

THE NEED TO REAUTHORIZE THE SEPTEMBER 11TH VICTIM COMPENSATION FUND

HEARING BEFORE THE SUBCOMMITTEE ON THE CONSTITUTION, CIVIL RIGHTS, AND CIVIL JUSTICE OF THE COMMITTEE ON THE JUDICIARY HOUSE OF REPRESENTATIVES ONE HUNDRED SIXTEENTH CONGRESS FIRST SESSION

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**THE NEED TO REAUTHORIZE THE
SEPTEMBER 11TH VICTIM
COMPENSATION FUND**

Tuesday, June 11, 2019

HOUSE OF REPRESENTATIVES

SUBCOMMITTEE ON THE CONSTITUTION, CIVIL RIGHTS, AND CIVIL
LIBERTIES

COMMITTEE ON THE JUDICIARY

Washington, DC

The Subcommittee met, pursuant to call, at 10:04 a.m., in Room 2141, Rayburn House Office Building, Hon. Steve Cohen [chairman of the subcommittee] presiding.

Present: Representatives Cohen, Nadler, Raskin, Scanlon, Dean, Garcia, Escobar, Jackson Lee, Johnson, Collins, Gohmert, Jordan, Armstrong, and Cline.

Staff Present: David Greengrass, Senior Counsel; John Doty, Senior Advisor; Lisette Morton, Director Policy, Planning, and Member Services; Madeline Strasser, Chief Clerk; Moh Sharma, Member Services and Outreach Advisor; Susan Jensen, Parliamentarian/Senior Counsel; James Park, Chief Counsel; Will Emmons, Professional Staff Member; Paul Taylor, Minority Counsel; and Andrea Woodard, Minority Republican Professional Staff Member.

Mr. COHEN. The Judiciary Committee's Subcommittee on the Constitution, Civil Rights, and Civil Liberties will come to order.

Without objection, the chair is authorized to declare a recess of the Subcommittee at any time.

I welcome everyone to today's hearing on the need to reauthorize the September 11th Victim Compensation Fund. I will now recognize myself for an opening statement.

September 11, 2001 was among the deadliest days in American history with almost 3,000 lives lost in New York, at the Pentagon, and in Shanksville, Pennsylvania, because of the terrorist attacks on the United States on that horrible day.

The casualty number is much higher than oft-cited statistics tell us. The fact is that we really do not know the full casualty count from the events of that day even now almost 18 years later. That is because, years after 9/11, tens of thousands of first responders who ran toward the raging infernos and toxic clouds unleashed on that day, as well as Members of the community surrounding the 9/11 crash site in New York, continue to develop and suffer from cancers and other severe diseases that have prematurely ended their lives or undermined their employment and life prospects. In-

deed, by one estimate, up to 400,000 people may be at risk of developing 9/11-related illnesses, and many of these people may not even be aware of that fact.

In recognition of this continued suffering, Congress, among other things, reopened the September 11th Victim Compensation Fund in legislation passed in 2010, signed into law in 2011, and authorized the Victims Compensation Fund for 5 years. Congress established the original fund just 10 days after 9/11 to provide compensation for those who were physically injured by the attacks and for relatives of those who were killed. That original fund operated from 2001 to 2004 and awarded over \$7 billion.

When it reopened the fund in 2011, Congress expanded the eligibility criteria to include workers who assisted with debris removal in the months after the attacks. Congress then reauthorized the fund in 2015 for an additional 5 years and is currently set to expire in December of 2020.

In reopening the Victims Compensation Fund, Congress was addressing the fact that responders and recovery workers reported significant higher risks of lower and upper respiratory diseases than the general population within 5 years of the 9/11 attacks, and 70 percent of the 9/11 first responders suffer from new or worsened respiratory symptoms in that time period.

These diseases only worsened in severity over time as they developed into interstitial lung disease and sarcoidosis conditions of which lung function substantially deteriorates preventing adequate oxygen from entering the bloodstream and vital organs and leading to additional life-threatening conditions like pulmonary disease.

Now, we are seeing that one of our witnesses, Dr. Jacqueline Moline, characterizes as a third wave of 9/11-related illnesses, including increased cancer rate among first responders and community Members since 2015.

Part of that reason is that cancer can have a very long latency period, meaning the symptoms of the disease may not manifest in a person for decades after the initial exposure to carcinogens. In the face of these trends, the fund, which is overseen by the Department of Justice, has done an admirable job. As of April 30, 2019, the Victims Compensation Fund received nearly 50,000 claims, found 24,000 claimants to be eligible for compensation—it is about half—and made additional or revised awards for 28,000 claims; awarded a total of than \$5 billion as of April 30.

