mr. Chairman.

Thank you, Secretary, for being here today.

You know, this Administration talks a lot about setting what I would call innovation killing price controls, but one of the things

that I do want to talk to you about where I think we could really work together on access and affordability of prescription drugs would be PBMs. Okay?

Obviously, our pharmacy benefit managers, which it is troubling to me that the three largest PBMs actually control 80 percent of the market. There is no transparency. They are making a lot of money by keeping rebates instead of passing them on to consumers.

They exclude drugs from their formulary, and they are dictating what their competitors are making, right? And they are crushing my small Mom and Pop pharmacies.

Here you have PBMs that are also the insurer and then they are the pharmacy, and they are controlling everything in terms of pricing. Okay?

For example, CVS Caremark, they also own the insurance company Aetna, and then they own the pharmacy, CVSes all over the country.

Now, do you think that is a problem?

Secretary BECERRA. Congresswoman, PBMs, you know, no one knows everything they do. We are surprised sometimes when we see what comes out, and there absolutely has to be more transparency in the way they do business.

Ms. MALLIOTAKIS. Well, the FTC recently announced their plans to probe the largest six PBMs in the U.S., and with the role that PBMs play in Medicare drug pricing, can you explain why HHS has not launched its own investigations, is not pushing for more transparency in order to shed some light into this very opaque process?

Secretary BECERRA. Well, Congresswoman, let me assure you we are working in this space. You may not have seen a particular rule come forward, but we are absolutely working in this space.

And if you are interested, we would love to work with you because this is an area where reform is needed.

Ms. MALLIOTAKIS. Well, you say you are working in the space. How so?

Secretary BECERRA. Some of the work that we are doing is in the process of we are trying to get some rules ready that would deal with some of this. At the same time we are trying to avoid some of the lawsuits that are being filed.

And what we are trying to do is continuing to give consumers access to some of these prescription drugs at the best cost we can get for them.

It is difficult, but we are trying to do what we can working within the constraints we have within the laws because we can only go as far as the authorities have given us.

Ms. MALLIOTAKIS. Well, I think actually the Administration is, I think, in a unique position to be going after the PBMs actually.

And you mentioned rules. You said that, "I see a rule," and then you said, "Well, we have some rules coming out."

You know, I think that needs to be clarified there that maybe you have not done anything just yet, but I am just trying to understand why HHS seems to be sitting on the sidelines and giving PBMs, you know, free rein considering the role that they are playing, particularly in Medicare prices, but also just pharmaceutical

drugs for all our constituents who are paying just way too much right now, and it is because of the games that they are playing and the lack of transparency.

Secretary BECERRA. Yes. I can guarantee you we are not sitting on the sidelines. As we have talked about insulin, it is $35 a month.

Ms. MALLIOTAKIS. Well, once again, that is a price control. That is not going after the PBMs.

Secretary BECERRA. But we are affecting the price of drugs. We are making them more affordable and that is what counts. And ultimately the work whether PBMs or making sure we negotiate prices for drugs, it is to make sure consumers, Americans, get better prices for their medication.

Ms. MALLIOTAKIS. I have run out of time.

Thank you.

Chairman SMITH. The gentleman from Ohio is recognized.

Mr. CAREY. Mr. Secretary, good to see you again.

In 2020, the Centers for Disease Control and Prevention reported that Ohio had the fifth largest overdose death rate in the country. In the same year, Ohio, fentanyl was involved in 81 percent of all of the overdose deaths, often with a combination of drugs.

Last year Drug Enforcement Agency seized enough fentanyl to kill every American, capturing more than 50 million fentanyl-laced pills and over 10,000 pounds of fentanyl powder.

I have been to the border. I have seen how the cartels are able to smuggle drugs into the communities, and we need HHS to protect Americans from fentanyl flooding our border.

We need to hold Mexico accountable and continue to warn Americans about the potential for fentanyl-laced drugs.

In the President's budget, there is roughly $40 million to combat fentanyl trafficking and disrupt international criminal organizations.

What steps, Mr. Secretary, is your agency taking to prevent fentanyl from entering the United States and killing more Americans, including constituents of mine back in Ohio?

Your answer, sir?

Secretary BECERRA. Congressman, and I want to be respectful here in the answer because you are asking me what I at HHS can do, and much of what you are asking is about the border, and that is not within the purview of Department of Health and Human Services.

I can tell you if you wish—I know you have limited time—what we are doing with regard to fentanyl, but it will not be so much at the border. That is really the Department of Homeland Security and other agencies.

Mr. CAREY. So is HHS working to combat the large amounts of fentanyl-laced drugs currently circulating in the U.S.?

Secretary BECERRA. Absolutely. We are dedicating some $11 billion in our budget for drug overdose prevention and to try to address it as best we can working with the States.

Mr. CAREY. Just one thing I found that was interesting in the President's budget. Climate is mentioned 74 times more than the word "fentanyl." So just an interesting point.

Real quick, I do want to just touch upon something that we have seen particularly during the COVID time with our EMS personnel and with the treatment in place that we have actually seen, and it has been really saving people a lot of money because, as you are well aware, EMS personnel in the past, and currently most of our EMS personnel, are actually only paid if they take somebody to a hospital.

But under this waiver program with this treatment in place, we are finding that these folks are able to actually save money by being able to diagnose it on site.

So it is a good program. It is something that I know works with your agency. I just wondered if you had any thoughts on that.

You know, I have 45 seconds.

Secretary BECERRA. And I will be brief. It moves us more toward prevention and rather than waiting till you send someone to the ER room and see if you can catch them before they die. It is trying to make use of the evidence that shows that certain preventive approaches can actually save lives early.

And so we want to move in that direction where we can.

Mr. CAREY. Okay. Thank you, Mr. Secretary.

Mr. Chair, I yield back.

Chairman SMITH. The gentleman from California is recognized.

Mr. PANETTA. Thank you, Mr. Chairman. Thank you, Ranking Member Neal.

Mr. Secretary, it is good to see you again. Thank you for coming back and being here and being willing to answer these questions.

In recent months, more so kind of in recent weeks, we have heard a lot of reports about the spread of illicit xylazine being cut with fentanyl. Fentanyl has been using xylazine to be cut and creating this drug that we are hearing that is called "Tranq" or "Zombie drug" that does some miserable things to the human body, including eating flesh and potentially leading to amputation and making the use of fentanyl cheaper, more addictive, and even deadlier.

Xylazine itself is used by people for sedatives in animals. So those are illicit uses. However, there is no licit purpose for it to be used in humans.

That is why I have introduced my bipartisan, bicameral bill today called Combatting Illicit Xylazine Act, which will help basically allow enforcement of the illicit use of Xylazine under Section 21 USC, as well as using the CSA under Schedule 3 of the CSA, of the scheduled drugs.

I just wanted to make you aware of that, but also wanted to see if your department is responding to the Xylazine threat in any way.

Secretary BECERRA. I can get back to you because I cannot tell you specifically what we might be doing, but we are generally speaking, whether it is opioids, whether it is fentanyl, we have a drug prevention strategy that tries to help localities address the scourge of drugs.

Mr. PANETTA. Great. Thank you.

Moving on to Medicare economic index, MEI, according to data from the Medicare Trustees, Medicare physician pay nationwide has increased just ten percent over the last two decades, as you know—well.

Meanwhile the cost of care increased 42 percent from 2001 to 2022. This type of inflation measured by the Medicare economic index is even worse in our home State of California.

This month MedPAC recommended that Congress increase physician fee rates above the current law and make an inflation-based payment tied to the MEI.

A couple of questions here for you. Can you talk more about why the physician fee schedule has failed to keep up with the cost of care?

Do you agree that indexing these fees for inflation is the right solution?

Is there anything that we can do legislatively to correct this?

Secretary BECERRA. Actually, your last statement is the most operative, Congressman, because having been where you are for 24 years, I remember going through this all the time.

By law we have to make sure we level set when it comes to the payments that we make to physicians. It has to be neutral. So if you raise it here, you have got to lower it here. You have to be budget neutral.

And so that is one of the issues that is at hand here. We cannot change that. You have to change that.

And so when you ask is there something that we, meaning Congress, can do, you have to take a look at how you want to do the reimbursement for physicians. If you are going to leave it to us and if we have to be budget neutral, we are always going to be making adjustments that hurt some and help others.

Mr. PANETTA. In the same note, obviously Medicare geographic adjustments, they really have not kept up with the cost of care and created access challenges for many constituents of mine receiving traditional Medicare.

Is the HHS doing anything about the geographic adjustments having not kept up with the cost of care?

Secretary BECERRA. Congressman, you are talking to a Californian.

Mr. PANETTA. Yes.

Secretary BECERRA. So fully aware. Again, where we can do, how we can do it, to some degree we are constrained by statutory prescriptions.

What we try to do is make sure we make the adjustments based on the best evidence we have in front of us.

Mr. PANETTA. Okay. Thank you, Mr. Secretary.

Mr. Chairman, I yield back.

Chairman SMITH. Thank you.

I want to thank you, Mr. Secretary, for staying throughout.

Oh, well, you are not done yet. We do have one more member.

Before we proceed there, I would like to just say how it is great to see so many of the Alzheimer's advocates in the audience today. You can see the passion that several of our members on both sides have in regard to making sure that you have the right medicines and the cures. But it is good to see you throughout the entire hearing.

Mr. Arrington from Texas.

Mr. ARRINGTON. Thank you, Chairman. My apologies for coming in late. I was balancing the budget. So I was delayed.

Secretary BECERRA. Congressman, you can go back to balancing the budget. That is okay with me.

Mr. ARRINGTON. I know. Well, listen. My constituents would say the same thing. Quit talking. Go save this country from a debt crisis.

In all seriousness, both parties have made their contributions to this runaway deficit and unsustainable debt trajectory, and I say that, Mr. Secretary, because I am not giving any party a pass on it.

But before we put out our budget and our long-term vision and the values reflected in that budget framework, we are unpacking President Biden's budget, and there is a lot to unpack because it is the highest levels of sustained spending, taxes, and deficits in the history of the United States.

And this after a lot of spending, a lot of inflation, soaring interest rates, and an economy that is spiraling downward.

So I am looking for a change in direction. I am looking for a course correction, and I see nothing but doubling down on the policies that are driving the deficit spending and the debt and very little consideration, in my opinion, for our children and grandchildren because we are really borrowing on their backs and their future to pay for this stuff.

When it comes to health care, which is a big driver and one that we all have to roll up our sleeves and figure out how do we lower cost of health care across the board, I was very concerned about the expansion of Obamacare subsidies in the IRA, about $65 billion worth, and now in the President's budget proposal, I am sure you are aware, $185 billion in more expansion.

Here is the first rub for me. We are expanding to people who already have insurance, as I know you are aware. In the IRA, we only covered 1.7 million people who were uninsured. The rest of the folks that were covered who were making, by the way, upwards of 200, $300,000 already had employer-based insurance.

So we are spending taxpayer monies to subsidize people that are making hundreds of thousands of dollars a year.

In the second round I have read—I have not confirmed this—that people making upwards of $600,000 are getting ACA subsidies. Now, that does not make sense in any world to me unless the intention is to move our country to a universal care system, to a single payer system.

Is that the real—it is okay. It is a position. It is a view of the world and government's role. It is not my view, but is that—and I am not being cute about it. Is that the intention of these expansions of Obamacare to people making hundreds of thousands of dollars who already have insurance?

Are you trying to move the country to a single payer system?

And I yield for the answer, and I appreciate your time.

Secretary BECERRA. Congressman, thank you for the question.

I have to start by saying that your depiction of the President's budget I cannot agree with. Your numbers that you mentioned, I do not know where you got them. I know nowhere where anyone has ever mentioned that someone making $600,000 would qualify for Affordable Care Act coverage with subsidies.

But what I can tell you is this. The President in his two years in office has reduced the deficits each year. The President's budget proposal that he put forward to Congress also reduces the budget deficits moving forward over ten years.

And so I am not sure where you are getting those numbers, but the President's numbers are out there, whether it is Office of Management and Budget in the Executive Branch or whether it is the Congressional Budget Office, CBO, which does the scoring for Congress. I remember that from 24 years.

Both have said that the President's budget would reduce deficits.

Mr. ARRINGTON. I know my time has expired. So I am not going to abuse that.

I am just going to say we have a wildly different opinion about it, but I respect your answer and I appreciate your time.

So I yield back and thank you.

Chairman SMITH. Mr. Secretary, in my opening statement I highlighted the point that you all had an interaction with, $183 billion in increased funding for Obamacare subsidies, and you can make up to $600,000 a year under the President's budget, and that was in my leading statement.

I do want to thank you for being here. We appreciate the opportunity that you can be before the Ways and Means members.

Please be advised that members have two weeks to submit written questions to be answered later in writing. Those questions and your answers will be made part of the formal hearing record.

With that, the committee stands adjourned.

[Whereupon, at 5:19 p.m., the committee was adjourned.]

MEMBER QUESTIONS FOR THE RECORD

Questions for the Record for the Honorable Xavier Becerra
House Ways and Means Committee
Full Committee Hearing on March 11, 2023
The President's Fiscal Year 2024 Health and Human Services Budget

Questions from Chairman Jason Smith

At our FY24 HHS budget hearing, I asked you questions about your department's responsiveness, implementation of the Inflation Reduction Act's harmful prescription drug policies, proposed changes to the Medicare Advantage program, and enforcement of the hospital price transparency rule. In addition to those important matters, there are additional areas of concern and opportunities that ought to be prioritized.

Access to Health Care
1. Question:
Advancements in medical care matter little to patients that do not have access to such services. We must strive to promote medical innovation while also preserving and expanding access to care, especially in rural and underserved areas. What is your department doing to ensure these patients, their medical care, and the facilities and providers that care for them will be protected and strengthened?

2. Question
Will your department commit to providing meaningful data on the benefits of and barriers to providing permanent telehealth in these communities, including audio-only modalities?

3 Question:
Will your department commit to working with our committee as we identify barriers surrounding access to care and explore strategic solutions?

Answer 1-3:
In response to the COVID-19 public health emergency, which is set to expire in May 2023, flexibilities for Medicare telehealth services were issued through legislative and regulatory authorities to increase access to care for patients and providers. The Consolidated Appropriations Act, 2023 recently extended many of these flexibilities through December 31, 2024. Extended telehealth flexibilities include removing geographic and site of service originating site restrictions so that Medicare patients can continue to use telehealth services from their home and allowing audio-only telehealth services. Additionally, the expanded list of providers eligible to deliver telehealth services is also extended so Medicare beneficiaries can continue to receive telehealth services furnished by physical therapists, occupational therapists, speech language pathologists, and audiologists, as well as receive telehealth services from Rural Health Clinics and Federally Qualified Health Centers through December 31, 2024. If you are interested in drafting legislation to make these flexibilities permanent, CMS would be happy to provide technical assistance.

Additionally, recent legislative and regulatory changes made several telehealth flexibilities permanent. Federally Qualified Health Centers and Rural Health Clinics can furnish certain

mental health and substance use disorder services via telecommunications technology. Medicare patients can continue to receive these telehealth services in their home as geographic restrictions on the originating site are eliminated for these telehealth services. Certain mental and substance use disorder telehealth services can be delivered using audio-only communication platforms, and rural emergency hospitals can serve as an originating site for telehealth services.

For private insurance coverage, as was the case during the PHE, coverage for telehealth and other remote care services will vary by private insurance plan after the end of the PHE. When covered, private insurance may impose cost-sharing, prior authorization, or other forms of medical management on telehealth and other remote care services. Section 3701 of the CARES Act amended the laws applicable to high deductible health plans (HDHPs) and Health Savings Accounts (HSAs) to provide flexibility with respect to telehealth and other remote care services. Specifically, section 3701 of the CARES Act amended section 223(c) of the Internal Revenue Code (Code) to provide a temporary safe harbor for providing coverage for telehealth and other remote care services before the deductible has been met. Section 4151 of the Consolidated Appropriations Act of 2023 extended this flexibility through 2024. For further questions concerning section 223 of the Code, we encourage you to reach out to the Department of the Treasury.

Shining Light on Pharmacy Benefit Managers

4 Question:

Ways and Means Committee members from both parties are concerned that pharmacy benefit managers (PBMs) are increasingly consolidating, now with just three companies controlling 80 percent of the market.[1] What is your department doing to address this opaque subsection of the drug pricing system?

5 Question:

Will your department commit to working with our committee to ensure that PBMs are subject to appropriate transparency requirements and fair, competitive business practices to ultimately benefit patients and taxpayers?

Answer 4&5:

Section 204 of Title II of Division BB of the Consolidated Appropriations Act, 2021 requires health plans and health insurance issuers offering coverage in the group and individual markets to submit to the Department of Health and Human Services (HHS), the Department of Labor (DOL), and the Department of the Treasury (collectively, the Departments) certain information about prescription drug and health care spending. The Departments will issue biennial public reports on prescription drug pricing trends and the impact of prescription drug costs on premiums and out-of-pocket costs. These reports are expected to enhance transparency and shed light on how prescription drugs contribute to the growth of health care spending and the cost of health

[1] https://www.hirc.com/PBM-market-landscape-and-imperatives

coverage and how prescription drug rebates, fees, and other remuneration impact individuals' premiums and out-of-pocket costs. Although section 204 does not require PBMs to report the data, most PBMs are submitting the data on behalf of their plan and issuer clients.

In April 2022 CMS finalized a policy that requires Part D plans to apply all price concessions they receive from network pharmacies to the negotiated price at the point of sale, so that the beneficiary can also share in the savings. Specifically, CMS is redefining the negotiated price as the baseline, or lowest possible, payment to a pharmacy, effective January 1, 2024. CMS is applying the finalized policy across all phases of the Part D benefit. This policy reduces beneficiary out-of-pocket costs and improves price transparency and market competition in the Part D program.

Fair Payments from Patients and Taxpayers

6 Question:

There is a growing body of evidence that certain medical procedures such as imaging, drug infusions, and even surgeries can safely be delivered in outpatient clinical settings.[2] What is your department doing to ensure that these services are being provided safely and reimbursed at fair rates?

7 Question:

Will your department commit to working with our committee to ensure that patients and taxpayers can benefit from savings associated with these shifts in the delivery of medical care and reimbursement?

Answer 6&7:

In CMS's annual updates to the Ambulatory Surgery Center (ASC) list of, and payment rates for, covered surgical procedures and covered ancillary services, the agency undertakes a review of excluded surgical procedures, new codes, and codes with revised descriptors, to identify any that meet the criteria for designation as ASC covered surgical procedures or covered ancillary services.

The Medicare statute requires CMS to specify, in consultation with appropriate medical organizations, surgical procedures that are appropriately performed on an inpatient basis in a hospital but that can also be safely performed in an ASC, a Critical Access Hospital, or a Hospital Outpatient Department, and to review and update the list of ASC covered surgical procedures at least every 2 years. CMS evaluates the ASC covered procedures list (ASC CPL) each year to determine whether procedures should be added to or removed from the list, and changes to the list are often made in response to specific concerns raised by stakeholders. However, as medical practice continues to evolve, CMS recognizes that there will be additional advancements and improvements that may allow these procedures to be safely offered in the ASC setting for the typical Medicare beneficiary. There is potential for some of the procedures recommended but not added to the ASC CPL to be added in the future if there is adequate evidence that these procedures meet CMS's criteria and can be safely performed on the typical

[2] Returns to specialization: Evidence from the outpatient surgery market - ScienceDirect

Medicare beneficiary in the ASC setting. CMS encourages interested parties to continue to submit this information for consideration in future rulemaking. Additionally, CMS is happy to provide technical assistance on any legislation you draft to implement changes to Medicare coverage and payment policy.

Modernizing Health Care

8 Question:

Innovation is prevalent in the private health care sector. Unfortunately, companies developing innovative, transparent, and value-based care delivery models frequently face regulatory barriers.[3] What is your department doing to ensure that policies such as the anti-kickback statue and Stark Law are providing meaningful protections while not inhibiting innovation?

9 Question:

Will your department commit to working with our committee as we identify potential barriers to innovation and explore strategic solutions?

Answer 8&9:

In 2020, CMS issued a final rule to modernize and clarify the regulations that interpret the Medicare physician self-referral law (often called the "Stark Law"), which has not been significantly updated since it was enacted in 1989. The final rule created, permanent exceptions to the Stark Law for value-based arrangements. Industry stakeholders have informed us that, because the consequences of noncompliance with the Stark Law are so dire, physicians and other healthcare providers may be discouraged from entering into innovative arrangements that would improve quality outcomes, produce health system efficiencies, and lower costs (or slow their rate of growth). The final rule unleashes innovation by permitting physicians and other healthcare providers to design and enter into value-based arrangements without fear that legitimate activities to coordinate and improve the quality of care for patients and lower costs would violate the Stark Law. The exceptions apply regardless of whether the arrangement relates to care furnished to people with Medicare or other patients.

These value-based exceptions include a carefully woven fabric of safeguards to ensure that the Stark Law continues to provide meaningful protection against overutilization and other harms. These final policies recognize that incentives are different in a healthcare system that pays for the value, rather than the volume, of services provided.

Additionally, Section 1115A(d)(1) of the Social Security Act (the Act) authorizes the Secretary of Health and Human Services to waive certain fraud and abuse laws as necessary solely for purposes of testing payment and service delivery models developed by the Center for Medicare and Medicaid Innovation (the Innovation Center). In connection with many of the Innovation Center models, unique waivers of certain fraud and abuse laws have been made generally available.

