ARTIFICIAL INTELLIGENCE AND ITS POTENTIAL TO FUEL ECONOMIC GROWTH AND IMPROVE GOVERNANCE

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TUESDAY, JUNE 4, 2024

UNITED STATES CONGRESS,
JOINT ECONOMIC COMMITTEE,
Washington, DC.

The hearing was convened, pursuant to notice, at 2:30 p.m., in 216 Hart Senate Office Building, before the Joint Economic Committee, Vice Chairman, David Schweikert, presiding.

Senators: Heinrich, Klobuchar, Schmitt, Hassan.

Representatives: Schweikert, Beyer.

Staff: Alexander Schunk, Kole Nichols, Tess Carter, Lia Stefanovich, Ron Donado, Colleen Healy, Jeremy Johnson, and Jessica Martinez.

Vice Chairman Schweikert. (off mic)—out there as we sort of build the record of how do we do policy in the future. All right.

I would like to introduce our four distinguished witnesses. Dr. Brian J. Miller is a practicing hospitalist and Professor of Medicine and Business at Johns Hopkins University. Dr. Miller is also a non-resident fellow at the American Enterprise Institute, where his research focuses on health care competition, FDA public policy, health policy and the integration of AI in the health care sector.

Then there is Mr. Adams. Mr. Adams here? Thierer. Mr. Thierer is a senior fellow for the Technology and Innovation Team at the R Street Institute. Mr. Thierer also serves as a commissioner on the U.S. Chamber of Commerce's Artificial Intelligence Commission on Competitiveness, Inclusion and Innovation, where he advises on a variety of issues, including Internet, government telecommunication policy and AI. Senator Heinrich.

Chairman Heinrich. Thank you for pulling this hearing together. It should be really interesting. A number of folks know that I have been heavily involved in these conversations, and we have been able to really put together a surprising amount of sort of bipartisan interest in where we think we need to, you know, where we really think the benefits are going to accrue from artificial intelligence and where are the places where we have to be careful and minimize some of the risks.

So I am very much looking forward to continuing that conversation today, and I am going to introduce our other two distinguished witnesses. Dr. Ayanna Howard is the Dean of Engineering at Ohio State University. Previously, she was chair of the Georgia Institute of Technology School of Interactive Computing in the College of

Computing, as well as the founder and director of the Human Automation Systems Lab.

Her career spans higher education, NASA's Jet Propulsion Laboratory and the private sector. Dr. Howard is the founder and president of the Board of Directors of Zyrobotics, a Georgia Tech spinoff company that develops mobile therapy and educational products for children with special needs.

She is also a fellow of the American Association for the Advancement of Science and the National Academy of Inventors, and was appointed to the National Artificial Intelligence Advisory Committee.

Dr. Jennifer Gaudioso is Director of the Center for Computing Research at Sandia National Laboratories, where she stewards the Center's portfolio of research from fundamental science to state-of-the-art applications. She is also the program executive for the National Nuclear Security Administration's Advanced Simulation and Computing Program there at Sandia.

Previously, she served as the director of the Center for Computation and Analysis for National Security, where she oversaw the use of systems analysis, cybersecurity and data science capabilities to tackle complex national security challenges.

[The prepared statement of Chairman Heinrich appears in the Submissions for the Record.]

Vice Chairman Schweikert. Thank you, Senator Heinrich. Let us go ahead and hear from our witnesses and Dr. Miller, everyone gets five minutes and then hopefully we can follow up with questions. Dr. Miller.

STATEMENT OF BRIAN J. MILLER, MD, AMERICAN ENTERPRISE INSTITUTE, WASHINGTON, D.C.

Dr. Miller. Thank you, Chairman Heinrich, Vice Chairman and Schweikert and distinguished members of the Committee for allowing me to share my views on AI and its potential to fuel economic growth and governance. I am a pragmatist, so I am going to focus on pragmatic applications and policy questions for the fifth of the economy that comprises health care.

As mentioned, I'm a practicing hospitalist at Hopkins, non-resident fellow at AEI. I actually work for four regulatory agencies, including the FDA and CMS and the FTC and FCC, and I also serve on MEDPAC. I should note that today I am here in my personal capacity, and my views are my own and do not represent those of Johns Hopkins, AEI or MEDPAC.

So I just actually finished a week working in the hospital on the night shift. It is an interesting experience. It is seven days in a row of flying a 747 with analog controls and no autopilot. It is not good thing for us to have systems focused this way across the country.

I would say actually since I first rounded in the hospitals as a medical student 15 years ago, things have not really changed. I do not really see a lot of change in clinical operations and what we do, and the broader economic data support this assertion. The Bureau of Labor Statistics tells us that for around 25 years, the hospital industry has had flat or declining labor productivity most years.

And demand is going up, right? People are getting sicker. We have more elderly patients, and we have a labor shortage as a consequence. So we are missing 78,000 registered nurses, 68,000 primary care physicians, amongst others, and also the spending is breaking the budget, right?

So Medicare and Medicaid are $1.7 trillion or more annually, and that crowds out other sort of transformative investments that we want to make in things like transportation, education, my personal favorite, space exploration.

So we have got to think differently. And so AI and automation can help solve our productivity problem in my industry and let us clinicians do what clinicians do best, which is focus on the patients instead of paperwork. Patients today face delays in diagnosis, clinical errors and tired and fatigued clinical staff who are focused on admin tasks.

So AI is not really Terminator 3. It is also not really Star Trek. It is an inherently practical and technical issue for implementing it in health care. We can use it to automate mundane administrative tasks like physician charting with ambient AI, coding and billing. Imagine if AI were summarizing your clinic visit as you were actually talking with the physician, instead of them staring at the computer.

And imagine if that physician could save time from the six hours a day spent in charting. This is actually being tested today and my colleagues at other hospitals are part of these pilots. It can also augment clinical labor. It could assist with mammography interpretation, melanoma diagnosis, improving efficiency and accuracy, identifying areas of concern in advance of physician review.

It can automate other elements of clinical practice, reading pathology slides, looking at EEGs to check for seizures and other neurologic problems. And then a lot of folks are really worried about the labor impact, and I have to say that with the average day for a primary care physician estimated at 26.7 hours if they complete all the tasks they are supposed to, there is plenty of room for us to have software and automation pick this up.

For consumers, the win is huge. So if you are a consumer and you have a chronic disease, the burden is significant. Being a diabetic, you have to check your sugars, you have to give yourself a bunch of shots, you have to catch your carbs, watch what you eat.

It is not easy. Imagine if we could create integrated systems with glucometers to check glucose, insulin pumps and we could take that burden away from the patient, so they could just focus on going about their life? From a policy perspective, we have to be careful not to over-regulate. So right now, this is—and I am a car guy. This is like putting airbags in cars in 1920 if we go too far.

We should be practical and use existing authorities that we have at agencies like the FDA and the Office of National Coordinator for Health IT, and we want sort of to facilitate permissive bottom-up innovation from clinicians, nurses, engineers and others, and we want that to come from the bedside.

We should also aim to pay for and drive competition amongst new and old care models, between humans and technology, and we want rapid cycles stacked incremental innovation to transform health care. We cannot tax and spend our way out of this, so we

must innovate and instead remember why America is great. Thank you.

[The prepared statement of Dr. Miller appears in the Submissions for the Record.]

STATEMENT OF ADAM THIERER, RESIDENT SENIOR FELLOW, TECHNOLOGY AND INNOVATION, R STREET INSTITUTE, WASHINGTON, D.C.

Mr. Thierer. Chairman Heinrich, Vice Chairman Schweikert, members of the Committee, thank you for the invitation to participate in this important hearing on artificial intelligence and its potential to fuel economic growth and improve governance.

My name is Adam Thierer, and I'm a senior fellow at the R Street Institute, where I focus on emerging technology issues. I also recently served as a commissioner on the U.S. Chamber of Commerce Commission on Artificial Intelligence, Competitiveness, Inclusion and Innovation.

Today I will discuss three points relevant to this hearing. First, AI and advanced computational technologies can help fuel broad-based economic growth and sectoral productivity, while also improving consumer health and welfare in important ways.

Second, to unlock these benefits, the United States needs to pursue a pro-innovation AI policy vision that can help bolster global competitive advantage and geopolitical security. Third, we can advance these goals through an AI opportunity agenda that includes a learning period moratorium on burdensome new forms of AI regulations. I will address each point briefly, but I have included three appendices to my testimony for more details.

AI is set to become the most important general purpose technology of our era, and AI could revolutionize every segment of the economy in some fashion. The potential exists for AI to drive explosive economic growth and productivity enhancements.

While predictions vary, analysts forecast that AI could deliver trillions in additional global economic activity, and significantly boost annual GDP growth. This would be over and above the four trillion of gross output that the U.S. Bureau of Economic Analysis says that the digital economy already accounted for in 2022.

But what really matters is what AI means to every American personally. AI is poised to revolutionize health outcomes in particular. AI is already helping with early detection and treatment of cancers, strokes, heart disease, brain disease, sepsis and other ailments. AI is also helping address organ failure, paralysis, vision impairments and much more. The age of personalized medicine will be driven by AI advancements.

AI can help make government more efficient as well. Ohio Lieutenant Governor John Husted recently used an AI tool to help sift through the state's Code of Regulations and eliminate 2.2 million words of unnecessary and outdated regulations. California Governor Gavin Newsome just announced an effort to use generative AI tools to improve public services and cut eight percent from the state's government operations budget.

And regulators are already using AI to facilitate compliance with existing policies, such as post-market medical device surveillance. AI also holds the potential to achieve administrative savings for

federal health insurance programs, or better yet, reduce the number of people dependent on them by identifying and treating ailments earlier.

There is an important connection as well between AI and broader national objectives. A strong technology base is a key source of strength and prosperity, so it is essential we do not undermine innovation and investment as the next great technology race gets underway with China and the rest of the world.

Luckily, U.S. innovators are still in the lead. Had a Chinese operator launched a major generative AI model first, it would have been a veritable Sputnik moment for America. Still, China has made imperial ambitions clear, its imperial ambitions clear to become a global leader in advanced computation by 2030, and it has considerable talent, data and resources to power those innovations.

Experts argue that China's whole of society approach is challenging America's traditional advantages in advanced technology. We therefore need an innovation policy for AI that will not only strengthen our economy and provide better products and jobs, but also bolster national security and allow our values of pluralism, personal liberty, individual rights and free speech to shape global information markets and platforms. If by contrast fear-based policies impede America's AI developments, then China wins.

To achieve these benefits that AI offers and meet the rising global competition, America needs what I call an AI Opportunity Agenda. An AI Opportunity Agenda begins with reiterating the freedom to innovate as a cornerstone of American technology policy, and the key to unlocking the enormous potential of our nation's entrepreneurs and workers.

As part of this agenda, Congress should craft a learning period moratorium on new AI proposals, such as AI-specific bureaucracies, licensing systems or liability schemes, all of which would be counterproductive and undermine our nation's computational capabilities.

In addition, this moratorium should consider preempting burdensome state and local regulatory enactments that conflict with our National AI Policy Framework. Next, Congress should require our government's existing 439 federal departments and sub-departments to evaluate their current policies towards AI systems, with two purposes in mind. First, to ensure that they are not overburdening algorithmic systems with outdated policies and second, to determine how existing rules and regulations are capable of addressing the concerns that some have raised about AI.

Taking inventory of existing rules and regulations can then allow policymakers to identify any gaps that Congress should address using targeted remedies. Finally, an AI Opportunity Agenda requires openness to new talent and competition. Experts providing that with a talent war brewing between the U.S. and China, China is moving ahead in some important ways, and we must take steps to attract and retain the world's best and brightest.

In sum, America's AI policy should be rooted in patience and humility, instead of a rush to over-regulate based on hypothetical worse case thinking. We are still very early in the life cycle. There is still no consensus on even how to define the term, let alone legislate beyond establishing definitions.

I thank you for holding this hearing and for your consideration of my views. I look forward to any questions you may have.

[The prepared statement of Mr. Thierer appears in the Submissions for the Record.]

STATEMENT OF DR. AYANNA HOWARD, DEAN OF ENGINEERING, THE OHIO STATE UNIVERSITY, COLUMBUS, OHIO

Dr. Howard. Chairman Heinrich, Vice Chairman Schweikert and members of the Joint Economic Committee, thank you for this opportunity to participate in today's hearing on artificial intelligence, and its potential for job growth and improved governance. It is an honor to be with you today.

My comments in this testimony are focused on the national importance of AI literacy, and its role in augmenting the current and future workforce talent pool, as well as the government's role enabling this to happen. While demographics of the U.S. are changing, these changes are not reflected in the diversity of students pursuing degrees related to AI, engineering and computer science.

According to the 2023 World Economic Forum Future of Jobs report, AI continues to shift the skills that are needed within the workforce, in some cases creating new jobs, augmenting old jobs and eliminating other jobs. AI talent shortage is thus not just a U.S. problem. Buying outside talent is thus no longer a viable option to solve this issue.

Too often though, we disregard our untapped talent pools. Organizations tend to over-index on hiring new talent with needed skills versus upskilling their current workforce. As an educator, I have witnessed bright students who, because of gaps in their high school curricula, leave the engineering major because they struggle when they take their first discipline-specific engineering course.

Yet when we have instituted enrichment programs such as Preface and Accelerate in the College of Engineering at Ohio State, we have seen quantifiable growth in student retention and graduation rates in engineering. There is thus no reason beyond intentionality and resources why organizations, government agencies and educational institutions cannot institute similar AI training and literacy programs within their own organizational borders.

There has been some movement in Congress to expand the Digital Equity Act into an AI Literacy Act, but there needs to be more. As a technology researcher and college dean, I also dabble a bit in policy with respect to AI and regulations. I think policy would be critical to building trust.

Policies and regulations allow for equal footing by establishing expectations and ramifications if companies or other governments violate them. Now some companies will disregard the policies and just pay the fines, but there is still some concept of a consequence.

Right now, there is a lot of activity around AI regulations. There is the European Union AI Act, which Parliament just adopted in March 2024. There are draft AI guidelines that were released by the Japanese government, and slightly different proposals in the U.S., including President Biden's AI executive order.

There is state-specific activity too. Over the past five years, it has been documented that 17 states have enacted 29 bills that focus on some aspect of AI regulations. In fact, on June 11th his

month, I will be participating in an AI symposium at the Ohio State House, which brings academic leaders, policymakers and industry experts to talk about the challenges and opportunities that AI poses for Ohio's universities.

But this practice of each state coming up with their own rules for regulating AI, it will continue to happen if AI bills are not being passed at a federal level, and that is a problem. I believe we have a lot of room for improvement and making sure that people not only understand technology and the opportunities it provides, but also the risks that it creates.

With new federal regulations, more accurate systems and increased AI literacy training and upskilling for the untapped labor market, this can happen. The intersection of the country's growing dependence on advanced AI technologies, coupled with the clear shortage of AI talent, is fast becoming a national security issue that must be addressed urgently. In 2001, Secretary of Defense Lloyd Austin emphasized in a speech that sophisticated information technologies, including artificial intelligence, will be key differentiators in future conflicts.

In the U.S. though, we have our risk and we don't have enough talent trained with sufficient AI literacy that is needed for advancing emerging technologies, critical to maintaining American leadership. If we are not careful, we might be living another 1957 Sputnik moment.

Today, with nearly every aspect of life evolving to being coupled to AI, the U.S. cannot afford to sit back and wait for an AI-based crisis to hit. We are at a crossroads. The U.S. must make an equivalently bold investment in growing the AI talent pool, to help protect democracy, citizens' quality of life and the overall health of the nation.

I want to thank you for this opportunity to participate in this important hearing, and I appreciate the Committee's attention to this topic, and look forward to answering your questions. Thank you.

[The prepared statement of Dr. Howard appears in the Submissions for the Record.]

STATEMENT OF DR. JENNIFER GAUDIOSO, DIRECTOR, CENTER FOR COMPUTING RESEARCH, SANDIA NATIONAL LABORATORY, ALBUQUERQUE, NEW MEXICO

Dr. Gaudioso. Chairman Heinrich, Vice Chairman Schweikert and distinguished members of the Committee, thank you for the opportunity to testify today on the crucial role of the national labs in driving AI innovations.

Doing AI at the frontier and at scale is crucial for maintaining competitiveness and solving complex global challenges. Today, I want to emphasize two key points about the national labs can and should contribute to Frontier AI at scale.

First, the role of the national labs in accelerating computing innovations through partnerships, and two, the role of the national labs in critical AI advances aligned with our national interest to date and going forward. But first, let me provide a brief overview of Sandia National Labs to provide context for the rest of my testimony.

Sandia is one of three research and development labs of the U.S. Department of Energy, National Nuclear Security Administration. Our roots go back to World War II and the Manhattan Project. Throughout its 75 year history as a multi-disciplinary national security engineering laboratory, Sandia's primary mission has been to ensure the U.S. nuclear arsenal is safe, secure and reliable, and can fully support our nuclear deterrence policy.

Importantly, there is strategic synergy and interdependence between Sandia's core mission and its capabilities-based science and engineering foundations, because breakthroughs in one area beget discoveries in others in a cycle that pushes breakthroughs and fuels advancements.

For decades, the Department of Energy National Labs have been pioneering breakthroughs in high performance computing through strong public-private partnerships. This collaborative approach has greatly enhanced America's overall competitiveness.

As Mike Schulte from AMD Research said, "One of the key takeaways is how impactful the forward programs were on our overall high performance computing, plus AI competitiveness. We not only created great systems for the Department of Energy, but in general it greatly enhanced U.S. overall competitiveness in high performance computing AI, and energy efficient computing."

Another powerful example is our recent tri-lab partnership with Cerebras Systems that I discussed in my written testimony. Let me expand upon that impact of that partnership by sharing the latest results.

Funded by NNAS, the team achieved a major breakthrough using the Cerebras wafer scale engine to run molecular dynamic simulations 179 times faster than the world's leading supercomputer. This required innovations in both hardware and software. This remarkable advancement has the potential to revolutionize material science and drive scientific discoveries across various domains.

For example, renewable energy experts will now be able to optimized catalytic reactions and design more efficient energy storage systems by simulating atomic scale processes over extended durations. This partnership exemplifies how to open up new frontiers in scientific research, potentially transform industries and address critical global challenges while pushing the boundaries of AI and computing technologies.

The DOE National Labs have also researched AI for decades, with a focus on addressing critical challenges for the nation. Recently, ten of these laboratories, including Sandia, showcased their work at the AI Expo for National Competitiveness in Washington, D.C. At the Expo, the labs highlighted their contributions to AI research and their ability to contribute to the frontiers of science and solve national energy and security challenges.

The labs are developing reliable and trust for the AI-based solutions for critical areas such as nuclear deterrence engineering, national security programs, non-proliferation, energy and homeland security needs and advanced science and technology. Pushing AI to the frontier and scaling it through the Department of Energy's Frontiers of AI for Science, Security and Technology initiative

known as FASST, will maintain U.S. competitiveness and solve global challenges.

The national labs' long history driving computing innovations, coupled with our strategic AI research focused on key applications, makes DOE and the labs invaluable partners for realizing AI's full potential through secure, trustworthy and high performance systems.

In New Mexico, we are working with our premier institutions and industrial partners in the state to finalize the New Mexico AI Consortium. This consortium seeks to transform the landscape of AI research, cultivate a skilled workforce, and build a robust infrastructure to support cutting edge AI research, education and commercialization in the state.

By harnessing the lab's capabilities through academic and industry partnerships, we can lead the world in AI while safeguarding our national interests. I welcome the discussions on how we can work together on this critical imperative. Thank you for convening the hearing, and I look forward to your questions.

[The prepared statement of Dr. Gaudioso appears in the Submissions for the Record.]

Vice Chairman Schweikert. (off mic)

Chairman Heinrich. Thank you, Vice Chairman Schweikert. Dr. Gaudioso, as you talk in your testimony, national labs like Sandia have historically played an important role in innovation and technology development. How has that prepared them to steward AI development?

Dr. Gaudioso. The national labs when it comes to AI development one, we have a history of working in AI, in the algorithms. Our work in advancing computing technologies has been focused on supporting the simulation missions and the science the labs have, but we can also have been using that computing power to start pushing large-scale AI.

We also in the national labs actually have the world's largest— the free world's largest scientific workforce, and the unique data sets that science has. So for instance, ChatGPT and other types of large language models are built on the corpus of knowledge that is in the Internet.

We know that we can build much more exquisite and impactful models if we train them on the exquisite science data that we have in the Department of Energy, and we look forward to using that data to build models that can transform how we do science to solve our challenges.

Chairman Heinrich. Can you explain a little bit of that, because you know, there is a tendency among some of our colleagues to think of AI now just as a really elegant chatbot, you know, something that can respond back with, you know, with language that you would be hard-pressed to know whether it was a human or not on the other side.

But when you take a large language model and you put in on top of some of these foundational science models, so that you can use language as the—basically to coach new science, new alloys, new molecules, new pharmaceuticals, out of these foundational models, you get really powerful combinations.

Can you talk about the opportunities there a little bit?

Dr. Gaudioso. I would be happy to discuss those opportunities, because I think, you know, we have the large language models that are trained on language, visual arts, other popular media. We now need to train physics models. We need to train them on chemistry data and these models will help us be able to make connections in the science data that today, you know, I am a chemist by training.

I was trained to read the scientific literature, comb through the data, spend years trying to make sense of the world around me, make a hypothesis, design experiments to test my hypothesis and iterate. Well, if we can train a chemistry AI model, I have my own student intern right there with all of the world's chemistry knowledge, or at least the trust chemistry knowledge included in it, and we can use that to make science go much faster and to make connections that no human is ever going to make, right?

And so we're already seeing this in materials discovery.

Chairman Heinrich. Yeah, material science in particular I just an incredibly slow, painful like long-term endeavor in the normal course of how we do science. I think it is really going to change that dramatically. We heard a little bit about the importance of labor and workforce in having, maintaining our advantages in AI.

But you mentioned something else, which is data. Talk a little bit about what the unique data sets that we have at places like our national labs, within our agencies, and how some of that—and for that matter data curation, the importance of data curation, how that gives us a leg up over some of our competitors as well.

Dr. Gaudioso. Yeah. The data is really at the heart of AI, right, and we have data both open science data, the Office of Science Laboratories. The national labs broadly do science to advance the public interest. So most of the science data we have is public.

But we as the scientists that discover and produce that data know how to interpret it and how to curate it to make it AI-ready, and to be able to use it to build these models. But we also have access—as federally funded research and development centers, we have trusted partnerships with the U.S. government, and we have access to national security science data that we use, as Sandia does, in designing hypersonic reentry bodies or nuclear weapons.

And that data, which of course we do not want to make public, can be used to train closed foundation models that will help us change the design life cycles and respond to—at the speed of the national security threats we are facing today.

Chairman Heinrich. Great. I am going yield back the rest of my time, Vice Chairman.

Vice Chairman Schweikert. Thank you, Chairman Heinrich. Dr. Miller, first you already know I am a bit of a fan what you do and the way you think. Can you play a game with me instead of just reading a written question here? I come to you, you get to use the full power of what you believe exists today and is going to exist over the next year.

How could you revolutionize medicine? How could you revolutionize the cost? How could you revolutionize making people well and the morality of ending and providing cures?

Dr. Miller. A couple of answers. One, if you had high blood pressure, we have software that could titrate the medications for you. You could do that home, you could send me a message. I could talk

with you about exercise, and in fact software in theory could titrate lots of medications for lots of common conditions.

You would not even have to necessarily leave your house to see me. In fact, a lot of the time you might not even need to see me, and then see me for acute concerns. You could automatically have your clinical preventive services ordered, right? You could have your colonoscopy, if relevant a PSA to check for prostate cancer.

So a lot of care could occur not just outside the walls of the clinic, but also even outside needing to see a physician. And then let us say you had a condition and you had to do a prior authorization, which my colleagues and I do not particularly enjoy doing.

Imagine if the first layer of approval or review and then approval were automated and in near-real time?