Unfortunately, the fund is now facing a funding crisis, one that is not of its own making. When Congress reauthorized the Victims Compensation Fund in 2015, it prohibited the fund from spending more than the appropriated \$7.4 billion to pay awards in administrative expenses.

By law, the fund must annually reassess its policies and procedures to assure, among other things, that it does not exceed the spending cap.

Yet, since 2015, the Victims Compensation Fund has seen an increase in claims driven by various factors, including a marked increase in cancer claims and claims from the survivor population. The result is that, effective February 25, 2019, the fund was forced to institute substantial cuts to pending and future awards: 50 per-

cent cuts for claims on or before February 1, 2019, and 70 percent cuts for claims filed thereafter.

Congress has proposed a solution, H.R. 1327, the Never Forget the Heroes: Permanent Authorization of the September 11th Victim Compensation Fund Act, would authorize the VCF until 2090 to ensure that sufficient funds are available to pay future claims, require payment of any award amounts that were cut, and make a number of other useful changes. By enacting this legislation, we will not have to force 9/11 responders and survivors to come begging to Congress every 5 years to step up and do the right thing.

I am proud to be a cosponsor of this bill. I am proud because this is not simply a New York event. I see Mr. Zeldin is here, who represents part of New York and is showing his interest, as well as Mrs. Maloney and Mr. King. Mr. Nadler has been a champion of this issue and as chairman of this Committee and primarily responsible for this hearing. This was an American tragedy, an American event, and I recall it so vividly.

I was in New York within a month and going to a baseball championship game and ran into Guiliani, who, at the time, was a friendly guy, and got me somehow down to 9/11. I went down there and had my mask, and you name it, walked around in the debris.

I commend all of you for what you did. You put yourself and your life at risk. We know that, and you need to be compensated. You are American heroes.

Representatives Maloney and King have introduced the bill that will affect the work on behalf of 9/11 responders and survivors. I thank them. I thank Representative Collins for his cosponsorship of the bill. I am thankful for the responders for their service and sacrifice for our country. Grateful to them, the survivors, and all the witnesses in to testify before us today.

This is a bit unusual, because this is my Subcommittee which I chair, and I am chairing it now. It is a special moment for Mr. Nadler. This is an issue that is very close to him and his constituents. For that reason, I will surrender the chair to him to oversee this meeting, which is appropriate. I guess this is the time that I will do it. I don't know if it is the right time, but this is the time I am doing it.

Well, I will recognize Mr. Johnson then, and then I am surrendering the chair.

Mr. JOHNSON of Louisiana. All right. Thank you.

Thank you, Mr. Chairman and Mr. Chairman.

The tragic events of September 11, 2001, in New York, in Pennsylvania, and Virginia took innocent lives on American soil on a scale not seen since the attack on Pearl Harbor. It also unified the country as brave first responders searched for bodies and headed a massive recovery effort.

In New York, the first responders did this amidst a smoldering pile of over 220 stories of building crushed into a dense accumulated mountain of steaming hot toxic chemicals that burned for months. My wife and I visited that site just a month after, and it was still seemingly on fire.

Many sacrificed their own health in their efforts to help their fellow Americans in and around debris that included two steel beams

in the shape a cross, which now rests in the National September 11 Memorial and Museum.

Just as that cross stood as a sign of hope for so many, so too do our programs to help take care of those to whom we owe our deepest gratitude.

After 9/11, a federally funded program was created to compensate and pay medical expenses for those who developed respiratory and other illnesses related primarily to the rehabilitation of the site of the former World Trade Center. Payments made from the fund are administered by a special master who has announced that the fund is running out of money and with some current and future claims that are yet unpaid. That fund was authorized in the manner in which all Federal programs should be authorized, namely for a limited duration within which time Congress is able to periodically revisit the program's operation and fiscal solvency before potentially reauthorizing and funding it further as it goes forward into the future.

The special master who runs this program and who is with us here today is a very well regarded public servant, and I am aware of no problems with the program's Administration. We have a lot of confidence in this program.

So, I support reauthorizing the program in a manner that is fair to everyone. This is unquestionably the right thing to do, and I expect that this bill will pass with broad bipartisan support.