[3] A Giant Leap Forward in Value-Based Innovation or an Avalanche of New Administrative Requirements? An Analysis of the Value-Based Aspects of HHS's AKS and Stark Proposed Rules | HUB | K&L Gates (klgates.com)

Further, the HHS and the HHS Office of Inspector General (OIG) use two primary tools, among others, to ensure sufficient regulatory flexibility under the Federal anti-kickback statute, 42 U.S.C. § 1320a-7b(b), to support innovation. In particular, the Department and OIG ensure regulatory flexibility by (1) establishing or modifying regulatory safe harbors to the Federal anti-kickback statute; and (2) responding to advisory opinion requests. With respect to safe harbor regulations, the Department and OIG periodically update the regulations to reflect changing business practices, technologies, and innovation in the health care industry. Notably, in December 2020, the Department and OIG published a final rule aiming to reduce regulatory barriers to care coordination and accelerate the transformation of the health care system into one that better pays for value and promotes care coordination. 85 Fed. Reg. 77,684 (Dec. 2, 2020), *available at* https://www.govinfo.gov/content/pkg/FR-2020-12-02/pdf/2020-26072.pdf. The Department identified the broad reach of the Federal anti-kickback statute and the civil monetary penalty (CMP) law provision prohibiting inducements to beneficiaries, 42 U.S.C. § 1320a-7a(a)(5), as potentially inhibiting beneficial and innovative arrangements that could advance the transition to value-based care and improve the coordination of patient care across care settings in both the Federal health care programs and commercial sector. In developing the new and amended safe harbors in this 2020 final rule, the Department and OIG strove to achieve the right balance between flexibility for beneficial innovation and better coordinated patient care with necessary safeguards to protect patients and Federal health care programs. OIG developed this rule in coordination with CMS, which has primary regulatory responsibility for the "Stark Law" and published a corresponding final rule in 2020). OIG and CMS coordinated to ensure has much consistency as possible for the regulated industry given the different statutory structures.

In addition to this recent rulemaking, OIG offers an advisory opinion process to the public through which stakeholders can request a legal opinion from OIG about the application of the OIG's fraud and abuse authorities to an existing or proposed business arrangement. The advisory opinion process is another vehicle for parties with innovative arrangements to seek feedback from OIG regarding the application of the Federal anti-kickback statute and potentially receive assurances that their arrangement will not be subject to OIG sanctions. More specifically, an OIG advisory opinion is legally binding on the Department and the requesting party or parties. A party that receives a favorable advisory opinion is protected from OIG administrative sanctions, so long as the arrangement at issue is conducted in accordance with the facts submitted to the OIG. In the advisory opinion process, OIG evaluates whether, in consideration of the facts and circumstances, including any potential benefits, such as innovation, and consequences to patients and Federal health care programs, an arrangement poses a sufficiently low risk of fraud and abuse such that OIG—in an exercise of its enforcement discretion—will waive the imposition of sanctions in connection with the arrangement.

Protecting Patients from Surprise Medical Bills

10 Question:

Your administration has consistently implemented a policy that is inconsistent with the No Surprises Act and may harm patients' access to care. This law was intended to protect patients from surprise medical bills and create a balanced process for health care providers and insurers

to settle payment disputes, yet your department has pursued the opposite goals.[4] Will your department commit to following Congressional intent and implement the No Surprises Act in a manner consistent with the law?

Answer:

CMS is committed to implementing the No Surprises Act (NSA) consistent with the law. Under the law, parties must exhaust a 30-business-day open negotiation period. If an agreed-upon amount for the out-of-network rate is not reached by the end of the 30-business-day open negotiation period, either party may initiate the Federal IDR Process by submitting a Notice of IDR Initiation to the other party and to the Departments. As required under the statute, when determining the total out-of-network payment rate for items and services subject to the federal IDR process, certified IDR entities are required to consider the qualifying payment amount (QPA) for the applicable year for the qualified IDR item or service; and additional information relating to the offers submitted by the parties, such as the factors described in PHS Act section 2799A-1(c)(5)(C)(ii), and which does not include information on prohibited factors described in PHS Act section 2799A-1(c)(5)(D). The QPA for a given item or service is generally the median contracted rate on January 31, 2019 for the same or similar item or service, increased for inflation.

The Biden-Harris Administration has also implemented critical provisions of the NSA that protect consumers from surprise medical bills. Key among the No Surprises Act's provisions is removing the patient from payment disputes between providers and payers in instances where surprise billing occurs and establishing how such disputes will be resolved. A recent report from the HHS Office of the Assistant Secretary for Planning and Evaluation (ASPE) reviewed key evidence on surprise billing and the need for the consumer protections in the No Surprises Act. The report showed that surprise billing is common among those with private insurance—nearly one in five patients who go to the emergency room, have an elective surgery, or give birth in a hospital receive surprise bills, with average costs ranging from $750 to $2,600 per episode.

Questions from Representative W. Gregory Steube

11 Question:

Please list all written communications between U.S. Department of Health and Human Services (HHS) staff or officials and any representative of the Cochrane Library (Cochrane) between January 1, 2023 and March 10, 2023.

12 Question:

[4] Texas Medical Association files fourth suit challenging surprise billing ban | Healthcare Dive

Please list all meetings, virtual meetings, or phone calls between HHS staff or officials and any representative of Cochrane between January 1, 2023 and March 10, 2023.

13 Question:

Please describe all efforts undertaken by HHS staff or officials to influence any analysis or reports put out by Cochrane between January 1, 2023 and March 10, 2023.

Answer 11-13:

The Cochrane Library is a collection of databases that contain evidence for the purpose of informing health care decision-making. One of the databases within the Cochrane Library is the Cochrane Database of Systematic Reviews (CDSR). A systematic review attempts to collect and analyze all evidence that answers a specific question. A search of the literature is performed, and a critical analysis of the search results is reported.

The Department of Health and Human Services (HHS) always strives to utilize the most up-to-date information to make evidence-based decisions. The Department has robust policies in place that govern HHS officials' interactions with non-governmental entities.

Questions from Representative Gwen Moore

14 Question:

Can you respond, in specific detail, to report language included in the FY2023 House Labor, Health and Human Services, Education, And Related Agencies appropriations bill in which the House Appropriations Committee sought information in your FY 2024 budget about how coverage and reimbursement policies in Medicare could be improved to help 1) reduce obesity and its comorbidities for those Americans who require clinical interventions and 2) reduce the racial/ethnic disparities in health care outcomes for beneficiaries suffering from obesity.

Answer:

As of the date of the hearing, CMS is working on a response to this reporting requirement. As detailed by the White House National Strategy of Hunger, Nutrition, and Health, the Administration set a goal of ending hunger and increasing healthy eating and physical activity by 2030 so fewer Americans experience diet-related diseases— while reducing related health disparities. Integrating nutrition and health can optimize Americans' well-being and reduce healthcare costs. Currently, only a limited number of Medicare beneficiaries are seeking nutrition and obesity counseling services. The President's FY 2024 Budget includes a proposal to expand access to additional beneficiaries with nutrition or obesity-related chronic diseases and make additional providers eligible to furnish services.

Currently, Medicare covers an array of services that aim to address obesity. For example, obesity screenings, intensive behavioral therapy for obesity for the prevention or early detection of illness or disability, bariatric surgical procedures, and diabetes screenings and participation in a diabetes prevention program are covered under Medicare in certain cases. Under current law, the

Medicare statute excludes "agents when used for anorexia, weight loss, or weight gain" from the definition of a Part D drug in section 1860D-2(e) of the Social Security Act. Despite this statutory exclusion, Part D sponsors wishing to provide coverage of prescription weight loss agents may do so as a supplemental benefit to enhanced alternative Part D plans, as they can with other prescription drugs that are excluded from the definition of a Part D drug.

Questions from A. Drew Ferguson, IV

15 Question:
The United States needs to be prepared for the next infectious disease outbreak. A critical component of being prepared is ensuring that we are actively conducting monitoring and surveillance of these pathogens at both the hospital and community setting. How will HHS ensure the correct diagnostic testing is being done to quickly identify infectious pathogens?

Answer
The use of Medicare and Medicaid waiver authority under current law has been central to CMS's emergency response activities during the pandemic; however, the Clinical Laboratory Improvement Amendments of 1988 program does not have similar statutory flexibilities. The FY 2024 President's Budget contains a proposal to enable the Secretary to temporarily modify or waive the application of specific requirements of the Clinical Laboratory Improvement Amendments of 1988 Act.

This proposal enables the Secretary to temporarily waive or modify the application of specific requirements of the Act to ensure laboratory services are accessible to the maximum extent feasible in any federally declared emergency period and area, among other things. Exempting certain requirements strengthens preparedness by allowing laboratory flexibilities for testing performed during federally declared emergencies and public health emergencies, thus allowing for expanded testing to underserved communities.

16 Question:

The COVID-19 pandemic has exhausted the misuse and overprescribing of antibiotics which has consequently increased the spread of antimicrobial resistance in the United States and around the world. Recent examples of resistance include the eye drop recall and the alarming spread of Candida auris - a deadly fungal infection - in hospitals. Unfortunately, diagnostic tests are not adequately being utilized prior to the prescription of an antibiotic. How will HHS help support efforts to decrease empiric antimicrobial therapy and encourage enhanced utilization of diagnostic tests?

Answer: Through the 2020-2025 National Action Plan for Combating Antibiotic-Resistant Bacteria (CARB), HHS is working with federal, state, and local partners to implement a suite of complementary actions to combat antibiotic resistance. The National Action Plan for CARB includes two goals particularly relevant to appropriate antibiotic use. Goal 2 supports antibiotic stewardship, which guides appropriate antibiotic use and thereby reduces the opportunities for

resistance to develop. Goal 3 supports the development and appropriate use of diagnostic tests to provide the right antibiotic at the right time in the right dose.

CDC, AHRQ, and CMS support the development, evaluation, and implementation of high-quality antibiotic stewardship programs across a variety of healthcare settings. CDC's Core Elements of Antibiotic Stewardship offer providers and facilities a set of key principles to guide efforts to improve antibiotic use and, therefore, advance patient safety and improve outcomes; this guidance has been tailored for hospitals, outpatient settings, nursing homes, and resource-limited settings. The AHRQ Safety Program for Improving Antibiotic Use was developed to help clinicians in hospitals, doctors offices, and long-term care apply the Four Moments of Antibiotic Decision Making and concepts derived from the Comprehensive Unit-based Safety Program (CUSP) to improve antibiotic stewardship by selecting the optimal antibiotic regimens, routes of administration, and durations. AHRQ and partners assessed the Safety Program's impact on patient safety culture and antibiotic prescribing practices across a total of 1,304 participating sites throughout the United States, including 476 units from 402 acute care hospitals, 439 long-term care facilities, and 389 ambulatory care centers. Results indicate that the Safety Program aided participating sites to develop and enhance their AS activities and to reduce antibiotic prescribing. At the end of each intervention, a toolkit was developed that contained materials developed for each cohort as well as additional information to allow sites that did not participate to recreate the Safety Program at their own facilities. CMS works closely with CDC in the development of its antibiotic stewardship program requirements as well as the interpretive guidelines that support these regulations. Through its published rules and guidance, CMS has strongly encouraged healthcare facilities to use CDC's Core Elements of Antibiotic Stewardship as a basis for establishing antibiotic stewardship programs in Medicare-participating facilities. In 2022, CMS published updates to interpretive guidance for hospital requirements under the Medicare and Medicaid Programs; Regulatory Provisions to Promote Program Efficiency, Transparency, and Burden Reduction Final Rule, which revised the regulatory requirements for hospitals related to infection prevention and control and antibiotic stewardship programs.

CDC, AHRQ, NIH, and FDA are working under the National Action Plan for CARB to fund research to better understand the appropriate use of diagnostic testing to address bacterial or fungal infections, and to use that evidence to promote the appropriate use of new and existing diagnostics that determine the presence, severity, or antimicrobial susceptibility or resistance of bacterial or fungal infections in human clinical care. For example, CDC used data from their Gonococcal Isolate Surveillance Project to guide updates to the 2020 gonorrhea treatment recommendations published in the Morbidity and Mortality Weekly Report. These data were used in determining recommended treatment regimens and for test-of-cure testing recommendations.

HHS agencies continue to monitor the implementation of these activities to understand their

impact and develop additional proposals to support appropriate antibiotic use, including through improved diagnostic testing. For example, the FY2024 President's Budget includes a proposal for CDC to advance laboratory science through shortening the time to develop diagnostic tests, evaluating and implementing new detection technologies, increasing the number of tests results available per day, ensuring the quality of test results, improving laboratory safety and efficiency, and developing uniform quality practice standards for CDC and other public health labs. AHRQ supports research to determine appropriate integration of approved diagnostics into clinical care. For example, AHRQ is currently funding several research projects aimed at diagnostic stewardship which helps avoid overtreatment of cultures that do not represent infection. AHRQ supports this research with funds earmarked for combating antimicrobial resistance.

17 Question:
As we know, the Public Health Emergency endeds on May 11, however many private payers have indicated through their current COVID-19 policies that they will no longer cover and reimburse COVID tests administered at point of care - meaning in pharmacies, urgent care centers and physician office labs. Point of care testing is essential for Test to Treat models and ensuring that patients receive the right treatment in a timely manner. Does HHS plan to work with private payers to ensure beneficiaries have access to COVID testing at point of care post-PHE and further integrate into routine medical care for respiratory illnesses?

Answer:
The requirement for group health plans and health insurance issuers offering group or individual health insurance coverage to cover COVID-19 tests without cost sharing, both for over-the-counter and laboratory tests, will end at the end of the Public Health Emergency (PHE). However, plans and issuers are encouraged to continue to provide this coverage, without imposing cost sharing or medical management requirements, after the PHE ends.

18 Question:
Over the past decade, well over I 00 hospitals have closed, negatively impacting patients, healthcare professionals, and communities across the United States, and this crisis has only been exacerbated over the past three years of the COVID-19 Public Health Emergency. It is no coincidence most of these hospital closures have occurred in areas with the lowest Medicare Area Wage Index rates, including in my state of Georgia. As you know, the Medicare Area Wage System adjusts how much Medicare pays hospitals in each region based on wage data self-reported by hospitals. Over the past 20 years, this CMS-created system has experienced a rapidly growing divide between hospitals in the bottom and top quartiles. In 2007, the lowest **AWI** hospitals had **AWI** of 0.77 and the highest **AWI** hospitals had AWi of 1.53. This year, the lowest AWi hospitals have AWi of 0.65, and the highest AWI hospitals have AWi greater than 1.89. Secretary Becerra, do you support policies, such as establishing a permanent national minimum **AWI,** to prevent this negative feedback cycle that is devasting low-AWI hospitals?

Answer:

To help mitigate wage index disparities between high wage and low wage hospitals, in the FY 2020 Hospital Inpatient Prospective Payment System (IPPS) final rule, CMS adopted a policy to increase the wage index values for certain hospitals with low wage index values (the low wage index hospital policy). This policy was adopted in a budget neutral manner through an adjustment applied to the standardized amounts for all hospitals. CMS also indicated its intention that this policy would be effective for at least 4 years, beginning in FY 2020, in order to allow employee compensation increases implemented by these hospitals sufficient time to be reflected in the wage index calculation. As CMS undertakes the rulemaking process for the FY 2024 IPPS rule, the agency will consider all stakeholder comments after the release of a proposed rule. Additionally, CMS is happy to work with you to provide technical assistance on any legislation you draft related to the Medicare Area Wage Index.

Questions from Representative Ron Estes

19 Question:

According to HRSA's Advisory Committee on Interdisciplinary, Community-Based Linkages, there is a growing trend toward providing care in smaller community-based clinics instead of academic hospitals. Large academic medical centers represent only five percent of all hospitals in the United States and only 20% of all hospital admissions, surgical operations and outpatient visits.

A. How does HHS define a community-based facility?

Answer:
While we do not have a standardized definition of a community-based facility, the Advisory Committee on Training in Primary Care Medicine and Dentistry (ACTPCMD) in its January 2018 report entitled "Enhancing Community-Based Clinical Training Sites: Challenges and Opportunities," defined community care sites as:

> *"Locations of outpatient clinics and facilities that include, but are not limited to: private and federally-qualified health centers; community mental health centers; rural health clinics; health centers operated by the Indian Health Service, an Indian tribe or tribal organization, or an urban Indian organization; and entities receiving funds under Title X of the Public Health Service Act"*

We acknowledge the importance of providing care in community-based settings for improving access to care for populations in need.

B. What percentage of health care is provided in community-based settings?

Answer:

HHS does not collect the data requested, however, a variety of HRSA programs provide care in community-based setting. The HRSA Health Center Program provides primary care health

services in medically underserved areas through community-based organizations. Approximately 1,400 HRSA-funded health centers operate nearly 15,000 health care sites, as well as mobile clinics and other satellite sites. Additionally, nearly 66 percent of HRSA's 22,500 workforce training sites supported medically underserved communities. These training sites include Rural Health Clinics and Federally Qualified Health Centers.

20 Question:

The traditional site of clinical training for students in many health professions has been the teaching hospital, often affiliated with a university or other academic center. As the provision of care has shifted to community-based settings, so has the training of medical students. Clinical training in these community-based settings expose medical students to the unique medical needs of rural and underserved populations and prepare them to serve those communities after graduation.

- What programs does HHS administer to support community-based medical training?

Answer: A key HHS program to support community-based medical training is the Teaching Health Center Graduate Medical Education (THCGME) Program through HRSA. Unlike most federal funding for graduate medical education which goes to hospitals, THCGME payments are made to community-based ambulatory patient care centers, that provide primary care residency training. Research demonstrates that doctors with training experience in community and underserved settings such as Federally Qualified Health Centers have an increased likelihood of practicing in community and underserved settings.[5, 6, 7] The FY 2024 budget includes $157 million in mandatory funding in 2024 and a total of $841 million over 2024-2026 for the Teaching Health Center Graduate Medical Education program to support over 1,400 resident full-time equivalent slots in community-based ambulatory settings.

Additionally, HRSA is investing in new rural residency training through the Rural Residency Planning and Development Program. This program supports rural hospitals and communities through the creation and accreditation of a new residency program, at which point applicants then secure funding through Medicare, Medicaid, and other sources to support the training of the residents in perpetuity. Eligible entities have included rural community-based ambulatory patient care centers and community-based organizations. The FY 2024 President's Budget includes $12.7 million to fund an additional 15 new awards and increased technical assistance.

Many of HHS' behavioral health workforce development programs, through HRSA, strive to expand the number of behavioral health professionals trained to work in underserved, community-based settings. This includes the Addiction Medicine Fellowship Program, the

[5] Morris CG, Johnson B, Kim S, and Chen FM. Training Family Physicians in Community Health Centers: A Health Workforce Solution. Family Medicine. 2008; 40(4):271-6.
[6] Phillips RL, Petterson S, Bazemore, A. Do residents who train in safety net settings return for practice? Academic Medicine. 2013; 88(12): 1934–1940.
[7] Goodfellow A et al. Predictors of Primary Care Physician Practice Location in Underserved Urban or Rural Areas in the United States: A Systematic Literature Review. Academic Medicine. 2016; 91(9): 1313–1321.

purpose of which is to expand the number of fellows trained as addiction medicine specialists who work in underserved, community-based settings that integrate primary care with mental health disorder and substance use disorder prevention and treatment services.

HRSA's Area Health Education Centers (AHEC) Program also develops and enhances education and training networks within communities, academic institutions, and community-based organizations. In turn, these networks broaden the distribution of the health workforce, enhance health care quality, and improve health care delivery to rural and underserved areas and populations. AHECs must establish and maintain community-based training programs with an emphasis on primary care in rural and underserved areas. The AHEC Program invests in interprofessional networks that address the social determinants of health of surrounding communities and incorporates community-based field placement programs. The AHEC Program also provides continuing education, simulation education and training activities, and information dissemination to practicing health professionals to increase their effectiveness in providing quality health care.

21 Question:

Many community clinics are set in rural or other underserved locations that need more primary care providers, and trainees exposed to underserved populations are more likely to practice in similar settings upon graduation. Research suggests that medical education in a rural location increases the number of medical graduates that will work in a rural place. However, over three-quarters of all medical schools report concerns about the number of clinical training sites and the quality and supply of preceptors, especially in primary care. To address workforce shortages and expanding needs, the provision of health care is shifting away from expensive and centralized hospitals to encompass more lower-cost, community-based settings.

A. How much money does the federal government spend on medical training in academic health centers?

Answer: HHS, via HRSA, categorizes workforce programs based on the type of training provided to the health care workforce rather than the type of facility where the training takes place. Most of our funding opportunities are open to a wide variety of program facilities, provided that the applicant can meet the training program funding requirements and goals. Some exceptions include the Children's Hospitals Graduate Medical Education (CHGME) Payment Program, which focuses on hospital-based residencies in freestanding children's teaching hospitals, and the Teaching Health Center Graduate Medical Education (THCGME) Program, which focuses on community-based ambulatory patient care centers. In FY 2022, the CHGME Payment Program was funded at $375 million and funding increased in FY 2023 to $385 million. Similarly, for the THCGME Program, the FY 2022 funding level was $119.3 million and the FY 2023 funding is the same. The FY 2024 President's Budget is seeking $157 million in mandatory funding in 2024 and $841 million over 2024-2026 for the THCGME Program to support more than 1,400 resident full-time equivalent slots in community-based ambulatory settings.

B. How much money does the federal government spend on medical training outside academic health centers?

Answer: As noted in the response to 21A, HHS, via HRSA, categorizes workforce programs based on the type of training provided to the health care workforce rather than the type of facility where the training takes place. Most of our funding opportunities are open to a wide variety of program facilities, provided that the applicant can meet the training program funding requirements and goals. In addition to academic health centers, these facilities include hospitals, Federally Qualified Health Centers (FQHCs) or Look-Alikes, physician offices, ambulatory practice sites, specialty clinics, community-based organizations, school-based clinics, Veterans Affairs Hospitals and Clinics, Rural Health Clinics, and Critical Access Hospitals.

Health care workforce needs are a pressing challenge across the country and the Budget makes a number of important investments to help grow the health care workforce. The FY 2024 Budget Request provides $2.7 billion for workforce programs in HRSA, which includes $947 million in mandatory funding to expand workforce capacity across the country.