Vice Chairman Schweikert. You know, we have that piece of legislation. So Doctor, within that scope, you have the data of my wearables, my breath biopsy, whatever it may be. Do you see a world at least at the basic level, the AI and then the algorithm that's attached to it could write the scrip?

Dr. Miller. Absolutely.

Vice Chairman Schweikert. Okay. That was clean without a whole lot of struggle. Dr. Howard, this is a little bit different, but in—and you need to correct me, because I was listening to your discussion about okay, we need more people, a variety who are writing AI and code. But in some ways, maybe I have the utopian vision of it provides access for more people to be able to do technology.

Most people have no idea of how to write an app, but they can use the app to do technical jobs. Is there some ways that yes, there may be this hierarchy of here is over here, my people writing code, doing those things. But over here, is not this an empowerment for almost every American to do things that are much more complex?

Dr. Howard. Yeah, it is. So when I define AI literacy, it is not about creating computer scientists or coders. It is about making every citizen understand how to interact with AI to do their jobs better. So it is allowing doctors to basically talk in their phone and then transcribe it into the actual records that can then be shared with other doctors. So that is really about it.

Vice Chairman Schweikert. Okay. That is much more elegant way to phrase it. Mr. Thierer, what is my GDP growth? What is my—I have a personal fixation on where we are demographically as a country. We are getting old very fast. We often do not want to talk about it.

We have to be brutally honest. 100 percent of calculated future debt for the next 30 years, interest, health care costs and if a decade from now we backfill Social Security. It is demographics. What is your vision of AI, the growth, the labor substitution? Does it save us?

Mr. Thierer. Yeah. Well, nothing can save us, but it can certainly make a major contribution towards the betterment of our government processes and potentially our debt. There has been various estimates, Congressman, on exactly how much AI could contribute to overall gross domestic product, the low end being somewhere like at least 1.2 percent annually, but it goes up from there, with one forecast for 15——

Vice Chairman Schweikert. I beg of you to be slightly louder.

Mr. Thierer. 1.2 percent annually GDP boost and 15.7 trillion potential contribution to the global economy by 2020, according to another report. I have all this data in a supplement to my testimony. And again, the estimates vary widely.

But the bottom line is almost all economists, political scientists and consultancies realize that this is a great, you know, opportunity for the United States to once again build on the success of our past technological, you know, success story of the Internet and digital economy, you know.

We look at the data that our government has put out, the Bureau of Economic Analysis. I mentioned one data point in my testimony. $4 trillion in gross output from digital economy in 2022. Nine million jobs, a huge amount of compensation. 18 of the 25 largest digital technology companies in the world by market capitalization are U.S.-headquartered companies. Fully 50 percent of the largest digital technology employers in the world are American technology companies. That happened because we got policy right.

Vice Chairman Schweikert. Thank you, Mr. Thierer. All right. To our true AI expert, Mr. Beyer.

Congressman Beyer. First of all Mr. Vice Chairman, thank you very much for convening this, and I am very excited to be here. Thank you very much for coming. I am a huge AI optimist, especially on the health care side.

So Dr. Miller, in fact I just got off a Zoom a couple of minutes ago with Dr. George Church at Harvard, who was explaining to me that he and his colleagues have built new microorganisms with DNA completely different from all the other DNA on the planet.

And because of that, the viruses do not work. They are completely, completely immune for viruses. Within these are the idea of making replacement organs that will not be rejected, because there will be nothing to reject. They will be unrecognizable. Just extraordinarily exciting.

So Dr. Miller, you talked about how agencies like ARC have been at the forefront, but we have seen in the past that to introduce the new technologies to medicine has not necessarily improved things. He specifically talked about the absence of labor productivity growth in health care. The best example I can think of is how EHR, electronic health records and the lack of interoperability.

Veterans Affairs and DoD have been fighting for years about how to bring them together. How do we take—how do we acknowledge the 17 to 19 percent GDP on health care, like double the highest of any other place in the world, and use AI to bring down those costs and bring labor products in the deal?

Dr. Miller. Thank you. I think a lot of this is practical, right? So one, one of the many things that gets in the way of actually us using it in a productive and proactive fashion is state and federal regulation. There is a role for state and federal regulation, but we do not want to go to town to prevent people from innovating at the bedside and getting it into practice.

Think about a radiologist, right, reading CT scans, mammograms. Imagine if software automatically went through all the images and I pre-identified the areas of concern. That could massively speed up the efficiency at which that radiologist reads those CT scans. Instead of reading ten an hour, maybe they read 12 or 14.

So if we direct payment and FTA policy to support this, for example, if a tech company is providing a service, why not let them bill, right? If they can provide that service cheaper than I as a physician or a nurse practitioner or a pharmacist, they should have the opportunity to bill for that and compete.

And if you have that competition within a population-based payment system like Medicare Advantage or Medicaid Managed Care, you can potentially drive service delivery and innovation for consumers to then have a choice.

They could have a choice of whether they want human in-person service; they could have remote human service, maybe with a blue tooth exam; they could have remote service like audio video only; they could have automated service, right, from software, or they could even have a phone visit or maybe an email visit.

And so if we drive policy to give consumers that choice, then that will improve labor productivity, because the consumers will choose.

Congressman Beyer. Thank you, Dr. Miller, very much. Mr. Thierer, your ten principles to guide AI policy, you said "It's equally important that lawmakers not demand that all AI systems be perfectly explainable in how they operated." We had Secretary Becerra in here recently over at Ways and Means. I asked him about that, and he said that HHS does not have enough authority to see behind the curtain. But we also, every doctor I talk to, is worried about prior authorization decisions being made by AI.

What are the limits of explainability? What can we as lawmakers really demand in terms of explainability?

Mr. Thierer. Yeah, well transparency is a good principle, but the question about how to mandate it by law is always tricky. And when you get specifically into algorithmic explainability, the question of exactly how do you explain all the inner workings of a model before it gets to market, right?

That is very difficult, and what I have articulated in the ten principles to the AI Task Force that I sent out were basically the need to, on the back end, look at how we can regulate the outputs or outcomes associated with algorithms, as opposed to trying to micromanage all the inputs and figure out how "explainable" they are, quote-unquote.

Because I think that is a fool's errand. I do not think that can be done efficiently without stopping a lot of that innovation from happening altogether. That does not mean again we do not regulate; we just regulate it as we look at the outputs or outcomes to see did it actually work as billed, right? That is the most important thing. Did it actually hurt anyone? Is there any actually consumer harm, and then we address it with targeted policies.

Congressman Beyer. Great, thanks. We do have a wonderful AI Foundation Model Transparency Act, bipartisan, two Dems, two Republicans in the House side, I think many on the Senate side, trying to find that right balance. But thank you for the principles, and Mr. Chairman, I will yield back.

Vice Chairman Schweikert. Mr. Schmitt.

Senator Schmitt. Thank you. Just a few comments, then I have a couple of questions. America's poised to enter the next decades of the 21st century hand in hand with the technology that could possibly define it: artificial intelligence.

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Decades of innovation and entrepreneurship have led to this point, from industry titans of NVIDIA to innovation centers like St. Louis' own geospatial hub. America is ahead in the AI race and has the resources to double down on its unique advantages.

Yet America's position in AI is under constant pressure. China is investing billions and billions into its own AI industry. Some of this investment is for AI surveillance technology, to export their malignant surveillance state abroad. There is no telling what could happen if China became the dominant player in the 21st century. I am sure China is watching us; Europe is too, hoping that we bury our burgeoning AI industry in unnecessary regulation and lose sight of what got us in this position in the first place.

The worse thing we could do in this race towards AI is stifle innovation by unleashing the bureaucrats and putting crippling regulations onto innovators. The EU has done this and now Europe will now most likely be watching this race from the sidelines.

Yet there have been rumblings here on Capitol Hill and fancy summits all over the world that the U.S. should over-regulate this industry. This would only serve to hamstring our innovation and give the China the keys to this amazing technology.

I want to zero in on this because we—I think this is a common theme that we hear about as far as over-regulating, and I think the American way here is a—we are concerned about this. But I want to drill down on that a little bit, and maybe Mr. Thierer I will start with you.

What do we mean by that? Like how would you define that? Colorado has passed some regulations that even their governor has questioned. I am just using that as one example. What is it that we should be concerned about in this framework?

Mr. Thierer. Certainly. Thank you for the question. So first of all, as of noon today, there are 754 AI bills pending across the United States of America. 642 of those bills are at the state level. That does not include all the city-based bills.

Probably the most important AI bill that has passed so far is New York City. Not New York state, New York City. And so there is patchworks and then there is patchworks, right? And so the cumbersome nature of all those compliance rules added on top of each other, even if well-intentioned, can be enormously burdensome to AI innovators and entrepreneurs. So that is just one thing to note.

The other thing to note is that there has been discussions about the idea of like overarching new bureaucracies or, you know, certain types of licensing schemes. I have no problem with existing license schemes as applied in the narrow focused areas where AI might be applied, whether it is medicine, you know, drones, driverless cars.

But an overarching new licensing regime for all things AI is going to be incredibly burdensome. That is a European approach. We do not want that. And sir, let me just say something about your China point, because this is really important.

You know, we are here on June 4th. This is the 35th anniversary of the Tiananmen Square Massacre. When we talk about like, you know, the importance of getting this right for America and our global competitiveness, it is important for exactly the reason you

pointed out. Because if we do not and China succeeds, then they are exporting their values, their surveillance systems, their censorship.

The very fact that I just uttered the term "Tiananmen Square" at this hearing means it will not—this hearing will not be seen in China. I apologize for that to everyone else here. But the bottom line means that that means what is at stake is geopolitical competitiveness and security and our values as a nation. So this is why we have to get it right.

Senator Schmitt. So it is interesting, because when I was going to school the idea was that sort of the more literate a society became, the more educated it became, the more open it became, the more likely they were to become a democracy, right, and China was kind of always an example of maybe if there are fewer poor people there and they are more literate, that ultimately they will demand more.

But interestingly, AI has uniquely, and very low tech AI as it relates to surveillance, has empowered Communist regimes, right? It empowers the totalitarian level of control that 30 years ago I am not sure anybody could really foresee, and that is certainly what they have capitalized on to your point.

If people think that that is a way to maintain power, which has been the way of the world in many places, you are right, you know—They become the dominant player in this. I do want to just shift with a little bit of the time I have left, and anybody please chime in on this point, but I will start with you, Mr. Thierer, again.

Big tech versus little tech here. I think there is a—there is a concern, at least that I have, that a regulatory scheme or we are doing something that sort of protects the big players, but ultimately leaves out the innovation, again that got us to this point now.

How would—how do you view this and what can we do to guard against that, because I do think there are some folks that want a more, sort of a protectionist view of the big players here, and they have all the answers. They are very important players, but not the only players. How do you guard against this shutting out little tech in this process?

Mr. Thierer. Amen to that. So, let us take a look at Europe. I mean one of the things that I always ask my students or crowds that I talk to about AI policy or technology policy, as I say, name the leading digital technology innovator headquartered in the European Union today. Silence, right?

That has everything to do with getting policy wrong, and what the European Union—the only thing they are exporting now is regulation. And basically that is all they have got left, and they are trying to regulate mostly large American tech companies.

And so what is ironic that—is it was meant to sort of like keep things more in check and competitive, but there is only a handful of large technology companies that can comply with those rules and regulations. We do not want that to happen in the United States. We have thousands upon thousands of small entrepreneurial companies starting up in the AI space right now, and this is the hope for the future, especially open course technology.

You know, right here in America that is happening on the ground. We have got to preserve that entrepreneurial, you know,

freedom to innovate kind of model for the United States, so we do not become the innovation backwater that is the European Union.

Senator Schmitt. Thank you. Thank you, Mr. Chairman.

Vice Chairman Schweikert. Senator Klobuchar.

Senator Klobuchar. Thank you very much. Thanks for doing this important hearing, and thank you to our witnesses. I come from a state that believes in innovation. We brought the world everything from the pacemaker to the post-it note, and I also think that we have to get ahead of this in a good way.

We have to put guardrails in place. That is something that we really did not do with tech policy, and now there are all kinds of issues with privacy. I am not going to go into everything that we need to do, that I hope we can do differently with AI.

I think David Brooks, a columnist, put it best when he said "The people in AI seem to be experiencing radically different brain states all at once. I found it incredibly hard to write about because it is literally unknowable whether this technology is leading us to heaven or hell."

We need guardrails that acknowledge that both are possible. So I will start with Senator Thune and I serve on the Commerce Committee, and we have introduced legislation that has gotten some positive feedback, the AI Research, Innovation and Accountability Act to increase transparency and accountability for non-defense applications, and sort of differentiating between some of the riskier applications like electric grids and then others, and directing the NIST, the Commerce Department to issue standards for critical impact systems.

So I guess I will start with you, Mr. Thierer. The bill that I just mentioned takes a risk-based approach that recognizes different levels of regulation are appropriate for different uses of AI. Do you agree that risk-based approach to regulation is a good way to put in place some guardrails?

Mr. Thierer. Yeah, absolutely. I wrote a paper about your bill, Senator, and I——

Senator Klobuchar. Maybe I know that. It gets kind of a softball beginning.

Mr. Thierer. Well, I love building on the NIST framework, right, because that exists and it was a multi-stakeholder, widely agreed to set of principles for AI risk management. And so it is really good utilize the sort of existing sort of regulatory infrastructure we already have, and build on that first.

Senator Klobuchar. Uh-huh, very good. Do you want to add something Dr. Howard? I also noticed that your testimony emphasized the importance of AI literacy, training and we actually in that bill direct the Commerce Department to develop ways of educating consumers that this has got to be part of anything, including the work that Senator Heinrich, our leader here, as well as Senator Schumer and Senators Rounds and Young have done for the bigger base bill, and that we hope to be part of. Do you want to talk about literacy a bit?

Dr. Howard. Yeah. I think even if you think about doing policy right, you have to have individuals understand that definition of right. If you do not understand AI and both the opportunities and the risks, there is no way that you can think about great policy.

And so when I think about this, it is not just computer scientists and engineers; it is everyone that is touching any type of technology, to understand how to define it, understand data, understand parameters, understand outcomes, understand what the impacts are on different markets, different populations. So that is really important.

Senator Klobuchar. Do you want to add anything, Dr. Gaudioso?

Dr. Gaudioso. You know, I think, that there is the importance of the risk framework. There is also research that needs to be done to give us the technical underpinning, right? Trust is something that a human conveys, but we are still in the early stages of doing research to understand what makes a model trustworthy.

When does it respond within the bounds of our data, what— where is it reliable, where is it not? And so I think, you know, policy just needs to keep in mind where we are heading and what the technical basis is at any given point in time, because the technology to understand the trustworthiness, the mathematical underpinnings is something the national labs have researched for a long time and is moving quickly.

Senator Klobuchar. Uh-huh, very good. One of the things that I am like hair on fire at the moment is just because I chair the Rules Committee, is the democracy piece of this, and I guess I will ask you. This is not the subject really. We are talking about innovation.

But if our democracy is unstable because people do not know if it is the candidate they love or the candidate they do not like that is speaking, because you cannot tell, it is just something that we have to think about in terms of going forward as a nation. Something like over 15 states now have required bans or disclosures on deep fake ads.

Senator Hawley and I, as well as Senator Collins and Coons and many others have put together a bill on actually banning deep fakes with exceptions for satire and the like. Senator Murkowski and I have the bill that we lead on disclaimers. And I am just really worried with federal elections, that while states are doing things, which is good, we do not preempt them on state ads, that we have to guardrail our democracy here so people know who they are hearing from.

And I often get worried that some little disclaimer at the end, no one is going to really know. Do you want to answer that?

Dr. Howard. That is true. It is just like with consent forms. Nobody actually reads them, and so one of the things is how do we provide individuals or how do we provide some transparency and trust on the information they are hearing, because we know it is very easy to manipulate individuals with advertisement and media.

And so if those advertisements and media are very, very real or associated with a candidate that people resonate with or do not, that will influence them, guaranteed 100 percent.

Senator Klobuchar. Uh-huh. And Dr. Miller, I think I am out of time, but I will put a question in writing to you on tech hubs. I know that you know a lot about this kind of—your testimony is on the importance of policies that promote development of new

science and new innovation, and we have a lot of medical device in Minnesota and it served our country well.

I just want to talk a little bit about that and tech hubs, and you can do it in writing, unless you want to add something and the Chair will let me ask you that. Is that okay? Do you want to add anything on that?

Dr. Miller. Yeah. I guess one thought, I think, with tech hubs and also just tech innovation, is we often do not realize that the current status of purely human-driven care is actually frequently low quality and often highly unsafe.

And so promoting innovation at universities, at small companies that change that and automate components of care delivery or assist nurses, doctors, pharmacists, whomever in making decisions, will actually massively raise the quality and safety and efficiency of care.

I would add, I would say my greatest fear is actually that we do not take advantage of this opportunity, because the care delivery system is a mess.

Senator Klobuchar. That is where you go to heaven or hell. We have got to make sure we have got it right. All right. Thank you very much, Dr. Miller. Thank you all.

Chairman Heinrich. And Senator, that was a terrific question. It is sort of the—we sometimes have, are emotionally tied and sometimes the disruption of the technology makes us nervous. But the math is the math.

You know, we have seen a number of papers that talk about some of the ability for the AI to read the data coming off my watch or the wearable or the glucose meter or the thing you blow into, and being able to analyze that data actually is remarkably good and statistically much more accurate, you know, someone that went to postgraduate school for what, nine years?

And I feel crappy saying that, because I cannot imagine what your student debt is.

Senator Klobuchar. On that note——

Vice Chairman Schweikert. Yeah, on that note. Thank you, Senator. And Congressman Beyer was actually—and he and I were sort of channeling each other. Where I am trying to get is a model where AI makes traffic better, where AI helps me attach an air quality monitor to these things, and we crowd source our environmental data, where AI is—and I accept some of that becomes technically an algorithm underlying. It is actually not, you know, crawling through a stack.

But even where Congressman Beyer was, the ability to revolutionize the cost and delivery and efficacy of health care, of—what was it, about three weeks ago, a month ago, we had one of the first drugs solely designed by AI, a new molecule that looks like it has a remarkable efficacy.

How do I get this to move fast, because I believe cures are moral? And it is an interesting—is the solution an environment as you and I think about policy, is it taking a look at the outcomes and making sure those outcomes are effective and in some ways moral, efficient?

Because if we do not do something fairly dramatically on the cost of delivering services, I mean yesterday we borrowed $101,000 per second over the last 366 days. It is a leap year.

You know, if I had come to you a few years ago and said we are going to be over $100,000 a second in borrowing, and almost all the growth of borrowing is interest. Interest now will be number two in our spending stack, and the growth of health care. Am I channeling you appropriately?

Congressman Beyer. Totally, very much so. It is terrifying to think that interest on the debt is greater than Medicare, greater than Medicaid, greater than the Defense budget. Only has to catch up with this discretionary non-defense.

Chairman Heinrich. Yeah, just Social Security.

Congressman Beyer. And Social Security.

Chairman Heinrich. So as I come to all of you, you have the ginormous computers and lots of technical data that is not public. You have the next generation students. You have the policy and you have the case of how we could revolutionize health care. How do I deal with the fact that when he and I have actually had conversations of telehealth, you know, digital health.

The fact of the matter is in many ways you know this because you sat and we talked about it. If the pandemic had not happened, I do not know if I would have ever gotten our telehealth bill a single hearing. It only moved forward—and because apparently grandma would not know how to work FaceTime. Turns out she is really good at it.

I do not believe the next generation is talking to someone on the phone. I think it is reading the data off my body. How do I sell this story, Dr. Miller? How do we sell the morality of doing it better, faster, cheaper and much more accurately?

Dr. Miller. I think it is immoral not to do that, right? So if we do not give patients the choice of having cheaper, more efficient, more accessible, more personalized care, I think that we would be making a massive moral error. You mentioned telehealth. 20 years ago if we talked about telehealth, people would say that we were cuckoo for Cocoa Puffs, right, because no one is going to call their doctor, do Skype or FaceTime, and now it is the standard.

It took a global pandemic where a million Americans died, for us to have telehealth. So I think the answer is one, hopefully we do not have another global pandemic, but we do not want to wait until there is some catastrophic event until we offer automated or autonomous care, right?

If you are a poor American with chronic disease, autonomous and automated care or AI-assisted care is basically the best thing ever, because you will get more access, you will get higher quality and it is going to be cheaper. So I personally think that we have to do it. It is not a choice.

Chairman Heinrich. Mr. Thierer, and if you—I know you are going to respond to that. Does it make a difference in our world that, what was it three weeks ago, Apple finally got its next generation a watch for cardiac arrhythmias, those things, essentially certified as a medical device.

Is that what you were talking about, that the next generation disruption is coming?

Mr. Thierer. Yeah, absolutely. And to answer your question, Congressman, about how we essentially sell these benefits, we talk about it in terms of opportunity cost. Like what would be losing, it is what kind of foregone innovation will we lose if we do not get this right?

Well, we can put our numbers on this. Let us talk about some of the biggest killers in America today. 800,000 people lose their lives to heart disease. 600,000 people lose their lives to cancers every year now. I mean how about—how about cars? Let us talk about public health and vehicles.

I mean every single day there are 6,500 people injured on the roads in America, 100 of them die. 94 percent of those are attributable to human error behind the wheel. I have to believe that if we had more autonomy in the automobiles sector, we could actually make a dent, excuse the pun, in that death toll.

Yeah, and so I mean this is where we can talk to the public about like the real world trade-offs that work if we get this wrong, right? I mean we have had a 50 year war on cancer that goes back to the time when Richard Nixon was in office and, you know, we have made some strides, but we could make a lot more if we had serious, robust technological change to bring to bear on this through the form of computation and algorithmic learning. I mean this is where we can make the most efforts.

Chairman Heinrich. Mr. Vice Chairman, if I can wonder for just 30 seconds?

Vice Chairman Schweikert. (off mic)

Chairman Heinrich. Okay, well I'm just—I just wanted to help you stay on message. But if I can go off message for a minute. I wanted to respond to one of the things that Senator Schmitt said about licensing. My dear friend Tom Wheeler, who chaired the FCC, a Democrat and clearly a left to center Democrat, called to tell me how important it was not to use licensing in AI.

That when we did that, all we were doing was essentially embracing anti-competitiveness, and locking in the advantage of the incumbents. We need to be very careful about that. Senator Schmitt also started with two minutes on China. I also want to quote Martin Wolf, who is the editor-in-chief of Financial Times, saying please do not give up.

That 20 years of liberalization is too soon to tell, that sooner or later, the state model of Virginia is sic semper tyrannis, that sooner or later the Chinese people are going to rise up. And we need to be worried about the Chinese Communist Party, not the Chinese people, that they will be demanding freedom sooner, hopefully rather than later.

Dr. Howard, I have two Brunonian children. So it is wonderful to have you here, and I really appreciate your service on the National AI Advisory Council. I mean you really set the stage for the big executive order and all that.

And I specifically understood your emphasis on digital literacy. We have been looking at what Finland has done with the multi-hour training in digital literacy. As we struggle with deep fakes, which are now coming more and more, that you start with the notion that we need to be teaching people what to be suspicious of, and let their own instincts kick in.

But how—how can we develop digital literacy in a much more robust way that we have done so far?

Dr. Howard. Well, I think this is an area where you have to bring in academics, industry, organizations, non-profits and government. I think about it as very similar to cybersecurity. Nowadays, people actually check to make sure is this really spam. I'm not going to click the link.

But I will tell you five years ago, everyone was clicking. And so how do you get people to be aware that this is an issue? Half of the Americans have no clue that, you know, there might be a fake. It might be manipulation. Advertisement might by via chatbot. I mean so what it really is is ensuring that we have this conglomeration of everyone thinking about how do we train within the organization, outside the organization, from K to 12 to gray.

Chairman Heinrich. David, also before yielding back to you, because you did not shorten my——

Vice Chairman Schweikert. This is a conversation. We are doing almost a colloquy question model.