I am personally myself the son of a firefighter who was critically burned and permanently disabled in the line of duty back in 1984. And I know the sacrifices and the needs of these heroes and their families personally. In addition to my dad being burned over 80 percent of his body, third-degree burns, he inhaled toxic chemicals in a fire, and he suffered the remaining 32 years of his life as a result of that tragedy.

The only concern we have here, and you will hear people talk about it, is just the latest proposal to reauthorize the program, H.R. 1327, creates an unlimited authorization for appropriations for the fund and extends it until the year 2090. The Congressional Budget Office isn't able to determine the cost of such an extended program. Of course, its rules limit it to predicting costs just 10 years out.

So, right now, we have a \$22 trillion Federal debt. That is just the thing that keeps us up at night. It makes us have to address these issues as responsibly as possible. I know everyone here understands and feels that burden.

Our objective, of course, is fairness to all. By all, we mean all Americans, including first responders nationwide who have heeded the call to service through the smoldering remains of terrorist attacks but also through the dense wildfire smoke of California and the wreckage following a Kansas tornado and the floods in Louisiana and all other disasters and tragedies everywhere.

We have to approach the reauthorization of this fund today in the same way we would approach any fund designed to compensate first responders nationwide and other similar circumstances in a way capable of making future funds available for future heroes as well.

With that, we look forward to hearing from all of our witnesses here today, including those who work so selflessly under very dangerous conditions to help our Nation heal.

I yield back the balance of my time.

Chairman NADLER. [Presiding.] Thank you, Mr. Johnson.

I now recognize myself for an opening statement.

Eighteen years ago, on September 11, 2001, Osama bin Laden orchestrated the deadliest terrorist attack in American history, killing almost 3,000 people in a single day and wounding thousands of more. In New York City, the attack happened in my district. The attacks created an environmental nightmare when the Twin Towers collapsed in Lower Manhattan. Hundreds of tons of contaminants poured onto the streets and covered first responders, residents, office workers, and students in a cloud of dust.

When many of us think of 9/11, we think of planes flying into the Twin Towers or we see the towers collapsing. There other pictures that day that captured the gravity of the loss, the scale of the destruction, and the massive amounts of toxins that were released into the air on that Tuesday morning. I want to share those images with you today.

As you can see, if you look at the jumbotrons, I suppose. As you can see, New York City was covered in toxic ash. The air was full of debris, dust, and other deadly toxins. Many of my constituents were forced to flee their homes. Firefighters, police, and rescue and recovery workers from around the country came to our aid, working in horrible dangerous conditions to help one another and help the United States get back on its feet.

I was in Washington with my wife when the attacks began, and we immediately rushed to return to New York City by train that day since all flights had been grounded. What sticks with me from that day was eerie silence that greeted us when we stepped out of Penn Station. The city seemed empty. Nothing moving. No people. No cars. No buses. No subway trains. Nothing. The only thing that was there was a strange odor that hung in the air.

The next day, on September 12th, I walked the streets of Lower Manhattan through the rivers of ash and debris, and I saw the thinkable damage. I was there with then-Mayor Giuliani. We were soon joined by then-President George Bush, then-Senator Hillary Clinton, and Senator Chuck Schumer. There was no question in our minds that we must work together in a bipartisan manner to do what it took to get New York back on its feet, to get the country moving again, and to get help for everyone affected by the attacks.

Within days following the attack, a problem arose. The EPA insisted, contrary to ample evidence, that the air in Lower Manhattan in Brooklyn was safe to breath. That was not true. It was an untruth that caused many thousands of people to become sick and, tragically, for many of those same people to die. It was an untruth I worked for many years to expose. Because as we knew even then, the air was not safe to breathe. In fact, it was deadly.

Thousands of responders from all over the country worked on the site. Thousands and thousands of responders and workers and residents were exposed to horrible toxins and were not provided with protective equipment. The Federal Government did not step in to conduct a proper comprehensive cleanup of the schools, offices, and

residents in Lower Manhattan. They told my constituents to clean up asbestos and other toxins from their apartments with a damp cloth and no protective equipment.

Today, as a result of the attacks and as a result of those lies, more than 95,000 responders and survivors are sick. It was for those tens of thousands of brave selfless and innocent responders and survivors that Congress came together in 2010, after years of struggles and negotiations, to pass the James Zadroga 9/11 Health and Compensation Act and to fulfill our moral obligation, as Lincoln said, to care for him who shall have borne the battle and for his widow and his orphan.