Highlights include the following:

- $965.6 million, an increase of $547.7 million, for the National Health Service Corps in 2024 to maintain a field strength of more than 20,000 clinicians practicing in rural and underserved communities in return for scholarships and loan repayment.
- $387.4 million, an increase of $190.3 million, for Behavioral Health Workforce Development Programs to support training for approximately 18,000 providers.
- $28 million for a new program to address modernizing health workforce training to address healthcare workforce shortages.
- $91.9 million, an increase of $32.5 million to expand, enhance, and modernize nursing education programs.

Questions from Representative Ron Estes

22 Question:

Rural Kansans have seen the benefits of telehealth for the past three years. We need to ensure that the option of telehealth is not taken away. We especially need to ensure that the federal government doesn't stand in the way of employers who want to offer a benefit like telehealth to their employees. That is why I lead H.R. 824, the Telehealth Benefit Expansion for Workers Act, which would codify tri-agency policy to allow telehealth to be offered as an "excepted benefit" for employees who get telehealth as a benefit from their employer. Under this policy, contracted and part-time workers who don't otherwise qualify for full health insurance coverage from their employer can still be offered telehealth benefits. This doesn't preclude the employee from seeking health coverage elsewhere, but acts as an added benefit that expands their options for care.

- Secretary Becerra, will you work with my colleagues and I to ensure that access to telehealth is not interrupted post-pandemic, including for populations who may typically be left behind in policy, such as part-time and contracted workers?

Answer:
We would be happy to work together with your office on technical assistance for your draft legislation. In general, a plan, fund, or program established or maintained by an employer (or employee organization) that provides medical care (including telehealth or other remote cares services) to employees or their dependents is a group health plan subject to federal requirements applicable to group health plans. During the COVID-19 PHE, the Departments provided temporary relief for a group health plan (and health insurance coverage offered in connection with a group health plan) that solely provides benefits for telehealth or other remote care services from some of the group market reforms under part 7 of ERISA, title XXVII of the PHS Act, and chapter 100 of the Internal Revenue Code. This relief was limited to telehealth and other remote care service arrangements that are sponsored by a large employer (as defined under section 2791(e)(2) of the PHS Act) and that are offered only to employees (or their dependents) who are not eligible for coverage under any other group health plan offered by that employer. The Departments provided details on this flexibility in an FAQ issued on June 23, 2020 (see: https://www.dol.gov/sites/dolgov/files/ebsa/about-ebsa/our-activities/resource-center/faqs/aca-part-43.pdf

Questions from Representative Blake D. Moore

23 Question:
The Fall 2022 HHS Unified Agenda regulatory calendar currently lists April 2023 as the target date for CMS to release the TCET proposed rule (CMS-3421), which would provide transitional Medicare coverage for new medical technologies. Can you assure us that CMS will issue the TCET proposed rule by April 2023, particularly given that this rule was initially scheduled for release in 2022, and originally discussed over two years ago when the MCIT rule was repealed? Assuming that CMS publishes the TCET proposed rule in April 2023, when does the agency expect to release and implement the final rule?

Answer:
CMS remains committed to expanding access to health care coverage and services, including new, innovative treatments when they are safe and appropriate. CMS rescinded the Medicare Coverage of Innovative Technology and Definition of "Reasonable and Necessary" (MCIT/R&N) final rule because of concerns that the provisions in the final rule may not have been sufficient to protect Medicare patients. By rescinding this rule, CMS will take action to better address those safety concerns in the future.

Improving and modernizing the Medicare coverage process continues to be a priority, and we remain committed to providing stakeholders with more transparent and predictable coverage pathways. CMS is working as quickly as possible to advance multiple coverage process

improvements that provide an appropriate balance of access to new technologies with necessary patient protections. As part of this effort, CMS has conducted several listening sessions to learn about stakeholders' most pressing challenges and to receive feedback from stakeholders about which coverage process improvements would be most valuable.

CMS intends to explore coverage process improvements that will enhance access to innovative and beneficial medical devices in a way that will better suit the health care needs of people with Medicare. This will also help to establish a process in which the Medicare program covers new technologies on the basis of scientifically sound clinical evidence, with appropriate health and safety protections in place for the Medicare population.

24 Question:
A congressional directive related to Breastfeeding Services and Supplies, found on page 220 of House Report 117-403, calls upon HHS to deliver a report on how health insurers have implemented comprehensive lactation services, the standards insurers use to set reimbursement rates for breastfeeding supplies and services, and the current best practices used to provide coverage to help women breastfeed. Furthermore, HHS was also directed to respond to a request for examination of the impact of clinically recommended breastfeeding rates on associated Medicaid expenditures, urgent care costs, and direct and indirect medical costs including workplace productivity and employee retention. What is the status of your agency's response, and expected timeline and schedule of steps being taken, to provide this report?

Answer:
HHS has encountered several challenges in addressing this report request, included, but not limited to a lack of access to the requisite data. HHS is committed to working with subcommittee staff to resolve these issues.

25 Question:
CMS says they've executed similar changes to what they are proposing in the MA Advance notice for plan year 2024 before. When exactly did CMS propose changes similar to the 2024 proposals? Can you detail the process that was involved?

26 Question:
In regard to the MA Advance Notice, CMS chose to use 2020 utilization data as the basis for the proposed risk model changes. Providers and others have raised questions over how statistically accurate medical utilization rates were in 2020 given that we were in the first year of the COVID-19 pandemic and hospitals/providers were postponing elective services while seniors everywhere were avoiding care altogether. Why did CMS choose to use 2020 data as the basis for changes to the risk model, knowing utilization was historically low that year? Why didn't CMS use data from any other year when utilization was more normalized?

27 Question:
When CMS previously proposed changes to the risk model in the MA Advance Notice, the agency shared these plans months in advance of the Advance Notice. They also provided detailed analysis with stakeholders in advance. They convened stakeholders for workgroups to discuss in advance, and they asked for written comments in advance with an extended timeframe to submit comments. Did CMS share these proposed changes in advance of the Annual Notice to give stakeholders appropriate time to provide feedback? Did CMS convene a transparent stakeholder workgroup? If the answer is "no," why not? Did you not think that was important?

Answer 25-27:
In February, CMS proposed routine technical updates to improve the accuracy of MA payments in the 2024 Advance Notice. The proposed adjustments in some codes help to ensure that the risk adjustment of MA payments better reflects a beneficiary's costs of care, which means MA plans serving beneficiaries with greater health care needs would receive appropriately higher payments. The proposed model updates do not impact coverage of Medicare services or requirements for MA plans to deliver covered services; rather, these proposed changes improve the accuracy of payments made to MA plans for covering care for enrollees.

The updates CMS is proposing for the risk model in 2024 are in line with the routine updates CMS has made in the past. For example, CMS recalibrated the MA risk adjustment model with updated data years and/or made additional revisions to the risk adjustment model for payment years 2007, 2009, 2013, 2014, 2017, 2019, and 2020. Additionally, MedPAC has noted that CMS routinely makes changes to the MA risk adjustment model, including by updating data years and diagnostic codes.

Additionally, all codes in the proposed MA risk model were evaluated with clinical input, with a special focus on condition areas that underwent significant changes from ICD-9 to ICD-10. CMS received clinical input from a panel of physicians in various specialties and with relevant expertise, including internal medicine physicians and clinicians with specific expertise in coding and disease burden.

As required by law, CMS sought public comment on the CY 2024 Advance Notice and will take this feedback into account when finalizing the Rate Announcement. CMS received a large number of comments in response to the CY 2024 Advance Notice and appreciates the commenters thoughts and input regarding payments under the MA program.

28 Question:
In rural communities across America, hospitals and health systems are cornerstones for the health and well-being of the patients and communities they serve. However, according to the American Hospital Association, there were 136 rural hospital closures between 2010-2021, with a record 19 closures in 2020 alone. These closures — whether due to declining financial performance, geographic isolation or low patient volume — have an outsized impact on the health and economic well-being of rural communities. Additionally, rural hospitals are disproportionately impacted by issues such as workforce

shortages, regulatory barriers, and increased expenses for labor, prescription drugs, supplies and equipment. These challenges create difficulties in maintaining access to care for people in rural communities. Secretary Becerra, what steps can HHS take to ensure that rural hospitals are able to stay open and continue providing health care services for people in their communities?

Answer:
CMS recognizes that more than 61 million Americans live in rural areas including rural, Tribal, frontier, and geographically isolated territories. These Americans face several unique challenges in health care that can differ dramatically among the different kinds of rural areas across the country. To ensure that the Agency's approach is responsive to the unique needs of these communities, CMS engaged with individuals, organizations, and government entities across the nation who have experience receiving health care or supporting health care service delivery in these communities to help shape the CMS Framework for Advancing Health Care in Rural, Tribal, and Geographically Isolated Communities. CMS is dedicated to ensuring that its policies, programs, initiatives, outreach, and local engagement are responsive to the needs of rural, tribal, and geographically isolated communities.

Questions from Representative Michelle Steel

Telehealth

29 Question:
Congress recently extended for two-years numerous flexibilities that were put in place during the COVID-19 public health emergency. This includes Medicare telehealth flexibilities and hospital-at-home waivers. Can you commit to working with the Ways and Means majority to develop solutions that will protect access to care and needed services, like these, beyond next year's deadline?

30 Question:
As you know, Section 3701 of the CARES Act created a temporary safe harbor that allowed high-deductible health plans (HDHPs) to cover telehealth and remote care services prior to a patient reaching their deductible through the end of 2021. With the enactment of the Consolidated Appropriations Act, 2022 in March, this safe harbor was reinstated through the end of the 2022.

We saw the positive impact of the CARES Act safe harbor which allowed 32 million Americans in the employer market with HSA-eligible HDHPs to receive telehealth benefits from their employer or health plan pre-deductible. This allowed patients to leverage virtual care to access a range of critical health care services during the pandemic. According to a survey by the Employee Benefit Research Institute (EBRI), about 96 percent of employers adopted pre-deductible coverage for telehealth services as a result of this policy.

As we are all considering which temporary pandemic health policies to extend, it is important to note that the HDHP telehealth safe harbor would allow half of American workers to continue accessing a range of clinically appropriate virtual services – for a range of common conditions – without the burden of first meeting a deductible. I joined last year with Representative Susie Lee

(D-NV) to introduce the Telehealth Expansion Act, which would make the HDHP telehealth safe harbor permanent. I look forward to working with my colleagues on this committee to support American workers and ensure this key policy continues beyond 2022.

Secretary Becerra, do you agree that there is value in expanding access to telehealth regardless of your health plan design? This policy has shown increased value to patients and providers. How is the Department approaching and analyzing telehealth policies like these to extend beyond the current public health emergency?

Answer 29&30:

In response to the COVID-19 public health emergency, which is set to expire in May 2023, flexibilities for Medicare telehealth services were issued through legislative and regulatory authorities to increase access to care for patients and providers. The Consolidated Appropriations Act, 2023 recently extended many of these flexibilities through December 31, 2024. Extended telehealth flexibilities include removing geographic and site of service originating site restrictions so that Medicare patients can continue to use telehealth services from their home and allowing audio-only telehealth services. Additionally, the expanded list of providers eligible to deliver telehealth services is also extended so Medicare beneficiaries can continue to receive telehealth services furnished by physical therapists, occupational therapists, speech language pathologists, and audiologists, as well as receive telehealth services from Rural Health Clinics and Federally Qualified Health Centers through December 31, 2024. If you are interested in drafting legislation to make these flexibilities permanent, CMS would be happy to provide technical assistance.

Additionally, recent legislative and regulatory changes made several telehealth flexibilities permanent. Federally Qualified Health Centers and Rural Health Clinics can furnish certain mental health and substance use disorder services via telecommunications technology. Medicare patients can continue to receive these telehealth services in their home as geographic restrictions on the originating site are eliminated for these telehealth services. Certain mental and substance use disorder telehealth services can be delivered using audio-only communication platforms, and rural emergency hospitals can serve as an originating site for telehealth services.

For private insurance coverage, as was the case during the PHE, coverage for telehealth and other remote care services will vary by private insurance plan after the end of the PHE. When covered, private insurance may impose cost-sharing, prior authorization, or other forms of medical management on telehealth and other remote care services. Section 3701 of the CARES Act amended the laws applicable to high deductible health plans (HDHPs) and Health Savings Accounts (HSAs) to provide flexibility with respect to telehealth and other remote care services. Specifically, section 3701 of the CARES Act amended section 223(c) of the Internal Revenue Code (Code) to provide a temporary safe harbor for providing coverage for telehealth and other remote care services before the deductible has been met. Section 4151 of the Consolidated Appropriations Act of 2023 extended this flexibility through 2024. For further questions concerning section 223 of the Code, we encourage you to reach out to the Department of the Treasury.

Traditional Coverage of Emerging Technologies

31 Question:

The Fall 2022 HHS Unified Agenda regulatory calendar currently lists April 2023 as the target date for CMS to release the TCET proposed rule (CMS-3421), which would provide transitional Medicare coverage for new medical technologies. Can you assure us that CMS will issue the TCET proposed rule by April 2023, particularly given that this rule was initially scheduled for release in 2022, and originally discussed over two years ago when the MCIT rule was repealed? Assuming that CMS publishes the TCET proposed rule in April 2023, when does the agency expect to release and implement the final rule?

32 Question:

Can I get your commitment to dedicate the right resources to ensure the Agency puts forward a proposed rule – scheduled for April - that is a meaningful, separate pathway for new devices that Congress, patients and those developing innovative technology have urged the Administration to pursue?

33 Question:

CMS indicated in the MCIT repeal rule that "breakthrough" designation from the Food and Drug Administration (FDA) alone would not necessarily result in a technology having eligibility to undergo the TCET process. Please describe the technologies CMS is considering could be potentially eligible for coverage under the TCET.

34 Question:

How complex would eligible devices need to be? Would follow-on devices potentially be eligible for Medicare coverage under the TCET?

35 Question:

Does CMS anticipate that provisions in the TCET rule will extend beyond refining the existing CED study criteria and process or does CMS envision TCET as limited to those new devices that CMS deems as requiring additional data collection to secure Medicare coverage through a revised CED process with updated study criteria?

36 Question:

Please explain how TCET as envisioned in the principles outlined in the HHS Unified Agenda would offer a meaningful coverage option for new devices with sound clinical evidence and safety data compared to the coverage processes that already exist today (i.e., NCDs and LCDs).

37 Question:

Without a specific option in TCET that guarantees seamless and timely coverage without the need for additional data collection, please explain how CMS is achieving its policy goals of providing "transitional coverage" and "promoting access to emerging medical technologies" for new and innovative devices that do not require additional evidence collection.

38 Question:

Does TCET as envisioned address how patients seeking to access new devices with sound clinical evidence and safety data will not continue to face significant delays in coverage and access due to existing the LCD and NCD approval backlogs?

39 Question:
Does CMS anticipate accepting most, or all, of the recommendations on recommended revisions to CED study criteria and process made by MEDCAC as part of the TCET proposed rule? Please explain why or why not.

40 Question:
Is CMS considering defining a specific threshold(s) in the rule that would necessitate additional data collection, either as part of CED study or otherwise, as a condition Medicare coverage under the TCET?

41 Question:
Does CMS agree with MEDCAC that data collection should be time-limited or could data collection occur in perpetuity under the CED studies? Please explain.

42 Question:
How will CMS ensure that the data collected in CED studies are fit-for-purpose and do not exceed what is necessary to obtain the information necessary for permanent Medicare coverage?

43 Question:
Are there any cases as part of the TCET pathway where additional evidence collection would never be required? If yes, please describe such cases. How will CMS minimize burden on Medicare beneficiaries and manufacturers in any data collection process required under the TCET? If no, please explain why CMS does not anticipate including an option for TCET coverage without the requirement for additional data collection.

44 Question:
Does CMS agree with the MEDCAC panel that there should be a clear process for timely completion of CED studies, inclusive of set milestones with flexibility to adjust as necessary if new information becomes available? Please explain why or why not.

45 Question:
Does CMS agree with the MEDCAC panel that CED studies and milestones should be tailored to individual treatments under evaluation in CED studies? Please explain why or why not.

46 Question:
As part of the process for timely completion of CED studies, does CMS intend to include a milestone for specifically evaluating whether or not the study has demonstrated the item or service is reasonable and necessary for Medicare coverage? Please explain why or why not.

47 Question:

Please describe the role that CMS envisions for manufacturers in mutually agreeing to the establishment of a set process for timely completion of CED studies. For example, will manufacturers have a role in setting the study milestones, clinical endpoints for evaluation, and evidentiary thresholds to meet? Please explain why or why not and provide examples of where CMS envisions manufacturer input will be considered as part of the CED process.

48 Question:
Please describe the process that CMS envisions for establishing permanent Medicare coverage for those new medical items and services that undergo CED studies, which successfully demonstrate they are reasonable and necessary for Medicare beneficiaries. How will CMS ensure a seamless transition to permanent coverage in these cases? What metrics will CMS use to evaluate and assess whether CMS has appropriately and seamlessly transitioned items and services in CED studies to permanent Medicare coverage?

49 Question:
Please describe the process that CMS envisions for establishing permanent Medicare coverage for those new medical items and services that do not have to undergo CED studies as part of TCET, but rather receive expedited coverage under the TCET pathway without additional data collection. How will CMS ensure a seamless transition to permanent coverage in these cases? What metrics will CMS use to evaluate and assess whether CMS has appropriately and seamlessly transitioned items and services that received coverage under TCET without CED studies to permanent Medicare coverage?

50 Question:
CMS indicated in the MCIT repeal rule that "breakthrough" designation from the Food and Drug Administration (FDA) alone would not necessarily result in a technology having eligibility to undergo the TCET process. Please describe the technologies CMS is considering could be potentially eligible for coverage under the TCET. How complex would eligible devices need to be? Would follow-on devices potentially be eligible for Medicare coverage under the TCET? Would new indications of existing technologies be eligible for coverage under the TCET?

51 Question:
Would a device approved by the FDA supported by a pivotal clinical trial including a minimum number or percentage of Medicare eligible patients be sufficient to demonstrate clinical benefit in the Medicare population for purposes of Medicare coverage?

52 Question:
Please describe the approaches CMS is considering to ensure that technologies covered under the TCET meet the policy goal of demonstrating clinical benefit in the Medicare patient population or subpopulation of interest.

53 Question:
Please describe the range of issues and topics that CMS believes would be appropriate and reasonable to cover as part of the "early evidence review." What does CMS view as the role of the manufacturer in the "early evidence review" process?

54 Question:
Please describe the range of issues and topics that CMS believes would be reasonable and appropriate to cover in the premarket meetings, as well as the goals CMS expects to achieve as a result of these meetings.

55 Question:
Please describe when CMS believes it would be appropriate to hold these premarket meetings. For example, could premarket meetings between CMS and device manufacturers occur during the period of design of pivotal clinical trials used to support FDA approval? Alternatively, does CMS envision these premarket meetings occurring later after initiation of pivotal clinical trials? Or could such premarket meetings occur at each or either of those stages of clinical development?

56 Question:
What metrics would be helpful in determining whether more active premarket engagement between CMS and manufacturers is successfully facilitating easy and timely Medicare beneficiary access to innovative medical technology once it becomes available?

57 Question:
Does CMS believe it would be necessary and appropriate for device manufacturers to separately report to FDA and CMS post-market safety data, or report any data to CMS beyond what is currently reported to FDA?

58 Question:
Is CMS developing a formal process for withdrawal of Medicare coverage for devices initially covered under the TCET that subsequently produce patient safety concerns?

59 Question:
CMS broadly is taking actions to advance health equity across the Medicare population. What types of health equity requirements, if any, is CMS considering for the TCET? What metrics would be helpful for assessing whether the TCET is reducing disparities and advancing health equity across the Medicare population?

60 Question:
Is CMS still intending to revise and expedite the NCD process as part of the TCET rule and, if so, please describe the policy approaches CMS is considering in this area.

61 Question:
What metrics would be useful in determining whether the revised NCD processes are having their intended impact?

62 Question:
Is CMS considering any changes to the LCD process as a part of the TCET rulemaking? If yes, what changes is the agency considering? Please describe metrics CMS could employ to evaluate whether any revisions to the LCD process are leading to their intended outcomes.

Answer 31-62:
CMS remains committed to expanding access to health care coverage and services, including new, innovative treatments when they are safe and appropriate. CMS rescinded the Medicare Coverage of Innovative Technology and Definition of "Reasonable and Necessary" (MCIT/R&N) final rule because of concerns that the provisions in the final rule may not have been sufficient to protect Medicare patients. By rescinding this rule, CMS will take action to better address those safety concerns in the future.

Improving and modernizing the Medicare coverage process continues to be a priority, and we remain committed to providing stakeholders with more transparent and predictable coverage pathways. CMS is working as quickly as possible to advance multiple coverage process improvements that provide an appropriate balance of access to new technologies with necessary patient protections. As part of this effort, CMS has conducted several listening sessions to learn about stakeholders' most pressing challenges and to receive feedback from stakeholders about which coverage process improvements would be most valuable.

CMS intends to explore coverage process improvements that will enhance access to innovative and beneficial medical devices in a way that will better suit the health care needs of people with Medicare. This will also help to establish a process in which the Medicare program covers new technologies on the basis of scientifically sound clinical evidence, with appropriate health and safety protections in place for the Medicare population.

In an October 2022 article published in *JAMA*, CMS outlined four principles that will guide its framework on new and emerging technologies.

1. Manufacturers may enter the process on a voluntary basis. This process will be limited to medical devices that fall within the Medicare statute and are relevant to the Medicare population.
2. The CMS may conduct an early evidence review (before the device secures FDA marketing authorization) and discuss with the manufacturer the best Medicare coverage pathway, depending on the strength of the evidence collected.
3. At the manufacturer's request, CMS may initiate the coverage review process before FDA market authorization, which could require developing an additional evidence development plan and confirming that there are appropriate safeguards and protections for Medicare beneficiaries.
4. If CMS determines that further evidence development is the best coverage pathway, the agency would explore how to reduce the burden on manufacturers, clinicians, and patients while maintaining rigorous evidence requirements.