Chairman Heinrich. Well, in a colloquy thing, I want to thank you for bringing together——

Vice Chairman Schweikert. And we are actually also stalling, because I have another member coming.

Chairman Heinrich. Oh okay.

Vice Chairman Schweikert. So keep going.

Chairman Heinrich. Thank you for getting the Joint Economic Committee to focus on the challenges of diabetes, and end stage renal disease. We had the same type hearing a few months ago, and we have both been worried about the cost of dialysis. It took Mitch Daniels, former OMB Director, etcetera, to do the math while we were sitting here and say 31 percent of our Medicare budget right now is just dialysis.

Vice Chairman Schweikert. Think about what he just said. 31 percent is Medicare; 33 percent is all health care. It's functionally diabetes.

Chairman Heinrich. $260 billion a year, and now we have GLP–1 antagonist. We have solutions. Not inexpensive, but so far——

Vice Chairman Schweikert. Can you help me do some things on the farm bill?

Chairman Heinrich. Oh, absolutely. Everything we can. But this, when we look at how to deal with the $100,000 a second and how we make the 19–18 percent of GDP on health care trim down, and not just GLP–1 but many other ways that we think are using technology and AI and better management to manage health care in America.

Vice Chairman Schweikert. Dr. Howard, just a stick in the back of your head and it is a slightly non-sequitur as you were talking about teaching people technology literacy. What is our only success functionally in the last decade of getting Americans to actually exercise?

We have spent hundreds of billions. This is somewhat of a trick question, and he may—he already knows the answer. It was gamification. It was Pokemon Go. I know that sounds absurd, but if you actually look at the data, Pokemon Go did more to get people

out chasing their little—and we have often had this running discussion.

What would happen if that type of technology, saying here is how I train you how to understand how to work ChatGPT. The gamification of even down to health care and maintaining—if drug adherence is 16 percent of all U.S. health care, when I forget to take my statin, when I do not do those things.

How do I make it so my pill bottle cap beeps at me and those sorts of things. There are solutions that are genuinely ahead of us, and we are actually struggling, saying is there a unified theory of the ability to use this technology disruption when I call the IRS? The person I am talking to is actually ChatGPT.

But it stays on the phone with me, and it helps me fill out my forms and then maybe texts me the form I need, instead of someone who has been dealing with crazy for seven hours and does not really want to be on the phone with me. That is actually going on right now and so far the early data of the IRS experiment of using a chatbot has been apparently early good.

That is human, so if it be from the curers to the education to the, you know, miracles of producing new materials. We are trying—help us sort of build the argument that, you know, many of us are not that bright, but we get to sit here and read things that smart people write for us.

But how do we create a unified theory of let the technology run, because God forbid, none of us truly know what it is going to look like a few years from now. I mean am I being fair?

Congressman Beyer. Mr. Chairman, will you yield for questions?

Chairman Heinrich. I thought you were going to tell us it was a pickle ball, rather than——

Vice Chairman Schweikert. You know I do not like you anymore. I tried one pickle ball and my eight year-old beat me. I mean——

Mr. Thierer. Could I just wholeheartedly endorse what Dr. Howard had to say about digital literacy, AI literacy, because this is really important. First of all, Representative Rochester has a really nice bill on digital AI literacy that I think we should take a look at. It is really good stuff.

And when we talk about this, you know, AI literacy/digital literacy, we are talking about, you know, learning for life. You know, no matter what kind of punches come out, if we can roll with those punches and figure out how to adapt when we know more about the technology.

It is about building resiliency, societal and individual resiliency. And you know, people sometimes laugh at this. I was on a—I was a co-chair of an Obama administration Online Safety and Security Task Force, where like the only thing anybody in the room could agree on was the importance of digital etiquette and literacy.

So there is a lot of agreement on this. This a good place to start. It is a good foundation for building that resiliency. And some people will say well, that is not enough. Okay fine. We will find other remedies. But it can go a long way.

You know, I am old enough to remember the problems we had in this country with littering and forest fires back in the 60's and

70's, and I remember well, I am sure some of you up there too as well, that you know "give a hoot, don't pollute." We addressed that, right? We went after Woodsy, you know, Woodsy the Owl and things like that, with Smokey the Bear and forest fires.

We made a huge difference just with societal education about the problems of littering and forest fires, right?

That was not a law that passed. That was actual societal learning. It was wrong to throw things out the window of your car, right?

So you apply that mentality to the world of like digital and AI policy, and we talk about again, AI etiquette, netiquette if you will, like proper behavior. Using algorithmic services and technologies, using LLMs, using, you know, these systems.

Vice Chairman Schweikert. I want to go, and actually I also want to Mr. Beyer to come into this. And you know, you teach students. You already have—you have to deal with lots of freaky, smart people. Most of them bathe, I assume, because it is actually really funny if you know some of your scientists.

How do I deal with my brothers and sisters here who are not Don Beyer, who are almost fearful of technology? I mean you know, what do we do to take away—I mean I swear they instantly think of a Terminator movie. I mean what do you do—I mean in health care.

I cannot tell you the—and I'm forgive my elegance in my language, the crap I take when I basically say the same things you have at forums of here's my health care cost, here's things we could do to disrupt it using technology.

And I will get administrators and this and that to come and say "well, we can't do that. It might be against our state law."

Dr. Miller. Technology allows us to operate at a higher level. I have a terrible sense of direction, right? So I use Google Maps and Uber and Lyft to get places. I do not pick up a rotary phone and call my friends to ask for directions and write them down on a note pad, right?

Vice Chairman Schweikert. Is that after you look it up in the phone book?

Dr. Miller. Right, yeah. I do not even have a—do not even have a phone book in the house anymore, and you know my iPhone organizes my calendar and email and tells me where to go and what to do, because I am a little absent-minded. And that is the standard. Like that is the standard of my day.

And I think if we make that an analogy over to health care, where right now we have the rotary phone and we actually single-handedly keep the fax machine lobby employed, we have an opportunity to totally transform that, so that the clinical example is like if your blood pressure is really low and you have septic shock and you are going to the ICU and you are getting pressers, have to stick some big IV in your neck, 30 years ago if they did that they would just look at, you know, the topical landmarks and put the IV in and hope that, you know, they didn't hit your carotid artery, which would be bad.

Now, you use ultrasound. You do ultrasound guided. You have a little probe and you take a look and if you try to do it the other

way, the nurse would run screaming into the room, telling you that you are about to be negligent and doing something bad.

And the answer here is that technology will allow us to do a safer, more effective job. It will become the standard and at some point to actually not use technology will be negligent.

Vice Chairman Schweikert. You get the last.

Congressman Beyer. Well first of all, on your comment on gamification, I wanted to show you, David, that I'm on Day 641 on Duo Lingo.

Vice Chairman Schweikert. I am so proud of you.

Congressman Beyer. And that is only because of gamification and——

Vice Chairman Schweikert. But it makes my point——

Congressman Beyer. And it will ring at 11:30 at night if I forgot to do it.

Chairman Heinrich. So that is what I want from pill bottle caps when you do not take your statin.

Congressman Beyer. And Dr. Gaudioso, I was very impressed with all of your testimony, but especially the notion that scientific machine learning, Sandia's fusing machine learning with scientific principles to solve scientific and engineering problems.

For me, that is maybe the most exciting part of AI. Not ChatGPT-4, 5 or 6 or 7, but the notion that everything from fusion energy to how our biology works, etcetera, etcetera, that you can use machine learning, the predictive parts of AI to figure things out. Can you expand on that as a scientist?

Dr. Gaudioso. I would love to. Thank you for the question. You know, I think—to me, this is—this is the really exciting potential, right? I mean ChatGPT has shown us how it can change our daily interactions and, you know, I was able to put my written testimony into our internal chat engine and ask it if it was, you know, helping me make it a little less technical and more general, and it was great for providing me with a first draft and editing.

But that is just been trained on the corpus of knowledge that is in the Internet. I think what I get really excited about is the transformative potential of training models on science data, so that I have my chemist intern with me that can help me discover new science properties, that can then help me think through the physics in thermal and mechanical stresses to design a part that can be manufactured today, right?

We can just go from a new material to something that can be in our hands and usable, and transform not just how we do medicine and how we interact with patients, but how we make things in the country. And so AI has the potential if we do it and we can train it with science, so that these concepts of hallucination and statistically guessing what the next answer should be based on what it has learned, we can constrain that with physics and chemistry and science data.

We can then do new manufacturing. We can make digital twins of the human body to take to drug discovery from decades down to months, maybe 100 days for the next vaccine.

Vice Chairman Schweikert. Beyer, anything to follow-up.

Congressman Beyer. No, but I am so glad that you are doing that and I—one of the things we do not talk about much is as

somebody who ran a small business for many, many years, the notion that one of the most important technologies is management.

We do not tend to think of it that way, but the way we can—the way we can explore the use of artificial intelligence, to make much better and management decisions much better. Once again to the issue of making our world much more efficient, dealing with the $100,000 per second that we borrow.

Vice Chairman Schweikert. And if we are lucky we will replace members of Congress with something intelligent. Never mind.

Congressman Beyer. Or raise our pay.

Vice Chairman Schweikert. And they have called votes for us on the House side.

Congressman Beyer. Oh no. Can I ask one more question?

Vice Chairman Schweikert. Will it be short?

Congressman Beyer. Yeah, yeah.

Vice Chairman Schweikert. You sure?

Congressman Beyer. I am positive.

Vice Chairman Schweikert. Okay.

Congressman Beyer. Dr. Howard, you started Zyrobotics, and you also made, what does it say, STEM tools and learning games for children with diverse learning needs.

Dr. Howard. Yes.

Congressman Beyer. I would love—you know, the chair of our AI Task Force, Jay Obernolte, Dr. Obernolte, machine learning, master's from Cal Tech, so sort of a smart guy, and he made his fortune in video games. I would love to get your insight into how we use gaming to help educate people, on not just artificial intelligence but on everything else in the science world?

Dr. Howard. Well with Zyrobotics, I could get five year-olds to learn how to code through gamification. And so—and it really is, is how do you provide small nuggets based on someone's knowledge, engaging with them, and bringing them along, scaffold them along til at the end they are like oh, I am actually putting code together to do simple things for a five year-old. I think that could be done with adults as well.

Congressman Beyer. Yeah, I would love to work with you. I have a couple of ideas which we could go offline with. But David, thank you so much, Mr. Chairman.

Vice Chairman Schweikert. And he knows that is actually one of my fixations. So you are—there is a reason I like you. Thank you for engaging in this hearing with us. You be prepared. You have—we are going to—for three days we may ask you questions.

I am going to ask also to do something a little bit different for the public record. If you have articles that you think would be appropriate for us to try to absorb, in reality we are going to make our staff read it and then give us the highlighted copy, please send it our direction. And with that we are off the boats. This hearing is adjourned.

[Whereupon at 3:40 p.m., the hearing was adjourned.]

Joint Economic Committee
Opening Remarks for Hearing "Artificial Intelligence and Its Potential to Fuel Economic Growth and Improve Governance"
June 4, 2024

Thank you, Vice Chairman Schweikert. And thank you and your staff for putting together this hearing today.

The rapid advancement of AI innovation created immense possibilities and opportunities.

This new technology is exciting. But with these advancements come potential challenges and risks that must be addressed.

AI could fundamentally alter the U.S. labor market in the very near future.

It could make some jobs obsolete while creating new opportunities for other workers. This could dramatically change people's salaries and job prospects in just a few years.

The federal government has an important role to ensure we reap the rewards of this new frontier, while mitigating the risks and dangers.

It is therefore crucial that AI technologies are developed in a way that reflects our democratic values and supports American industry and the American workforce.

Last month, I helped to introduce a new bipartisan roadmap for the development of legislation on artificial intelligence.

This roadmap will position us to better deliver major scientific and medical advancements and help us maintain our global leadership.

Most importantly, the roadmap lays out the guardrails necessary to mitigate the risks of AI.

This includes steps that would block corporations from using Americans' data against them, safeguard the work of creative professionals, and prevent automation for key tasks that should only be done by humans.

Congress has already started to tackle some of these issues with legislation.

Thanks to my bill, the National AI Initiative Act, the National Science Foundation recently announced $140 million in funding for seven new National Artificial Intelligence Research Institutes as a part of a cohesive, cross-governmental approach to address AI-related opportunities and risks.

These new institutes will advance research on ethical and trustworthy technologies in cybersecurity, climate change, understanding the human brain, and enhancing education and public health – all while supporting the development of a diverse AI workforce.

Congress can continue to aid these efforts by better understanding how companies are integrating technology in ways that either augments workers or replaces them, and proposing policies that are pro-augmentation where that makes sense.

We can also keep American leadership in AI by bolstering STEM education and workforce training efforts that encourage AI literacy.

It is critical that we invest as a nation to make sure the United States is leading the way when it comes to both embracing opportunities and managing the safety and security risks that come with AI.

Seven months ago, President Biden issued a historic executive order to do just that.

To date, all the federal agencies have now taken the necessary steps laid out in that order. These actions will help protect Americans' privacy, advance equity and civil rights, stand up for workers and consumers, and promote innovation and competition.

For example, agencies are working together to make sure AI can't be used to engineer dangerous biological materials.

They're taking steps to ensure that federal contractors and employers comply with worker protection laws as they introduce AI elements into the workplace.

They're working to prevent AI from being used to discriminate when it comes to housing opportunities or public benefits programs like SNAP.

And they've created an AI Safety and Security board to advise government actors, private sector stakeholders, and the general public on the safe and secure development of AI technology in our nation's critical infrastructure.

The Biden administration is also taking steps to make sure that we can take advantage of all the good that AI has to offer.

AI could help us streamline bureaucratic benefit application processes or government permitting processes that are often too redundant and time-consuming.

It could help us identify and respond to threats to our national security and wellbeing, including threats to utilities or our energy grid.

It could help us advance scientific research to address some of our more pressing challenges, including medical advances and climate change mitigation.

These advances in AI and the corresponding need to ensure it is safely deployed have also help create more jobs.

Federal agencies and the private sector alike are hiring talented tech workers and professionals to help advance AI and the regulations and policies needed for its safe and effective use.

These workers will be critical to making sure the United States stays at the forefront when it comes to how we use this technology.

The key to continuing this work is funding it properly.

We need to embrace interdisciplinary collaboration, and collaboration between the private and public sectors.

And we need to gather a wide variety of experts and stakeholders who can contribute their evolving knowledge to these undertakings.

I'm pleased to join my colleagues and the experts we've invited today to further explore these issues in today's hearing.

[End]

Testimony of Brian J. Miller, M.D., M.B.A., M.P.H.

Assistant Professor of Medicine and Business (Courtesy)
The Johns Hopkins University School of Medicine
The Johns Hopkins Carey Business School

Nonresident Fellow
American Enterprise Institute

Before the

U.S. State Congress Joint Economic Committee

On

"Artificial Intelligence and Its Potential to Fuel Economic Growth and Improve Governance."

June 4, 2024

Chairman Heinrich, Vice Chairman Schweikert, and distinguished members of the Joint Economic Committee:

My name is Brian Miller, and I practice hospital medicine at the Johns Hopkins Hospital. As an academic health policy analyst, I serve as an Assistant Professor of Medicine and Business (Courtesy) at the Johns Hopkins University School of Medicine and as a Nonresident Fellow at the American Enterprise Institute. My research focuses on how we can build a more competitive and vibrant health sector to make healthcare more efficient, flexible, and personalized for patients. This perspective is based upon my prior regulatory experience at four federal regulatory agencies. Through my current role as a faculty member, I regularly engage with regulators, policymakers, and businesses in search of solutions to help create a better healthcare system for all. Today I am here in my personal capacity, and the views expressed are my own and do not necessarily reflect those of the Johns Hopkins University or the Johns Hopkins Health System, the American Enterprise Institute, or the Medicare Payment Advisory Commission.

In my testimony today, I will focus on three areas:
1. Improving the clinical efficiency of care delivery through labor productivity growth
2. Driving administrative efficiency for delivery systems and insurers
3. Policies to promote the development of new science and new innovation

1. Improving the clinical efficiency of care delivery through labor productivity growth
Over the past 60 years, innovation has driven changes in clinical practice, with the life sciences industry developing over 1,200 new drugs.[1] Today, there are over 20,000 prescriptions drugs approved for marketing, 400 licensed biologic products, and 6,500 FDA-regulated medical device product categories[2] offering patients a variety of benefits including reduced mortality, morbidity, and improved functional status or quality of life. While retail prescription drug spending represents just 9% of national health expenditures,[3] it has driven massive transformations in care for patients and reduced morbidity and mortality. In contrast, the 51% of health care spending representing care delivered in hospitals and clinics largely remains a vast plain yet to be significantly transformed by operational and technological innovation.

It is this arena that automation and artificial intelligence (AI) offers the most promise to transform care. Through a combination of monopoly,[4] legal barriers to competition such as Stark Law,[5] and regulatory policy, current models of care delivery that are ill-suited to patients' needs and clinical efficiency have become encased in policy concrete. Economic measures lend further credence to the challenges of this policy story, with labor productivity in private community hospitals remaining on average flat or negative since at least as far back as 2000.[6] Other economic research suggests that health care suffers from Baumol's cost disease,[7] wherein the sector's wages rise despite a lack of productivity growth due to rising wages in other sectors with high productivity growth, driving rising health care delivery costs without consequential gains for consumer-patients.

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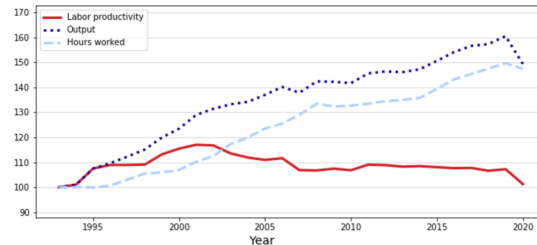
Figure 1: Labor productivity for private community hospitals (Index, 1993 = 100)[8]

The absence of labor productivity growth has created a politically challenging combination of unsustainable spending–totaling $4.5 trillion[9] and growing at an average rate of 4.7% annually[10] – coupled with a growing need for and gap in the skilled labor supply. As care delivery outputs increase without any improvement in labor productivity, the care delivery sector has an ever insatiable appetite for more workers. In a system subject to time lags, financing challenges,[11,12] and varying degrees of state-based occupational regulation[13,14] of the health professions,[15,16,17,18,19] it is no surprise that there are shortages across a wide range of skilled trades, with a projected shortage of 78,610 registered nurses (by 2025),[20] 68,020 primary care physicians (by 2036),[21] and 21,150 adult psychiatrists (by 2030)[22] within the next decade just to name a few, all worsened by the recent COVID-19 pandemic amongst other factors driving burnout.[23,24,25] With Medicare and Medicaid expenditures in 2022 growing at 5.9% and 9.6% year over year

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respectively and comprising 15% and 13% respectively of the federal budget,[26] crowding out discretionary spending, and industry stakeholders suggesting that we subsidize our way out of labor shortages[27,28] now is the time to think differently.

Various policy experts including the Congressional Budget Office have enumerated policy options to promote either separately or simultaneously[29,30] cutting spending[31] and increasing taxes[32] as a way out of our health care cost problem. Spending cuts invariably cut someone's revenue, a politically fraught exercise with large incumbent hospital[33] and physician lobbies,[34] while taxes reduce profits of individuals and businesses, both large and small, thereby discouraging investment.[35,36,37] Yet, a tax and spend approach does not address the inherent labor productivity problem and leaves Baumol's cost disease unsolved.

Instead, automation and AI offer us the opportunity to use our existing human capital more efficiently and treat Baumol's cost disease.[38] AI can be defined amongst multiple frames of reference, including system type, types of intelligence, or mechanism of learning:

System Type	Types of Intelligence	Learning
Reactive	Artificial Narrow Intelligence	Reinforcement Learning
Limited Memory	Artificial General Intelligence	Unsupervised Learning
Theory of Mind	Artificial Super Intelligence	Supervised Learning
Self-Aware AI		Deep Learning
		Machine Learning
		Artificial Intelligence

Figure 2: Definitional framings for AI[39,40]

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While the exact boundaries of the definitions of AI can be debated, the principle behind it–automation–can serve to transform care delivery and improve labor productivity. AI has three primary categories of application in health care: 1) automation of the mundane (administrative tasks), 2) augmentation of human-driven clinical practice, and 3) automation of elements of clinical practice.[41] This section will address the potential of the latter two categories of use to improve labor productivity by both automating tasks and simultaneously up-scoping the activities of clinical professionals.

Augmentation of human-driven clinical practice can transform medical care. For example, intelligent warnings such as blind spot monitors, advanced driver assistance systems like Toyota Lane Change Assist, and automated safety systems like Mercedes PRE-SAFE ensure a safer driving experience. Current care delivery modalities are akin to a 747 with analog controls and no autopilot, with AI-driven technology (clinical decision support) and adaptive displays offering the potential to improve clinical practice in acute and critical safety settings for intensivists, anesthesiologists, nurses, and other providers to manage patients more effectively and efficiently while also addressing human factors concerns[42] such as information overload, situational awareness, and task management.[43]

In other clinical settings, automation and AI may improve the efficiency and accuracy of clinical practice, assisting clinicians in diagnostic tasks built upon pattern recognition, such as diagnosis based upon CT scans,[44] mammography interpretation,[45] melanoma diagnosis,[46] or review of pathology slides.[47] Other emerging areas include prognostication in cancer[48] and improving radiation treatment planning,[49] with AI-assisted care likely to become the standard of care in multiple areas. Much of this innovation occurs and will continue to evolve at the bedside as part of clinical practice, as front-line practitioners identify and begin to solve longstanding problems in conjunction with engineers and software developers.

Beyond augmentation, automation of elements of clinical practice can drive increased efficiency. With the time required to provide appropriate guideline-directed primary care estimated at a 26.7 hour workday,[50] it is clear that there is an opportunity to automate clinical tasks in order to better serve patients, improve labor productivity, and not harm the clinical workforce. Autonomous AI-driven care can support service delivery, from screening for diabetic retinopathy to point-of-care digital cytology[51] to interpretation of electroencephalograms[52] with some clinical use cases even revealing higher performance for machine learning when compared to humans.[53] All of these opportunities offer an ability for existing clinicians to devote more time to patient counseling, clinical coordination, procedures, and other tasks, unlocking productivity gains in health care delivery for the first time in decades.

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Augmentation and automation may also occur in the home or real-world setting to facilitate consumer-driven care, as technology can augment traditional patient-clinician relationships promoting self-management and independence. For example, a closed-loop system consists of insulin pump tied with a continuous glucose monitor with dosing driven by algorithms, tested first in small groups[54] and in broader populations[55] including young children[56] with improved blood glucose control. While a simple example, many chronic conditions such as diabetes, atrial fibrillation, hypertension, and other diseases offer the potential for patient-driven treatment assisted by automation and AI in conjunction with the use of wearables expanding access while reducing the real-life burden on patients of managing disease. Given well-documented care gaps and consequential personal and societal costs for millions of Americans with obesity, diabetes,[57] hypertension,[58] and other conditions due to an inadequate labor supply, maldistribution of clinicians, and inefficient delivery system, the need for scalable, low-cost personalized solutions that operate at a time and in a setting most convenient for patients is critical

2. Driving administrative efficiency for delivery systems and insurers

Automation and AI also offer the opportunity to improve labor productivity through automation of the mundane or administrative tasks. With over half of physicians suffering from burnout[59] frequently driven by administrative tasks and burnout driving quality losses,[60,61] improving labor productivity is both a pragmatic economic and moral imperative. Recent research demonstrates that clinical workers spend a significant fraction of their time on administrative tasks: the average primary care physician spends over 6 hours daily writing note, hospital nurses on medical-surgical units spend 35.3 of their time on documentation as compared to 19.3% on patient care activities,[62] while internal medicine residents spend 13% of their day in face-to-face contact. Agencies such as the Agency for Healthcare Research and Quality have funded successful descriptive research in this arena for over 20 years,[63] providing a clearly measured imperative for action.