The Zadroga Act established a national health program to care for those made sick by exposure to toxins in the days, weeks, and months after the 9/11 attack. It also reopened the Victim Compensation Fund, the VCF, to provide support for sick responders or survivors.

As the programs are set to expire in 2015, Congress once again came together in a bipartisan manner and reauthorized them. We made the health program essentially permanent and set the expiration date far into the future, the year 2090, ensuring that all those affected by the attacks on September 11, 2001, would have the healthcare they need for as long as they need it. The 2015 reauthorization only extended the VCF for 5 years.

Today, the programs are mostly working. Residents of 433 out of 435 congressional districts receive care through the 9/11 health program. More than 28,000 individuals representing all 50 States have been found eligible for compensation from the VCF. More than \$5.1 billion has been awarded.

Our actions as a Congress have touched many lives, provided comfort to the sick, and helped families struggling with the loss of a loved one to pay the bills and send children to college. We know all too well that people who are sick now will only get sicker. Unfortunately, many will die. Those who are not sick now may become sick years in the future as diseases surface after long latency periods. We are already seeing the impact that long delay cancers have had. Nearly 11,000 responders and survivors have been diagnosed with cancer to date, a number which will only go up. It is clear the 5-year reauthorization was not nearly long enough.

Further, as the number of sick responders and survivors continues to rise, the limited resources Congress provided to the VCF have been strained. Now, because of the greater number of sick people anticipated, the thousands of sick responders and survivors are facing up to 70 percent cuts in compensation because the money is running out. These cuts were certainly not intended by Congress, and we know that the Administration and the special master are not making these cuts maliciously. Rather, the VCF is working to keep the funded—I am sorry—is working to keep the program funded as long as possible to give every sick responder and survivor at least some compensation.

That does not mean we can simply accept these cuts and allow the program to expire when so many more men, women, and young adults will need compensation and care. That is what brings us here today. A 70-percent cut in compensation to victims of 9/11 is simply intolerable, and Congress must not allow it. Congress also

must not allow the VCF to expire while people are still sick and the World Trade Center Health Program is still operational. The time has come for us to act.

In the past, I would have had to call upon the Committee chairman to call a hearing or to schedule a markup on legislation to address these problems. Today, as chairman of the Judiciary Committee, I am able to convene this hearing and to announce that we will not wait to mark up this legislation. We will hold a markup of this legislation tomorrow.

There are two moral imperatives that dictate why we must act. Number one, it was America that was attacked on 9/11, not just New York or Washington, DC.

Number two, it was the Federal Government that bears some responsibility because it told everyone it was safe to return to Lower Manhattan when it knew that it was not. Now the Federal Government must bear the burden to care for and support the people affected by the September 11 attacks and their aftermath.

Again, I am proud to work in a bipartisan manner with my long-time colleagues Representatives Carolyn Maloney and Peter King and Senators Kirsten Gillibrand and Chuck Schumer to reauthorize these critical programs. I am pleased that we also have the support of Senator Cory Gardner and our very own Ranking Member of the full Judiciary Committee, Representative Doug Collins. In fact, we have more than 300 bipartisan cosponsors of this bill in the House. I want to thank the people in this room for everything they have done to get so many congressional cosponsors so quickly. I urge all of my colleagues to work with us and support a reauthorization and to move this bill through Congress to the President's desk as quickly as possible.

Just as we stood together as a Nation the days following September 11, 2001, and just as we stood together in 2010 and 2015 to authorize and fund these vital programs, we must now join forces one more time to ensure that the heroes of 9/11 are not abandoned when they need us most. We must sustain the VCF. We must protect the heroes and survivors of 9/11. We must pass the Never Forget the Heroes Act of 2019, and we will.

Before I yield back, I want to add one more thing. For many people in this country, and perhaps even people on this committee, 9/11 ended that day. Perhaps they light a candle in church every year on the anniversary. Perhaps they pray for the victims. For our panel of witnesses today, for many people in the audience, for Congresswoman Maloney, for Congressman King, and for me and my staff, 9/11 never ended. We live every day with the events of that morning and the impact of the decisions made by the Federal Government in the aftermath.

While I know it can be frustrating watching a body as large as the U.S. Congress work its will, when we do act, we can bring tremendous resources and the strength of the entire Federal Government to bear on a problem, and we can improve the lives of so many. It is my hope and my sincere wish that Congress will Act swiftly to stop these devastating cuts, to extend this program, and to provide as much peace of mind as we possibly can to those who continue to suffer from the 9/11 attacks. We will never forget.

I yield back.