CMS believes that these principles would strike a balance between promoting access to emerging medical technologies and maintaining the protections and rigorous evidence standards that are essential to the welfare of Medicare beneficiaries. CMS is also considering whether it should establish a clear timeline for decisions requiring coverage with evidence development. In promoting and then reviewing the evidence needed to make a determination that a medical device is reasonable and necessary, CMS will consider whether a device is associated with an overall improvement in health (benefits exceed any harms) in the Medicare population or a

subset of individuals. The agency will also consider whether the evidence generated will help guide patients and clinicians in deciding whether to use new or emerging technologies.

63 Question:
Are there currently duplicative or burdensome requirements from FDA approval to CMS coverage that we should look to streamline or coordinate in order to expedite investment in and access to innovative devices? Do you believe that earlier interactions between the FDA and CMS could ensure more certainty for innovators and expedite access for Medicare beneficiaries to life-saving medical devices upon FDA approval or clearance? Does any pathway for such communication exist today between the FDA and CMS or amongst the device manufacturer, CMS and FDA? Please explain what the Department is considering to improve communication and interactions amongst CMS, FDA, and device manufacturers.

64 Question:
Do you believe that earlier interactions between the FDA and CMS could foster more seamless and equitable Medicare beneficiary access to life-saving medical devices upon FDA approval or clearance? If so, how can FDA and CMS work together more effectively and efficiently in the pre-market and post-market settings (as necessary) to best ensure Medicare coverage for innovative medical technology upon market entry? What topics should be covered in these early interactions between FDA and CMS? Should a formal process be established for FDA and CMS to routinely discuss with manufacturers the clinical data and other information necessary to support simultaneous FDA approval or clearance and Medicare coverage for a new medical device? What metrics would be helpful in determining whether more active engagement between CMS and FDA is successfully facilitating easy and timely Medicare beneficiary access to innovative medical technology once it becomes available?

65 Question:
How can FDA and CMS work together better and earlier, to ensure that Medicare beneficiaries do not face additional barriers to coverage once FDA approves or clears an innovative and life-saving medical device? For example, would it be helpful for CMS to communicate with FDA at an early development stage important issues that should be addressed in clinical trials to help facilitate timely Medicare coverage upon market entry? What steps can FDA and CMS put in place to obviate the need for post-market data collection by CMS so that Medicare beneficiaries do not experience further burden in accessing the medical devices they need to improve health outcomes and extend survival? What measures would effectively assess whether FDA and CMS are working effectively to minimize burden for Medicare beneficiaries in accessing life-saving medical technology?

Answer 63-65:
Ensuring the availability of innovative interventions for people is a shared priority for both CMS and FDA. HHS recognizes the important and related – but different – roles of these respective agencies and know that CMS and FDA decisions have an outsized impact on the U.S. health care system, as well as implications for the rest of the world.

Underpinning both of these agencies' work is the unwavering commitment to use reliable data to ensure that effective treatments are made available to patients. The FDA's decision to approve a new medical product is based on a careful evaluation of the available data and a determination that the medical product is safe and effective for its intended use. In some instances, the FDA has the authority to require additional studies after approval to provide additional information regarding the anticipated clinical benefit for the medical product. CMS can conduct its own independent review to determine whether an item or service should be covered nationally by Medicare, including examining whether it is reasonable and necessary for use in the Medicare population. The work of both of these agencies is critical to ensure that medical products are available to people across the country.

One example of CMS and FDA collaboration is the parallel review program, in which both agencies collaboratively engage with manufacturers regarding evidence development for FDA premarket review decisions and the reasonable and necessary coverage criteria of CMS. Early feedback can assist manufacturers in designing pivotal trials and collect evidence that can answer evidentiary questions from both agencies. If there are insufficient data that are relevant to the statutory requirements of CMS, it is difficult for the agency to make a favorable evidence-based decision regarding whether a drug, device, or other medical product meets the legal criteria to be reasonable and necessary. CMS is also considering releasing a series of "Medicare Evidence Development and Coverage Advisories" that would provide more guidance to manufacturers about the clinical outcomes the agency will be looking for when reviewing studies, as well as the clinical differences that will be considered meaningful.

HHS recognizes the impact these decisions have on people with serious and life-threatening conditions and their loved ones. We share a common goal of wanting to advance the development and availability of innovative medical products. CMS and FDA remain committed to using their distinct set of authorities to ensure the continued availability of medical products that meet their respective standards to care for the people they serve.

Medicare Home Health

66 Question:

Secretary Becerra, you have testified that this Administration is committed to home-based care and that President Biden is not proposing to cut Medicare. However, the Medicare home health program is experiencing steep payment reductions. These include a nearly $5 billion reduction resulting from CMS implementation of a 2018 payment reform law that many believe is flawed. In addition, home health has received a smaller market basket, inflationary update in recent years than warranted. These reductions make it more challenging for over 130,000 beneficiaries in my district to access high-quality home health services. My question is focused on the market basket component. Would the Administration consider a one-time adjustment to the home health market basket update for 2021 and 2022 to correct for forecasting of costs that ended up being inaccurate?

Answer:

CMS updates the rates it pays to home health agencies (HHA) for providing home health services annually as the statute requires. The Calendar Year (CY) 2023 final rule finalized routine, statutorily required, updates to the home health payment rates for CY 2023. CMS estimates that Medicare payments to HHAs in CY 2023 will increase in the aggregate by 0.7%, or $125 million, compared to CY 2022, based on the finalized policies.

The Home Health (HH) PPS market basket updates are required by law to be set prospectively, which means that the update relies on a mix of both historical data for part of the period for which the update is calculated and forecasted data for the remainder. There is currently no mechanism to adjust for market basket forecast error in the HH PPS payment update. Additionally, note that the final CY 2023 home health market basket growth rate of 4.1 percent would be the highest market basket increase we have implemented in a final rule since the beginning of the HH PPS.

Durable Medical Equipment

67 Question:

What are the Administration's plans for the next round of the Medicare Durable Medical Equipment Competitive Bidding Program? The most recent round (Round 2021) was the first time CMS implemented safeguards to improve the bidding process. However, the Agency did not move forward with implementation for 13 product categories because the bidding rates did not achieve the expected savings. What will happen with all 16 product categories after the end of Round 2021?

68 Question:

Will the Administration consider rate relief for Competitive Bidding Program items in non-rural and Competitive Bidding Areas (CBA)? During the Public Health Emergency, there has been 50/50 blended rates in rural areas and 75/25 in non-rural areas. CMS has made the 50/50 blended rates permanent, while 75/25 rates are slated to end at the end of this year. All the while, former CBAs have not seen any relief, with rates still based on bid submissions from 2015 as CMS largely declined to implement the most recent, 2021 round.

Answer 67&68:

As you note, the CARES Act increased the payment rates to a 75/25 blend for durable medical equipment (DME) and enteral nutrients, supplies, and equipment furnished in areas other than rural and non-contiguous non-CBAs through the duration of the COVID-19 Public Health Emergency (PHE) period. In the May 2020 COVID-19 Interim Final Rule with Comment Period (IFC), CMS stated its belief that the purpose of this provision of the CARES Act was to aid suppliers in furnishing items under very challenging situations during the PHE. Furthermore, CMS has long maintained that the fully adjusted rates in non-rural non-CBAs are sufficient. CMS will continue to monitor payments in all non-CBAs, as well as health outcomes, assignment rates, and other information.

Inflation Reduction Act

69 Question:

We continue to see new information on how the IRA could result in limiting access to innovative medicine out of reach for seniors. What actions is CMS taking to ensure thorough and proper oversight of formularies?

Answer:
CMS supports continued drug innovation and believes it is vitally important that beneficiaries have access to innovative new therapies. We are striving to implement the Medicare Drug Price Negotiation Program in a thoughtful way that both improves drug affordability and accessibility for people with Medicare and supports innovation.

The Negotiation Program will make drugs more affordable for people with Medicare. We're also expecting negotiation to encourage drug makers to create business models to stay competitive, fostering the development of new treatments and delivery methods. With all of the changes in the new drug law, drugs will be more affordable – and both patients and drug companies will reap those benefits. More affordable drugs allow more patients to purchase those drugs and adhere to their medications.

The law requires Medicare Part D plans to include each covered Part D drug that is a selected drug for the Negotiation Program on Part D formularies during Contract Year (CY) 2026 and all subsequent years for which the maximum fair price that is negotiated for the selected drug is in effect during the price applicability period.

Post-Traumatic Stress Disorder
70 Question:
Data shows that people with economic insecurity are at increased risk for developing post-traumatic stress disorder (PTSD), a mental disorder that can result in serious functional impairment that substantially interferes with - or limits - one or more major life activities. Individuals in high-poverty areas experience worse mental health outcomes than those in low-poverty areas, and studies indicate that socio-demographic variables - including race, gender, income level, amongst other factors - can impact medical care delivery, further exacerbating disparities. What is HHS doing to increase rates of equitable screening of and treatment for individuals experiencing PTSD?

Answer:
CMS strives to improve access to high quality, affordable, person-centered behavioral health care, and ensure parity in access, coverage, and quality for physical and mental health services, including care enabled through telehealth and technology. The agency seeks to incorporate health equity into new care and payment models and optimize whole-person care for beneficiaries with and at risk of behavioral health conditions.

CMS launched community-based mobile crisis intervention services for people with Medicaid, helping states integrate these services into their programs - a critical component in establishing a sustainable and public health-focused support network. In 2021, CMS awarded $15 million in planning grants to 20 states to support development of these crisis intervention services.

Medicare covers many behavioral health services, including depression screening, psychological tests, alcohol screening and counseling, psychotherapy for crisis services, and treatment for substance use disorders and co-occurring mental health disorders. Medicare also covers the Annual Wellness Visit with no deductible that includes establishing, screening, and monitoring a beneficiary's risk factors for mental health and substance use disorder conditions, allowing the provider to make referrals to specialists as needed. CMS will also implement the provisions of the Consolidated Appropriations Act, 2023 (CAA, 2023) in its Calendar Year (CY) 2024 rules which expanded behavioral health services under Medicare. For example, the CAA, 2023 established new Medicare benefit categories for marriage and family therapist (MFT) services, mental health counselor (MHCs) services, and intensive outpatient services when furnished by hospital outpatient departments, community mental health centers, RHCs, and FQHCs.

Answer:
Many of SAMHSA's programs identify and serve individuals with PTSD. For example, Community Mental Health Services Block Grant (MHBG) program funds are available to states to provide comprehensive, community-based mental health services to adults with serious mental illnesses (SMI) and to children with serious emotional disturbances (SED). States may use MHBG funds for mental health services to assist individuals with SMI or SED with PTSD. Additionally, the Certified Community Behavioral Health Clinic (CCBHC) program, which is administered in partnership with the CMS and ASPE, is designed to ensure equitable access to comprehensive, coordinated behavioral health care. All CCBHCs are required to train staff who come into contact with the people they serve in trauma-informed care and CCBHCs are required to conduct an inclusive assessment of patients which includes trauma-history as a part of the evaluation and diagnosis process.

Another example of HHS efforts to address children's traumatic stress includes SAMHSA's National Child Traumatic Stress Network (NCTSN). NCTSN creates access to services that address child trauma and plays an important role in improving practice related to child trauma, including addressing PTSD. Since its creation, NCTSN has grown from a collaborative network of 17 funded sites to 184 funded sites, and over 200 previously funded affiliate centers located nationwide in universities, hospitals, and a range of diverse community-based organizations with thousands of national and local partners and has provided training on best practices and other aspects of child trauma to over 2 million participants throughout the country.

SAMHSA also funds several Centers of Excellence (COEs) in Behavioral Health for the following populations: African Americans; Asian American, Native Hawaiian and Pacific Islanders (AANHPI); Lesbian, Gay, Bisexual, Transgender, Queer, Intersex +; and a new Hispanic/Latino COE (funding announcement was recently posted, closes on May 23, 2023). These COEs provide training and technical assistance for behavioral health providers serving these populations, which can include screening and treatment for PTSD.

Medicare Advantage
71 Question:
Risk Model: CMS is considering policy to eliminate over 2,200 codes, many of which are used to diagnose and treat chronic diseases commonly experienced by low-income seniors and people

with disabilities, including depression, vascular conditions, and heart disease. The American Medical Association (AMA) and over two dozen patient disease groups have raised concerns about the elimination of these codes and asked for a delay in the implementation of this new model.

Have you conducted an analysis on how this proposal would directly impact providers and beneficiaries in each state and territory? Have you analyzed how this proposal will impact the national healthcare workforce and physician shortage in each state and territory? How it would impact providers in value-based care arrangements or in full risk or capitated care contracts with MA plans? Can you share this analysis? In California there are a significant number of physicians in these type of arrangements and will have a real impact on patient care and access.

72 Question:
Physician Advisory Board: CMS released an FAQ stating the agency did engage the clinical community for the significant proposed coding changes from ICD-9 to ICD-10 in the MA Advance Notice. Did this clinical community you speak of specifically advise you to remove over 2,000 diagnosis codes for things like depression and cardiovascular disease?
Who were these clinicians? Does it account for physicians who primarily treat low-income/high risk patients? Does it include physicians who primarily participate in value-based agreements? Is there board diversity? Help me understand why you are saying you engaged with clinicians, but the AMA and other provider groups are saying what you have put forward could harm seniors access to supplemental benefits [such as acupuncture, which is important to my constituents], and access to innovative care?

73 Question:
CMS released an FAQ stating the agency did engage the clinical community for the significant proposed coding changes from ICD-9 to ICD-10 in the MA Advance Notice. Did this clinical community you speak of specifically advise you to remove over 2,000 diagnosis codes for things like depression and cardiovascular disease? Who were these clinicians? Does it account for physicians who primarily treat low-income/high risk patients? Does it include physicians who primarily participate in value-based agreements? Is there board diversity? Help me understand why you are saying you engaged with clinicians, but the AMA and other provider groups are saying what you have put forward could harm seniors access to supplemental benefits [such as acupuncture, which is important to my constituents], and access to innovative care?

74 Question:
CMS is considering policy to eliminate over 2,200 codes, many of which are used to diagnose and treat chronic diseases commonly experienced by low-income seniors and people with disabilities, including depression, vascular conditions, and heart disease. The American Medical Association (AMA) and over two dozen patient disease groups have raised concerns about the elimination of these codes and asked for a delay in the implementation of this new model. Have you conducted an analysis on how this proposal would directly impact providers and beneficiaries in each state and territory? Have you analyzed how this proposal will impact the national healthcare workforce and physician shortage in each state and territory? How it would impact providers in value-based care arrangements or in full risk or capitated care contracts with MA plans? Can you share this analysis?

Answer 71-74:
In February, CMS proposed routine technical updates to improve the accuracy of MA payments in the 2024 Advance Notice. The proposed updates help to ensure that the risk adjustment of MA payments better reflects a beneficiary's costs of care, which means MA plans serving beneficiaries with greater health care needs would receive appropriately higher payments. The proposed model updates do not impact coverage of Medicare services or requirements for MA plans to deliver covered services; rather, these proposed changes improve the accuracy of payments made to MA plans for covering care for enrollees.

Moving to the ICD-10 diagnosis coding system in the MA risk adjustment model would align the MA risk model with the coding classification system used throughout the U.S. health care system, which has been using ICD-10 instead of the outdated ICD-9 coding system since 2015. Additionally, the use of ICD-10 provides CMS with a greater level of precision and granularity than exists with ICD-9. This change would help ensure that MA plan payments more accurately reflect the costs of beneficiaries' care so that plans serving beneficiaries with greater health care needs receive appropriately higher payments.

All codes in the proposed MA risk model were evaluated with clinical input, with a special focus on condition areas that underwent significant changes from ICD-9 to ICD-10. CMS received clinical input from a panel of physicians in various specialties and with relevant expertise, including internal medicine physicians and clinicians with specific expertise in coding and disease burden.

Medicare, and thus MA plans, will continue to pay for the services beneficiaries need to treat depression. The proposed risk adjustment model does not impact coverage of Medicare services or requirements for MA plans to deliver covered services. Under the 2024 Advance Notice, MA payments would more accurately reflect the costs of care associated with this condition. While some depression codes were removed from the model because they did not predict cost well or were duplicative or were related to diagnoses in remissions, more than 350 depression codes remain in the risk adjustment model.

As required by law, CMS sought public comment on the CY 2024 Advance Notice and will take this feedback into account when finalizing the Rate Announcement. CMS received a large number of comments in response to the CY 2024 Advance Notice and appreciates the commenters thoughts and input regarding payments under the MA program.

Surprise Billing
75 Question:
As you know, the No Surprises Act protects patients from surprise medical bills and was enacted in December 2020 after a bipartisan, bicameral agreement among several Congressional Committees, the Congressional Leadership, and other interested Members of Congress. That legislation reflected a hard-earned compromise that the arbitration process considers a number of important factors. As a Federal court recently ruled, you and your Department ignored the plain language of the No Surprises Act and clear Congressional intent in issuing regulations that

directed arbitrators to focus on only one of those factors – median in-network rate. Why did you do that, and more importantly, what is your plan to fix it in a way that gives equal weight to all factors in the legislation?

Answer:
CMS is committed to implementing the No Surprises Act (NSA) consistent with the law. Under the law, parties must exhaust a 30-business-day open negotiation period. If an agreed-upon amount for the out-of-network rate is not reached by the end of the 30-business-day open negotiation period, either party may initiate the Federal IDR Process by submitting a Notice of IDR Initiation to the other party and to the Departments. As required under the statute, when determining the total out-of-network payment rate for items and services subject to the federal IDR process, certified IDR entities are required to consider the qualifying payment amount (QPA) for the applicable year for the qualified IDR item or service; and additional information relating to the offers submitted by the parties, such as the factors described in PHS Act section 2799A-1(c)(5)(C)(ii), and which does not include information on prohibited factors described in PHS Act section 2799A-1(c)(5)(D). The QPA for a given item or service is generally the median contracted rate on January 31, 2019 for the same or similar item or service, increased for inflation.

The Departments of the Treasury, Labor, and Health and Human Services (collectively, the Departments) and the Office of Personnel Management (OPM) have issued several rules implementing various provisions of the NSA, including the Federal IDR Process for payment determinations. Additionally, the Departments have issued numerous guidance documents to assist disputing parties and certified IDR entities. Many of these rules and guidance documents can be found at: https://www.cms.gov/nosurprises/policies-and-resources/overview-of-rules-fact-sheets.

Questions from Representative Brian Higgins

76 Question:

By our best estimate, there are currently over 31,000 Americans living with amyotrophic lateral sclerosis (ALS). Approximately 5,000 Americans are newly diagnosed with the disease every year. In 2008, Congress created the National ALS Registry within the Centers for Disease Control and Prevention. Although the registry is a valuable resource, many ALS patients and advocates believe the registry could be further refined and strengthened to better serve the ALS community.

When the registry was created, CDC expected there to be a two- to three-year time lag before the data taken in by the registry could be processed to produce public prevalence reports. But the most recent data we have seen today is from 2017, almost a six-year time lag. The mean survival

time for someone with ALS after diagnosis is two to five years, making it especially important to process and publish data from the registry in as timely a manner as possible.

- Can you help us understand what is causing this significant delay in releasing registry data, and how the registry is working to reduce this time lag?

Answer:

Because ALS, like most noncommunicable diseases, is not a notifiable disease in the U.S., ATSDR uses a novel approach to identify newly diagnosed and existing cases of the disease. The first approach uses large administrative federal databases (i.e., Centers for Medicare and Medicaid Services (CMS) and the Department of Veterans Affairs (VA) to identify approximately 80% of the national cases. There is typically a multi-year lag in the data from these federal agencies before they are released to ATSDR for processing and analysis. After the Registry receives the CMS and VA data, epidemiologists and statisticians clean and process the data through an algorithm to identify cases. The second approach uses an online web portal people can use to self-enroll in the Registry to identify the remaining 20% cases not contained in the administrative databases. The administrative data are then merged with Registry self-enrollment case data to form a final dataset. The final dataset is sent to the National Death Index to determine who has passed away so they can be removed as a case. From the time the Registry receives data from CMS and VA, it typically takes up to 24 months to remove duplicate information from the datasets and finalize the number of ALS cases.

In summary, the CDC/ATSDR is largely reliant upon other federal agencies to provide source data to the National Registry. As such, the Registry moves as quickly as possible to make annual reports available once the data are compiled. Regardless, ATSDR is taking proactive steps to get additional patient datasets from ALS support organizations such as the ALS Association and the Muscular Dystrophy Association. Such datasets will help complement the data we are already receiving and will make the data timelier.

77 Question:

Disease registry data is useful not only in the development of new treatments, but also in the development of quality measures to inform care and monitor treatment outcomes.

- To what extent has the National ALS Registry been used in developing quality measures for ALS patients?

One of the main purposes of the Registry is to better understand the epidemiology (e.g., prevalence, incidence, mortality) of ALS in the U.S. These epidemiological estimates are important for industry and researchers to better understand how ALS impacts patients, caregivers, and the community at large. These measures can also be used for disease trends as well as determining the public health burden. The Registry also collects longitudinal Amyotrophic Lateral Sclerosis Functional Rating Scale (ALSFRS) data that shows disease

progression for patients, along with data on patient use of medical devices, medications, and insurance (e.g., tracheotomies, riluzole, Medicare/PPOs, respectively). Such data can be used by external researchers for developing quality measures to help ALS patients.

- How does the delay in releasing registry data impact the registry's ability to be used for research into treatments and quality measures for ALS?