Many day-to-day administrative tasks can be automated through AI such as diagnostic coding and billing and charting, freeing up clinical staff inclusive of nurses and physicians to spend more time counseling and directly interacting with patients. For example, companies such as Nuance, DeepScribe, Nabla, and Suki are working on early attempts to use ambient AI to automate clinical notetaking. Eventually clinicians will review, edit and then sign AI-generated notes as opposed to spending time during and between patient encounters to document visits. With over 70,000 ICD-10 diagnosis codes to support billing, AI could save time and reduce physician cognitive burden while simultaneously improving billing and diagnosis coding accuracy (the latter of which would prevent fraud, waste, and abuse in risk-adjusted capitated health benefit programs).

AI can also be prudently deployed to address concerns regarding innumerable challenges and administrative burdens of prior authorizations for both clinicians and health plans. With the average physician reporting filing out 37 prior

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[54] Brown S, Raghinaru D, Emory E, Kovatchev B. First Look at Control-IQ: A New-Generation Automated Insulin Delivery System. *Diabetes Care*. 2018;41(12):2634-2636. doi:10.2337/dc18-1249

[55] Brown SA, Kovatchev BP, Raghinaru D, et al. Six-Month Randomized, Multicenter Trial of Closed-Loop Control in Type 1 Diabetes. *N Engl J Med*. 2019;381(18):1707-1717. doi:10.1056/NEJMoa1907863

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[58] Centers for Disease Control and Prevention (CDC). Vital signs: awareness and treatment of uncontrolled hypertension among adults--United States, 2003-2010. *MMWR Morb Mortal Wkly Rep*. 2012;61:703-709.

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[63] Physician Burnout. Agency for Healthcare Research and Quality. https://www.ahrq.gov/prevention/clinician/ahrq-works/burnout/index.html

authorization forms weekly,[64] the average oncology office having 6 full time staff to manage prior authorization,[65] while an internal survey of an academic dermatology department found that 6.6% of all visits generated a prior authorization.[66] With prior authorization long a topic of policy consternation resulting in the introduction of legislation to implement gold card programs[67] and CMS rulemaking,[68] AI and automation offer the potential to reduce clinician and patient burdens, improving productivity. For example, AI could automate data submission for clinicians, while for health plans at the first level of review where there are clear guidelines, algorithms could be utilized for *approval*. Eventually, frictions in the prior authorization process could be reduced through automation allowing near real-time adjudication during a clinical visit for the first layer of review, freeing up clinicians and health plan employees to focus on either patient care or more complex care management decisions.

Automation and AI can also drive efficiency and good governance for large public benefits programs such as Medicaid. Functions that are not inherently governmental functions can be undertaken by contractors instead of by governmental personnel, as defined by the Federal Activities Inventory Reform Act of 1998, the Office of Management and Budget Circular A-76, and the recent Office of Procurement Policy (OFPP) Policy Letter 11-01.[69] Agencies undertake 2 tests, specifically (1) the nature of function test (i.e. exercise of sovereign power is inherently governmental) and (2) exercise of discretion test. In the context of Medicaid, the procedural determination of Medicaid eligibility and redetermination are ripe for intervention.[70]

There is bipartisan frustration with Medicaid enrollment and eligibility determinations. Recent rules target administrative barriers to entry,[71] while others emphasize the role that eligibility plays in improper payments, where it accounts for account for 73.7% or >$61 billion 2022.[72] Regardless of one's perspective, these challenges highlight the need for process improvement. As part of the 2020 Families First Coronavirus Response Act, Congress increased the federal Medicaid matching funds by 6.2% if states implemented continuous Medicaid coverage for enrollees, with redetermination starting on April 1, 2023. With redetermination for over 20 million Americans ongoing,[73] both initial eligibility and redetermination offer an opportunity to deploy AI and automation, as eligibility is defined in statute leaving little discretion.

Other use cases such as a fraud detection, long a concern in both Medicare and Medicaid, with CMS noting that the improper payment rate in Fee For Service Medicare was 7.38% or $31.2 billion, contrasting with $16.6 billion or 6.01% in Part C.[74] Improving payment accuracy, eligibility, and redetermination all offer an opportunity to reduce fraud, waste and abuse while ensuring that Americans who need these programs can continue to benefit from them.

[64] Survey quantifies time burdens of prior authorization. American Medical Association. Published January 30, 2017. Accessed July 10, 2023. https://www.ama-assn.org/practice-management/prior-authorization/survey-quantifies-time-burdens-prior-authorizationc

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[71] Streamlining the Medicaid, Children's Health Insurance Program, and Basic Health Program Application, Eligibility Determination, Enrollment, and Renewal Processes Final Rule Fact Sheet. Centers for Medicare & Medicaid Services. March 27, 2024. https://www.cms.gov/newsroom/fact-sheets/streamlining-medicaid-childrens-health-insurance-program-and-basic-health-program-application

[72] 2022 Medicaid & CHIP Supplemental Improper Payment Data. Centers for Medicare & Medicaid Services. November 2022. https://www.cms.gov/files/document/2022-medicaid-chip-supplemental-improper-payment-data.pdf-0

[73] Medicaid Enrollment and Unwinding Tracker. Kaiser Family Foundation. May 23, 2024. https://www.kff.org/report-section/medicaid-enrollment-and-unwinding-tracker-national-federal-unwinding-and-enrollment-data/

[74] Fiscal Year 2023 Improper Payments Fact Sheet. Centers for Medicare & Medicaid Services. November 15, 2023. https://www.cms.gov/newsroom/fact-sheets/fiscal-year-2023-improper-payments-fact-sheet

3. Policies to promote the development of new science and new innovation

Policymakers have multiple policy options to promote the use of automation and AI to drive productivity gains in health care delivery. First, policymakers should look to facilitate bottom-up innovation from clinicians and engineers by both streamlining and strengthening FDA oversight. Within FDA product review centers AI can be deployed to undertake basal first layer analysis of clinical trial data, both speeding upon pharmaceutical product and medical device review while allowing FDA staff to undertake more complex analytical questions. Policymakers should consider requiring the FDA to hold public workshops, integrate innovators' and entrepreneurs' feedback, and subsequently issue a strategic plan delineating steps (e.g. guidance, NPRM) to operationalize key regulatory principles in FDA discussion papers on distributed manufacturing and point-of-care manufacturing of drugs (which could reduce product costs for consumers),[75] AI in drug manufacturing,[76] AI in drug and biological products,[77] and uses of AI in medical product centers.[78] In order to both facilitate innovation, the FDA should also delineate areas of device and drug development where applications of AI do not require oversight or necessitate minimal oversight, in accordance with the FDA's own stated principles of risk-based regulation and least burdensome principles.[79]

Recognizing that liability concerns may present barriers to adoption, the FDA should work with entrepreneurs, physicians, patients, and engineers to explore the potential of performance-based regulation for software-driven medical devices and pure software as a medical device. Voluntary alternative pathways[80] in addition to (not in place of) traditional 510(k) and premarket approval (PMA pathways) for FDA approval would strengthen and provide FDA oversight flexibility for a rapidly evolving marketplace. Recognizing that AI and software exist on a rapid cycle improvement model as opposed to discrete innovation in traditional devices, performance-based regulation would promote pragmatic innovation emerging from the exam room and hospitals.

Clinical evidence of safety and efficacy could be generated in a variety of ways, such as meeting technical consensus standards derived from standards development organizations, testing in an accredited third party lab, substantial equivalence, modeling simulations, and other mechanisms. As a first step, policymakers could require the FDA to convene stakeholders and undertake a public workshop to explore best practices in performance-based regulation for medical software. Doing so would build on prior work to adapt the risk-based device regulatory framework such as the predetermined change control software,[81] software as a medical device (SaMD),[82] and precertification program.[83] These actions would facilitate rapid cycle innovation, promoting both stacked incremental innovation and revolutionary innovation.

Recognizing the problems with excessive centralization of standards, clinical evidence of safety and efficacy should be driven by scientific and clinical appropriateness coupled with innovator preferences, and not be tied to any single third party standards organization. The Government Accountability Office (GAO) has long highlighted the problems with standards and certification monopolies, with a 2004 GAO report[84] highlighting challenges with the Joint Commission's certification process to ensure that hospitals meet the Medicare Conditions of Participation, resulting in Congress revoking the Joint Commission's certification monopoly in 2008 as part of the Medicare Improvements

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[75] Distributed Manufacturing and Point-of-Care Manufacturing of Drugs. U.S. Food & Drug Administration. October 2022. https://www.fda.gov/media/162157/download?attachment
[76] Artificial Intelligence in Drug Manufacturing. U.S. Food & Drug Administration. 2023. https://www.fda.gov/media/165743/download?attachment
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[78] Artificial Intelligence & Medical Products: How CBER, CDER, CDRH, and OCP are Working Together. U.S. Food & Drug Administration. March 2024. https://www.fda.gov/media/177030/download
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[80] Cho T, Gowda V, Schulzrinne H, Miller BJ. Integrated Devices: A New Regulatory Pathway to Promote Revolutionary Innovation. *Milbank Q.* January 22, 2024. doi:10.1111/1468-0009.12692
[81] Marketing Submission Recommendations for a Predetermined Change Control Plan for Artificial Intelligence/Machine Learning (AI/ML)-Enabled Device Software Functions. U.S. Food & Drug Administration. April 3, 2023. https://www.fda.gov/media/166704/download
[82] Software as a Medical Device (SAMD): Clinical Evaluation. U.S. Food & Drug Administration. December 8, 2017. https://www.fda.gov/media/100714/download
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[84] CMS Needs Additional Authority to Adequately Oversee Patient Safety in Hospitals. U.S. Government Accountability Office. July 2024. https://www.gao.gov/assets/gao-04-850.pdf

for Patients and Providers Act of 2008. The FDA would benefit from additional Congressional oversight to ensure that a single standards development organization does not control AI product development.

Finally, and most importantly, payment policy must deploy automation and AI-driven care to promote competition and lower costs. CMS should not create additional standards for AI tied to Medicare Conditions of Participation,[85] noting that product liability, medical malpractice, state hospital licensing, and finally existing conditions of participation require a lengthy list of quality and safety management programs, which already encompass and address many of the risks of the deployment of software and AI products. Further regulations tied to conditions of participation would restrict access to AI innovation and undermine the FDA's role as a science-based product regulator, thus depriving patients and clinicians of meaningful and tangible productivity improvements.

Instead, policymakers should work to shape the Medicare program to pay for new technology by driving competition. Ideally beneficiaries will be able to choose by which modality to safely and conveniently access care:

1. Audio only
2. Audio/video
3. Audio/video with a remote, technology-assisted exam
4. Automated/AI-driven service either remote or in-person
5. Technology-augmented in-person, human capital-driven medical service
6. Human-driven, in-person service

While Medicare Advantage–the managed care version of Medicare–has the flexibility to cover additional services, policymakers must ensure that beneficiaries in fee for service (FFS) Medicare have equal access to innovative technologies that expand access and lower cost.

Recent history reminds us of the challenges of avoiding innovation, where concerns about induced demand and fraud, waste, and abuse collectively prevented us from meaningfully covering and paying for telehealth for over 20 years. With the Medicare Payment Advisory Commission denoting that over 5 million Medicare beneficiaries using telehealth in 2022 and practitioners developing specialization,[86] telehealth has finally begun to become a routine part of care, a change unfortunately forced by a global pandemic.[87]

Policymakers should avoid repeating this mistake and promote tiered payment for automated/AI-driven service. For example, a modifier that serves as a multiplier could be added to the physician fee schedule in order to reflect resource intensity, varying with the service in question (e.g. 0.1 for audio-only service, 0.5 for automated/AI-driven service, and 1.0 for human-driven, in-person service). This would promote competition between software developers, physicians, and health systems to find the most patient-centric and efficient way to deliver services.

4. Conclusions

Both patients and clinicians are tired of inefficient and expensive care delivery and administration. Statistics enumerate this story well, with the median Emergency Department wait time of 330 minutes in the District of Columbia[88] to a median wait time of 51 days to see a nephrologist at a hospital in North Carolina[89] to 25 years without labor productivity growth. There is more than enough room to use automation and AI to drive efficiency gains.

Together we can deploy AI And automation to cure Baumol's cost disease–a chronic condition that is killing our economy–in healthcare. Policymakers should ensure that regulatory policy facilitates the use of automation and AI, encouraging bottom up innovation from the exam room to ensure that innovation has a chance to augment and automate elements of clinical practice. AI can also improve administrative efficiency reducing waste through

[85] Facilitating Responsible Governance of Healthcare AI Tools: Testimony presented to the U.S. Senate Committee on Finance, February 8, 2024. https://www.finance.senate.gov/imo/media/doc/02082024_mello_testimony.pdf

[86] O'Donnell B & Tabor L. Telehealth in Medicare: Status Report. MedPAC. April 11, 2024. https://www.medpac.gov/wp-content/uploads/2023/10/Telehealth-April-2024-SEC.pdf

[87] Lee JS, Bhatt A, Pollack LM, et al. Telehealth use during the early COVID-19 public health emergency and subsequent health care costs and utilization. *Health Aff Sch.* 2024;2(1):qxae001. doi:10.1093/haschl/qxae001

[88] Bean M. ED visit times, by state. *Becker's Hospital Review*. February 1, 2024. https://www.beckershospitalreview.com/rankings-and-ratings/ed-visit-times-by-state.html

[89] Schettini P, Shah KP, O'Leary CP, et al. Keeping care connected: e-Consultation program improves access to nephrology care. *Journal of Telemedicine and Telecare*. 2019;25(3):142-150. doi:10.1177/1357633X17748350

simplifying prior authorization for patients and physicians or addressing Medicaid improper payments. The FDA can facilitate innovation, while avoiding the ills of standards monopolies and the government placing its finger on the scales of competition. Policymakers can also empower CMS to pay for automation, promoting service delivery innovation and competition. By promoting instead of fearing innovation and facilitating mechanisms to pay for safe and effective rapid cycle innovation, together we can improve our care delivery system.

SUBMITTED STATEMENT OF
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R STREET INSTITUTE

BEFORE THE
JOINT ECONOMIC COMMITTEE
UNITED STATES CONGRESS

HEARING ON
"ARTIFICIAL INTELLIGENCE AND ITS POTENTIAL TO FUEL ECONOMIC GROWTH AND
IMPROVE GOVERNANCE"

JUNE 4, 2024

ADAM THIERER TESTIMONY, HEARING ON "ARTIFICIAL INTELLIGENCE AND ITS POTENTIAL TO FUEL ECONOMIC GROWTH AND IMPROVE GOVERNANCE"

Chairman Heinrich, Vice Chairman Schweikert, and members of the Committee:

Thank you for the invitation to participate in this important hearing on "Artificial Intelligence and Its Potential to Fuel Economic Growth and Improve Governance." My name is Adam Thierer, and I am a senior fellow at the R Street Institute, where I focus on emerging technology issues. I also recently served as a commissioner on the U.S. Chamber of Commerce's Commission on Artificial Intelligence Competitiveness, Inclusion, and Innovation.[1]

Today I will discuss three points relevant to this hearing:

1. First, AI and advanced computational technologies can help fuel broad-based economic growth and sectoral productivity while also improving consumer health and welfare in important ways.
2. Second, to unlock these benefits, the United States needs to pursue a pro-innovation AI policy vision that can also help bolster our global competitive advantage and geopolitical security.
3. Third, we can advance these goals through an AI Opportunity Agenda that includes a learning period moratorium on burdensome new AI regulations.

I will address each point briefly, but I have included three appendices to my testimony offering more details.

AI Could Drive Economic Growth, Increase Sectoral Productivity, and Improve Human Well-Being

AI is set to become the "most important general-purpose technology of our era," and AI could revolutionize every segment of the economy in some fashion.[2] The potential exists for AI to drive explosive economic growth and productivity enhancements.[3] While predictions vary, analysts forecast that AI could deliver trillions in additional global economic activity and

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[1] Commission on Artificial Intelligence Competitiveness, Inclusion, and Innovation, *Commission on Artificial Intelligence Competitiveness, Inclusion, and Innovation: Report and Recommendations*, U.S. Chamber of Commerce, March 2023.
https://www.uschamber.com/assets/documents/CTEC_AICommission2023_Report_v6.pdf.

[2] Erik Brynjolfsson and Andrew McAfee, "The Business of Artificial Intelligence," *Harvard Business Review*, July 18, 2017. https://hbr.org/2017/07/the-business-of-artificial-intelligence.

[3] Tom Davidson, "Could Advanced AI Drive Explosive Economic Growth?," Open Philanthropy, Research Report, June 25, 2021. https://www.openphilanthropy.org/research/could-advanced-ai-drive-explosive-economic-growth; Ege Erdi and Tamay Besiroglu, "Explosive growth from AI automation: A review of the arguments," Arxiv, Oct. 1, 2023. https://arxiv.org/abs/2309.11690.

ADAM THIERER TESTIMONY, HEARING ON "ARTIFICIAL INTELLIGENCE AND ITS POTENTIAL TO FUEL ECONOMIC GROWTH AND IMPROVE GOVERNANCE"

significantly boost annual GDP growth.[4] This would be over and above the $4 trillion of gross output that the U.S. Bureau of Economic Analysis says the U.S. digital economy already accounted for in 2022.[5] [*See* Appendix I]

But what really matters is what AI means for every American personally. AI is poised to revolutionize health outcomes, in particular. AI is already helping with early detection and treatment of cancers, strokes, heart disease, brain disease, sepsis, and other ailments. AI is also helping address organ failure, paralysis, vision impairments, and much more. The age of personalized medicine will be driven by AI advancement. [*See* Appendix 2]

AI can help make government more efficient, too.[6] Ohio Lt. Gov. Jon Husted recently used an AI tool to help sift through the state's code of regulations and eliminate 2.2 million words' worth of unnecessary and outdated regulations.[7] California Gov. Gavin Newsom just announced an effort to use generative AI tools to improve public services and cut 8 percent from the state's government operations budget.[8] And regulators are using AI to facilitate compliance with existing policies, such as post-market medical device surveillance.[9]

AI also holds the potential to achieve administrative savings for federal health insurance programs or, better yet, reduce the number of people dependent on them by identifying and treating ailments earlier.[10]

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[4] Jacques Bughin, et al., "Notes from the AI Frontier: Modeling the Impact of AI on the World Economy," McKinsey Global Institute, Discussion Paper, Sept. 4, 2018. https://www.mckinsey.com/featured-insights/artificial-intelligence/notes-from-the-ai-frontier-modeling-the-impact-of-ai-on-the-world-economy.

[5] U.S. Bureau of Economic Analysis, "U.S. Digital Economy: New and Revised Estimates, 2017–2022," Dec. 6, 2023. https://apps.bea.gov/scb/issues/2023/12-december/1223-digital-economy.htm.

[6] Richard Williams, "Can AI Help with Forever Regulations?," *Public Health Without Politics*, April 18, 2024. https://fixingfood.substack.com/p/can-ai-help-with-forever-regulations.

[7] Ned Oliver, "Ohio uses AI to eliminate unnecessary words in state administrative code," *Axios*, April 29, 2024. https://www.axios.com/local/columbus/2024/04/29/artificial-intelligence-ai-ohio-state-administrative-code-husted.

[8] Sophia Bollag, "Newsom announces $27.6 billion budget deficit — after state already cut $17 billion," *San Francisco Chronicle*, May 10, 2024. https://www.sfchronicle.com/politics/article/newsom-may-budget-19447474.php.

[9] Jessica Karins, "FDA Draws On AI For First-Ever Proactive Postmarket Surveillance Of Devices," *Inside Health Policy*, May 14, 2024. https://insidehealthpolicy.com/daily-news/fda-draws-ai-first-ever-proactive-postmarket-surveillance-devices.

[10] Mariam Baksh, "Sen. Rounds argues case for spending big on AI-enabled weapons systems, health care," *Inside AI Policy*, May 24, 2024. https://insideaipolicy.com/ai-daily-news/sen-rounds-argues-case-spending-big-ai-enabled-weapons-systems-health-care.

Computational Freedom Is Important for America's Geopolitical Competitiveness and Security

There is an important connection between AI and broader national objectives. A strong technology base is a key source of strength and prosperity, so it is essential that we do not undermine innovation and investment as the next great technological race gets underway with China and the rest of the world.[11]

Luckily, U.S. AI innovators are still in the lead. Had a Chinese operator launched a major generative AI model first, it would have been a "Sputnik moment" for America. Still, China has made its imperial ambitions clear with a goal to become the global leader in advanced computation by 2030, and it has considerable talent, data, and resources to power those ambitions.[12] Experts argue that "China's whole-of-society approach is challenging America's traditional advantages" in advanced technology.[13]

We need a pro-innovation national AI policy that will not only strengthen our economy and provide better products and jobs, but also bolster national security and allow our values of pluralism, personal liberty, individual rights, and free speech to shape global information platforms and markets.[14]

If fear-based policies impede America's AI development and diffusion, then China wins.[15]

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[11] James Pethokoukis, "What's Really at Stake If We Get AI Regulation Wrong," *Faster, Please!* Oct. 30, 2023. https://www.aei.org/articles/whats-really-at-stake-if-we-get-ai-regulation-wrong; American Edge Project, "American Innovation Under Siege: Venture Capital Data Reveal Risks From Rising Global Regulatory Overreach," April 2024. https://americanedgeproject.org/wp-content/uploads/2024/04/AEP-and-PitchBook-Study-March-2024.pdf.

[12] Paul Scharre, *Four Battlegrounds: Power in the Age of Artificial Intelligence* (New York: W. W. Norton & Company (2023); Mariano-Florentino Cuéllar and Matt Sheehan, "AI Is Winning the AI Race," *Foreign Policy*, June 19, 2023. https://foreignpolicy.com/2023/06/19/us-china-ai-race-regulation-artificial-intelligence; Remco Zwetsloot et al., "China is Fast Outpacing U.S. STEM PhD Growth," Center for Security and Emerging Technologies, *CSET Data Brief*, August 2021, https://cset.georgetown.edu/wp-content/uploads/China-is-Fast-Outpacing-U.S.STEM-PhD-Growth.pdf; "Just how good can China get at generative AI?," *The Economist*, May 9, 2023. https://www.economist.com/business/2023/05/09/just-how-good-can-china-get-at-generative-ai; Emerging Technology Observatory, "The state of global AI research," May 2, 2024. https://eto.tech/blog/state-of-global-ai-research.

[13] Graham Allison, et al., "The Great Tech Rivalry: China vs the U.S.," Harvard Kennedy School Belfer Center for Science and International Affairs, *Paper*, December 2021. https://www.belfercenter.org/sites/default/files/GreatTechRivalry_ChinavsUS_211207.pdf.

[14] Loren B. Thompson, "Why U.S. National Security Requires A Robust, Innovative Technology Sector," Lexington Institute, Oct. 8, 2020. https://www.lexingtoninstitute.org/why-u-s-national-security-requires-a-robust-innovative-technology-sector.

[15] Keegan McBride, "The Threat of "AI Safety" to American AI Leadership," *National Interest*, April 28, 2024. https://nationalinterest.org/blog/techland/threat-"ai-safety"-american-ai-leadership-210780.

Protect the Freedom to Innovate with an "AI Opportunity Agenda"

To achieve the benefits AI offers and meet the rising global competition, America needs an AI Opportunity Agenda.

An AI Opportunity Agenda begins by reiterating that the freedom to innovate is the cornerstone of American technology policy and the key to unlocking the enormous potential of our nation's entrepreneurs and workers.[16]

As part of this Agenda, Congress should craft a learning period moratorium on new proposals, such as new AI-specific bureaucracies, licensing systems, or liability schemes, all of which would be counterproductive and undermine our nation's computational capabilities. [*See* Enclosure I]

In addition, this moratorium should preempt burdensome state and local regulatory enactments that conflict with our national AI policy framework.[17]

Next, Congress should require our government's existing 439 federal departments to evaluate their current policies toward AI systems with two purposes in mind. First, to ensure that they are not over-burdening algorithmic systems with outdated policies, and second, to determine how existing rules and regulations are capable of addressing the concerns that some have raised about AI. Taking inventory of existing rules and regulations can then allow policymakers to identify any gaps that Congress ought to address using targeted remedies.