Answer:

The delay in data reporting as explained above does not appear to impact quality measures, rather we feel our data complements external research. For example, the Registry helps ALS researchers recruit patients into clinical trials and epidemiologic studies to better understand the etiology of ALS. To date, ATSDR has assisted researchers in recruiting thousands of patients into over 70 international and domestic research studies. Additionally, the National ALS Biorepository, a component of the Registry, collects biological samples from living patients (e.g., blood, hair, nails) and postmortem samples as well (e.g., brain tissue, bone, skin). These valuable biospecimens are provided to researchers around the world who are studying ALS. The Registry has also funded 24 institutions to better understand what causes ALS and the risk factors. Lastly, the Registry has authored, co-authored, or supported over 100 articles in peer-reviewed journals in order to disseminate findings to the public. A publicly available Registry Dashboard was also created and launched to better convey to the public its impact.

78 Question:

Input from ALS patients, their caregivers, and other advocates is crucial to ensure that the registry is serving the ALS community to the fullest extent possible. Congress recognized the value of community input when it created the registry and included the ability of CDC to stand up an Advisory Committee—made up in part by patients with ALS or their families—to provide guidance and feedback.

- Can you provide an accounting of how ALS patient and caregiver input is collected by the registry, and ways in which this input has been used to make improvements to the way the registry communicates or operates?

Answer:

The Registry is continuously seeking and responding to feedback. One way is our 2-day annual meeting where stakeholders, including persons with ALS and caregivers, can ask questions of Registry staff and funded grantees and provide feedback on ways to improve the National ALS Registry in an open forum. In addition, during 2022 the Registry engaged in multiple listening sessions where we received constructive feedback from patients and caregivers. From the feedback, the Registry introduced a way for patients to opt out of emails as well as increased the frequency of removing deceased patients from the database. Several recommendations to improve transparency and communication of data and information have been implemented or are underway.

Questions from Representative Brian Higgins

79 Question:
Health care labor costs have significantly increased over the last three years. Many nurses have left their hospital-based positions for the higher pay, more flexible scheduling, and improved work-life balance offered by travel nursing agencies. But the prices charged by these agencies for hospitals to fill open nursing positions with contract nurses are unsustainable, with some hospitals accusing staffing agencies of price-gouging. In Western New York, between 2019 and 2022 contract labor costs for hospitals have increased 375%. Meanwhile, the median operating margin for a hospital in my district is -12.7%.

A. What tools does HHS have to conduct oversight into entities like travel nursing agencies and to prevent them from engaging in price-gouging?

B. How can Congress provide HHS with additional authority to increase oversight and transparency regarding these agencies?

Answer:
HHS prioritizes program integrity to ensure responsible stewardship of taxpayer dollars. This budget invests a total of $5.2 billion in new mandatory and discretionary Health Care Fraud and Abuse Control funding to provide oversight of CMS health programs, strengthen the HHS Office of Inspector General investigations, promote good governance, and protect beneficiaries against healthcare fraud. This robust program integrity agenda will yield a combined return-on-investment of $19.7 billion over ten years.

Further, the HHS Office of Inspector General (OIG) is the largest inspector general office in the federal government, with approximately 1,600 employees dedicated to combating fraud, waste, and abuse and improving the efficiency and effectiveness of HHS programs.

The FY 2024 President's Budget requests $515 million in Total Program Level for OIG, including $236 million in discretionary funding which is $37 million above FY 2023 Enacted. Funding enables OIG to target oversight efforts and ensure efficient and effective resource use within the Department's programs through the development of new models and tools to support data-driven audits, evaluations, and inspections. The request also includes the HHS sponsored Health Care Fraud and Abuse Control Mandatory Rebasing Proposal, which is supported by OIG, CMS, and the U.S. Department of Justice, and would provide a meaningful, targeted investment over time starting in FY 2024.

80 Question:
The economic and emotional burden of Alzheimer's disease in the United States continues to grow as more and more people are diagnosed with the disease every year. While there are new treatments that have recently been approved and more in the pipeline, options for Alzheimer's patients remained limited. CMS's National Coverage Determination (NCD) for monoclonal antibodies directed against amyloid for the treatment of Alzheimer's disease covers these drugs under coverage with evidence development (CED), limiting who can receive these treatments

only to those participating in a CMS-approved study. CMS has indicated that they will revisit the NCD if new evidence on the clinical benefits of these drugs emerges. However, despite the urging of Members of Congress and outside stakeholders to revisit the NCD based on new evidence that has emerged since the NCD went into effect, in February CMS declined to do so, stating that the new evidence does not meet the required criteria to revisit the NCD.

A. How is CMS working with researchers and other stakeholders to ensure that evidence from CMS-approved studies under the NCD with CED for these drugs meets CMS requirements, and therefore maximizes these studies' ability to provide relevant and useful information to the agency?
B. And should new evidence come to light that meets CMS's threshold for revisiting the NCD, can you guarantee that that the agency will move as quickly as possible to appropriately modify the NCD, so that these treatments can be covered for all those who could benefit from them?

Answer:
Alzheimer's disease is a devastating illness that affects millions of Americans and their families. CMS is committed to helping people get timely access to treatments and improving care for people with Alzheimer's disease and their families. CMS has a responsibility to ensure that people with Medicare have appropriate access to therapies that are reasonable and necessary for use in the Medicare population.

The FDA performs a vital and an important role. CMS recognizes the important and related – but different – roles of the respective agencies. The FDA determines whether to approve a new medical product based on a careful evaluation of the available data and a determination that the medical product is safe and effective for its intended use. CMS conducts its own independent review to determine whether an item or service is reasonable and necessary for use in the Medicare population and should be covered nationally by Medicare.

81 Question:
Over the past half century, the United States has made incredible strides in reducing cancer mortality, pioneering new cancer treatments, and improving health outcomes for cancer patients. But the COVID-19 pandemic will have a long-lasting negative impact on the gains we have made in cancer care, with many patients stopping or delaying care or skipping screenings out of fear of contracting the virus. Lung cancer continues to be the leading cause of cancer death in the US, and is the second most common cancer amongst both men and women. Catching lung cancer early can make a significant difference in outcomes and save lives, making lung cancer screening one of the most powerful tools we have in combatting this disease. But screening rates in the US remain unacceptably low, and there are significant race and gender disparities in terms of who gets screened.

Last year CMS updated its National Coverage Determination (NCD) for lung cancer screening with low-dose computed tomography (LDCT) to expand the number of people eligible for screening. The NCD also removed the requirement that providers submit lung cancer screening data to an approved registry in order to receive reimbursement from Medicare. While removal of the registry requirement can ease barriers to offering screening for providers, the data contained

within registries can be valuable to track and study which populations are being screened and how that translates into outcomes. In my district, Roswell Park Comprehensive Cancer Center, a NCI-designated comprehensive cancer center and national leader in cancer care, research, and prevention, is developing a free lung cancer screening registry to collect valuable patient data on screening without burdening providers with a financial barrier to access.

- Mr. Secretary, will you commit to ensuring that data on lung cancer screening – whether from patient registries, claims data, or other sources – is still available to the research community, and encourage and facilitate the collection of that data by CMS or other organizations whenever possible? Can you also elaborate on what other steps HHS is taking to reduce gender and racial health disparities in the area of lung cancer, both in terms of screening and treatment outcomes?

Answer:
Lung cancer is an important issue to the Medicare population and CMS, which is why the agency has updated national coverage determination (NCD) for Medicare coverage of screening for lung cancer with low dose computed tomography (LDCT). As of February 10, 2022, submission of data to a registry is no longer a coverage requirement. However, we still provide the information for the CMS-approved lung cancer screening registry that had satisfied the registry participation requirement of the prior NCD on our website.

Questions from Representative Beth Van Duyne

82 Question:
Last March, California Auditor Elaine Howie released a report identifying indicators of fraud, including a rapid increase in the number of hospice agencies and excessive geographic clustering of hospices at the same address.

- After the report was released, did anyone at HHS conduct an immediate review of hospices throughout the country that met the criteria of fraud outlined by the California Auditor?

83 Question:
While there have been voices that have claimed that the oversight of the rapid growth in potentially fraudulent hospices is the responsibility of the state licensing agency, the reality is that these bad actors cannot bill Medicare or Medicaid until they are a Medicare-certified agency. After California put a moratorium on state licensure beginning January 1, 2022, CMS still certified over 400 hospices in California and over 40 at a location identified explicitly in Auditor's report (Friar Street).

- Can you explain CMS proceeding with certifying agencies without doing extra due diligence to ensure whether these new hospices are associated with the bad actors?

84 Question:
A preliminary analysis of CY 2021 claims data indicates that CA, AZ, NV, and TX have more outlier counties than the national average. For example, the national average hospice payment per Medicare enrollee was $315, but the average payment per enrollee in LA County was over $600, and in Bexar County, Texas was over $700.

- What is HHS doing to ensure that the Medicare program and hospice patients are protected from potential bad actors?

85 Question:
The California Auditor also noted that there is potential fraud within home health in LA County. In fact, an analysis of the CY 2021 home health payments indicated that 7 percent or $1 billion, of the total Medicare home health spend, was in LA County. State licensure and Medicare certification data confirms that many hospices and home health agencies are collocated at the same address.

- Has CMS examined the home health claims data in LA County for the past several years to see if there is a pattern of fraudulent and abusive behavior and if that behavior is linked to the bad hospices?

Answer 82-85:
Effective oversight and enforcement are important to protect the integrity of the Medicare program, especially when it comes to end-of-life care. CMS oversees hospice providers through the survey and certification process, through provider enrollment efforts, and through other payment program integrity work. First, to participate in Medicare, hospices must meet federal requirements called conditions of participation (CoPs), or standards for health and safety. Hospices are surveyed at least once every 3 years to verify their compliance with federal requirements. A primary role of the hospice surveyor is to identify any quality of care concerns that may violate patient's rights. Surveyors conduct home visits and interviews with patients and staff, as well as observe operations. The surveyor documents all findings in an official survey, including citing any deficiencies for correction. Post-survey onsite revisits are conducted as necessary to address any serious deficiencies cited. While hospices are surveyed at a 36-month interval, additional surveys may be conducted at any time for complaint investigations. Depending on the severity of deficiencies cited during a survey or investigation, hospices may be terminated if they are unable to come back into compliance generally within 90 days. CMS has worked to strengthen and improve hospice surveys to ensure that beneficiaries receive quality care. For example, CMS regularly provides training for hospice surveyors to ensure they are familiar with certification requirements.

CMS also routinely assesses program integrity risks and vulnerabilities; prioritizes those with the largest potential for financial loss, harm to individuals, and/or likelihood of occurrence; and creates mitigation strategies to address identified risks and vulnerabilities, including those related to hospice. CMS continuously analyzes claims data to monitor, trend, and respond to existing suspect hospice billing patterns and emerging fraud schemes. The Fraud Prevention System – a predictive analytics technology that runs sophisticated algorithms against Medicare fee-for service claims nationwide – identifies aberrant activity or patterns to automatically generate and prioritize leads for further review and investigation. Based on the results of the information collected, CMS takes appropriate administrative actions to recover improper payments and prevent future loss of funds, as well as refer cases to law enforcement in instances of suspected fraud. These actions include pre- and post-payment review, recovery of overpayments, payment suspensions, and the revocation of a provider's Medicare billing privileges.

CMS has a nationwide project to conduct site visits for hospices enrolled in Medicare, focusing on hospices that are co-located at one address. If a provider enrollment site visit reveals that a hospice is non-operational, CMS will take steps to remove the hospice from the Medicare program.

CMS typically refers instances of suspected fraud to our law enforcement partners, such as the Department of Health and Human Services Office of Inspector General and the Department of Justice, to investigate whether fraud occurred and, if so, to take appropriate enforcement actions. CMS has supported our federal law enforcement partners throughout various fraud investigations, including those related to hospice. CMS continues to meet regularly with law enforcement to discuss new cases, suspected fraud referrals, active law enforcement cases, and paths for various administrative actions.

Protecting Medicare hospice care against fraud, waste, and abuse is critically important. To that end, CMS is working on a holistic approach to address the concerns raised and build upon our current oversight efforts.

86 Question:

Secretary Becerra, is Dr. Anthony Fauci currently employed by HHS, and if not, are there any discussions or plans to bring him back?

Answer

Dr. Fauci is not currently employed by HHS, and there are currently no plans for Dr. Fauci to return to federal employment at HHS.

Questions from Representative Lloyd Smucker

87 Question:

In 2021, Congress passed, and President Biden signed into law, the Infrastructure Investment and Jobs Act (P.L. 117-58). This bill included provisions that would require manufacturers of certain single-dose container or single-use package drugs to provide refunds to the Centers for Medicare & Medicaid Services (CMS) for certain discarded amounts of the drug. In the Calendar Year (CY) 2023 Medicare Physician Fee Schedule (MPFS) final rule, CMS issued a requirement that manufacturers provide refunds to CMS for any amount of discarded single-dose vial or single-use drug over 10 percent of the total allowed charges in each calendar quarter beginning January 1, 2023.

I have questions on how CMS intends to implement this section of the law, and how much flexibility will be afforded to individual products. For instance, one product has received a variance to this requirement, but there is not yet a process outlined for current or future products to receive similar variances. Clarity over implementation will allow for predictability regarding both manufacturer liability and government savings.

I was encouraged to hear that on February 1st, 2023, CMS hosted a town hall meeting to gather stakeholder feedback on the unique circumstances surrounding the implementation of this law.

A. Can you please elaborate on CMS' takeaways from the town hall meeting
B. Can you explain how your agency plans to adopt a prospective, flexible framework for identifying products with unique attributes that would warrant an increased applicable percentage?

Answer:
As part of the Calendar Year (CY) 2023 Medicare Physician Fee Schedule Final Rule, CMS finalized the definition of a refundable single-dose container or single-use package drug as a drug or biological for which payment is made under Part B and that is furnished from a single-dose container or single-use package.

For drugs with unique circumstances, CMS solicited comment on whether an increased applicable percentage would be appropriate for drug that is reconstituted with a hydrogel and administered via ureteral catheter or nephrostomy tube into the kidneys; in this circumstance, there is substantial amount of reconstituted hydrogel that adheres to the vial wall during preparation and not able to be extracted from the vial for administration. Based on comments received, CMS finalized an increased applicable percentage of 35 percent for this drug.

CMS also solicited comments on whether there are other drugs with unique circumstances that may warrant an increase in the applicable percentage. As a result of public comments, CMS plans to collect additional information about drugs that may have unique circumstances along with what increased applicable percentages might be appropriate for each circumstance. CMS will revisit additional increased applicable percentages through future notice and comment rulemaking.

Questions from Representative Claudia Tenney

88 Question:
Hospital outpatient departments in both rural and urban areas are a principal source of primary care and other physician services for many New Yorkers; in some communities, hospital-based clinics are the only access patients have to physician services. In fact, many HOPD clinics are located in Health Professional Shortage Areas - designated as such due to a lack of healthcare providers.
Unfortunately, while Medicare payments under the Outpatient Prospective Payment System often do not cover the cost of care, CMS implemented site-neutral payment reductions mandated by Section 603 of the Bipartisan Budget Act of 2015, and has gone on to administratively expand upon those cuts.
In recognition of the threat these payment cuts pose to access to critical healthcare services in underserved communities, CMS will now exempt rural Sole Community Hospitals from site-neutral payment rates for excepted off-campus HOPDs for basic clinic services.

- Is the Administration planning on maintaining this exemption?

Answer:
In the CY 2019 OPPS/ASC final rule, CMS finalized a proposal to pay the Physician Fee Schedule (PFS)-equivalent payment rate for the clinic visit service when provided at an excepted

off-campus provider-based department (PBD) paid under the OPPS, as a method to control the unnecessary increases in volume CMS had observed for that covered outpatient department service. The PFS-equivalent payment rate is approximately 40% of the OPPS payment rate, and the clinic visit is the most frequently billed service under the OPPS. In order to maintain access to care in rural areas, CMS finalized in the CY 2023 OPPS/ASC final rule its proposal to exempt Rural Sole Community Hospitals (SCHs) from this policy and pay for clinic visits furnished in excepted off-campus PBDs of these hospitals at the full OPPS rate. CMS believes that implementing this exemption will help to maintain access to care in rural areas by ensuring rural providers are paid for clinic visit services provided at off-campus PBDs at rates comparable to those paid by on-campus departments. This exemption for rural SCHs is in keeping with prior CMS policies to provide rural SCHs a 7.1% add-on payment for OPPS services, to account for their higher costs compared to other hospitals. We will continue to monitor the effects of this change in Medicare payment policy.

89 Question:

Throughout the pandemic the federal government enacted unprecedented new policies such as the department's COVID-19 vaccine requirement for noncitizen non-immigrants to board a flight to the United States and the Center for Medicare and Medicaid Services' (CMS) COVID-19 vaccine requirement for staff at covered healthcare facilities.

These policies have worsened staffing shortages at our nations' hospitals and healthcare facilities, reducing Americans' access to essential healthcare. They also refuse to factor in the protection provided by natural immunity and have done little to nothing to slow the spread of COVID-19 now that it is endemic.

- What is the Department of Health and Human Services' plan to repeal these rules to American life can return to normal?

Answer:

Vaccination remains the safest and most dependable strategy to build immunity. Most adverse events following vaccination are mild and resolve quickly, such as pain at the injection site and fever. Serious adverse events are rare.

That said, COVID-19 vaccine safety remains a top priority for HHS, and reports of health problems are taken seriously. CDC, FDA and its partners use several complementary vaccine safety systems to monitor for adverse events.

We are dedicated to transparency and report findings from safety monitoring publicly, as part of an open and transparent process, to CDC's Advisory Committee on Immunization Practices (ACIP), to FDA's Vaccines and Related Biological Products Advisory Committee, and to update the information for health care providers, caregivers and recipients, as appropriate.

As the pandemic evolves and the public health emergency ends, the Biden-Harris Administration will continuously evaluate appropriate public health policies to ensure the safety and well-being of families and communities across the United States.

In terms of the impact on staffing, the data do not support the argument that vaccine requirements have worsened staffing shortages. VA, the largest integrated health care system in the United States, has hired more staff in FY 2023 through June than any previous year in the same time period, and the workforce has grown by 4.9%. Retention is also improving following 2 years of increased losses that were the result of strong economic conditions leading to increased job opportunities and competition with the private sector. The combination of increased hiring and reduced losses are resulting in very strong growth rates in VA to meet the expanding Veteran demand for health care services. At the same time, VA employees are rating the organization even more strongly as one of the best places to work.

90 Question:

After the recent U.S. District decision in Texas regarding the lawfulness of the Food and Drug Administration's (FDA) approval of the abortion pill mifepristone, you refused to rule out the possibility of the department unlawfully ignoring this ruling.

- Do you think any federal department, agency, or official is permitted to knowingly violate a court order? If so, where does this power derive from and how is it compatible with our system of checks and balances?

Answer: The Biden-Harris Administration is committed to the rule of law. As the Department of Justice explicitly reaffirmed at oral argument in the Fifth Circuit, the Administration would abide by a ruling from the courts and comply with any orders.

91 Question:

You and your Department have created a chaotic mess in your implementation of the No Surprises Act - bipartisan legislation aimed at protecting patients from surprise medical bills. Due to your mismanagement, you already had created a massive backlog in arbitration claims, and now you have been forced to pause arbitrations due to a Federal court ruling that invalidated your regulations because the regulations are contrary to Congressional intent.

This is bad for patients, this is bad for the doctors, nurses, and other dedicated health professionals providing care, and this is bad for our health care system.

- Do you pledge to fix this by issuing new regulatory guidance that is consistent with the bipartisan No Surprises Act and that gives equal weight to all of the arbitration factors enumerated therein?

Answer:

CMS is committed to implementing the No Surprises Act (NSA) consistent with the law. . Under the law, parties must exhaust a 30-business-day open negotiation period. If an agreed-upon amount for the out-of-network rate is not reached by the end of the 30-business-day open negotiation period, either party may initiate the Federal IDR Process by submitting a Notice of IDR Initiation to the other party and to the Departments. As required under the statute, when determining the total out-of-network payment rate for items and services subject to the federal IDR process, certified IDR entities are required to consider the qualifying payment amount (QPA) for the applicable year for the qualified IDR item or service; and additional information

relating to the offers submitted by the parties, such as the factors described in PHS Act section 2799A-1(c)(5)(C)(ii), and which does not include information on prohibited factors described in PHS Act section 2799A-1(c)(5)(D). The QPA for a given item or service is generally the median contracted rate on January 31, 2019 for the same or similar item or service, increased for inflation.

On March 17, 2023**,** certified IDR entities were instructed to fully resume making payment determinations for disputes. Certified IDR entities have now resumed processing all payment determinations. The standards governing a certified IDR entity's consideration of information when making payment determinations for disputes involving items or services furnished on or after October 25, 2022 are provided in the August 2022 final rules, as revised by the opinion and order of the U.S. District Court for the Eastern District of Texas in *Texas Medical Association, et al. v. United States Department of Health and Human Services et al.,* Case, No. 6:22-cv-372 (February 6, 2023). Following the district court's opinion and order, certified IDR entities briefly ceased processing payment determinations while the Departments made updates to the Federal IDR portal and provided certified IDR entities with updated guidance to comply with the order. As of March 17, 2023, the Departments completed the necessary updates to the Federal IDR portal and Federal IDR process guidance documents to reflect these revised payment determination standards and certified IDR entities resumed processing all payment determinations.

The primary cause of delays in the processing of disputes is the complexity of determining whether disputes are eligible for the federal IDR process. Eligibility reviews conducted by certified IDR entities are processed more quickly when both parties provide all information required for federal IDR process initiation. To address these issues, CMS, together with the Departments of Labor and the Treasury (the Departments) added data elements to the dispute initiation form to ensure it includes information sufficient to identify the item or service under dispute and the disputing parties (e.g., claim number and plan type). In addition, the parties are now directed to attach documents supporting or contesting eligibility when initiating or challenging disputes to ensure that certified IDR entities have all required eligibility information. To help facilitate eligibility determinations, the Departments engaged a contractor and additional government staff to conduct pre-eligibility reviews, which include outreach and technical assistance in support of the certified IDR entities' eligibility determinations. The Departments are also considering additional policy and operational improvements, including through rulemaking, to improve the process for determining the eligibility of disputes and ultimately increase the speed with which certified IDR entities render payment determinations.

The Biden-Harris Administration has also implemented critical provisions of the NSA that protect consumers from surprise medical bills. Key among the No Surprises Act's provisions is removing the patient from payment disputes between providers and payers in instances where surprise billing occurs and establishing how such disputes will be resolved. A recent report from the HHS Office of the Assistant Secretary for Planning and Evaluation (ASPE) reviewed key evidence on surprise billing and the need for the consumer protections in the No Surprises Act.

The report showed that surprise billing is common among those with private insurance—nearly one in five patients who go to the emergency room, have an elective surgery, or give birth in a hospital receive surprise bills, with average costs ranging from $750 to $2,600 per episode.

92 Question:
Throughout the COVID-19 pandemic many states, such as New York, shut down visitation to long term care facilities for months on end, forcing residents to suffer and deteriorate in isolation without their essential caregivers. At the same time, New York also had a policy of placing COVID-19 positive patients in long term care facilities, fueling infection amongst this vulnerable population and contributing to at least 14,000 deaths in the state. These events are nothing short of a tragedy and were completely preventable.

- What steps is HHS taking to protect long term care facility residents' access to their essential. caregivers and to prevent these visitation lockdowns from ever occurring again?

Answer:
While CMS guidance during the PHE has focused on protecting nursing home residents from COVID-19, CMS recognizes that physical separation from family and other loved ones has taken a physical and emotional toll on residents and their loved ones. In light of this, CMS revised the guidance regarding visitation in nursing homes during the COVID-19 Public Health Emergency (PHE). Under CMS guidance, visitation must be permitted at all times with very limited and rare exceptions, in accordance with residents' rights. States may instruct nursing homes to take additional measures to make visitation safer, while ensuring visitation can still occur.

Questions from Representative Brad R. Wenstrup, D.P.M

93 Question:
Secretary Becerra, as you know, I remain deeply concerned about the flawed implementation of the No Surprises Act. You mentioned in your testimony the significant volume of claims that have been submitted to the Independent Resolution Dispute (IDR) claims process.

A. Why has the response to a backlog been to increase dispute filing fees by 600%?
B. The 600% increase in the non-refundable administrative fee came just two months after the departments had announced that the fee would remain at $50 for 2023. What changed in those two months?
C. The sudden and drastic increase came just four days before it took effect. Can you explain how you took comment from affected parties prior to implementing this policy?

Answer:
The No Surprises Act requires the Departments to establish the IDR administrative fee at a rate where the total amount of fees paid is estimated to be equal to the amount of expenditures estimated to be incurred by the Departments in administering the Federal IDR process. On December 23, 2022, the Department issued amended guidance that modified the administrative fee announced in the prior 2023 guidance to reflect the rising volume of disputes and additional expenditures associated with the Departments' enhanced role in 2023 in conducting pre-eligibility reviews to address the backlog of disputes. Specifically, there is a very high volume of

disputes being submitted without sufficient information to determine eligibility for the federal IDR process. These submissions require additional assistance by the Departments to gather the information necessary to determine eligibility, which led to increased Federal administrative costs. Through December 5, 2022, there were over 160,000 disputes submitted for resolution through the IDR portal, nearly 10 times greater than the Departments initially estimated. During that time, non-initiating parties challenged the eligibility of over 68,000 disputes for the Federal IDR process. IDR entities have had to perform a substantial amount of outreach and analysis to determine whether a submitted dispute is eligible for the Federal IDR process. Assessing the information received and making an eligibility determination can be a time-consuming process for IDR entities, but an eligibility determination must be made before a dispute can proceed to IDR. Cases can be ineligible for a number of reasons. Some common reasons include: incomplete documentation, lack of compliance with applicable timelines, non-completion of open negotiation, incorrect batching and incorrect jurisdiction (federal vs State). These issues are detailed in our first report on the IDR process and the amended 2023 fee guidance. In order to address delays in the process, the Departments have engaged a contractor and government staff to conduct pre-eligibility reviews, which have also led to increased Federal costs. The Departments are also considering additional policy and operational improvements, including through rulemaking, to improve the process for determining the eligibility of disputes and ultimately increase the speed with which certified IDR entities render payment determinations. We plan to adjust the Administrative fee as operational requirements change over time.

94 Question:

For more than a decade, China has been one of the largest producers of active pharmaceutical ingredients (APIs) in the world. It is estimated that Chinese manufacturers make up around 40 percent of all APIs used worldwide, and that China and India are the source of approximately 80 percent of the APIs imported to the United States.

- Given how important domestic drug manufacturing is to ASPR's National Health Security Strategy, what is the department doing to further incentivize the domestic supply and production of API and medical countermeasures?

Answer: With funds appropriated though COVID-19 supplementals, ASPR is investing in domestic manufacturing of several important medical supplies, including API. As an example, on May 18, 2020, BARDA awarded Phlow Corp. a contract (75A501200C00092) to address the near-term threat of drug shortages of essential medicines for hospitalized COVID-19 patients, to establish a Strategic Active Pharmaceutical Ingredient (API) Reserve (SAPIR), and to build U.S.-based advanced large scale commercial manufacturing capabilities to supply domestic self-sufficiency for manufacturing of critical APIs and finished essential medicines to prevent future drug shortages. This work is intended to strengthen U.S. national health security interests by enhancing the nation's supply chain resiliency for essential medicines, including those used for COVID-19 patients, and ensuring that the United States has the necessary API reserve and U.S.-based manufacturing capabilities to meet the nation's needs for patient care in national emergency situations. These initial efforts have proven successful and Phlow has met all the

contractual milestones; however, additional funds as requested in the FY 2024 President's Budget will be required to sustain these efforts going forward.

To build and sustain a domestic advanced pharmaceutical manufacturing ecosystem, additional HHS investments through the ASPR Office of Industrial Base Management and Supply Chain (ASPR-IBMSC) have been directed at developing and deploying innovative manufacturing technologies, as well as establishing new partnerships to improve the responsiveness and resilience of the domestic pharmaceutical supply chain. These investments to address API and key starting material supply chain vulnerabilities include domestic direct, biologically derived production of APIs and antibiotics and fine chemicals or catalysts whose use are more prevalent in U.S. pharmaceutical production.

The FY 2024 President's Budget includes a $400 million Pandemic Preparedness and Biodefense request. The $400 million requested will ensure we are able to maintain the capabilities built and used extensively during the COVID-19 pandemic to strengthen the domestic manufacturing base. In addition, the $400 million requested will ensure HHS has ready resources to immediately scale up manufacturing of vaccine and therapeutic prototypes at the first indication of an outbreak. The requested funding would also accelerate advanced development and additional manufacturing of medical countermeasures for clinical trials and, when appropriate, patient care as part of an emergency response.

95 Question:

Step therapy is a utilization management technique that requires patients to try one or more drugs before they can access the drug prescribed by their health care provider. While step therapy policies are designed to help manage drug costs, they may also impact medication adherence, block or delay access to medication, or limit treatment options which can result in negative outcomes for patients. Step therapy practices can limit a provider's ability to tailor care to individual patient needs and interfere with the patient-provider relationship.

- Is the Administration committed to working with Congress to continue addressing utilization management tools that impact a provider's ability to effectively treat their patient?

96 Question:

Mr. Secretary, I continue to hear from physicians who are unable to treat their patients without added delay because of harmful red tape caused by utilization management policies.

A. Are you comfortable with prescriptions and treatment plans being rendered by a physician or non- physician who has never had any interaction with the involved patient?

B. In instances where utilization management practices such as prior authorization are causing a third party to dictate patient care and prescriptions, should the third party be held liable for problems that may occur because of these decisions?

Answer 95&96:

CMS is committed to reducing administrative burden and advancing interoperability and national standards. CMS has continued to seek public input on barriers to accessing health care and related challenges to inform our work and better support the populations we serve.

Prior authorization has a role in health care, in that it can ensure that covered items and services are medically necessary and covered by the payer. However, patients, providers, and payers alike have experienced burden from the process. It has also been identified as a major source of provider burnout, and can become a health risk for patients if inefficiencies in the process cause care to be delayed. In the Advancing Interoperability and Improving Prior Authorization Processes proposed rule (87 FR 76238) issued last December, CMS proposed a number of policies to help make the prior authorization process more efficient and transparent.

CMS proposed requiring impacted payers to build and maintain a Prior Authorization Requirements, Documentation and Decision Application Programming Interface (PARDD API) that would automate the process for providers to determine whether a prior authorization is required, identify prior authorization information and documentation requirements, as well as facilitate the exchange of prior authorization requests and decisions from their electronic health records or practice management system. CMS proposed requiring impacted payers to include a specific reason when they deny a prior authorization request. CMS proposed requiring impacted payers to send prior authorization decisions within 72 hours for expedited (i.e., urgent) requests and seven calendar days for standard (i.e., non-urgent) requests. CMS also proposed requiring impacted payers to publicly report certain prior authorization metrics by posting them directly on the payer's website or via publicly accessible hyperlink(s) on an annual basis. The comment period for this proposed rule closed on March 13, 2023 and CMS is considering comments received for final decision making.

In addition to these CMS activities, the Office of the National Coordinator for Health IT (ONC) is working to better enable providers to interact with health care plans and other payers for the automated, electronic completion of prior authorization tasks. More information is available here: https://www.healthit.gov/topic/laws-regulation-and-policy/request-information-electronic-prior-authorization-standards-implementation-specifications. Further, ONC recently proposed rulemaking to advance interoperability, improve transparency, support the access, exchange, and use of electronic health information, enhance health IT certification, and reduce burden and costs. More information is available here: https://www.govinfo.gov/content/pkg/FR-2023-04-18/pdf/2023-07229.pdf

In 2020, HHS released a comprehensive strategy to reduce the regulatory and administrative burden related to the use of health IT, including EHRs. Reflective of public comment, the *Strategy on Reducing Regulatory and Administrative Burdens Relating to the Use of Health IT and EHRs* targets burdens tied to regulatory and administrative requirements that HHS can directly impact through the rulemaking process. The report's strategies, recommendations, and policy shifts aim to give clinicians more time to focus on what matters – caring for their patients. This report was developed as a collaborative effort between ONC and CMS. ONC, CMS, and HHS as a whole are working to implement strategies identified within the report to reduce burden and advance interoperable health IT.

97 Question:
I want to make sure that our seniors have access to the most innovative technologies available. My colleague, Susan DelBene, and I have been working with you and this committee in a bipartisan manner to ensure that CMS proposes a robust and meaningful separate expedited pathway for transitional coverage of innovative FDA-approved devices.

- Can I get your commitment that the Agency will put forward a proposed rule - by this Apri1 - that is a meaningful, separate pathway for new devices with existing sound data?

Answer:
CMS remains committed to expanding access to health care coverage and services, including new, innovative treatments when they are safe and appropriate. CMS rescinded the Medicare Coverage of Innovative Technology and Definition of "Reasonable and Necessary" (MCIT/R&N) final rule because of concerns that the provisions in the final rule may not have been sufficient to protect Medicare patients. By rescinding this rule, CMS will take action to better address those safety concerns in the future.

Improving and modernizing the Medicare coverage process continues to be a priority, and we remain committed to providing stakeholders with more transparent and predictable coverage pathways. CMS is working as quickly as possible to advance multiple coverage process improvements that provide an appropriate balance of access to new technologies with necessary patient protections. As part of this effort, CMS has conducted several listening sessions to learn about stakeholders' most pressing challenges and to receive feedback from stakeholders about which coverage process improvements would be most valuable.

CMS intends to explore coverage process improvements that will enhance access to innovative and beneficial medical devices in a way that will better suit the health care needs of people with Medicare. This will also help to establish a process in which the Medicare program covers new technologies on the basis of scientifically sound clinical evidence, with appropriate health and safety protections in place for the Medicare population.

98 Question:
Mr. Secretary, Congress passed a variety of Medicare Graduate Medical Education (GME) provisions these past two years to help address the physician shortage. As you know, HRSA's Council on GME ("COGME") suggested back in 2020 as part of its Report to Congress, mandated by the CARES Act that we extend the five-year GME residency cap.

- As the PHE winds down and we look to ways to address the physician shortage, are you considering extending the five-year GME residency cap as a solution to this problem?

Answer:

In 2020, HRSA's Council on Graduate Medical Education (COGME) recommended allowing flexibility and extending the five-year GME cap period for new GME programs during the pandemic in high priority and needed specialties. This recommendation recognized that many rural hospitals with new GME programs were struggling to adapt in the COVID crisis and lacked

the necessary resources to fully focus on and develop their residency programs within the mandated five-year cap period. COGME suggested that these hospitals may need regulatory flexibility regarding the cap period to better allow for full implementation of their programs and address the health needs of rural America.

99 Question:
As you know, patients suffering from End Stage Renal Disease (ESRD) are among the most vulnerable patients in the Medicare population. To protect ESRD patients and their right to elect the coverage that best meets their needs and that of their families, Congress created the Medicare Secondary Payer Act (MSPA). In a June 2022 ruling, the Supreme Court interpreted the law in a way that could allow private insurers to evade the MSPA protections for ESRD patients.

- Will you commit to continue working with Congress to provide Technical Assistance on draft legislation looking to address this issue?

Answer:
HHS agrees that it is critical to preserve and increase access to high quality, affordable health care, including services to treat ESRD. As always, HHS appreciates the opportunity to provide technical assistance to Congress on important health care issues.

100 Question:

At the end of 2022, CDC released its revised guidelines for prescribing opioids. While these were an improvement over the 2016 guidelines, the non-opioid alternatives do not reflect the continuum of pain management options available to patients today.

- What steps will HHS and CDC take to increase awareness and education for patients and providers on non-opioid pain management options?

Answer:
CDC supports providers and healthcare systems with resources to support and increase safe and effective pain care, maximize the use of prescription drug monitoring programs (PDMP), and advance insurer and health systems interventions at the federal, state, and local level.

To further improve our understanding of patterns of chronic pain as well as the use of various treatments for pain in the U.S., CDC continues to conduct research on these topics using nationally representative population-based survey data (such as the Medical Expenditure Panel Survey (MEPS) and the National Ambulatory Medical Care Survey (NAMCS)). Additional work is being conducted using administrative claims data from commercially insured patients and the Medicare and Medicaid population. For example, recent studies published by CDC examined the prevalence of chronic pain and the prevalence of opioid prescriptions, nonopioid prescriptions, and nonpharmacological therapies among patients with chronic pain.

The *CDC Clinical Practice Guideline for Prescribing Opioids for Pain* (2022 Clinical Practice Guideline), released in November 2022, is voluntary guidance for clinicians that was created to help inform decision making. The 2022 Clinical Practice Guideline was developed because CDC recognized that clinicians need current recommendations for prescribing opioids to improve pain

management and patient safety. In support of development of the 2022 CDC Clinical Practice Guideline, CDC conducted outreach to people living with pain, their caregivers, and the clinicians who help manage their pain. CDC posted two notices in the Federal Register to learn more about values and preferences related to pain and pain management options (including but not limited to the benefits and harms of opioid use) to complement ongoing guideline update efforts.

The 2022 Clinical Practice Guideline, provides recommendations to promote a multimodal and multidisciplinary approach to pain management and implementation strategies to reduce disparities in pain care. In addition, addressing primary injury prevention, improved access to affordable, culturally responsive health care, and more effective pain management therapies can mitigate the burden of chronic pain. CDC released a suite of translation and communication materials to support implementation of the 2022 Clinical Practice Guideline and continues to develop additional resources for clinicians, patients, and other audiences.

The agency remains committed to working with clinical partners and patient organizations to improve pain care by giving patients and clinicians the data, tools, and guidance they need to make informed, individualized, and patient-centered treatment decisions based on the latest science and the human story of pain.

101 Question:
As pair of the SUPPORT Act, CMS was mandated to issue the Dr. Todd Graham Pain Management Study to provide CMS with important information about pain treatment in Medicare, and help us understand the roles of behavioral health, specialty care integration, care planning, health disparities in pain, opioid use, and opioid use disorders treatment.

- When will CMS be releasing the Todd Graham Study?

Answer:
As part of its work on the Dr. Todd Graham Pain Management Study required by Section 6086 of the Substance Use-Disorder Prevention that Promotes Opioid Recovery and Treatment for Patients and Communities Act, the Centers for Medicare and Medicaid Services (CMS) consulted with the required stakeholders. In September 2020, CMS held a virtual discussion for Medicare beneficiaries with acute or chronic pain, their caregivers, and advocacy organizations on barriers to care, Medicare coverage, care for beneficiaries with substance use disorders or suicidal ideation, and pain during the COVID-19 pandemic. The comments provided during this session will be used to inform the required Report to Congress. CMS also held a listening session on the study for clinicians in August 2020 to get feedback on Medicare coverage of evidence-based treatments, technologies, and models; barriers from utilizing non-opioid treatments and technologies to treat acute and chronic pain; how Medicare can improve care for beneficiaries with pain who have SUD; and how the COVID-19 public health emergency impacted treatment. In addition, the Agency for Healthcare Research and Quality (AHRQ) has undertaken three topic briefs and two systematic reviews to inform Medicare coverage and payment for treatment of acute and chronic pain as a part of the study. CMS will distribute the final report to Congress, as required by statute.

Questions from Representative Brian Fitzpatrick

102 Question:

Two or three large GPO write the contracts that control the flow of 90% of all supplies into hospitals, nursing homes and other medical institutions. These GPO's were given by law an exemption from the anti-kickback statute in 1987. Under that law GPO contracts are supposed to ensure that the money they can collect from medical manufacturers is less than or equal to 3% of the cost of the product. the HHSOIG was given the regulatory authority to Audit, the contracts between manufacturers and GPO's. This has never been done.

- Can the HHS OIG exercise their regulatory authority and audit the contracts for products that are currently in shortage, as well as previous years contracts to ensure that GPO's are not overstepping their bounds and shed light on how these practices may be causing dangerous medical supply shortages?

Answer:
As a point of clarification, the exemption for GPO fees under the criminal Federal anti-kickback statute established by statute in 1987, and noted in the question above, does not include a 3% limit on fees that GPOs can collect. The statutory exception does not cap the amount of the fees that can be protected from sanctions under the statute. In subsequent rulemaking, HHS OIG issued a safe harbor regulation addressing GPO arrangements. The safe harbor includes a condition that either (1) the written agreement between the GPO and the participating vendor pay a fee of 3% or less of the purchase price of the goods or services provided by the vendor or (2) if the fee is not fixed at 3% or less, the written agreement specify the amount (or maximum amount) the GPO will be paid by the vendor, where the amount may be a fixed sum or fixed percentage of the value of purchases made from the vendor by the members of the group. Compliance with a Federal anti-kickback statute exception or safe harbor is voluntary; if an arrangement does not comply with an exception or safe harbor, it is subject to case-by-case analysis under the Federal anti-kickback statute, including an assessment of the intent of the parties. OIG has not audited compliance with the GPO safe harbor's requirements, which would be challenging given that compliance with safe harbor is entirely voluntary and safe harbors serve as an affirmative defense to a criminal statute.

OIG, however, completed audit work on GPOs in 2001, 2003, and 2005 (unrelated to compliance with the GPO safe harbor requirements). These audits generally focused on quantifying GPO revenues derived from contracts and the disposition of this revenue (e.g., how that revenue was used by the GPOs and how much was distributed to their membership). OIG does not currently have work underway looking at GPOs. OIG will consider future work on GPO contracting and shortages during our normal work planning process.

Questions from Representative David Kustoff

103 Question:
As you may be aware, the flawed Medicare Area Wage Index (AWi) negatively impacts hospitals in my district in West Tennessee and across our state. In 2019, CMS acknowledged this

disparity and implemented the Low Wage Index Hospital Policy. This essential policy increases the wage index for hospitals in the lowest quartile where, unfortunately, many of our hospitals in Tennessee fall.
Providers in my district have said the Low Wage Index Hospital Policy has been a critical lifeline for hospitals across our state, particularly rural ones at risk of closure. It has provided Tennessee almost $100 million in reimbursement relief between Fiscal Year 2020-2022.
That is why I joined a recent bipartisan letter to CMS Administrator Brooks-LaSure urging for a four-year extension of the Low Wage Index Hospital Policy, which is set to expire this year unless CMS acts to extend this vital lifeline.

A. Do you agree that the end of the Low Wage Index Hospital Policy would have a devastating impact on hospitals in Tennessee and in other states across the country, especially in rural communities?
B. Can I get your commitment the agency will extend the policy to support rural hospitals?
C. Secretary Becerra, if you are not ready to commit to extending that policy right now, will you commit to working with me and this Committee on this issue moving forward?
D. COVID-19 further skewed the labor market and other factors incorporated in the flawed AWi. Would extending this valuable policy allow hospitals and CMS to better understand the policy's true impact in a more normal environment?

Answer:
To help mitigate wage index disparities between high wage and low wage hospitals, in the FY 2020 Hospital Inpatient Prospective Payment System (IPPS) final rule, CMS adopted a policy to increase the wage index values for certain hospitals with low wage index values (the low wage index hospital policy). This policy was adopted in a budget neutral manner through an adjustment applied to the standardized amounts for all hospitals. CMS also indicated its intention that this policy would be effective for at least 4 years, beginning in FY 2020, in order to allow employee compensation increases implemented by these hospitals sufficient time to be reflected in the wage index calculation. As CMS undertakes the rulemaking process for the FY 2024 IPPS rule, the agency will consider all stakeholder comments on the proposed rule. The comment period is currently open through June 9, 2023. Additionally, CMS is happy to work with you to provide technical assistance on any legislation you draft related to the Medicare Area Wage Index.