Finally, an AI Opportunity Agenda requires an openness to new talent and competition.[18] With experts finding that a "talent war is brewing between the US and China," and that China is moving ahead in some important ways, we must take steps to attract and retain the world's best and brightest data scientists and computer engineers.[19]

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Conclusion

In sum, America's AI policy should be rooted in patience and humility instead of a rush to over-regulate based on hypotheticals and worst-case thinking.[20] We are still very early in the AI lifecycle, and there is still no consensus on how to define the term, let alone legislate beyond establishing definitions.[21]

To ensure America leads this next great technological revolution, Congress must once again uphold the freedom to innovate and craft a flexible, risk-based AI policy vision to ensure we can meet global competition, advance economic opportunity, and improve the well-being of every citizen.

Thank you for holding this hearing and for your consideration of my views. I look forward to any questions you may have.

See pages 6-12 for Appendix 1, "How AI Could Drive Economic Growth and Sectoral Productivity."

See pages 13-21 for Appendix 2, "AI's Potential for Improving Medicine and Health Outcomes."

See pages 22-25 for Enclosure 1, "Getting AI Policy Right Through a Learning Period Moratorium," R Street Institute, May 29, 2024. https://www.rstreet.org/commentary/getting-ai-policy-right-through-a-learning-period-moratorium.

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Appendix 1: How AI Could Drive Economic Growth and Sectoral Productivity

Over the past half century, there have been waves of both great excitement and disillusionment about the prospects for AI advancement.[22] AI historians often speak of the many AI "springs" and "winters"—what one might think of as AI booms and busts—that have come and gone.[23]

It did not help that some of AI's early pioneers over-exuberantly predicted that powerful "superintelligence" would be with us in short order. In the late 1960s, for example, noted AI researchers confidentially predicted that "machines will be capable, within twenty years, of doing any work a man can do," (Herbert A. Simon), and that "[i]n from three to eight years we will have a machine with the general intelligence of an average human being" (Marvin Minsky).[24] Such exuberance was replaced by pessimism in the 1970s, resulting in a "winter" period for AI research and investment.

Today, however, AI is generally thought to be in the midst of another spring as enthusiasm grows around specific capabilities and applications. Economists predict that AI is set to become the "most important *general-purpose technology* of our era."[25] General-purpose technologies will become intertwined with almost every other economic sector and used ubiquitously throughout society.[26] These developments are coming about because we live in an era of rapid-fire *combinatorial innovation* in which new technologies are building on top of one another in a symbiotic fashion, further accelerating their development and sophistication.[27]

Improving Many Sectors, Including Government

The power of algorithmic technologies is all around us in products and services such as speech and image recognition tools on our smartphones and the recommender systems many media providers and other companies use to tailor goods, services, and content to our interests. AI will be used by almost all organizations to help improve analytics and marketing, enhance customer

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service, and boost sales or performance in various new ways. And it will completely upend the way production and work is done in countless fields and professions.

AI and ML capabilities are operating behind the scenes to help with fraud and spam detection, computer virus filtering, content management/moderation,[28] mapping/navigation,[29] travel planning,[30] weather forecasting and natural disaster prediction,[31] warehouse automation/inventory management,[32] supply chain management,[33] and various other logistics.[34] For example, in 2021, McKinsey & Company estimated that "[s]uccessfully implementing AI-enabled supply-chain management has enabled early adopters to improve logistics costs by 15 percent, inventory levels by 35 percent, and service levels by 65 percent, compared with slower-moving competitors."[35] These productivity enhancements will likely accelerate as algorithmic techniques are further refined.

AI and ML capabilities also power most of the devices that make up the so-called *Internet of Things* and various connected "smart" devices, including many wearable technologies and other devices with embedded sensors.[36] Another related term here is *ambient computing*[37] or *ubiquitous computing*, which essentially means "using computers without knowing that you are

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[37] Christopher Mims, "Why the Future of the Computer Is Everywhere, All the Time," *The Wall Street Journal*, Oct. 29, 2022. https://www.wsj.com/articles/computer-technology-ambient-computing-11666992784.

using one," or using smart systems without explicitly calling them computers.[38] These technologies have powerful health and medical applications, among other things.

Meanwhile, various AI-powered robotic technologies are already at work in many industrial sectors.[39] AI, ML, and advanced robotics technologies promise to revolutionize many fields including advertising and marketing,[40] agriculture,[41] archeology,[42] auto safety,[43] aviation,[44] education,[45] endangered species protection,[46] energy and climate solutions,[47] entertainment,[48]

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[38] Ethem Alpaydin, Machine Learning (The MIT Press, 2021), p. 9.

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financial services,[49] legal services,[50] retail,[51] transportation,[52] and others.[53] Going forward, every segment of the economy will be touched by AI and robotics in some fashion; therefore, it should be equally clear that public policy will be transformed in the process.

AI will affect government processes, too.[54] In April 2024, Ohio Lt. Gov. Jon Husted used an AI tool to help sift through the state's code of regulations and eliminate 2.2 million words' worth of unnecessary and outdated regulations.[55] In May 2024, California Gov. Gavin Newsom announced an effort to use generative AI tools to improve public services and cut 8 percent from the state's government operations budget.[56] AI is also being used by regulators to facilitate compliance with existing policies. For example, the U.S. Food and Drug Administration (FDA) has been using AI for post-market medical device surveillance.[57]

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AI, Economic Growth, and Productivity Gains

The potential exists for AI to drive explosive economic growth and productivity enhancements.[58]
While predictions vary, most analysts believe that "AI will have a significant economic
impact."[59]

- According to Grand View Research, a market research and consulting company based in
  India and the United States, the global AI market was valued at $93.5 billion in 2021 and
  is projected to expand at a compound annual growth rate of 38.1 percent from 2022 to
  2030.[60]
- A 2018 McKinsey study estimated that "AI has the potential to deliver additional global
  economic activity of around $13 trillion by 2030, or about 16 percent higher cumulative
  GDP compared with today. This amounts to 1.2 percent additional GDP growth per
  year."[61] In the summer of 2023, McKinsey released another study estimating that
  generative AI alone could add up to $4.4 trillion of value to the global economy
  annually.[62]
- An earlier PwC report forecast a $15.7 trillion potential contribution to the global
  economy by 2030.[63]
- A 2023 Goldman Sachs report predicted AI could help boost U.S. labor productivity by
  1.5 percentage points each year, while Peterson Institute for International Economics
  estimates AI will add an additional 1.0 percentage points to productivity growth over the

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https://www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html.

2025-2028 timeframe.[64] Goldman also says generative AI could drive a 7 percent (or almost $7 trillion) increase in global GDP over a 10-year period.[65]

- Another leading economist with a specialization in technology argues that AI will double productivity in the coming decade.[66]

Even if AI's economic impact falls far short of those estimates, it would still generate enormous growth opportunities across many segments of the economy. AI is also invigorating new types of tech competition, especially from open-source players and platforms.[67] It also promises to benefit small businesses by creating new products and jobs. A U.S. Chamber of Commerce report finds that 87 percent of small businesses reported increased efficiency due to new technology platforms and that one in four small businesses are already using AI.[68]

The Past Can Be Prologue

If this potential for explosive growth still sounds outlandish, consider that, in 1998, Nobel Prize-winning economist Paul Krugman infamously predicted that the internet's impact on the global economy would be "no greater than the fax machine's."[69] President Bill Clinton thought differently, predicting that the internet's potential was "nothing short of revolutionary" and that "[i]n just a few years, it will generate hundreds of billions of dollars in goods and services."[70]

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[64] Joseph Briggs and Devesh Kodnani, "The Potentially Large Effects of Artificial Intelligence on Economic Growth," Goldman Sachs, *Global Economics Analyst*, March 26, 2023. https://www.gspublishing.com/content/research/en/reports/2023/03/27/d64e052b-0f6e-45d7-967b-d7be35fabd16.htmlhttps://www.gspublishing.com/content/research/en/reports/2023/03/27/d64e052b-0f6e-45d7-967b-d7be35fabd16.html; Adam Posen, "The Keynote Economic Forecast by Dr. Adam Posen, Peterson Institute - Endowments & Foundations Roundtable West 2024," *Institutional Investor*, Feb. 8, 2024. https://iinetworks.com/content/keynote-economic-forecast-dr-adam-posen-peterson-institute-endowments-foundations.

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Clinton's optimism was vindicated. Electronic commerce exploded, and digital innovation became the foundation of significant economic growth, new jobs, and boundless speech opportunities. According to the U.S. Bureau of Economic Analysis, in 2022, the U.S. digital economy accounted for over $4 trillion of gross output, $2.6 trillion of value added (translating to 10 percent of U.S. GDP), $1.3 trillion of compensation, and 8.9 million jobs.[71]

These astonishing results came about thanks to wise bipartisan public policies formulated by the Clinton administration and a Republican-led Congress.[72] Freedom to innovate was America's policy default for digital services, and burdensome state regulations (and even taxes) were preempted to a degree.[73] Federal policymakers made a firm break with the old regulatory models of the analog era, which had constrained competition. The results speak for themselves. In addition to generating remarkable economic output and opportunity, this approach resulted in global dominance of digital technology markets. Today, 18 of the 25 largest digital companies in the world are U.S.-based, and it is difficult to name any from Europe.[74] In essence, as a recent

Wall Street Journal headline observed, the European Union now "regulates its way to last place" on digital technology.[75]

This should serve as a cautionary tale for U.S. policymakers. America got policy right for the internet, but the sort of approach adopted for AI remains to be seen. If we want U.S. firms to once again lead the world—and help counter China's looming influence on AI markets in particular—it is essential for policymakers to strike the right policy balance once again.[76]

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Appendix 2: AI's Potential for Improving Medicine and Health Outcomes

AI is already revolutionizing the field of healthcare and the practice of medicine.[77] Increasingly powerful algorithmic systems—often combined with new wearable technologies—are already helping many people better monitor their health and fitness.[78] Generative AI tools will also supplement remote medicine with virtual health care assistants.[79] More sophisticated AI tools are allowing doctors and scientists to create highly personalized care options and develop new medical treatments tailored to the unique needs of each patient.[80] As two medical experts and authors of *The Age of Scientific Wellness* have noted, "those who fold these systems into their practices will be doing their patients (and themselves) a great service" because "they are akin to having not one expert but thousands upon thousands, all working together at top speed. Because AI is generally inexpensive to run once it has been developed, the potential for optimizing care and making it radically cheaper is striking."[81]

AI and ML-enabled technologies are already having a profound impact on public health. Machine learning refers to the processes by which a computer can train and improve an algorithm or computer model without step-by-step human involvement.[82]

In 2022, for example, an AI technology from Google DeepMind called AlphaFold was able to model the structure of nearly all known proteins, representing "a significant advance in biology that will accelerate drug discovery and help address problems such as sustainability and food insecurity."[83] Researchers from the Fundamental AI Research Team at Meta have a competing

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[81] Lee Hood and Nathan Price, "The AI Will See You Now," *The Wall Street Journal*, April 7, 2023. https://www.wsj.com/articles/the-ai-will-see-you-now-5f8fba14.

[82] Ethem Alpaydin, *Machine Learning* (The MIT Press, 2021), p. 16.

[83] Steven Rosenbush, "DeepMind AI Lab Predicts Structure of Most Proteins," *The Wall Street Journal*, July 28, 2022. https://www.wsj.com/articles/deepmind-ai-lab-predicts-structure-of-most-proteins-11659048143.

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ML-created database of 617 million predicted protein structures.[84] These advances are leading to what some researchers call a "protein design revolution" driving "the next quantum leap in the biotech industry," which could completely transform medicine.[85] This competition continues, as DeepMind announced the latest and more powerful iteration of AlphaFold in April 2024.[86]

A Broad Range of Health Benefits

AI, ML, and robotics are driving many other major medical advances today, becoming a crucial part of early detection of various ailments and diseases.[87] "Artificial-intelligence algorithms are processing vast troves of data in electronic medical records, searching for patterns to predict future outcomes and recommend treatments," notes a *Wall Street Journal* medical reporter.[88] "They are creating early-warning systems to help hospital staff spot subtle but serious changes in a patient's condition that aren't always visible or noticed in a busy unit, and predicting which patients about to be discharged from the hospital are at highest risk of being readmitted."[89]

Here are some other specific examples of how AI, ML, and robotics technologies are already advancing medical science and helping improve health outcomes.

- *Organ donation*: In the field of organ donations, "[p]aired kidney donation is one of the great success stories of artificial intelligence," helping doctors and patients by taking "an incredibly complex problem and solves it faster and with fewer errors than humans can, and saving more lives as a result."[90]
- *Heart attack detection and treatment*: AI and ML tools are helping detect and treat heart disease and heart attacks, a leading cause of death globally.[91] Scientists at Cedars-Sinai

[84] Justin Jackson, "Predicting protein folding from single sequences with Meta AI ESM-2," *Phys.org*, March 23, 2023. https://phys.org/news/2023-03-protein-sequences-meta-ai-esm-.html.

[85] Sidney P Walker, et al., "Arming Yourself for The In Silico Protein Design Revolution," *Trends in Biotechnology* 39:7 (July 2021), pp. 651-664. https://pubmed.ncbi.nlm.nih.gov/33139074; Ewen Callaway, "AI tools are designing entirely new proteins that could transform medicine," *Nature*, July 2023. https://www.nature.com/articles/d41586-023-02227-y.

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[88] Laura Landro, "How Hospitals Are Using AI to Save Lives," *The Wall Street Journal*, April 10, 2022. https://www.wsj.com/articles/how-hospitals-are-using-ai-to-save-lives-11649610000.

[89] Ibid.

[90] Corinne Purtill, "How AI Changed Organ Donation in the US," *Quartz*, Sept. 10, 2018. https://qz.com/1383083/how-ai-changed-organ-donation-in-the-us.

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developed an algorithmic tool in 2022 that can quantify coronary plaque buildup in five to six seconds compared to at least 25 to 30 minutes before.[92] This will greatly improve the ability to predict who will have a heart attack. Other researchers have developed AI tools to help improve personalized treatment for women who have had heart attacks.[93] Women who suffer a heart attack have a higher mortality rate than men, often because their symptoms are not properly understood or diagnosed. Meanwhile, the British National Health Service recently started using a new AI tool that can detect heart disease in just 20 seconds while patients are in an MRI scanner, compared with the 13 minutes or more it usually takes doctors to analyze images manually after performing a scan.[94]

- *Cancers*: President Richard Nixon declared a national "war on cancer" over 50 years ago.[95] More recently, the Obama and Biden administrations pushed for a "cancer moonshot."[96] Unfortunately, cancers remain the second leading causes of death in the United States,[97] claiming 602,350 lives in 2020 alone.[98] AI and ML-enabled technologies are poised to help reduce that staggering death toll. Mayo Clinic researchers have shown how ML models can help diagnose and treat pancreatic cancer at an earlier stage.[99] Pancreatic cancer is the third leading cause of cancer deaths, claiming 46,774 lives in 2020.[100] British scientists have recently reported on new AI software that can spot signs of pre-cancer during endoscopies in 92 percent of patients, which could significantly lower deaths from esophageal cancer.[101] AI/ML techniques are also helping with early

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fast, accurate way of diagnosing heart attack," *New Atlas*, May 15, 2023. https://newatlas.com/health-wellbeing/code-acs-machine-learning-algorithm-accurate-heart-attack-diagnosis.

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[94] Tammy Lovell, "NHS rolls out AI tool which detects heart disease in 20 seconds," *Health Care IT News*, March 16, 2022. https://www.healthcareitnews.com/news/emea/nhs-rolls-out-ai-tool-which-detects-heart-disease-20-seconds.

[95] Colin Farrelly, "50 years of the 'war on cancer': lessons for public health and geroscience," *Geroscience* 43:3 (June 2021), pp. 1229-1235. https://pubmed.ncbi.nlm.nih.gov/33860442.

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[98] Centers for Disease Control and Prevention, "An Update on Cancer Deaths in the United States," Feb. 28, 2022. https://www.cdc.gov/cancer/dcpc/research/update-on-cancer-deaths.

[99] Shania Kennedy, "Mayo Clinic ML Can Predict Pancreatic Cancer Earlier than Usual Methods," *Health IT Analytics*, July 19, 2022. https://healthitanalytics.com/news/mayo-clinic-ml-can-predict-pancreatic-cancer-earlier-than-usual-methods.

[100] Centers for Disease Control and Prevention. https://www.cdc.gov/cancer/dcpc/research/update-on-cancer-deaths.

[101] Cameron Henderson, "UK Scientists Invent an Artificial Eye Which Can Pick up Early Oesophageal Cancer," *Daily Mail*, July 23, 2022. https://www.dailymail.co.uk/health/article-11041985/British-scientists-invent-artificial-eye-pics-deadly-throat-cancer.html.

detection and treatment of lung cancer,[102] breast cancer,[103] brain cancer,[104] cervical cancer,[105] and many other types of cancer[106] (including undiagnosable cancers[107]), aided by increasingly personalized screening techniques.[108] The FDA has started approving more AI-powered medical devices that can help facilitate early detection of the most prevalent cancers.[109] AI-enabled cancer detection tools can help alleviate some of the workload that human radiologists and other cancer doctors face.[110]

- *Sepsis and superbugs:* Recent medical studies have also documented how AI-powered monitoring systems are helping detect antibiotic-resistant "superbugs"[111] and sepsis,[112]

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saving thousands of lives each year as a result. Roughly 1.7 million adults develop sepsis each year in the United States, and more than 250,000 of them die.[113] Researchers find that the use of AI "dramatically cuts the time it takes to sort through thousands of promising compounds" to fight drug-resistant pathogens.[114]

- *Paralysis*: The Christopher & Dana Reeve Foundation has estimated that nearly 1 in 50 people in the United States are living with paralysis.[115] The combination of AI and robotic technologies holds promise for helping paralyzed individuals regain certain motor functions.[116] In May 2023, a Dutch man paralyzed from the waist down for more than a decade regained his ability to walk thanks to brain and spine implants and an AI-enabled thought decoder that helped him translate electrical brain signals into muscle movement.[117] He is now able to walk around his own home and get in and out of a car on his own. A paralyzed American man regained his sense of touch and mobility thanks to similar AI-enabled brain implants.[118] AI and ML capabilities are powering other brain-machine implants that are helping address disabilities in other ways, including regaining the ability to speak after a stroke.[119] And *The New York Times* recently documented how a woman who lost her arm in an accident is now able to control her new prosthetic robotic arm thanks to advances in AI and sensors embedded in her body.[120]

"AI Could Prevent Thousands of Sepsis Deaths Yearly," *Futurity*, July 22, 2022. https://www.futurity.org/sepsis-artificiall-intelligence-hospitals-deaths-2771192-2; Emily Henderson, "New machine learning model estimates optimal treatment timing for sepsis," *News Medical Life Sciences*, April 6, 2023. https://www.news-medical.net/news/20230406/New-machine-learning-model-estimates-optimal-treatment-timing-for-sepsis.aspx.

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[120] Alice Zoo, "Her A.I. Arm," *The New York Times*, May 26, 2024. https://www.nytimes.com/card/2024/05/26/technology/ai-prosthetic-arm.

- *Mental health and drug addiction*: AI can help identify and address mental health problems through textual analysis, which can supplement human-based analysis at a time when there is a nationwide shortage of health care workers in this area.[121] AI tools are also being tapped to help find novel drugs that can help counter opioid addiction, which has become a chronic problem in recent years.[122]

There are many other current or potential health-related applications for algorithmic technologies, including abnormal chest X-ray detection,[123] AI-powered ultrasounds,[124] new drug and vaccine discovery,[125]and detecting and addressing eye disease and blindness.[126] In April 2024, the National Institutes of Health announced a new breakthrough in AI retinal imaging that produces high-resolution images of cells in the eye 100 times faster and with a 3.5-fold improvement in image contrast.[127] AI and ML will power other advanced learning capabilities that will help doctors and scientific researchers access and understand massive amounts of patient and health data and put it to even better use. These same capabilities will help innovators create new personalized health monitoring and tracking systems for the public.[128]

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[121] Shirley S. Wang, "Can Mental-Health Chatbots Help With Anxiety and Depression?," *The Wall Street Journal*, May 12, 2024. https://www.wsj.com/health/wellness/ai-chatbots-mental-health-5184eca2; Shania Kennedy, "AI Tool Can Detect Signs of Mental Health Decline in Text Messages," *Health IT Analytics*, Oct. 13, 2022. https://healthitanalytics.com/news/ai-tool-can-detect-signs-of-mental-health-decline-in-text-messages; Dhruv Khullar, "Can A.I. Treat Mental Illness?," *The New Yorker*, Feb. 27, 2023. https://www.newyorker.com/magazine/2023/03/06/can-ai-treat-mental-illness; Hazel Tang, "How AI can predict suicide before it's too late," *AIMed*, March 10, 2021. https://ai-med.io/special-report-neurosciences-mental-health/how-ai-can-predict-suicide-before-its-too-late.

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AI Will Help Doctors, Nurses, and Scientists Advance Treatments

In 2022, I served as a member of the U.S. Chamber of Commerce's "AI Commission on
Competition, Inclusion, and Innovation," a group formed to study AI governance. At a spring
2022 field hearing, our Commission heard remarks from Cleveland Clinic CEO and President
Tom Mihaljevic, MD and several of his colleagues.[129] These doctors and scientists highlighted
how they were already using AI/ML to improve patient care and save lives. They noted how
teams of doctors and researchers are now able to share information from tissue samples with
much larger teams of medical experts, who can—with the help of algorithmic systems—work
together at a distance to better understand and use all the information at their fingertips.
Additionally, along with other medical centers, the Clinic has developed better AI-driven
methods to detect irregular heartbeats and strokes and to diagnose degenerative brain diseases
like Alzheimer's, dementia, and Parkinson's.[130]

This only scratches the surface of what AI/ML will mean for patient care.[131] Dr. Mihaljevic
noted that, when he started practicing medicine in the 1980s, the overall volume of medical
information doubled roughly every seven years; today, it doubles every 73 days.[132] Meanwhile,
7,000 medical papers are published *every day*.[133] A recent study in *Science* shows that, in the
closely related field of medical robotics, the number of scientific papers has grown exponentially
from less than 10 published in 1990 to more than 5,200 in 2020.[134] These numbers align with
broader trends in technical and scientific literature. "Since the scientific literature doubles
roughly every 12 years, this means that of all scientific work ever produced, half of it has been
produced in the last 12 years," note the authors of *The Science of Science*.[135]

[129] Adam Thierer, "What I Learned about the Power of AI at the Cleveland Clinic," *Medium*, May 6, 2022.
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6:60 (Nov. 10, 2021). https://www.science.org/doi/full/10.1126/scirobotics.abi8017.

[135] Dashun Wang and Albert-Laszlo Barabasi, *The Science of Science* (Cambridge University Press, 2021), p. 163.

The only way to take full advantage of this explosion of knowledge is with the power of machine-reading and -learning technologies. As the National Cancer Institute summarizes, "what scientists are most excited about is the potential for AI to go beyond what humans can currently do themselves. AI can 'see' things that we humans can't, and can find complex patterns and relationships between very different kinds of data."[136] The authors of *The Age of Scientific Wellness* speak of the rise of 'centaur doctors' who, combining the best parts of human intelligence and AI assistance, will be empowered to make bold medical decisions with far fewer unintended consequences."[137] Further, AI assistants can help address the significant paperwork and filing burdens today's doctors and nurses face, freeing up time for patient care and research.[138]

In the process, AI/ML will also help share medical knowledge across far more institutions and reach more patients as a result. Dr. Mihaljevic estimated that the Cleveland Clinic—one of the most important medical research facilities in the nation—is only able to reach an estimated 1.5 percent of Americans using traditional means of care. ML and AI can change that equation by greatly expanding opportunities for Americans to access the benefits of scientific knowledge and medical care from the Cleveland Clinic and America's many other world-class medical facilities, labs, and universities. Dr. Mihaljevic specifically highlighted AI's key role in improving home-based medical care, which will become an essential way to help a rapidly aging population in the future, regardless of where they live.[139] AI will also become crucial for various surgeries, improving outcomes when operations are necessary (often through robotic-assisted surgery)[140] or, better yet, avoiding the need for invasive procedures altogether.[141] Robotic surgery at a distance is also becoming possible thanks to recent advances.[142]

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[136] Nadia Jaber, "Can Artificial Intelligence Help See Cancer in New, and Better, Ways?," National Cancer Institute, March 22, 2022, https://www.cancer.gov/news-events/cancer-currents-blog/2022/artificial-intelligence-cancer-imaging.