104 Question:
The issue of denials remains significant for patients with Medicare Advantage (MA) coverage, and it seems to be getting worse. While I appreciate CMS taking steps to remove barriers to care by proposing to streamline the prior authorization process for some plans in their recent proposed rule, that may not be enough. Congress is also examining legislation to help improve uptake of electronic prior authorizations that would have a direct impact on improving access.

A. Secretary Becerra, what is the expected timeline for full implementation of the administrative efforts around improving MA prior authorizations?
B. What additional authority is needed to ensure patients are accessing the coverage they deserve and signed up for?

Answer:
In the Advancing Interoperability and Improving Prior Authorization Processes proposed rule issued last December, CMS proposed a number of policies to help make the prior authorization process more efficient and transparent. CMS proposed requiring impacted payers, such as Medicare Advantage (MA) Organizations, to build and maintain a Prior Authorization Requirements, Documentation and Decision Application Programming Interface (PARDD API) that would automate the process for providers to determine whether a prior authorization is required, identify prior authorization information and documentation requirements, as well as facilitate the exchange of prior authorization requests and decisions from their electronic health records or practice management system. CMS proposed requiring impacted payers to include a specific reason when they deny a prior authorization request. CMS proposed requiring impacted payers to send prior authorization decisions within 72 hours for expedited (i.e., urgent) requests and seven calendar days for standard (i.e., non-urgent) requests. CMS also proposed requiring impacted payers to publicly report certain prior authorization metrics by posting them directly on the payer's website or via publicly accessible hyperlink(s) on an annual basis. The comment period for this proposed rule will close on March 13, 2023. CMS will consider comments received for final decision making.

In December 2022, CMS also issued the CY 2024 Policy and Technical Changes to the MA and Part D Programs Proposed Rule. This proposed rule includes several proposals to address concerns about the use of prior authorization by MA plans and to ensure MA enrollees have timely access to medically necessary care.

The proposed rule proposes clarifications and revisions to the regulations governing when and how MA plans develop and use coverage criteria and utilization management policies to ensure that MA enrollees receive the same access to medically necessary care they would receive in Traditional Medicare. The proposed rule also would streamline prior authorization requirements, including adding continuity of care requirements and reducing disruption in ongoing care for beneficiaries by requiring that when an enrollee is granted prior authorization approval it will remain valid for the full course of treatment. First, CMS proposed that prior authorization policies for coordinated care plans may only be used to confirm the presence of diagnoses or other clinical criteria and/or ensure that an item or service is medically necessary. Second, CMS proposed that plans must provide a minimum 90-day transition period when an enrollee currently undergoing treatment switches to a new MA plan. Third, to ensure prior authorization is being used appropriately, CMS proposed to require that all MA plans establish a Utilization Management Committee to review policies annually and ensure consistency with Traditional Medicare's national and local coverage decisions and guidelines. The comment period for this proposed rule closed on February 13, 2023 and CMS is considering comments received for final decision making.

Questions from Representative Mike Kelly

Prior Authorization Proposed Rule

105 Question:

Secretary Becerra, at the end of 2022, CMS proposed several rules streamlining and improving prior authorization (PA) for patients enrolled in federally sponsored health care programs, including Medicare Advantage (MA). I appreciate your work on this issue, and I remain a strong advocate of ensuring patients receive timely access to the health care they deserve.
As you know, last year I was the House Republican lead on H.R. 3173, the Improving Seniors' Timely Access to Care Act, which passed the House unanimously on suspension in September 2022. Like CMS' proposed rules, the legislation would have created an electronic prior authorization system and accelerated prior authorization decision time frames for seniors on Medicare Advantage. It included important transparency requirements that focused on shortening timelines while improving beneficiary protections. Additionally, the legislation sought to create a real-time decision-making process for insurers, a provision which was not adopted in CMS' proposed rules.

- What is CMS' timeline for finalizing the electronic prior authorization rules? Does CMS intend to finalize before the end of calendar year 2023?
- Will CMS consider adding a real-time decision-making process to the finalized rule?

Answer:
In the Advancing Interoperability and Improving Prior Authorization Processes proposed rule issued last December, CMS proposed a number of policies to help make the prior authorization process more efficient and transparent. CMS proposed requiring impacted payers, such as Medicare Advantage (MA) Organizations, to build and maintain a Prior Authorization Requirements, Documentation and Decision Application Programming Interface (PARDD API) that would automate the process for providers to determine whether a prior authorization is required, identify prior authorization information and documentation requirements, as well as facilitate the exchange of prior authorization requests and decisions from their electronic health records or practice management system. CMS proposed requiring impacted payers to include a specific reason when they deny a prior authorization request. CMS proposed requiring impacted payers to send prior authorization decisions within 72 hours for expedited (i.e., urgent) requests and seven calendar days for standard (i.e., non-urgent) requests. CMS also proposed requiring impacted payers to publicly report certain prior authorization metrics by posting them directly on the payer's website or via publicly accessible hyperlink(s) on an annual basis. The comment period for this proposed rule will close on March 13, 2023. CMS will consider comments received for final decision making.

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Vaccine Injury Compensation Program

106 Question:

Secretary Becerra, when a new vaccine is approved and marketed, what steps are required to ensure access to liability compensation under the National Vaccine Injury Compensation Program (VICP)?

- What happens if the new vaccine is not added to the list of taxed vaccines and what are the potential ramifications?

Answer: For a category of vaccines to be covered by the National Vaccine Injury Compensation Program (VICP), the category of vaccines must be subject to an excise tax which has not been passed by Congress. The excise tax has not been enacted by Congress and this category of vaccines has not been added to the Vaccine Injury Table. If Congress does act, HRSA will work diligently to implement the law in line with statutory and regulatory requirements.

Patient Matching at ONC:

107 Question:

Secretary Becerra, in your patient matching report to Congress last year, your recommendations stated patient matching transparency should be healthcare's top priority and that investments should be made in uniform data standards for demographic and other data elements used in patient matching.

- Has any progress been made on improving transparency or creating a standardized data set to improve patient matching that could be used by developers and providers to improve the chance of an accurate match?
- If additional support is needed from Congress, what is required?

Answer:
We appreciate and share your concerns regarding the challenges patients, providers, and health IT developers face when it comes to patient matching. Over the past seven years, the Office of the National Coordinator for Health IT (ONC) has taken a multifaceted approach to address this challenge, including three regulatory actions: in the "2015 Edition Health Information

Technology (Health IT) Certification Criteria, 2015 Edition Base Electronic Health Record (EHR) Definition, and ONC Health IT Certification Program Modifications" final rule, in its "21st Century Cures Act: Interoperability, Information Blocking, and the ONC Health IT Certification Program" final rule, and more recently, in the "Health Data, Technology, and Interoperability: Certification Program Updates, Algorithm Transparency, and Information Sharing (HTI-1)" proposed rule.

In ONC's 21st Century Cures Act, ONC adopted the United States Core Data for Interoperability (USCDI) as a standard. The USCDI is a standardized set of health data classes and constituent data elements for nationwide, interoperable health information exchange. USCDI Version 1 included several data elements that are used in patient matching within the patient demographics data class, including but not limited to, current and previous address, phone number, phone number type and email address. Health IT systems certified through the ONC Health IT Certification Program are now required to collect and share patient data with these additional data elements. More recently, in the HTI-1 proposed rule, ONC proposed the adoption of USCDI Version 3 to replace USCDI Version 1 in the Certification Program. USCDI Version 3 includes additional patient demographic data elements that could be used to improve patient matching in EHRs and in the exchange of patient data between systems. USCDI Version 3 also contains standards such as Project US@ for current and previous address. This address specification has been created through a public-private process over the past two years and is designed to improve address data accuracy and facilitate improved patient matching.

- If additional support is needed from Congress, what is required?

The FY 2023 and FY 2024 President's Budgets requested $103,614,000 for ONC, $37.4 million above the FY 2023 Enacted level. With additional support from Congress, ONC would continue to ensure that it meets its mandatory statutory requirements, which have expanded since HITECH codified ONC in 2009. ONC could also pursue work to enhance transparency associated with patient matching algorithms and establish industry consensus on publicly reportable patient matching metrics. This work could include, but would not be limited to, producing a test dataset, key, and a dashboard showing matching algorithm evaluation metrics. This dashboard would enable anyone to view matching metrics and other details for any specific developer, compare across developers or implementations of health IT across providers, and access resources designed to aid in education and data quality improvement. While industry partners have indicated their interest in such testing and its value, many view this work as a public good and look to HHS and ONC to support and coordinate it.

As further background on this topic, patient matching errors are a result of many factors, including but not limited to data quality and the effectiveness of the algorithm(s) used to match patient records within and between healthcare providers. Because of this, the root cause of patient matching errors is difficult to pinpoint and at times difficult to ameliorate—especially if the data is being shared between providers, thereby relying on different human and technical policies, practices, and capacities to identify and correct mistakes. In addition, variability exists in the design and performance of patient matching algorithms that are used by clinics and health systems nationwide, creating a situation where it is impossible to accurately calculate and

compare true match rates, matching error rates, or changes to either metric after modifications have been made to either the data or the algorithm(s) used or changes to patient population characteristics that have occurred over time.

One key issue and impediment in this area on which coordination is required is that there is no consistent approach and no accepted standard measure of effectiveness for patient matching accuracy across healthcare. Because of this and because most of the industry relies on proprietary approaches to match patient records, the frequency of matching errors is largely unknown. Data on the frequency of patient matching errors is sparse and inconsistent, for several reasons. First, healthcare organizations have no incentive to publicly share the rate of patient matching errors that occur within their organization or between their organization and others, and some providers may have concerns about potential negative effects on their public image. Second, there is no agreed-upon definition of what constitutes a patient matching error, and there is some variation in the statistical errors that are often used to describe patient matching errors. Finally, patient matching algorithm performance assessment relies on an extremely large and representative test dataset and the creation of a "key" - a manually curated dataset that relies on human review - against which algorithm output is compared. These efforts require significant financial and technical resources, specialized skill sets among staff, access to data, and some flexibility in the algorithm being tested.

Questions from Representative Adrian Smith

108 Question:

Re-iterating questions from my letter dated March 10, 2023 regarding the Office of Refugee Resettlement (ORR) and illegal child labor:

A. How does the ORR vet sponsors to which children in the Unaccompanied Children Program (UCP) are released?

Answer:

ORR has thorough sponsor screening and vetting processes in place for each category of sponsor. These categories are for parents or legal guardians (Category 1), or other specified family members (Category 2), as well as more distant relatives or unrelated sponsors (Category 3), often identified by the child's parent.

At a minimum, the Trafficking Victims Protection Reauthorization Act (TVPRA) requires that sponsor suitability assessments include verification of the sponsor's identity and relationship to the child, if any, and an independent finding that the sponsor has not engaged in any activity that would indicate a potential risk to the child. ORR's process for the safe and timely release of a child from federal custody includes several steps such as separate interviews with the child and sponsor and speaking with the child's parents, if available; a sponsor application, address checks, and supporting documentation; background checks (including sex offender registry checks) and

in some cases, FBI fingerprint checks; as well as home studies where applicable, including those required by the TVPRA, mandated by ORR policy, or required at the discretion of ORR staff reviewing the facts of the case. Additional details on this process are available in ORR's Unaccompanied Children (UC) Program Policy Guide Section 2: Safe and Timely Release from ORR Care[8].

B. How many UCP Children did ORR lose contact with in fiscal year 2022?

Answer: ORR's custodial responsibilities end when a child is released to their sponsor. ORR has policies in place, such as every child receiving a Safety and Well-being call after being discharged, to promote their safety and well-being as they transition into a new community. Per ORR policies, ORR care providers are required to make a minimum of three attempts for every child to reach and speak with the child and the sponsor. Although children and sponsors are not required to participate in Safety and Well-being calls and may choose not to answer a call for a variety of reasons, in fiscal year (FY) 2022, ORR care providers made contact with either the child, the sponsor, or both in more than 81 percent of households.

C. What action does ORR take after initially losing contact with a child and their sponsor? How frequently does ORR re-establish contact?

Answer: ORR's custodial responsibilities end when a child is released to their sponsor. ORR has policies in place, such as every child receiving a Safety and Well-being call after being discharged, to promote the safety and well-being as they transition into a new community. Per ORR policies, ORR care providers are required to make a minimum of three attempts for every child to reach and speak with the child and the sponsor. Although children and sponsors are not required to participate in Safety and Well-being calls and may choose not to answer a call for a variety of reasons, in FY 2022, ORR care providers made contact with either the child, the sponsor, or both in more than 81 percent of households. There are many reasons why someone may not answer the phone or wish to speak with government officials—that in and of itself is not always cause for concern. If the ORR care providers identify or suspect any cause for concern or safety issue, they are required under ORR policy to issue a Notification of Concern to ORR and appropriate investigative agencies, including local law enforcement and child protective services.

ORR also provides post-release services (PRS) to unaccompanied children who are required to receive PRS under the TVPRA, and to children who, in the determination of a care provider, would benefit from ongoing assistance, including all children who are victims of trafficking in any form. PRS includes timely referrals and connection to community resources, as well as intensive services in cases where additional support is necessary to address a child's specific needs or challenges. These referral and case management services are offered by a

[8] See the ORR UC Program Policy Guide Section 2: Safe and Timely Release from ORR Care at https://www.acf.hhs.gov/orr/policy-guidance/unaccompanied-children-program-policy-guide-section-2#:~:text=ORR%27s%20policies%20require%20the%20release,able%20to%20provide%20for%20the.

network of ORR-funded grant recipients across the United States. PRS can include help with placement stability and safety, support in finding and accessing health and mental health care, coordinating and ensuring attendance at immigration court proceedings, as well as compliance with DHS requirements, education services, and other supports to ensure children's well-being.

ORR is committed to expanding PRS tailored to the unique needs of each child. In FY 2022, ORR more than doubled the rate of children provided with PRS, serving more than 40 percent of children compared to just over 20 percent in FY 2021. ORR is currently on track—with the continued funding support from Congress—to achieve its goal of providing all children with PRS by the end of FY 2024. ORR has been developing and progressing with the implementation of expanded PRS, including a pilot project in September 2022. This full rollout will consist of three levels of services, which may be elevated at any time, ranging from Level 1 (consisting of three comprehensive virtual or in-person check-ins) to Level 3 (involving intensive, in-person case management).

D. What percentage of children in UCP remain in contact with ORR when they receive a final verdict on their immigration case?

Answer: ORR does not track the status of immigration cases for unaccompanied children not in its care.

E. How regularly does ORR check on the health and wellbeing of children they have discharged to sponsors?

Answer: Per ORR policies, ORR care providers are required to make a minimum of three attempts for every child to reach and speak with the child and the sponsor. For all Safety and Well-being calls, if care providers identify or suspect any safety concerns with the child, they are required to report to the appropriate investigative agencies. Upon their release, ORR provides children and sponsors with information on the ORR National Call Center (ORRNCC), a 24-hour, seven days a week resource not only for released children, but their family members, sponsors, legal service providers, Child Advocates, and other members of the community who can request assistance or report concerns to the ORRNCC on the child's behalf. The ORRNCC also connects children directly with the appropriate authority when possible and places an additional Safety and Well-being follow-up call to the child to confirm if any further actions are needed.

F. Does ORR track results or outcomes in any way after a child under their supervision calls the hotline to report a problem? How many calls did the hotline get in fiscal year 2022? How many calls went unanswered in 2022?

Answer: In FY 2022, the ORRNCC received approximately 218,400 calls, with fewer than 1 percent of callers recorded as disconnected or hung up prior to speaking to an ORRNCC representative. Calls that are disconnected receive a call back from an ORRNCC representative, and the average wait time for incoming calls is approximately 6 seconds. The ORRNCC is required to document and report any safety concern to ORR, in accordance with mandatory reporting laws, state licensing requirements, federal laws and regulations, and ORR policies and

procedures, as well as to the appropriate local law enforcement agency, state and local child protective services, or both.

G. What plans, if any, does ORR have to improve hotline operations to better connect complaints to law enforcement or other appropriate agencies?

Answer: Over the last few months, ORR implemented a requirement for the ORRNCC to provide children who contact the helpline and express safety concerns with information regarding the authorities to which their safety concerns will be reported. It also connects children directly with the appropriate authority when possible and places an additional Safety and Well-being follow-up call to the child to confirm if any further actions are needed.

109 Question:
As we discussed during the hearing, one of the primary objectives of the CMS Innovation Center (CMMI) is smarter spending on health care services. To accomplish this goal, CMMI must consider innovation in model design decisions such as benchmarking methodology, as well as its process, decisions, and priorities.

I believe this requires greater transparency and more robust dialogue with model participants and external stakeholders. Additional steps are needed to ensure that CMMI is reaching its full potential in reducing health care costs, addressing health disparities, and improving the quality of care delivered for beneficiaries, while remaining accountable to patients and providers. The CMMI model development and implementation processes have, at times, been opaque to Congress and stakeholders. The statutory requirement to gather input from interested parties has not always been observed and CMMI demonstrations are less effective than they could be given this lack of external expertise.

A. How will CMMI increase transparency for participant providers and interested stakeholders in all its processes to ensure continued, and even perhaps more successful, participation in its models?
B. Do you support standardizing a notice-and-comment rulemaking process for new models? If not, please explain your rationale in detail.

Answer:
CMS and the Innovation Center are committed to engaging with stakeholders throughout the policymaking process and clearly explaining how the Innovation Center activities will improve our healthcare system and the health outcomes of beneficiaries.

When designing new payment and service delivery models, in accordance with the requirements of section 1115A of the Social Security Act, the Innovation Center actively seeks input from a broad array of stakeholders across the country and utilizes various tools to gather stakeholder feedback, including, but not limited to, requests for information, model-specific listening sessions, webinars, and information sharing sessions. Information on these activities is available online at https://data.cms.gov/Special-Programs-Initiatives/CMS-Innovation-Center-Webinarsand-Forums/r7vd-wcky/data. The Innovation Center's biennial Report to Congress, most recently submitted in December 2022, also details stakeholder engagement activities during the period covered by the Report. Also, in accordance with the requirements of section 1115A,

the Innovation Center formally evaluates each payment and service delivery model that it tests. Reports on the evaluations are publicly available at https://innovation.cms.gov/data-and-reports and the reports for each model describe in detail the evaluation methods used to analyze changes in the cost and quality of care.

Further, stakeholder input has been central to the Innovation Center's strategic refresh, in October 2021. The Innovation Center looked back on ten years of lessons-learned in order to reestablish a shared vision of the healthcare system we are driving toward. As part of this strategic work, we hosted six listening sessions, in which we engage with thought leaders representing a variety backgrounds and experience to hear their vision for the healthcare system of the future and how the CMS Innovation Center's work can better achieve that vision. These discussions included primary-care providers, safety-net providers, patient advocacy organizations, specialty-care providers, policy experts, academics and other key stakeholders.

We are continuing to consider the views of stakeholders and Members of Congress as we to move forward with our strategic refresh. CMS is committed to maintaining our positive partnership with providers that commit to value-based care – and to all the stakeholders of the Innovation Center's work.

110 Question:

The Consolidated Appropriations Act of 2022 included language from the Technical Reset to Advance the Instruction of Nurses, or the TRAIN Act, which is designed to aid hospital-based schools of nursing and allied health, including four in Nebraska. This statutory fix was intended to address an error made by CMS over the past 20 years which resulted in CMS recouping large payments from schools.

I have been made aware that, as implemented by CMS, most schools will only get back between 29 percent and 37 percent of what was taken from them by CMS under the new payback formula. Something so clear in statute - language which incorporated technical support from CMS - should not be implemented in this way.

A. Can you explain how implementation is so significantly different than clear Congressional intent?
B. What, if anything, will CMS do to correct this mistake?
C. If the provision stays in effect as implemented, what effect does CMS expect this to have on the ongoing shortage of certified nurse clinicians?

Answer:

CMS is working to clarify any confusion and is committed to implementing this provision of the CAA, 2023 correctly. CMS commits to engaging with interested Congressional offices upon implementation.

111 Question:

For decades the United States has led the world in health care innovation, especially in developing innovative new treatments for rare diseases. In fact, since the bipartisan Orphan Drug

Act was enacted 40 years ago, rare disease and cancer patients have benefited from the development of over 600 new treatments. This is a tremendous achievement, though there's more work to be done. Too many patients living with rare diseases and cancers still have no treatments available for them.

Unfortunately, as I highlighted repeatedly before its passage, the partisan "Inflation Reduction Act" which Democrats forced through last year threatens this legacy of successful innovation. Specifically, the IRA does not protect therapies that treat two or more orphan diseases from the law's price-setting scheme. As a result, at least two companies have already cited concerns with IRA as a reason for abandoning rare disease drug development efforts. Republicans repeatedly warned that the IRA would bring us fewer cures, and now that is clearly coming true even faster than we predicted.

A. Will you commit to doing what you can via guidance and the rulemaking process to ensure the pipeline for life-altering therapies continues for patients with rare diseases and cancers?
B. Would you support extending the rare disease price-setting protections to potential new drugs that treat more than one condition, assuming all potential indications are for rare diseases?

Answer:
CMS supports continued drug innovation and believes it is vitally important that beneficiaries have access to innovative new therapies. We are striving to implement the Medicare Drug Price Negotiation Program in a thoughtful way that both improves drug affordability and accessibility for people with Medicare and supports innovation.

The law requires CMS to exclude certain orphan drugs approved or licensed when identifying qualifying single source drugs, referred to as the orphan drug exclusion. To be considered for the orphan drug exclusion, the drug or biological product must (1) be designated as a drug for only one rare disease or condition by the FDA and (2) be approved by the FDA only for one or more indications within such designated rare disease or condition.

Questions from Representative Vern Buchanan

112 Question:

It has come to our attention multiple medical providers nationwide, including several not-for-profit community hospitals, have not been paid for stepping up to the plate during the COVID emergency for providing crucial covid related services to countless uninsured individuals. HHS abruptly shuttered the program with only 7 days' notice. Due to the rushed closure of the program, it appears the government has not paid debts owed for services rendered to uninsured individuals as a result? Are these outstanding bills to medical providers going to be addressed in your budget requests before us?

Answer:

HHS has now processed and paid all eligible claims submitted to the program by the deadlines with the exception of a small number of claims requiring technical, administrative adjustments or

program integrity review of which impacted providers have been notified.

In February 2022, the cost of Uninsured Program claims was up to $2 billion a month. Continuing to pay claims at this rate was not sustainable with the funds allotted for the program at that time.

Therefore, on March 15, 2022, the White House announced that the COVID-19 Uninsured Program would have to stop accepting claims for testing and treatment on March 22, 2022, and stop accepting claims for vaccination administration on April 5, 2022. HHS followed up on this public announcement with additional notices to providers and Congress, alerting them of the deadlines to submit claims. Unfortunately, some providers were unable to complete the claims submission process for all potential claims by the submission deadlines.

In the three weeks after the announcement that the COVID-19 Uninsured Program would need to wind down, nearly 35 million claims were submitted to the Program's portal. The claims submitted after the announcement represents over 12.3 percent of all claims submitted to the Uninsured Program – nearly 1 in 8 claims received.

113 Question:
Given the VA decided to cover this new drug, will you commit today to have CMS reconsider the NCD for these drugs so our nation's most vulnerable patients are not blocked from using them?

Answer:
Alzheimer's disease is a devastating illness that affects millions of Americans and their families. CMS is committed to helping people get timely access to treatments and improving care for people with Alzheimer's disease and their families. CMS has a responsibility to ensure that people with Medicare have appropriate access to therapies that are reasonable and necessary for use in the Medicare population. Our protocol requirements ensure appropriate clinical care, and reassure patients and their caregivers that further research with anti-amyloid monoclonal antibodies will be conducted in settings to minimize potential harms from the treatment. As is outlined in the Medicare National Coverage Determination (NCD) with CED for monoclonal antibodies directed against amyloid for the treatment of Alzheimer's disease, we do not restrict the setting of approved clinical trials, in order to ensure that anti-amyloid monoclonal antibodies that receive FDA approval based upon evidence of efficacy from a direct measure of clinical benefit may be given to a broader patient population.

114 Question:
Will you direct CMS to reconsider this rate notice and not implement a cut to Medicare – breaking the president's promise – that will hurt seniors' access to care?

Answer:
In February, CMS proposed a series of routine technical updates, improvements, and recalibrations to improve the accuracy of MA payments in the 2024 Advance Notice. The proposed updates help to ensure that the risk adjustment of MA payments better reflects a

beneficiary's costs of care, which means MA plans serving beneficiaries with greater health care needs would receive appropriately higher payments. The proposed model updates do not impact coverage of Medicare services or requirements for MA plans to deliver covered services; rather, these proposed changes improve the accuracy of payments made to MA plans for covering care for enrollees.

115 Question:
Will you work with Congressional Republicans to preserve Part A by promoting value-based care and healthier living instead of supporting over $1 trillion in new, punitive taxes?

Answer:
Medicare is a key pillar of our health care system and we are committed strengthening the program both now and in the future. Thanks to our efforts, this year's Medicare Trustees Report estimated that the solvency of the Medicare Hospital Insurance (HI) Trust Fund has been extended by three years since last year's report. In addition, adoption of the proposals in the President's FY 2024 Budget would extend Medicare solvency by at least 25 years, without cutting benefits or raising costs for people with Medicare. The FY 2024 budget also includes a targeted package of Medicare proposals totaling $8 billion over 10 years that supports the Administration's priorities such as investing in mental health, strengthening nursing home oversight, and enhancing program benefits. We look forward to continuing to work with Congress to further strengthen this vital program that serves over 65 million Americans.

Questions from Representative Carol D. Miller

Telehealth

116 Question:

What will be done for individuals needing access to clinically appropriate prescriptions of controlled substances for a wide variety of medical circumstances, including for mental health and substance use disorders when their continuity of care is severed?

Answer:

SAMHSA has worked to make behavioral health care as accessible as possible to every individual across the country, regardless of circumstances. For example, for any practitioner-patient telemedicine relationships that have been or will be established up to November 11, 2023, the full set of telemedicine flexibilities regarding prescription of controlled medications established during the COVID-19 PHE will be extended for one-year—through November 11, 2024. SAMHSA and the DEA are currently working together on the final rule and cannot comment on the active rulemaking process, , but remain committed to meeting the needs of patients with changing circumstances.

117 Question:

How will you ensure they don't fall through the cracks of our healthcare system without access to the medications they need?

Answer:

SAMHSA has worked to make behavioral health care as accessible as possible to every individual across the country, regardless of circumstances. SAMHSA and the DEA are currently working together on the final rule and cannot comment on the active rulemaking process.

118 Question:

With the end of the pandemic-era telehealth flexibilities some 43,000 of our nation's veterans, who rely on telehealth would have their care interrupted, unable to access critical clinical services and medications remotely. The most significantly impacted would be individuals with behavioral health needs and rural patients.

- What will be done to ensure these veterans have access to the care they need especially for those who live in rural areas?

Answer:

In response to the COVID-19 public health emergency, which is set to expire in May 2023, flexibilities for Medicare telehealth services were issued through legislative and regulatory authorities to increase access to care for patients and providers. The Consolidated Appropriations Act, 2023 recently extended many of these flexibilities through December 31, 2024. Extended telehealth flexibilities include removing geographic and site of service originating site restrictions so that Medicare patients can continue to use telehealth services from their home and allowing audio-only telehealth services. Additionally, the expanded list of providers eligible to deliver telehealth services is also extended so Medicare beneficiaries can continue to receive telehealth services furnished by physical therapists, occupational therapists, speech language pathologists, and audiologists, as well as receive telehealth services from Rural Health Clinics and Federally Qualified Health Centers through December 31, 2024. If you are interested in drafting legislation to make these flexibilities permanent, CMS would be happy to provide technical assistance.

Additionally, recent legislative and regulatory changes made several telehealth flexibilities permanent. Federally Qualified Health Centers and Rural Health Clinics can furnish certain behavioral and mental health services via telecommunications technology. Medicare patients can continue to receive these telehealth services in their home as geographic restrictions on the originating site are eliminated for these telehealth services. Certain behavioral and mental telehealth services can be delivered using audio-only communication platforms, and rural emergency hospitals can serve as an originating site for telehealth services.

Answer

SAMHSA has worked to make care as accessible as possible to every individual across the country, including veterans and those in rural and remote locations. In addition, our colleagues

at the VA have proposed legislative changes in the President's budget that would eliminate key telehealth barriers for Veterans. HHS encourages Congressional engagement with VA to better understand VA's barriers to telehealth and their proposed solutions. SAMHSA and the DEA are currently working together on the final rule and cannot comment on the active rulemaking process.

119 Question:

For the last year, there have been repeated assurances by HHS and the White House that CMS patients will not fall off the telehealth cliff.

- What will be done to ensure this highly vulnerable patient population isn't left without life-saving medication?

Answer:

SAMHSA has worked to make behavioral health care as accessible as possible to every individual across the country, regardless of circumstances. SAMHSA and the DEA are currently working together on the final rule and cannot comment on the active rulemaking process.

120 Question:

Reports and investigations during the COVID-19 public health emergency (PHE) from the Department of Health and Human Services (HHS) Office of the Inspector General (OIG) have found cases of fraud via telehealth in the Medicare program have been rare despite the lifting of restrictions such as in-person requirements, and that fraud that does occur mirrors that found in the in-person modality.

- With that in mind, what is the justification for imposing in-person barriers to care that limit a patients access to clinically necessary treatment?

Answer:

In response to the COVID-19 public health emergency, which is set to expire in May 2023, flexibilities for Medicare telehealth services were issued through legislative and regulatory authorities to increase access to care for patients and providers. The Consolidated Appropriations Act of 2023 recently extended many of these flexibilities through December 31, 2024. Extended telehealth flexibilities include waiving geographic and site of service originating site restrictions so that Medicare patients can continue to use telehealth services from their home and allowing audio-only telehealth services. Additionally, the expanded list of providers eligible to deliver telehealth services is also extended so Medicare beneficiaries can continue to receive telehealth services furnished by physical therapists, occupational therapists, speech language pathologists, and audiologists, as well as receive telehealth services from Rural Health Clinics and Federally Qualified Health Centers through December 31, 2024. If you are interested in drafting legislation to make these waivers permanent, CMS would be happy to provide technical assistance.

Additionally, recent legislative and regulatory changes made several telehealth flexibilities permanent. Federally Qualified Health Centers and Rural Health Clinics can furnish certain behavioral and mental health services via telecommunications technology. Medicare patients can

continue to receive these telehealth services in their home as geographic restrictions on the originating site are eliminated for these telehealth services. Certain behavioral and mental telehealth services can be delivered using audio-only communication platforms, and rural emergency hospitals can serve as an originating site for telehealth services.

MA Question
121 Question:
According to the American Diabetes Association: 232,336 West Virginians have diagnosed diabetes. An additional 45,000 have diabetes but don't know it and 502,000, 34.8% of the adult population have prediabetes. Goes without saying that this is an important issue for me on behalf of my constituents.

A. Secretary Becerra, could you explain to me why the Biden Administration is proposing a rule in the Medicare Advantage program that downgrades and eliminates codes used by doctors in diagnosing conditions like diabetes?
B. I have seen letters from the AMA saying what your administration is doing could harm patients like my constituents. Who did you consult before making these dramatic decisions?

Answer:

The proposed 2024 Advance Notice published on February 1, 2023 includes a series of routine technical updates, improvements, and recalibrations that would result in an increase to MA payments for plans in 2024. MA payments are expected to increase by 1.03% from 2023 to 2024, as proposed. This is about a $4 billion increase in MA payments for next year. The proposals in the Advance Notice improve payment accuracy to ensure MA plan payments better reflect the expected costs of care, with higher payments going to plans serving people with greater health care needs. This helps ensure that people in MA can continue to access the care they need.

Under the proposed model updates, Medicare, and thus MA plans, will continue to pay for the services beneficiaries need to treat chronic conditions such as diabetes. As part of updating the risk adjustment model, certain diabetes codes were removed because they are not reliable predictors of cost. Over 300 diabetes codes remain in the risk adjustment model. The proposed model would provide extra payments for patients with diabetes who have complications associated with diabetes, like chronic kidney disease, heart disease, and diabetic retinopathy. In addition, there are other payment factors, such as a condition count bump, that increases payment when beneficiaries have more comorbidities. Thus, the 2024 Advance Notice proposals for this aspect of the MA risk model would provide a more targeted and accurate payment increase for a diabetic patient because it adjusts MA payments according to the patient's full health profile, rather than using only a diabetes diagnosis as a proxy for increased health care costs. This approach would help ensure that higher payments are directed to diabetic patients with the greatest health care costs.

All codes in the proposed MA risk model were evaluated with clinical input, with a special focus on condition areas that underwent significant changes from ICD-9 to ICD-10. CMS received clinical input from a panel of physicians in various specialties and with relevant expertise,

including internal medicine physicians and clinicians with specific expertise in coding and disease burden.

122 Question:
TRAIN Act
The Consolidated Appropriations Act of 2022 included a provision designed to aid hospital-based schools of nursing and allied health. Our statutory fix was intended to address an error made by CMS over the past 20 years, where CMS was recouping payments from schools. Unfortunately, that does not appear to be happening. A CMS Transmittal Notice (number 11904/change request 13122) that was issued by CMS just last week and lays out a very complicated formula that describes how the nursing and allied health schools will get their money back. We have had more than 20 schools inform us that under this new CMS payback formula, most schools will only get back between 29 percent and 37 percent of what was taken from them by CMS.

- Why has this occurred and what is CMS doing to correct it?

Answer
CMS is working to clarify any confusion and is committed to implementing this provision of the CAA, 2023 correctly. CMS commits to engaging with interested Congressional offices upon implementation.

Questions from Representative Suzan K. DelBene

Breakthrough Devices
123 Question:
I recently introduced legislation with Congressman Wenstrup, Congressman Moore, Congresswoman Sewell, and others to provide seniors on Medicare with faster access to medical devices that receive a "breakthrough" designation and are approved by the FDA. These devices are cutting-edge, safe, and have the potential to improve or even save lives. Seniors should not be forced to wait years for these treatments once the FDA approves them.

- Could you provide an update on CMS's efforts to create a Medicare coverage pathway for new and emerging medical devices?

Answer:

[*CMS remains committed to expanding access to health care coverage and services, including new, innovative treatments when they are safe and appropriate. CMS rescinded the Medicare Coverage of Innovative Technology and Definition of "Reasonable and Necessary" (MCIT/R&N) final rule because of concerns that the provisions in the final rule may not have been sufficient to protect Medicare patients. By rescinding this rule, CMS will take action to better address those safety concerns in the future.*

Improving and modernizing the Medicare coverage process continues to be a priority, and we remain committed to providing stakeholders with more transparent and predictable coverage

pathways. CMS is working as quickly as possible to advance multiple coverage process improvements that provide an appropriate balance of access to new technologies with necessary patient protections. As part of this effort, CMS has conducted several listening sessions to learn about stakeholders' most pressing challenges and to receive feedback from stakeholders about which coverage process improvements would be most valuable.

CMS intends to explore coverage process improvements that will enhance access to innovative and beneficial medical devices in a way that will better suit the health care needs of people with Medicare. This will also help to establish a process in which the Medicare program covers new technologies on the basis of scientifically sound clinical evidence, with appropriate health and safety protections in place for the Medicare population.]

Value-Based Care *Incentives*

124 Question:

Congress enacted the Medicare Access and Chip Reauthorization Act (MACRA) to transition the way Medicare pays for health care to pay for value and incentivize higher quality care at a lower cost. MACRA's incentive payments have been instrumental in encouraging participation in advanced Alternative Payment Models (APMs). At the end of 2022, Congress passed a one-year 3.5 percent extension of MACRA's APM bonus payment and froze participation thresholds at 50 percent. While more ACOs are taking on risk each year, participation in advanced APMs continues to fall well below the administration's goals. In the 2023 Medicare physician fee schedule, CMS projects that expiring APM incentives and corresponding qualifying threshold increases could result in roughly 100,000 fewer qualifying APM participants.

- How would an expiration of the advanced APM incentives and the corresponding jump in qualifying thresholds at the end of 2023 impact the administration's goal to have all beneficiaries in accountable care programs by 2030?
- Will HHS work with Congressional leaders to support efforts to again extend MACRA's APM incentives?
- Would giving the administration more flexibility to set qualifying thresholds help increase participation in advanced APMs?

Answer:

Ensuring adequate payment rates for physicians and other health care professionals is essential in maintaining access to high-quality and affordable health care. I appreciate Congress' leadership in the Consolidated Appropriations Act, 2023 to provide temporary, one-year increases in payment amounts for all services under the physician fee schedule by 2.5 percent in 2023 and 1.25 percent in 2024. CMS does not have the legal authority to implement increases in payment outside of budget neutrality without additional action taken by Congress. Annual Medicare physician payment updates have been set in statute since 2015. CMS does not have the authority to use a different update.

I also appreciate Congress' work to extend incentive payments for clinicians who are qualifying participants in advanced alternative payment models through 2025. CMS has indicated that the statutory incentive structure under the Quality Payment Program after the expiration of the APM Incentive Payments could potentially lead to a drop in Advanced APM participation, and a

corresponding increase in Merit-Based Incentive Payment System (MIPS) participation as eligible clinicians may believe their payments would be higher if they receive the MIPS payment adjustment. A significant reduction in Advanced APM participation stemming from changes in financial incentives under the Quality Payment Program could potentially bias the CMS Innovation Center's model tests of voluntary Advanced APMs, thereby interfering with the evaluation of current model tests and interfering with potential participation in future models. If Congress wants to change the law, we would be happy to provide technical assistance on legislation you draft.

Air Ambulance Services Reimbursement

125 Question:

I have raised concerns over the years about the need to update Medicare reimbursement for air ambulance services, which have not been updated in over 20 years, based on data that reflects the actual cost of providing air ambulance services.

- Do you support allowing CMS to use cost data to update the air ambulance fee schedule?
- Can we work together to update the fee schedule so we can preserve access to care, particularly in rural America?

Answer:

CMS pays for ground and air ambulance services as required by section 1834(l) of the Social Security Act, under the ambulance fee schedule (AFS). The AFS payment is based on the level of services furnished, including a base payment, a separate payment for mileage to the nearest appropriate facility, and a geographic adjustment factor. As required by statute, the AFS is updated annually by an ambulance inflation factor (AIF).

Generally, the AIF is meant to capture changes in prices that could impact ambulance providers and suppliers. Specifically, the AIF is determined by the percentage increase in the Consumer Price Index for all Urban Consumers for the 12-month period ending with June of the previous year, reduced by a productivity adjustment, which is equal to the 10-year moving average of changes in economy-wide private nonfarm business multi-factor productivity index. For calendar year (CY) 2022, the AIF is 5.1 percent and for CY 2023, the AIF is 8.7 percent. The CY 2023 AIF is the largest inflation update since the implementation of the AFS in 2002. Beyond the AIF update, CMS does not have the authority to adjust the ambulance fee schedule rates.

CMS is happy to provide technical assistance on any legislation you draft related to Medicare payment for air ambulance services.

Questions from Representative Kevin Hern

ICHRAs

126 Question:

On June 20, 2019, the previous Administration finalized the Individual Coverage Health Reimbursement Arrangement (ICHRA) rule, which allows employers to make tax-

advantaged, defined contributions for employees to purchase their own health insurance or pay for medical expenses.[9] ICHRAs became available to employers January 1, 2020. Since then, over hundreds of thousands of workers are obtaining ACA compliant healthcare coverage through ICHRAs.

During the hearing I asked if you support ICHRAs and you responded by saying "If you are talking about plans that violate the affordable care act, we do not support those."

As you may know, the ICHRA rule explicitly states that ICHRAs must meet the same requirements as the bipartisan QSEHRA legislation. The rule builds on those requirements by allowing ICHRA enrollees to access ACA compliant health coverage through the individual market. The rule states that health coverage must be in "compliance with PHS Act sections 2711 and 2713" Additionally, data shows ICHRAs and QSEHRAs are bringing younger workers into the ACA's individual risk pool, further strengthening the individual market.

- Given this information, can you clarify your response to my question?

Answer:

In June 2019, the Departments of the Treasury, Labor, and Health & Human Services jointly published a final rule to expand the flexibility and use of health reimbursement arrangements (HRAs) and other account-based group health plans to provide Americans with additional options to obtain quality, affordable health care. The June 2019 HRA final rule allows employers to meet Patient Protection and Affordable Care Act (PPACA) requirements by offering an Individual Coverage HRA (ICHRA) that requires employees and any covered dependents to be enrolled in individual health insurance coverage; or Medicare Parts A and B, or Part C; in order to receive reimbursements for medical care expenses from the ICHRA. Reimbursements from the ICHRA may include premiums and cost sharing for individual health insurance coverage, and for Medicare. Employers were able to begin offering ICHRAs beginning January 1, 2020.

In addition, beginning with the 2023 plan year, HHS will start collecting from Qualified Health Plans (QHPs) data on whether enrollees in QHPs are utilizing ICHRAs. This ICHRA Indicator data will allow HHS to better understand the characteristics of the employees enrolling in coverage using ICHRAs and will allow HHS to conduct analyses to examine whether there are any unique actuarial characteristics of the ICHRA population, (such as the health status of enrollees with ICHRAs), and to investigate what impact (if any) ICHRA enrollment is having on State individual (or merged) market risk pools.

SNPs

127 Question:

Several analyses have shown that the proposed changes to the Part C risk model will directly and negatively impact beneficiaries who are enrolled in special needs plans (SNPs) or are dually eligible for Medicaid and Medicare. According to a Milliman report Dual SNPs could experience a 5.8 percent cut, while Chronic Condition SNPs could be cut by 11.1 percent. Furthermore, a

[9] Federal Register :: Health Reimbursement Arrangements and Other Account-Based Group Health Plans

Wakely analysis found an average negative 6.4 percent impact for plans serving beneficiaries who are dually eligible for Medicare and Medicaid, with variability in impacts.

- Will you commit to monitoring and reporting the impacts, with a high level of transparency and stakeholder input, on an ongoing basis as the changes are phased in? Specifically, looking at each population including Independent-SNPs, Chronic-SNPs, Dual-SNPs and all dual-eligible beneficiaries that could be impacted?

Answer:

[*The proposed 2024 Advance Notice published on February 1, 2023 includes a series of routine technical updates, improvements, and recalibrations that would result in an increase to MA payments for plans in 2024. MA payments are expected to increase by 1.03% from 2023 to 2024, as proposed. This is about a $4 billion increase in MA payments for next year. The proposals in the Advance Notice improve payment accuracy to ensure MA plan payments better reflect the expected costs of care, with higher payments going to plans serving people with greater health care needs. This helps ensure that people in MA can continue to access the care they need.*

Additionally, there are protective features built into the MA risk adjustment system to ensure that plans caring for dually eligible individuals are paid adequately, and nothing in this proposal changes those features. We will continue to pay much more for someone who is dually eligible than someone who is not, even when they have the same diagnoses. These higher payments decrease incentives for plans to favor healthier enrollees or discriminate against sicker patients.

To the extent beneficiaries who are low-income or who are living in rural or underserved areas have greater health care needs, the proposed model would better compensate plans for that care. Furthermore, federal law protects most dually eligible individuals from any cost sharing for Medicare services, so specific plans changes in cost sharing cannot be passed onto those dually eligible beneficiaries.