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ADAM THIERER TESTIMONY, HEARING ON "ARTIFICIAL INTELLIGENCE AND ITS POTENTIAL TO
FUEL ECONOMIC GROWTH AND IMPROVE GOVERNANCE"

Conclusion

Policymakers should not underestimate the importance of AI/ML technology and must work diligently to ensure America remains a leader in this field. While some experts predict another AI winter could be coming following some notable narrow AI disappointments, they oftentimes fail to identify how public policy influences that outcome.[143] The overall amount of innovation we can expect to flow from this space is fundamentally tied up in the question of whether or not America creates the right innovation culture for AI.[144] To achieve its full potential and bring about the "AI revolution in medicine" that some predict, America will need to set its policy defaults in such a way that encourages innovation while addressing the many legitimate concerns about various AI capabilities.[145]

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[145] Peter Lee, et al., *The AI Revolution in Medicine: GPT-4 and Beyond* (Pearson, 2023).
https://www.amazon.com/AI-Revolution-Medicine-GPT-4-Beyond/dp/0138200130.

ADAM THIERER TESTIMONY, HEARING ON "ARTIFICIAL INTELLIGENCE AND ITS POTENTIAL TO FUEL ECONOMIC GROWTH AND IMPROVE GOVERNANCE"

Enclosure 1: Getting AI Policy Right through a Learning Period Moratorium

By Adam Thierer
May 29, 2024

While some artificial intelligence (AI) critics want to pause AI development, the pause most needed today is on overzealous regulatory proposals that could kneecap America's lead in computational science and algorithmic technologies. With over 700 federal and state AI legislative proposals threatening to drown AI innovators in a tsunami of red tape, Congress should consider adopting a "learning period" moratorium that would limit burdensome new federal AI mandates as well as the looming patchwork of inconsistent state and local laws.

The time to do so is now, with the race for AI supremacy against China intensifying and other nations investing heavily to counter the United States. Handcuffing our AI innovators with layers of red tape would diminish domestic entrepreneurialism and investment, deny citizens many life-enriching innovations, and limit economic growth. Equally worrisome is how overregulation could undermine our technology base and potentially even our national security.

Mountains of Red Tape

Unfortunately, many lawmakers seem oblivious to these dangers, floating extreme AI proposals premised on far-fetched hypotheticals and dystopian sci-fi plots. Such fear-based thinking has led states to propose far-reaching controls on algorithmic technologies. Colorado just became the first state to advance a comprehensive AI regulatory measure, which Gov. Jared Polis (D) signed even though he worried state regulations like his could create "a complex compliance regime for all developers and deployers of AI" and a patchwork of mandates that will "tamper innovation and deter competition." California is also rapidly advancing a major bill that would impose onerous restrictions on "frontier" AI models and create a new bureaucracy to administer the rules.

Overregulation also looms at the federal level, with more than 100 AI-related measures pending in Congress. The Biden administration is simultaneously pursuing unilateral regulation on AI through its "Blueprint for an AI Bill of Rights," a massive 110+ page executive order, and a litany of new agency directives premised on vague notions of "algorithmic fairness."

Most of these efforts are premised on the notion that government can preemptively legislate "responsible AI" by forcing innovators to run new ideas through a maze of bureaucrats to get a permission slip before innovating. Earlier this year, a top Biden administration tech official called for "a system of AI auditing from the government," and suggested the need for "an army of auditors" to ensure "algorithmic accountability." The resulting layers of technocratic meddling could lead to a death-by-a-thousand-cuts scenario for AI developers.

Undermining a Winning Formula

This is the exact opposite of the more [flexible, market-driven approach](#) the Clinton administration and Congress wisely crafted in the 1990s for the internet, digital commerce, and online speech. Rooted in policy restraint, that framework protected the freedom to innovate without first needing some bureaucrat's blessing to launch the next great application or speech platform.

If American innovators and values are to shape today's most important technology, we must not [shoot ourselves in the foot](#) as the global AI race heats up. Congress should pause overzealous micromanagement before it is too late. In the past, lawmakers have used forbearance requirements and moratoriums to protect innovation and competition, albeit to varying effect.

The Telecommunications Act of 1996 [specified](#) that "[n]o State or local statute or regulation, or other State or local legal requirement, may prohibit or have the effect of prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service." The law included other [specific preemptions](#) of state and local regulation, as well as a [provision](#) requiring the Federal Communications Commission (FCC) and state regulators to forbear from regulating in certain instances to enhance competition.

[Another portion](#) of the Communications Act meant to "encourage the provision of new technologies and services to the public" specifies that any party who opposes innovations "shall have the burden to demonstrate that such proposal is inconsistent with the public interest" and forces the FCC to make a decision within a year. Sadly, the FCC mostly ignores both this provision and the Telecom Act's forbearance requirements, continuing to overregulate communications and media markets instead.

Federal moratoria have been more effective in protecting new technologies from bureaucratic meddling and excessive taxes. Congress passed the [Internet Tax Freedom Act](#) of 1998 (made permanent in 2016) to contain the spread of "multiple and discriminatory taxes on electronic commerce" and internet access. Similarly, the [Commercial Space Launch Amendments Act](#) of 2004 made sure federal regulators did not undermine the nascent market for commercial human spaceflight.

How to Structure an AI Moratorium and Preemption

These and other laws could provide a template for how to craft a moratorium or preemption for AI regulation. An AI learning period moratorium should block the establishment of any new general-purpose AI regulatory bureaucracy, disallow new licensing schemes, block open-ended algorithmic liability, and preempt confusing state and local regulatory enactments that interfere with the establishment of a competitive national marketplace in advanced algorithmic services.

An AI learning period moratorium would have many benefits. First, it would create breathing space for new types of algorithmic innovation to grow. This is especially important for smaller AI firms and the open-source AI marketplace, both of which could be decimated by premature overregulation of a still-developing sector.

Second, an AI regulatory moratorium would give policymakers and technology experts the chance to determine what problems deserve greater scrutiny and potential regulation. This pragmatic policy approach would limit damage from rash decisions and help us gain knowledge by testing predictions and policies before advancing new rules.

A learning period moratorium on new AI regulations does not mean zero regulation, however. Many existing laws and regulations already cover any AI-enabled practices that violate civil rights, consumer protections, the environment, intellectual property, and national security. Policymakers can still enforce those policies where harms exist and fill gaps as necessary, or they can use less restrictive approaches like transparency and education-based measures.

A federal AI preemption standard will need to include carve-outs for some areas of traditional state authority including education, insurance, and law enforcement. But regulatory preemption will be challenging because, as the "most important general-purpose technology of our era," AI touches almost every field. For better or worse, some sectors and issues must be left to the province of state and local governments.

Where a national framework proves untenable, state and local governments should craft harmonized light-touch frameworks—perhaps in the form of multistate compacts—to avoid burdening the development of a robustly competitive and innovative national marketplace in AI firms and technologies.

Review Existing Regulatory Capacity

When formulating an AI moratorium, Congress should simultaneously demand that our government's 439 federal departments be required to do two other things. First, agencies should study and review existing policies that might already address algorithmic innovation in their field and consider how AI systems might already be overregulated under current law. Second, agencies should identify additional ways in which AI technologies might help improve government services. (It would be wise for state and local governments to engage in a similar review, although it need not be mandated by federal law).

The Trump administration's Office of Management and Budget (OMB) recommended some of these ideas to agency heads in a November 2020 guidance memo. "Federal agencies must avoid regulatory or non-regulatory actions that needlessly hamper AI innovation and growth," the OMB memo ordered. "Fostering AI innovation and growth through forbearing from new regulation may be appropriate," and "agencies must avoid a precautionary approach that holds AI systems to an impossibly high standard such that society cannot enjoy their benefits and that could undermine America's position as the global leader in AI innovation."

Unfortunately, in the wake of recent Biden administration orders and statements, agencies have instead been encouraged to consider how to expand their regulatory ambitions toward AI, even though Congress has not authorized such actions.

Conclusion

For the United States to remain the global leader in algorithmic technologies and computational capabilities, AI policy must be rooted in patience and humility rather than a rush to overregulate. Policymakers must avoid locking down America's innovative potential and instead pause the panic-based AI regulatory policies under consideration today.

It is essential that our nation get the policy prerequisites of growth and prosperity right by once again embracing an innovation culture that positions us as the global leader in advanced computation as the next great technological race with China and the rest of the world heats up.

Testimony of Ayanna Howard, Dean of Engineering, The Ohio State University

U.S. Congress Joint Economic Committee

"Artificial Intelligence and Its Potential to Fuel Economic Growth and Improve Governance"

June 4, 2024

Chairman Heinrich, Vice Chairman Schweikert, and members of the Joint Economic Committee:

Thank you for the opportunity to participate in today's hearing on artificial intelligence and its potential for job growth and improved governance. It's an honor to be with you today.

My name is Ayanna Howard, and I am an innovator, entrepreneur, leader, and international expert in robotics and AI. Currently, I am the Dean of Engineering at The Ohio State University and Monte Ahuja Endowed Dean's Chair. Previously, I served as the Chair of the School of Interactive Computing at the Georgia Institute of Technology. I have also served as the Associate Director of Research for the Institute for Robotics and Intelligent Machines, Chair of the Robotics Ph.D. program, and the Associate Chair for Faculty Development in the School of Electrical and Computer Engineering at Georgia Tech.

From 1993-2005, I was at NASA's Jet Propulsion Laboratory where I held the titles of Senior Robotics Researcher and Deputy Manager in the Office of the Chief Scientist. I hold a degree in engineering from Brown University, a M.S. and Ph.D. in Electrical Engineering from the University of Southern California, and an M.B.A. from the Drucker Graduate School of Management.

After leaving NASA in 2005, I entered academia and started up my own robotics research lab. My research encompasses advancements in artificial intelligence (AI), assistive technologies, and robotics, and has resulted in over 275 peer-reviewed publications. In 2013, I founded Zyrobotics, a university spin-off, which designed AI-powered STEM tools and learning games for children with diverse learning needs.

I regularly consult and sit on the advisory boards of several organizations concerned with robotics, AI, and workforce development. This includes my appointment as a member of the National AI advisory committee which is tasked with advising the President and the National AI Initiative Office on topics related to AI. My work has also been highlighted through a number of awards and articles, including highlights in *Vanity Fair, USA Today, Upscale, Black Enterprise*, and *TIME Magazine*, as well as being recognized as one of the 23 most powerful women engineers in the world by *Business Insider* and one of the Top 50 U.S. Women in Tech by *Forbes.*

Needless to say, I am not only a practitioner and developer of AI technologies but I've also been a committed advocate for developing the diverse talent pool that is needed for addressing the future workforce needs involving these advanced technologies.

My comments in this testimony are therefore focused on the national importance of AI literacy and its role in augmenting the current and future workforce talent pool as well as the government's role in enabling this to happen.

While demographics of the United States are changing, these changes are not reflected in the diversity of students pursuing degrees related to AI, engineering, or computer science. According to the 2023 World Economic Forum Future of Jobs Report, AI continues to shift the skills that are needed within the workforce – in some cases creating new jobs, augmenting old jobs, and eliminating other jobs. When I attended the World Economic Forum this past January as an invited speaker in Davos, it was clear that the AI talent shortage is not just a U.S. problem. Buying outside talent is thus no longer a viable option to solve this issue. Too often though, we disregard our untapped talent pools. Organizations tend to over index on hiring new talent with needed skills versus upskilling their current talent.

As an educator, I have witnessed bright students whom, because of gaps in their high school curricula, leave the engineering major because they struggle when they take their first discipline-specific engineering courses. Yet, when we have instituted enrichments programs, such as the PREFACE and ACCELERATE program in the College of Engineering at The Ohio State University, we have seen quantifiable growth in student retention and graduation rates in engineering. There is thus no reason, beyond intentionality (and resources), why organizations, government agencies, and educational institutions cannot institute similar AI training and literacy programs within their own organizational borders. We must provide more mechanisms than currently exist in order to be able to support the diversity of American participation and welcome all into the AI ecosystem.

There has been some movement in Congress to expand the Digital Equity Act into an AI Literacy Act but there needs to be more. We can no longer sit by and not have an unprecedented investment in expanding AI training and literacy, starting from early education through upskilling of the current workforce. Such an investment addresses a looming workforce need, a national security issue, and a major risk to national welfare. If AI is to live up to its potential of providing equitable solutions to enhancing our lives positively, the government should recommit to its fundamental mission of focusing on the public good and providing for the needs of society. We must act now to institute an AI educational transformation that provides every interested mind an equitable seat at the table.

As a technology researcher and college dean, I also dabble a bit in policy with respect to AI and regulations. I've been thinking about technology and trust for much of my career. I wrote an opinion piece about the possibility of regulations around AI back in 2019. I think policy will be critical to building trust. Policies and regulations allow for equal footing by establishing expectations and ramifications if companies or other governments violate them. Now, some companies will disregard the policies and just pay the fines — but there still is some concept of a consequence.

Right now, there's a lot of activity around AI regulations. There's the European Union AI Act, which the Parliament adopted in March 2024. There are draft AI guidelines that were released by

the Japanese government, and slightly different proposals in the United States, including President Biden's AI executive order.

There's state-specific activity, too. Over the past five years, it's been documented that 17 states have enacted 29 bills that focus on some aspect of AI regulations. This year, California introduced Senate Bill 1047, a comprehensive AI Bill with the goal of establishing safe and secure AI innovation. On June 11, I'll be participating in an AI symposium at the Ohio Statehouse, which will bring together academic leaders, policymakers, and industry experts to discuss opportunities and challenges of artificial intelligence for Ohio's universities. This practice of each state coming up with their own rules for regulating AI will continue if policies and AI bills are not being passed at a federal level. And that's a problem. AI doesn't understand the concept of borders and state lines – it's becoming as ubiquitous as the internet. Policies and regulations, when it's done correctly with diverse perspectives and iterative feedback from all impacted stakeholders, can be accomplished smartly without impeding innovation or entrepreneurship.

I believe we have a lot of room for improvement in making sure that people not only understand technology and the opportunities it provides but also the risks it creates. With new federal regulations, more accurate systems, and increased AI literacy training and upskilling for the untapped labor market, this can happen.

The intersection of the country's growing dependence on advanced AI technologies coupled with a clear shortage of AI talent is fast becoming a national security issue that must be addressed urgently.

In an April 30, 2021, speech, Secretary of Defense Lloyd J. Austin III emphasized that sophisticated information technologies, including artificial intelligence, will be key differentiators in future conflicts. The United States though risks not having enough talent trained with sufficient AI literacy that is needed to advance emerging technologies critical to maintaining American leadership.

If we are not careful, we might be living another 1957's Sputnik moment, when the United States suddenly realized the need to invest in science education to avoid losing the space race with the then-Soviet Union. When the Soviet Union launched Sputnik in 1957, the United States launched a bold initiative - the National Defense Education Act of 1958, which legitimatized federal funding for higher education and led to the transformational talent growth of new engineers and scientists. This powered the economy growth of the U.S. and American innovation through the subsequent decades. Today, with nearly every aspect of life evolving to being coupled to artificial intelligence, the United States cannot afford to sit back and wait for an AI-based crisis to hit. We are at a crossroads. The U.S. must make an equivalently bold investment in growing the AI talent pool to help protect democracy, citizens' quality of life, and the overall health of the nation.

Thank you for the opportunity to participate in this important hearing. I appreciate the Committee's attention to this topic. I stand ready to answer your questions and work with you on

moving forward to help create an ecosystem that allows for the democratization of AI technology that ensures no one is left behind as we drive forward American innovation and competitiveness.

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Exceptional service in the national interest

Joint Economic Committee

June 4, 2024

Testimony of Dr. Jen Gaudioso
Sandia National Laboratories[1]

Artificial Intelligence and Its Potential to Fuel Economic Growth and Improve Governance

Chairman Heinrich, Vice Chairman Schweikert, and distinguished members of the Committee, I want to thank you for the opportunity to testify today regarding artificial intelligence (AI) and innovation and specifically for the chance to talk about the role of the national labs in this area.

Summary

This afternoon, I want to make a few key points, and since I am a Sandia National Labs employee, I will use Sandia as an example of the critical role that the Department of Energy (DOE) national labs play in computing and highlight how this provides them with a solid foundation for leading in AI innovations going forward.

The DOE labs have:

- Led in computing breakthroughs throughout the nation's history,
- Addressed critical societal and security challenges through decades of strategic AI research, and
- Accelerated computing innovations through collaboration with universities and the private sector.

Sandia National Laboratories Overview

Sandia is one of three research and development (R&D) labs of the U.S. DOE's National Nuclear Security Administration. We are a multimission laboratory with most of Sandia's employees working in Albuquerque, New Mexico (NM) or at its second principal laboratory in Livermore, California, to deliver innovative and reliable solutions in a changing world. Our roots go back to World War II and the Manhattan Project. The lab was established in 1949 with the goal of advancing U.S. national security by developing science-based technologies. Throughout its 75-year history as a multidisciplinary, national security, engineering laboratory, [2] Sandia's primary mission has been to ensure the U.S. nuclear arsenal is safe, secure, reliable and can fully support our nation's nuclear deterrence (ND) policy, but there is strategic synergy and interdependence between Sandia's ND mission and its capability-based science and engineering foundations because breakthroughs in one area beget discoveries in others in a cycle that pushes boundaries and fuels advancement.

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[1] Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia LLC, a wholly owned subsidiary of Honeywell International Inc. for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525. **SAND2024-067400**
[2] https://www.sandia.gov/news/publications/fact-sheets/

Through this cycle, Sandia has: [3]

- Designed a brain-inspired cybersecurity system to detect malicious players 100 times faster, while using less electricity than a standard 60-watt light bulb,
- Developed an ion exchange material that was later used to remove radioactive material from wastewater in Japan's earthquake-damaged Fukushima Daiichi nuclear power plant,
- Developed robots that can reach trapped miners, demilitarize submunitions, and disable Improvised Explosive Devices,
- Created zero-emission fuel cells for marine application that are now powering a passenger ferry in the California Bay Area, and
- Designed and manufactured radiation-hardened microelectronics that enabled the Galileo spacecraft to travel 2.8 billion miles and withstand Jupiter's intense radiation belts.

This cycle also allows Sandia to assist a wide variety of small businesses throughout NM through the New Mexico Small Business Assistance (NMSBA) Program. [4] The NMSBA Program facilitates access for select small businesses to experts at Sandia and Los Alamos national laboratories who can help them gain knowledge and solve challenges utilizing the labs' cutting-edge technologies. In addition, since the NMSBA was established in 2000, 11,116 new jobs have been created and retained in NM through $80.6M in technical assistance to 3,267 New Mexico small businesses, and all 33 NM counties have been supported. Overall, Sandia has contributed over $140 billion to the United States economy through its local, regional, and national partnerships since 2003.

Now, I would like to employ a quote from the past related to new stockpile needs to help our discussion transition into a segment showcasing how Sandia's history of significant contributions in computing position it and other national labs to continue the pivotal ongoing exploration and development of AI technologies.

"We have a 10-year window; if we do not have sufficient computer simulation capabilities by then, we will need to go back to testing and that will probably not be an option. We must succeed. The laboratories will need to change to being experiment- and computer-driven within a 10-year window, rather than test-driven as in the past."
-Dr. Victor Reis, DOE Assistant Secretary for Defense Programs

Dr. Reis' call to action resulted in the Accelerated Strategic Computing Initiative (ASCI), leading the three DOE NNSA national laboratories, Sandia, Lawrence Livermore, and Los Alamos to partner with each other, industry, and academia to quickly develop, deliver, and support the high-performance computational capabilities needed for the U.S. nuclear deterrence mission. ASCI, now known as the Advanced Simulation and Computing (ASC) program, has revitalized the U.S. supercomputing industry through strategic technical leadership and partnership with industry. [5]

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[3] https://www.sandia.gov/app/uploads/sites/165/2022/03/70-ways_2019-12801M.pdf
[4] https://www.nmsbaprogram.org/
[5] https://www.hpcwire.com/2018/11/09/how-asci-revolutioned-the-world-of-high-performance-computing-and-advanced-modeling-and-simulation/

Snapshot of Sandia's Role in Computing Innovations

Sandia's legacy in high performance computing (HPC) has brought together experts from various fields—ranging from engineering and physics to computer science—to work collaboratively on improving computing technologies. This teamwork has led to the creation of some of the most powerful computers in the world.

Notably, Sandia developed the first massively parallel processing supercomputer in 1990 and the supercomputer Red Storm in 2006, which enabled nuclear stockpile calculations, modeled the amount of explosive powder needed to destroy an asteroid, and demonstrated how changes in the composition of the Earth's atmosphere affects climate. Peter Ungaro, the CEO of Cray in 2001, reflected on the integral nature of Red Storm and their partnership with Sandia saying, "Literally, this program saved Cray." [6] In addition, Sandia's commitment to improving supercomputing performance earned three R&D 100 Awards[7] in a 10-year period for increasing the efficiency of massively parallel computing across a variety of science and engineering systems.

On behalf of NNSA's ASC Program, the Vanguard program at Sandia continues the commitment to advancing computing technologies. One of the Labs' notable achievements includes the development of the Astra platform, [8] a computer that marked a significant advancement by using technology commonly found in smartphones (ARM processors) to perform complex calculations at unprecedented speeds. This innovation represents a major shift in how powerful computing technologies are built and used. These ARM architectures are now found in NVIDIA's Grace Hopper AI chips.

Industry engagement though the PathForward initiative[9] was also central to helping advance HPC technologies for the DOE Exascale Computing Project. This collaborative effort between U.S. national laboratories and industry partners fostered partnerships with leading tech companies such as AMD, Cray, Hewlett Packard Enterprise, IBM, Intel, and NVIDIA, and accelerated the development of exascale computing systems capable of performing a billion calculations per second. To get to this milestone and overcome challenges related to power, consumption, scalability, and reliability, the collaborators had to innovate in hardware, software, and system integration. The initiative overall helped ensure the U.S. remained at the forefront of computational science, facilitating significant scientific, economic, and national security advancements. As Trish Damkroger at HPE said, "Exascale supercomputing has already demonstrated a significant impact on the scientific community, which spans various initiatives across public and commercial sectors...At HPE, we are honored to continue closely collaborating with the U.S. Department of Energy, the Exascale Computing Project, and national laboratories to bring exascale technology to life and into the hands of researchers, scientists, and engineers that are solving problems to advance humanity." [10]

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[6] https://www.datacenterdynamics.com/en/analysis/after-the-storm-the-supercomputer-that-saved-cray/
[7] https://www.sandia.gov/app/uploads/sites/165/2022/03/HighPerformanceComputing_2018.pdf
[8] https://www.sandia.gov/labnews/2018/06/21/arm/
[9] https://www.exascaleproject.org/research-group/pathforward/
[10] https://www.exascaleproject.org/quotes/

Sandia is also exploring new frontiers in computing that mimic the human brain through a partnership with Intel Corp.[11] Earlier this year, Sandia researchers heralded the arrival of Hala Point, a groundbreaking brain-based computing system, housing 1.15 billion artificial neurons within a compact container roughly the size of a microwave oven. This system, believed to be the largest brain-based computing system in the world, is set to revolutionize research efforts by enabling large-scale brain-based computing. This blend of traditional and neuromorphic computing underscores Sandia's unique role in driving AI technologies forward and offering solutions to complex problems while optimizing energy efficiency.

In collaboration with industry leaders like NVIDIA, Sandia, Lawrence Livermore, and Los Alamos are also engaged in developing advanced memory technologies, underscoring NNSA's commitment to pushing the boundaries of computing even further. These partnerships are part of broader efforts to strengthen the U.S.' competitiveness in next-generation computing technologies, ensuring that the nation remains at the forefront of HPC innovation. Through initiatives like these, Sandia and its partners are creating a more robust computing ecosystem through strong engagement with industry, paving the way for future technological breakthroughs that will benefit society.

Innovations extend beyond computing hardware

Open source software, by its very nature, promotes a culture of collaboration and shared creativity. It allows researchers, developers, and organizations across the globe to contribute to and benefit from the collective intelligence of the community. Recognizing the value of open-source software for furthering innovations in computing, DOE established a policy[12] in 2003 requiring its national labs to provide all publicly releasable software as either open-source software or as government software.

To ensure the sustainability of key open-source software, the national labs took initiative to partner with the Linux Foundation and launched the High Performance Software Foundation (HPSF), [13] a key moment in the evolution of open-source software for HPC and AI. These two institutions have been instrumental in recognizing the need for HPSF and driving its creation. Their vision for a collaborative platform that enhances the development, accessibility, and efficiency of high-performance software has been a key catalyst in bringing this initiative to life.

Currently, HPSF is working on a portable core software stack for HPC, which will make high-performance software development more accessible and efficient, and further enable the exploration and implementation of AI solutions. By rallying industry, academia, and government entities around the shared goal of advancing HPC and AI through open-source collaboration, national labs have created a powerful ecosystem for innovation and underscored their commitment to spearheading the next wave of scientific computing and AI advancements that can be used to address complex challenges and pave the way for future technological breakthroughs.

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[11] https://newsreleases.sandia.gov/artificial_neuron/
[12] https://science.osti.gov/-/media/ascr/pdf/research/docs/Doe_lab_developed_software_policy.pdf
[13] https://hpsf.io/

AI @ Sandia[14]

Sandia's research in AI can be traced back to the early 1980s, at least. With today's combination of algorithms, data, and computing, Sandia is making significant impacts to national security through AI.

AI revolutionizes the speed in which we model and analyze data to inform decisions. It enables us to handle vastly larger amounts of data than humans can process alone, helps significantly reduce human errors and better complete repetitive tasks. AI's unrealized potential impact on the future of Sandia's mission spaces is vast, and the research we are doing will help realize that future for the benefit of the nation.

In the last few years, leading experts at Sandia have utilized AI and machine learning (ML) to solve complex science problems such as predicting ionic liquid diffusion for renewable energy storage applications,[15] recognizing radar targets quickly and accurately,[16] and designing strong and flexible interlocking metasurfaces for aerospace applications used in extreme environments.[17] Our ground-breaking work in trusted AI and computing co-design also continues to be leveraged in support of national security applications and other mission work.

As we consider the breadth and pace of AI progress by others around the globe, Sandia weighs three factors in focusing our research activities: (1) where we have, or could have, technical strengths in AI; (2) where there is strong mission need for AI solutions for NNSA and other government agencies; and (3) where is industry unlikely to supply the AI tools. As a result, Sandia's differentiated AI strategy focuses on:

- **AI Security & Reliability:** Sandia is developing methods and measures required to produce reliable and trustworthy AI-based solutions for its core nuclear deterrence engineering and design efforts, national security programs, global security, energy and homeland security, and the Labs' underlying advanced science and technology.
- **Scientific Machine Learning:** Sandia is fusing ML with scientific principles to solve scientific and engineering problems.
- **Data-driven AI for Mission Critical Applications:** Sandia is supporting high-consequence national security missions by developing and deploying critical applications enabled by data-driven AI.
- **Generative AI for National Security:** Sandia is engaged in assessing opportunities to deploy safe, reliable, generative AI systems to address national security and advanced manufacturing challenges.
- **Transitioning AI Research into Production:** Sandia is leveraging its depth and breadth of unique expertise to mature robust AI software that meets mission needs.
- **Infrastructure, Policy, & Operations:** Sandia is ensuring that critical infrastructure, computing power, workforce, and responsible AI policies are in place to support our business needs and mission research. We are identifying, developing, and promoting training opportunities to our entire workforce, especially when it comes to increasing the use of AI operationally among non-experts.

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[14] https://www.sandia.gov/research/area/computing-information-science-and-mathematics/ai/
[15] https://www.sandia.gov/news/publications/hpc-annual-reports/article/predict-ionic-liquid-diffusion/
[16] https://www.sandia.gov/news/publications/hpc-annual-reports/article/recognize-radar-targets-quickly-and-accurately/
[17] https://www.sandia.gov/news/publications/hpc-annual-reports/article/design-strong-and-flexible-interlocking-metasurfaces/

Continuing our established practice of partnering to advance computing technologies, Sandia's AI research is making mission impacts through collaborations with academia, other national labs, and the private sector. Two recent examples highlight the diversity of these impacts.

(1) With Lawrence Livermore and Los Alamos, we have embarked on a groundbreaking project[18] with Cerebras Systems to explore the application of the Wafer-Scale Engine technology in advancing simulation and computing applications crucial for the nation's stockpile stewardship mission. The Cerebras Systems AI chip design utilizes an entire wafer of integrated circuits versus current technology which cuts wafers into individual microprocessor cores that become graphics processing units (GPU) or central processing units (CPU).

This partnership, part of the NNSA's post-Exascale-Computing-Initiative investment portfolio, seeks to sustain technological R&D momentum, fostering a robust domestic high-performance computing ecosystem. The initiative is poised to significantly impact future mission applications by integrating AI and ML techniques into production simulation workloads, marking a pivotal step in enhancing the capabilities of the U.S. in HPC and AI technologies.

(2) Sandia's Materials Learning Algorithms (MALA) project,[19] which received a prestigious R&D 100 award in 2023, is a cutting-edge program using ML to simplify and speed up complex calculations related to the properties of materials. This tool makes it easier for scientists to model materials at different scales, enhancing our understanding and development of new materials. MALA is designed to be user-friendly and open to everyone, allowing for easy use with just a few lines of code. Developed through a partnership between Sandia and the German Center for Advanced Systems Understanding, MALA represents a major leap forward in materials science, making it simpler and faster to explore the microscopic world of materials.

Frontiers of AI for Science, Security, and Technology (FASST Initiative)

Through the DOE FASST Initiative announced several weeks ago at the AI Expo in Washington, D.C., DOE and its national labs seek to dramatically accelerate the pace of R&D and enable scientific capabilities previously thought to be impossible through AI. With all that we have covered using Sandia as a national labs' exemplar, I hope it is easy to see how the national labs will strategically support the FASST Initiative and advance U.S. leadership in AI.

Under the FASST Initiative, as outlined by DOE and NNSA, the national labs will:

- Lead R&D to develop tuned and adapted AI models that solve pressing scientific and national security challenges. They will focus on training, testing, and validating frontier foundation models and other AI tools aligned with robust data sets,

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[18] https://newsreleases.sandia.gov/cerebras_research/
[19] J. A. Ellis, L. Fiedler, G. A. Popoola, N. A. Modine, J. A. Stephens, A. P. Thompson, A. Cangi, S. Rajamanickam (2021). Accelerating Finite-temperature Kohn-Sham Density Functional Theory with Deep Neural Networks. Phys. Rev. B 104, 035120 (2021)

- Continue to build on their history of partnering with the private sector and extend these partnerships to focus on the development and construction of next-generation AI platforms, and
- Prioritize the development of tools for efficient, safe, and effective aggregation, generation, curation, and distribution of AI training data sets used across the platforms.
  The national labs are already beginning to jointly create hubs and put together teams that organize data for AI training and evaluation and specifically address DOE mission grand challenges. Collaborations, such as the one exemplified by the envisioned New Mexico AI Consortium (NMAIC), enable the sharing of resources and knowledge, while allowing for the creation of proprietary outcomes that benefit commercial, public, and national security applications.

New Mexico AI Consortium

Mr. Chairman, across NM, we are finalizing the NMAIC—a Consortium envisioning a future where the collaborative power of NM's premier institutions and industrial partners transforms the landscape of AI research, workforce development, and infrastructure. By uniting the strengths of Sandia, Los Alamos, the University of New Mexico (UNM), New Mexico State University (NMSU), New Mexico Institute of Mining and Technology, Central New Mexico Community College (CNM), and our industrial partners, NMAIC will foster an ecosystem of innovation and broaden both academic and community input to shape the future of AI and propel the state and nation forward.

Research: NMAIC is committed to pioneering the advancement of AI through a synergistic approach that integrates hardware, software, numerical methods, data, algorithms, and practical applications. Our consortium aims to ensure that AI research is not only at the forefront of technological progress but will also provide trustworthy solutions directly aligned with the critical needs of our nation and state. By leveraging our collective research expertise and resources, we aim to solve complex challenges, drive economic growth, and enhance the well-being of our communities.

Workforce: NMAIC is dedicated to cultivating a diverse, skilled, and innovative workforce capable of leading the future of technology. Through comprehensive education, training programs, and collaborative initiatives, we aim to equip individuals with the knowledge and skills necessary to excel in the evolving AI landscape. Our consortium is committed to creating opportunities for lifelong learning and career advancement, ensuring that NM remains at the forefront of AI innovation and application. In addition, all the NM universities and colleges are minority-serving and Hispanic-serving institutions and will bring diverse perspectives to AI research and education. Through the NMAIC partnership with UNM, we will pilot an approach to university collaboration, and by utilizing UNM's role in the Alliance of Hispanic-Serving Research Universities (HSRU), we plan to expand these partnerships to other HSRU across the country.

Infrastructure: At the heart of the NMAIC vision is the development of a robust, state-of-the-art infrastructure that supports the ambitious goals of our consortium. NMAIC is focused on building and enhancing the physical and digital frameworks necessary for cutting-edge AI research, education, and commercialization. By investing in high-performance computing facilities, data storage and management systems, and collaborative spaces, we will provide our researchers, students, and industrial partners with the tools they need to succeed.

I would like to highlight a few Sandia examples showcasing the types of foundations that can further be built upon through the NMAIC.

- The ASC Predictive Science Academic Alliance Program[20] is a partnership between Sandia, Los Alamos, and UNM focused on advancing science-based modeling and simulation.
- The robust research and internship programs Sandia has with multiple Historically Black Colleges and Universities (HBCU) partners provides a talent pipeline for the national laboratories. Through UNM, we are integrating recruitment efforts that will attract diverse talent seeking to advance their education upon graduating from HBCU. The joint faculty loan agreements currently in place between Sandia, Los Alamos, and UNM enables staff members to teach at the university, thereby introducing students to career paths at the laboratories.
- RS21[21] is a current collaboration between NMSU, UNM, Los Alamos, and several NM industrial partners. RS21, founded by a former Sandia employee who separated from the laboratory through our Entrepreneurial Separation to Tech Transfer program,[22] integrates AI, data engineering, user experience, and modern software development methods to enable organizations to make data-driven decisions.

The NMAIC envisions a future where collaboration, innovation, and excellence in AI drive national progress and prosperity and improve the quality of life for all.

Conclusion

In summary, the DOE laboratories, including Sandia, have historically been at the forefront of technological breakthroughs, particularly in computing innovations. Their pioneering development of advanced supercomputers and engagement in codesign activities have laid a solid historical foundation that should underscore the necessity of their role in driving future AI innovations forward.

Mr. Chairman and Members of the Committee, Sandia and our national lab peers are ready to continue executing in computing excellence and committed to engaging our academic and industry partners in jointly educating the future generation of AI engineers and designers. It will be our privilege to lead the nation's exploration, development, and safe use of AI in the interest of our taxpayers and our national security.

Thank you for convening this hearing, and I look forward to your questions.

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[20] https://psaap.llnl.gov/
[21] https://rs21.io/
[22] https://www.sandia.gov/labnews/2024/05/02/former-sandian-added-to-entrepreneurial-wall-of-fame/

Jennifer Gaudioso, PhD

Director, Center for Computing Research

Jennifer Gaudioso is Director of the Center for Computing Research at Sandia National Laboratories where she stewards the Center's portfolio of research from fundamental science to state—of-the-art applications. The Center's work includes computer system architecture (both hardware and software); enabling technology for modeling physical and engineering systems; and research in discrete mathematics, data analytics, cognitive modeling, and decision support materials. She is also the Program Executive for NNSA's Advanced Simulation and Computing Program at Sandia. Jen also serves on Sandia's AI Board of Directors.

Previously, she served as the Director of the Center for Computation and Analysis for National Security where she oversaw the use of systems analysis, cybersecurity, and data science capabilities to tackle complex national security challenges. In this role, Jen also led Sandia's Homeland Infrastructure Security and Resilience Program which was underpinned by "data to decision" capabilities.

Jen began her Sandia career in 2002 and, in 2010, she moved into management, leading the International Biological and Chemical Threat Reduction Program. Jen's leadership established Sandia as a critical contributor to the U.S. government's response to the Ebola outbreak in West Africa. The team's ground-breaking efforts were also acknowledged with a DOE Secretary of Energy Award. In her role as Senior Manager for Global Strategic Futures, Jen led development of the Global Security Division's mission, science and technology pipeline, and mission-aligned programs. She also led Sandia's contributions to the next-generation Nuclear Command, Control, and Communications (NC3) and coordinated a Sandia-wide emerging non-proliferation initiative at the interface of NA-10, NA-20, NA-80, and DOE-IN, earning a Department of Energy (DOE) Secretary of Energy Award for the team.

Jen served on two National Academies Committees addressing biodefense issues and was an MIT Seminar XXI Fellow. She has a PhD and a master's degree in physical chemistry from Cornell University and a bachelor's degree in chemistry from Bard College. Jen's time at Bard taught her to value diverse perspectives in problem-solving.

"Artificial Intelligence and Its Potential to Fuel Economic Growth and Improve Governance"

Hearing before the Joint Economic Committee

Tuesday, June 4, 2024

QUESTIONS FROM Vice Chairman David Schweikert for

Brian Miller, M.D.

Please submit additional information on AI's implementation to improve administrative processes in Medicare and Medicaid (i.e. using AI to process claims or audit incorrect claims) and about how exactly AI can help doctors write scripts and process lab orders etc.

Attachment—Additional Questions for the Record

**U.S. State Congress Joint Economic Committee Hearing on
"Artificial Intelligence and Its Potential to Fuel Economic Growth and Improve Governance "**

June 4, 2024

Brian J. Miller, M.D., M.B.A., M.P.H.,
Assistant Professor of Medicine
The John Hopkins University School of Medicine

The Honorable David Schweikert
1. Please provide any additional information to be submitted to the record on AI's implementation to improve administrative processes in Medicare and Medicaid (i.e. using AI to process claims or audit incorrect claims) and about how AI can help doctors write prescriptions, process lab orders, etc.

Automation and artificial intelligence (AI) can be used to improve clinical care through three primary applications:
   1) Automation of the mundane (administrative tasks)
   2) Augmentation of human-driven clinical practice
   3) Automation of elements of clinical practice.

In examining administrative tasks that increase costs and decrease labor productivity in health care delivery and government, automation and AI could be used for a variety of tasks:
   - *The Centers for Medicare and Medicaid Services (CMS) could deploy AI and automation for Medicaid eligibility and redetermination*
   - *Both CMS and private health plans could utilize AI for screening claims pre- and post-payment to identify fraud, waste, and abuse and reduce costs*
   - *Physician charting could be automated, with passive AI utilized to create clinical notes for physician review and editing (e.g. Nuance, SafeScribe).*
   - *Automation of diagnostic coding to support billing in both fee for service (FFS) Medicare (e.g. primary and secondary diagnosis to support diagnosis-related group and acuity for the hospital inpatient prospective payment system) and for Medicare Advantage (e.g. diagnostic coding for risk adjustment). With over 70,000 ICD-10 diagnosis codes, deploying AI to improve diagnosis coding would significantly reduce burdens on clinicians and improve the accuracy of payment for hospital care and other services in FFS Medicare in addition to improving the accuracy of risk-adjusted payment in Medicare Advantage.*

Automation and artificial intelligence can also be deployed across clinical medicine in order to both augment existing clinical labor:
   - *Augment pathologists' classification of colorectal polyps[1]*
   - *Improve radiologists' cancer detection rate when reviewing mammograms[2]*
   - *Improve physician detection and diagnosis of melanoma[3]*
   - *Improve pathologist review and assessment of prostate biopsies to detect and diagnose prostate cancer[4]*
   - *Clinical decision support to improve clinician differentiation of colon cancer and acute diverticulitis on computed tomography (CT) scans[5]*

Automation and artificial intelligence can also be deployed across clinical medicine to automate elements of clinical practice:
   - *AI shows promise in independently assessing mammograms[6]*
   - *Automated interpretation of routine electroencephalograms[7] (i.e. brain wave monitoring)*
   - *Automated review of point-of-care digital cytology[8] for pap smears to detect atypia and low and high-grade lesions*
   - *Autonomous review of images and subsequent diagnosis of diabetic retinopathy[9]*

In summary, our country is on the cusp of the beginning of a revolution in care delivery. AI and automation can decrease administrative burdens, freeing up clinicians to spend time on diagnostic, prognostic, and therapeutic tasks and most importantly spend more time with their patients, thus expanding access. AI and automation can also augment existing clinical efforts or even automate elements of clinical practice, expanding access, improving quality and safety, and decreasing costs. Our health care delivery system and our broader economy stands to benefit from stacked, incremental innovation in clinical and administrative processes, driving improved labor productivity, lowering costs, and expanding access to mass-customized, mass-produced health care for all Americans.

Please see the enclosed additional resources:
  a. *Spear J, Ehrenfeld JM, Miller BJ. "Applications of Artificial Intelligence in Health Care Delivery." Journal of Medical Systems 2023;47(121).*
  b. *Cho T, Miller BJ. "Using Artificial Intelligence to Improve Administrative Process in Medicaid." Health Affairs Scholar Volume 2, Issue 2, February 2024, qxae008, https://doi.org/10.1093/haschl/qxae008*

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COMMENT

Applications of Artificial Intelligence in Health Care Delivery

Joseph Spear[1] · Jesse M. Ehrenfeld[2,3] · Brian J. Miller[4,5]

Abstract

Health care costs now comprise nearly one-fifth of the United States' gross domestic product, with the last 25 years marked by rising administrative costs, a lack of labor productivity growth, and rising patient and physician dissatisfaction. Policy experts have responded with a series of reforms that have – ironically - increased patient and physician administrative burden with little meaningful effect on cost and quality. Artificial intelligence (AI), a topic of great consternation, can serve as the "wheat thresher" for health care delivery, empowering and freeing both patients and physicians by decreasing administrative burden and improving labor productivity. In this Viewpoint, we discuss three principal areas where AI poses an unprecedented opportunity to reduce cost, improve care, and markedly enhance the patient and physician experience: (1) automation of administrative process, (2) augmentation of clinical practice, and (3) automation of elements of clinical practice.

Applications of Artificial Intelligence in Health Care Delivery

Health care costs now comprise nearly one-fifth of the United States' gross domestic products, with the last 25 years marked by rising administrative costs, a lack of labor productivity growth, and rising patient and physician dissatisfaction [1]. Policy experts have responded with a series of reforms that have – ironically - increased patient and physician administrative burden with little meaningful effect on cost and quality. Some programs, such as Accountable Care Organizations have driven consolidation [2] while other

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long-touted interventions such as comprehensive primary care showed no systematic impact on cost or quality [3]. With decades of reliance on micro policy adjustments not yielding the desired outcomes, now is the time to think differently. Artificial intelligence (AI), a topic of great consternation, can serve as the "wheat thresher" for health care delivery, empowering and freeing both patients and physicians. In this Viewpoint, we discuss three principal areas where AI poses an unprecedented opportunity to reduce cost, improve care, and markedly enhance the patient and physician experience: (1) automation of the mundane, (2) augmentation of human-driven clinical practice, and (3) automation of elements of clinical practice.

Automation of the Mundane

Nearly two-thirds of physicians suffer from burnout, with many citing electronic health record documentation and inbox messages, prior authorization, and other routine administrative tasks [4]. This collective experience is mirrored in empirical research: a recent time motion study of internal medicine residents demonstrated that only 13% of the average day is spent in face-to-face contact with patients [5] while other work demonstrates that a typical primary

care physicians spend 6 h per clinic day writing patient notes [6].

AI offers the opportunity to restore joy in clinical practice through automation of the mundane – or manual, human capital driven tasks. With companies such as Augmedix, Deep-Scribe and Amazon presenting early attempts at automating clinical notetaking, eventually the burden of recordkeeping should shift from the clinician to technology. Ultimately, clinicians should be able to review and sign AI-generated notes as opposed to spending their limited time during and after patient encounters documenting visits. Early evidence suggests that automation of simple responses to patient messages may not only decrease burden, but also increase satisfaction as AI may be perceived in some circumstances as having greater empathy [7]. Finally, the arduous painful tasks of coding and billing could be similarly automated, saving clinicians from struggling with over 70,000 unique diagnosis codes.

A process that could arguably not be worse for all those involved, prior authorization offers another obvious opportunity for improvement using AI. The average oncology practice has over 6 full-time staff to handle prior authorizations, [8] while physicians generally report filling out an average of 37 prior authorization forms per week with 75% reporting this as a "high" or "extremely high" burden [9]. Using AI to automate the submission of data as the first level of review for some prior authorization processes based upon clear and transparent guidelines could eliminate the need for physician involvement. Eventually, AI could help facilitate near real-time adjudication of prior authorization requests during a clinical visit, freeing up both clinicians and health plan staff to engage in more meaningful, complex reviews.

Augmentation of human-driven Clinical Practice

AI can transform how clinicians use information and make decisions, driving increasingly personalized care. AI technology [10] drives dynamic displays in Teslas, alerting drivers of potential harm thus facilitating quick decision making and real-time interventions while BlueCruise in Fords facilitates hands-free highway driving. Medical care is no different, requiring split second decisions in an environment of countless informational inputs. AI-driven technology can offer meaningful clinical decision support, enabling clinicians in acute care environments such as intensivists, anesthesiologists, and nurses to manage patients more efficiently and effectively by highlighting concerning trends, gaps in care, or suggesting actions that would otherwise be omitted or delayed.

Technological innovations like magnetic resonance imaging and genetic sequencing have provided clinicians with additional diagnostic tools to customize and personalize care, with AI and automation offering a similar opportunity to upskill clinicians while improving productivity. Through algorithmic pattern recognition, AI applications may more accurately read CT scans, [11] mammography, [12] or pathology slides, [13] catching diagnoses that might have been missed and enhancing the capability of the supervising clinicians. We expect that these tools will, for example, enable pathologists to spend time reviewing suggested diagnoses of routine cases and devote more time to selecting assays, improving overall lab performance, and addressing complex cases. For some cancers, AI tools will eventually be able to suggest treatment options for oncologists to review and then discuss with their patients. This will enhance the consistency of care and accelerate the adoption of newly generated scientific evidence which today often takes decades to come into routine clinical practice.

Automation of Elements of Clinical Practice

While fully autonomous AI-driven medical care is likely decades away, automation of specific narrow tasks is already underway. Technology like IDx-DR [14] (Digital Diagnostics Inc, Iowa) can streamline screening for diabetic retinopathy without physician interpretation and with such precision that the company holds liability insurance. In resource-limited settings, point-of-care digital cytology with AI is being used for cervical cancer screening [15]. After being trained on 30,493 electroencephalograms, an AI model was able to achieve diagnostic performance similar to human experts [16].

These initial narrow and specific autonomous AI applications offer insight into the future of innovation. For example, as radiological AI applications reach the market, images will be read increasingly by machine learning algorithms with diagnoses being determined with a pre-specified degree of certainty, enabling radiologists to review cases with a low degree of certainty. The transition to automation will be gradual with human practitioners remaining relevant and in the loop supervising the algorithms while finding new avenues to care for patients, requiring physicians to develop the skills to oversee and manage the output and activities of AI-enabled technologies.

Policy Opportunities

With technological advances comes the fear of the unknown. The wheat thresher was alleged to destroy the agricultural industry and put farmers out of business. In reality, it provided much needed efficiencies in agriculture and allowed farmers to scale and meet increasing demand. AI will play a similar long-term role in that it is an innovative and flexible answer to one of the largest issues facing the healthcare

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sector: the lack of labor productivity growth coupled with rising administrative costs. Like technological change in order industries, AI may drive some short term costs through implementation, with eventual, significant long-term cost savings.

Important and answerable policy questions remain. Medical licensure for independently practicing products should be avoided. Instead, noting that current U.S. Food and Drug Administration regulatory pathways are ill-suited for complex and rapidly evolving software products, policymakers should consider the creation of a series of voluntary, alternative regulatory pathways fit for software as a medical device, inclusive of AI and software-driven medical devices. Liability remains a question and should be placed with the parties best positioned to mitigate the risk. Policymakers and courts will sort out the gray line between product, clinician, and consumer liability for AI-augmented and AI-driven medical care.

Regardless, the benefits of AI to patients and clinicians must not be overlooked. AI has the potential to transform care delivery augmenting physicians and the healthcare team, leading to the provision of superior care and substantial costs savings, the stated policy goals of many previously failed policy interventions. If the profession panics and fails to capitalize on the positive potential of AI, it will neglect an important opportunity to revolutionize healthcare.

The views of this paper do not necessarily represent those of the Medicare Payment Advisory Commission or the American Medical Association.

Declarations

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Using artificial intelligence to improve administrative process in Medicaid

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Abstract

Administrative burden across state–federal benefits programs is unsustainable, and artificial intelligence (AI) and associated technologies have emerged and resulted in significant interest as possible solutions. While early in development, AI has significant potential to reduce administrative waste and increase efficiency, with many government agencies and state legislators eager to adopt the new technology. Turning to existing frameworks defining what functions are considered "inherently governmental" can help determine where more autonomous implementation could be not only appropriate but also provide unique advantages. Such areas could include eligibility and redetermination of Medicaid eligibility as well as preventing improper Medicaid payments. However, while AI is promising, this technology may not be ready for fully autonomous implementation and instead could be deployed to augment human capabilities with robust safeguards until it has proven to be more reliable. In the meantime, the Centers for Medicare and Medicaid Services should release clear guidance around the use of AI by state Medicaid programs, and policymakers must work together to harness AI technologies in order to improve the efficiency and effectiveness of the Medicaid program.

Key words: Medicaid; administration; artificial intelligence; enrollment; eligibility; redetermination.

Using artificial intelligence to improve administrative process in Medicaid

Administrative burden in public benefits programs is generally high, with joint state–federal programs adding additional complexity. Estimates for administrative spending range from 15% to 30% of total health care spending—half of which has been characterized as wasteful[1,2]—with recent estimates of annual administrative spending reaching $1 trillion.[3] There are a variety of definitions of what constitutes administrative spending; however, broadly speaking, administrative spending is generally characterized as spending that is nonclinical in nature, which includes spending in categories such as billing and insurance.[1,4] While there may be some divergence as to the exact proportion of overall health care spending that is attributed to administrative spending, there is no doubt that it represents a significant portion of overall health care spending.

High administrative burden in health care is typically attributed to the large number of nonclinical staff, many of whom perform routine or repetitive tasks that could readily be automated.[5] The recent boom in artificial intelligence (AI), which includes technologies such as machine learning, natural language processing, and large language models, has promised to create tools to automate and reduce administrative burden,[6,7] with some even estimating savings as high as

$200–$360 billion in health care spending using existing technologies realized in the next 5 years.[6] Despite this potential, there are many who are skeptical of AI and even those who see potential for profound risks to society,[8,9] given recent advances that have come in leaps and bounds, sometimes referred to as emergent abilities. However, more recent evidence calls into question the claims of emergent abilities[10-12] and supports others' claims that such concerns may be exaggerated.[13,14] While it is important to create commonsense safeguards to prevent unethical or even dangerous applications of these technologies with unintended consequences, the potential uses of AI to reduce administrative waste and increase efficiency will be pivotal to making the US health care system more sustainable. In this commentary, we review governmental interest in adopting AI technologies, opportunities to improve administrative efficiency and operations in the Medicaid program, as well as associated targeted policy recommendations.

Government is eager to adopt AI

Although the government at both the state and federal levels often lags in the adoption of new technology, AI technologies are already being used throughout the federal government, with a 2020 survey citing 45% of government agencies surveyed expressing interest in AI, with many having planned,

piloted, or implemented such technologies.[15] As mandated by Executive Order 13960, "Promoting the Use of Trustworthy Artificial Intelligence in the Federal Government,"[16] the Department of Health and Human Services[17] reported 23 use cases applicable to the Centers for Medicare and Medicaid Services (CMS), including fraud detection,[18,19] payment forecasting, and drug-cost anomaly detection.[17] At the state level, policymakers have started the conversation around setting boundaries and implementing certain AI applications, with at least 25 states, Puerto Rico, and the District of Columbia introducing AI bills, and 14 states and Puerto Rico adopting resolutions or enacting legislation in the 2023 legislative session.[20]

With these current and future impending waves of interest in and adoption of AI technologies, it is important to understand where these technologies will thrive and maximize their potential. There are certain functions within government that are designated as "inherently governmental functions." Per definitions in the Federal Activities Inventory Reform (FAIR) Act of 1998, the Office of Management and Budget Circular A-76, and most recently, the Office of Procurement Policy (OFPP) Policy Letter 11-01, certain government functions are considered to be "inherently governmental" in that they are "so intimately related to the public interest as to mandate performance by government personnel."[21] Functions that are not considered "inherently governmental" are designated "commercial functions" that can be performed by contractors. While there is a litany of different statutory, regulatory, and policy authorities designating specific functions as either inherently governmental or commercial, per most recent guidance given in OFPP Policy Letter 11-01, there are 2 tests that agencies are required to use to identify inherently governmental functions (see Figure 1), as follows:

1. "Nature of the function" test: functions involving exercise of US sovereign power are inherently governmental
2. "Exercise of discretion" test: a function should be categorized as inherently governmental when it allows for exercising of discretion that "commit[s] the government to a course of action where two or more alternative courses of action exist and decision making is not already limited or guided by existing policies, procedures, directions,

orders, and other guidance that: (I) identify specified ranges of acceptable decisions or conduct concerning the overall policy or direction of the action; and (II) subject the discretionary authority to final approval or regular oversight by agency officials"[22]

At present, the determination of whether a function performed by AI is "inherently governmental" or "commercial" is, in many cases, a moot point as most AI applications are currently implemented as tools empowering users to more easily or more proficiently perform their duties and functions rather than as separate entities performing a function autonomously. However, these 2 tests become more important as AI advances and begins to function more autonomously. Functions that satisfy the "nature of the function" test and allow for exercising of US sovereign power would be of too high importance to allow for any possible error due to malfunction or otherwise unintended outputs from AI. It could also be argued that AI performs best in functions that have discrete and specific parameters that would preclude it from being categorized as "inherently governmental" per the "exercise of discretion" test. Together, these tests should help us identify functions that are not "inherently governmental" and would not only be appropriate but perhaps also even uniquely benefit from the application of AI technologies.

When specifically looking at CMS oversight of and actions of state Medicaid agencies, 1 area that has often been acknowledged as being more difficult and complicated than it needs to be is the oversight and procedural determination of Medicaid eligibility, both the initial determination as well as subsequent redetermination processes. Millions of Americans are unable to access benefits due to administrative holdups, prompting ongoing efforts to streamline and simplify the process,[23] while simultaneously, millions of other Americans remain inappropriately enrolled. Redetermination is a critical administrative process, with an estimated 17 of the 20 million Medicaid beneficiaries added during the pandemic who may lose Medicaid coverage with the unwinding of the continuous enrollment requirement of the Families First Coronavirus Response Act.[24] Medicaid eligibility requirements are codified by law, allowing for little to no discretion, so the processes of initial determination and redetermination of eligibility would
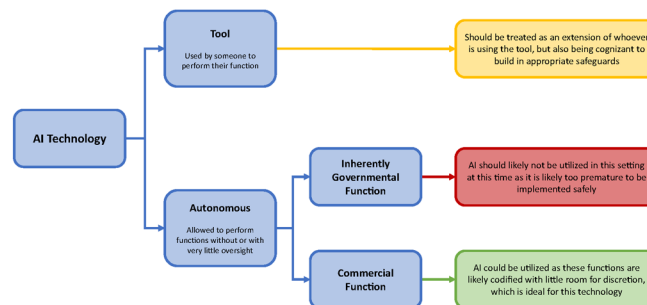

Figure 1. Flowchart for evaluation and classifications of uses of artificial intelligence (AI) functions (created by authors).

represent areas of immediate administrative need for states where AI could be used to help bridge the gap. Additionally, AI could further be used to augment and digitize the communications process to convey status updates to beneficiaries regarding their determination process as well as other important information even outside of the determination process.

Another notable area that may benefit from AI intervention is the prevention of improper Medicaid payments. Improper Medicaid payments are quantified and tracked as mandated by the Payment Integrity Information Act of 2019.[25] Improper payments do not necessarily indicate fraud but rather payments made that did not meet statutory, regulatory, or administrative requirements—most often due to missing information. They do, however, still create a significant financial burden, with improper Medicaid payments reaching \$80.57 billion in 2022.[26] Although Managed Care represents 72% of the Medicaid marketplace,[27] just 0.1% of improper payments are attributed to Managed Care.[26] In contrast, eligibility is estimated to account for 73.7% (>\$61 billion) in improper payments, with Fee for Service Medicaid accounting for 26.2% (nearly \$22 billion) in improper payments in 2022.[26] These improper payments are made due to a variety of reasons that include insufficient or no documentation, coding errors, unbundling, and other errors.[26] Whether or not a Medicaid payment can be determined to be improper is again a codified determination with little to no room for discretion, making the prevention of improper Medicaid payments another area ripe for AI intervention.

Avoiding potential pitfalls

Despite their promise, AI technologies are still works in process. Previous attempts to apply data-mining and algorithmic technologies to various areas of government, including administering welfare programs, have not been without controversies or failures.[28] This is not particularly surprising given that even the more advanced technologies underlying AI are prone to inaccuracies—some of which are referred to as "hallucinations"[29]—and improperly built (ie, using incomplete, skewed, or otherwise poor-quality training data) or implemented AI tools can also be prone to algorithmic bias,[30] which, if introduced into government functions, could prove disastrous. A prominent example of this includes facial recognition algorithms that are often heavily influenced by demographics due to training on incomplete datasets.[31]

Given these limitations, for now, AI technologies should be used to augment human capabilities until they have proven to be more stable and can be built upon more robust datasets. While it is likely that AI will eventually come to be implemented in many truly autonomous fashions, AI should be implemented more cautiously through the initial, liberal use of human review because of the potential for severe consequences should AI fail to behave as expected when implemented in government functions. Further safeguards include building in auditing functions to help with human review of outputs as well as implementing easy ways to rollback or otherwise "undo" AI-driven actions.

Recommendations

In order to help advance the adoption of AI, CMS should release clear guidance detailing which functions that state Medicaid programs would be permitted or even encouraged to utilize AI tools to reduce administrative burden. This could be maintained in a public database that state Medicaid programs could then use to signal their desire to purchase, acquire, or otherwise work with vendors offering services as well as to specify technical specifications and requirements. An improvement over the status quo of a CMS webpage listing of state Medicaid IT procurement websites,[32] federal guidance would create regulatory clarity for state Medicaid programs and signal to the private sector where the need for AI tools in improving administrative processes is greatest. Additionally, in order to maintain this momentum, policymakers should establish a requirement for CMS to release clear guidance that should be updated yearly given the rapidly evolving nature of AI technologies. Together, these recommendations will help create a solid regulatory framework upon which both states and the private sector can collaborate to bring the fruits of AI to beneficiaries.

While perhaps not entirely ready to be unleashed without supervision, AI continues to demonstrate rapid development and positive potential to significantly improve administrative processes in Medicaid and other health benefits programs, public and private. Policymakers must work together to harness and implement AI technologies in order to improve the efficiency and effectiveness of the Medicaid program. With over \$1 trillion in administrative spending nationwide, now is certainly a good time to try.

Supplementary material

Supplementary material is available at *Health Affairs Scholar* online.

Conflicts of interest

Please see ICMJE form(s) for author conflicts of interest. These have been provided as supplementary materials.

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"Artificial Intelligence and Its Potential to Fuel Economic Growth and Improve Governance"

Hearing before the Joint Economic Committee

Tuesday, June 4, 2024

QUESTIONS FROM Vice Chairman David Schweikert for

Mr. Adam Thierer

Questions:

1) What are the segments of the economy (say top 3) where AI adoption would have the greatest impact on economic growth and why?
2) What are would be the (top 3) highest cost-saving ways to integrate AI into government services (fraud detection in Medicare/Medicaid, eligibility analysis for SNAP, etc.) to save on administrative waste and reduce outlays due to efficiency gains?

"Artificial Intelligence and Its Potential to Fuel Economic Growth and Improve Governance"

Hearing before the Joint Economic Committee

Tuesday, June 4, 2024

QUESTIONS FROM SENATOR MARK KELLY

Questions for Dr. Ayanna Howard:

1. Arizonans and small business owners are inundated every day with advertisements for products and services that use AI, from chatbots to health monitoring apps to personal assistant apps. Sometimes those tools are embedded into existing products without the chance for consumers to opt-in or opt-out. In fact, Arizona small business owners have visited my office to ask for guidance from the government.

   a. What kind of AI literacy do people need to make informed decisions about which products to use in their everyday lives?

Although there are several definitions for AI literacy, the one I believe applies most directly when it comes to the American public and small business owners is: "A set of competencies that enables individuals to critically evaluate AI technologies; communicate and collaborate effectively with AI; and use AI as a tool online, at home, and in the workplace." [Long, D., & Magerko, B. (2020). "What is AI literacy? competencies and design considerations. Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems." https://doi.org/10.1145/3313831.3376727].

In essence, citizens must have basic awareness of the benefits and risks of AI as well as the ability to recognize when it should (and should not) be used.

   b. What is the best way to reach them?

*As identified in the **Enhancing AI Literacy for the United States of America Recommendations** provided by the National Artificial Intelligence Advisory Committee (NAIAC) [https://ai.gov/wp-content/uploads/2023/12/Recommendations_Enhancing-Artificial-Intelligence-Literacy-for-the-United-States-of-America.pdf], one of the best ways government*

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can reach the public is through "informal learning opportunities such as standalone public sessions, social media campaigns, and public messaging efforts."

2. Generative AI is a great tool for creating stories. It can be used to generate realistic, interactive training scenarios for workers in a variety of sectors.

   a. Where is industry going in terms of using AI tools for workforce development, to help people get and keep good jobs?

   b. What gaps do you see at this point that need to be addressed in order for us to get the most out of AI for job training and workforce development?

Training and retraining—whether because new jobs are created or old jobs are redefined—requires the ability to effectively educate humans as AI evolves. Hybrid teams where machines, as non-human co-workers, will need to adapt to humans and humans will need to learn how to align with AI will be just as important as learning the job itself. New types of management skills will be needed that involve dealing with HR issues that just don't involve humans not getting along, but also humans and AI in conflict with each other. Creating an inclusive environment, where inclusion includes robots and how to deal with that diverse element, will require training for all humans in how AI works and what it can and cannot do.

   c. None of us have a crystal ball, but looking ahead to the next ten-plus years, how can we anticipate new jobs that don't even exist today?

AI will indeed replace many jobs people perform today, but, at the same time, it will create new roles that we can't yet imagine. For example, teaching, one of the oldest professions in the world, conceptually remains the same in today's times as it did a thousand years ago—a teacher's goal is to support a student's current knowledge so that they can learn and retain new skills and perform new tasks. Although the teaching profession has not been eradicated, the tools that teachers employ have changed over the centuries—from books to YouTube videos, from chalkboards to ChatGPT, from teaching ABCs to teaching coding skills.

Whatever those jobs are of the future, the characteristic that will ensure that humans remain relevant is one primary factor—our curiosity—that intrinsic drive to learn. This is also where AI literacy comes into play.

d. And how can we prepare workers to step into those roles?

Just like past technologies have changed agriculture and manufacturing and other sectors of our society, AI will continue to displace certain workforces. But there will also be new jobs created - ones that we can't even imagine right now. Of course, there is one major difference between the impact of AI technology on the workforce of today versus in the past. Although automation has slowly eradicated blue-collar labor-intensive jobs in past innovation cycles, the AI of today is now allowing automation to replace white-collar jobs. With the current trends in AI, the future of work will require us to lean into the concept that the workforce will contain teams composed of humans and AI working together. And to ensure humans don't become irrelevant, we need to expand our conversation about robotization from the three D's to the four D's—by also talking about diversity. While the first three D's (dirty, dull, and dangerous) all provide reasons for AI to replace humans, the fourth D, diversity, provides the key to ensure humans remain relevant. [A. Howard, "Human Diversity Will Save Your Job From the Robot Takeover," MIT Sloan Management Review, January 12, 2022. https://sloanreview.mit.edu/article/human-diversity-will-save-your-job-from-the-robot-takeover/]

3. I understand your research portfolio includes looking at how AI and robotics can be used in health care. At this point, we've heard some good things and some bad things here: the use of robotics to make surgeries more precise and efficient is great, but the ability for health insurers to use algorithms to deny care is not.

a. Could you help give us a sense of the landscape of AI use in healthcare?

Over the last few years, there's been an increase in the adoption of AI in the healthcare domain. From AI for the detection of breast cancer that doctors might miss to predictive algorithms that identify preemies at risk of developing a motor

disability based on how they kick, there are AI applications already in use and those in development that are poised to make a big impact. Healthcare AI is currently being used to provide solutions along four primary pillars: improving health diagnoses, achieving better patient outcomes, improving our quality of life - all while trying to reduce healthcare costs. In fact as of March 2024, the U.S. Food and Drug Administration (FDA), had already authorized over 850 AI-enabled medical devices [https://www.fda.gov/medical-devices/software-medical-device-samd/artificial-intelligence-and-machine-learning-aiml-enabled-medical-devices]

There has also been a corresponding increase in the use of healthcare robots to address patient needs ranging from robotic surgical procedures to use of care robots to assist caregivers and promote aging at home.

       b. What are your concerns in how health care facilities are currently using AI.

Although many healthcare facilities have started to use AI to positively guide health decisions for patients, bias is still a concern in ensuring equal outcomes for all patients. The standard strategy for training these AI algorithms is based on data derived from historical practices, which can have biases. For example, heart disease is often misdiagnosed in women and their symptoms can be very different from the stereotypical ones that men experience. So diagnostic algorithms trained on historical data may frequently miss that diagnosis and send women home untreated. This phenomena also impacts patients of color. In 2019, researchers published a study in which they examined patient records from a large academic hospital that used an AI algorithm to identify patients with health conditions that would likely lead to more serious complications and refer them to a care coordination program for help. [Starre Vartan, "Racial Bias Found in a Major Health Care Risk Algorithm," Scientific American, October 24, 2019. https://www.scientificamerican.com/article/racial-bias-found-in-a-major-health-care-risk-algorithm/]. The study found that the AI tool was incorrectly steering some Black patients away from the care coordination program. Since bias in the medical field predates the creation of healthcare AI, these biases could begin to be deeply encoded into the very fabric of the healthcare system as AI continues to gain a foothold.

"Artificial Intelligence and Its Potential to Fuel Economic Growth and Improve Governance"

Hearing before the Joint Economic Committee

Tuesday, June 4, 2024

QUESTIONS FROM SENATOR MARK KELLY

Questions for Dr. Jennifer Gaudioso:

1. AI technology is advancing at a rapid pace, and I believe it's critical for the United States must maintain its competitive edge on the global stage. The development of this technology could have significant implications for our economic growth and national security.

   In exploring strategies and policies necessary to ensure that the U.S. remains at the forefront of AI innovation and its ethical development, it's important to consider the competitive pressures from other nations, including our adversaries, that are making substantial investments in AI.

   a. Dr. Gaudioso, in addition to compute power and access to high quality data sets, what are some of the other driving forces for maintaining leadership in AI development?

      The DOE and NNSA labs have been catalysts for innovation, driving economic growth through groundbreaking research that combines foundational science, engineering, and practical applications. Their contributions span from clean rooms to genome sequencing, with far-reaching impacts across industries. For instance, Sandia Labs alone has generated a $140 billion economic impact nationwide from 1990 to 2020, holding over 1,800 patents and introducing over 300 new inventions just last year.

      Maintaining U.S. leadership in AI development requires several key driving forces beyond compute power and high-quality datasets:

Strategic, Long-term Investments: Consistent support from Congress and the White House has enabled the labs to plan and implement cutting-edge computing capabilities. The deployment of three Exascale computers and Sandia's recent deployment of the world's largest neuromorphic computer, developed with Intel, exemplify this forward-thinking approach. Continued investment in next-generation systems is crucial for future AI breakthroughs.

Multidisciplinary Workforce: A diverse, highly skilled workforce is essential for tackling the complex challenges of AI development. The labs must attract and retain experts in AI computing, programming, data curation, and related fields. This multidisciplinary approach enables the labs to address big science questions and drive innovation across various domains.

Public-Private Partnerships: Collaboration between national labs, academia, and industry is vital for accelerating AI innovation. These partnerships, like the one between Sandia and Intel, facilitate knowledge transfer, resource sharing, and the rapid translation of research into practical applications.

Dedicated AI Programs: Initiatives like the DOE Frontiers for AI in Science, Security, and Technology proposal demonstrate the labs' commitment to advancing AI capabilities. These programs provide a framework for focused research and development in critical areas of AI.

Innovation Ecosystem: The labs' role in fostering a broader innovation ecosystem, through technology transfer and commercialization efforts, is crucial. This not only drives economic growth but also ensures that AI advancements benefit various sectors of the economy.

By leveraging these key factors – strategic investments, a multidisciplinary workforce, public-private partnerships, dedicated AI programs, and a robust innovation ecosystem – the DOE and NNSA labs are well-positioned to maintain U.S. leadership in AI development. This comprehensive approach ensures that the labs can

continue to drive technological breakthroughs and address critical national challenges in the rapidly evolving field of AI.

b. Dr. Gaudioso, understanding the importance of workforce in advancing U.S. leadership in the development of AI and the increasing interest from foreign nations in this technology, what else could we be doing to maintain our competitive edge?

To maintain the U.S. competitive edge in AI development, it is crucial to leverage and expand existing collaborations between national laboratories and academic institutions. In my written testimony, I describe how Sandia and Los Alamos National Labs provide good exemplars as they are working closely with New Mexico universities to share computing resources, collaborate on research, facilitate joint faculty appointments, and focus on workforce development.

These partnerships are integral to initiatives like the FASST program, which aims to engage more universities and provide additional opportunities for students to gain hands-on experience in AI. By hosting undergraduate, graduate, and postdoctoral researchers for year-round research and engineering experiences, the national labs play a pivotal role in guiding students towards careers in AI, whether in national labs or the private sector. Moreover, aligning FASST with the National Science Foundation's National Artificial Intelligence Research Resource (NAIRR) can enhance AI research and application development by providing small AI computing clusters accessible to universities.

Despite the challenges in recruiting and retaining critical AI staff as highlighted in the May 29, 2024 Government Accountability Office Report (Improvements Needed for Overseeing Contractor Workforce Recruitment and Retention Efforts), initiatives like the Department of Energy Computational Science Graduate Fellowship (DOE CSGF) are successful and provide a strong foundation to build upon. Established in 1991, the DOE CSGF supports doctoral students in computational sciences, fostering a community of researchers who are committed to national interests while advancing their work. This

fellowship not only ensures a steady supply of well-trained scientists and engineers but also strengthens the collaborative ties between academia and national labs. By building a multidisciplinary network of professionals, the program helps cultivate the next generation of leaders in AI and computational sciences, ensuring the U.S. remains at the forefront of AI innovation.

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