It is now my pleasure to recognize the Ranking Member of the full committee, the gentleman from Georgia, Mr. Collins, for his opening statement.

Mr. COLLINS. Thank you, Mr. Chairman. This is a day in which we do come together in this committee, I think with a common purpose. I want to thank Congresswoman Maloney and Congressman King. Also my friend Lee Zeldin, who has a number of these folks in his district, along with you, Mr. Chairman, who have been carrying this fight. Because as we look across what are talking about here, we have to remember that, on that day, depraved Islamic terrorists designed September 11 attacks to murder as many innocent Americans as possible either on that day or in the future is what happened.

Those attacks killed almost 3,000 people and left a smoldering pile of toxic debris in New York. In the wake of such depravity, thousands of rescuers responded with nobility and courage. First responders scaled smoldering piles of debris, exhumed victims with dignity, and restored Ground Zero to its current place in the center of a loving, resilient community, a place that includes the National September 11 Memorial.

Even yesterday, this lives on, as I heard a story just yesterday that they had identified another victim 18 years later. No one is forgotten. No one is left behind. That is what our country symbolizes.

It is also fitting Congress do more than memorialize it. We must help take care of those heroes. The 9/11 first responders, like all first responders, deserve to have their sacrifices recognized. This program will mitigate the damage these public servants and their families experienced as a direct result of their sacrifice on behalf of others.

Legislation has been introduced to reauthorize the current September 11 Victims Compensation Fund. While the fiscal impact of this legislation isn't clear at the moment, what is clear is our collective duty to see that our first responders are treated fairly in accordance with what they have already given to a grateful Nation.

I must also say on a personal note: You never forget. I carried the images that I am proud Chairman actually showed this morning with me when I was in Iraq. For the time I served there was a reminder of the service that had already been given, not knowing on that morning what would happen but knowing on that morning it will not be forgotten. What we are seeing today is—I can remember back as a chaplain, what I serve as in Air Force, and still do, 19 years later, is I remember Chaplain Judge being carried out, the first, the honest sacrifice of one serving others and the many that were to follow. Those are the images that bring us to this hearing today. We can have differences. But they became heroes, angels in heaven, if you would, without asking. They began that day with hope, with love on a morning very similar as today. Out of the fires of terror revealed the steel of our country. It is still revealed in our people today.

With that, it is our time to act. It is our time to finish this. It is our time to remember the work, the life, the pictures, and the families that we will never forget. In fact, we will look back on and

find our strength in those who went before and who are suffering now.

With that, I yield back.

Chairman NADLER. Thank you, Mr. Collins.

Before I introduce the witnesses, I want to note the presence here of our colleague Lee Zeldin. I want to take this opportunity to thank him for his great work in supporting the bill and in gathering a lot of the cosponsors.

I will now introduce the witnesses on the first panel. The Honorable Carolyn Maloney represents the 12th Congressional District of New York. She has been a Member of Congress since 1993. Among her many accomplishments, she is one of the lead sponsors of H.R. 1327, the Never Forget the Heroes: Permanent Authorization of September 11th Victim Compensation Fund Act. She has long been a leader in fighting to help victims of the 9/11 attacks and has been a staunch advocate for the Victim Compensation Fund.

The Honorable Peter King represents the Second Congressional District of New York. He has also been a Member of Congress since 1993 and, among other things, has been a tireless champion of 9/11 responders and survivors. He has long worked with Representative Maloney and with me to create the World Trade Center Health Program and to reopen and sustain the Victim Compensation Fund.

Please note that your written statements will be entered into the record in their entirety. Accordingly, I ask that you summarize your testimony in 5 minutes. I am supposed to read this, which you know. To help you stay within that time, there is a timing light on the table. When the light switches from green to yellow, you have 1 minute to conclude your testimony. When the light turns red, it signals your 5 minutes have expired. I hope the Members of the second panel have heard that, so I don't have to repeat that later.

Representative Maloney, you may begin.

TESTIMONY OF THE HON. CAROLYN B. MALONEY

Mrs. MALONEY. Thank you. Thank you, Chairmen Nadler and Cohen, Ranking Members Collins and Johnson. I want to thank you for inviting me to testify today on the Never Forget the Heroes: Permanent Authorization of the September 11th Victim Compensation Fund, which I introduced with Chairman Nadler, King, and 90 of our colleagues.

Today, we are proud to have a strongly bipartisan bill with 306 cosponsors; 80 of them are Republican. I am grateful that the Committee recognizes the importance of supporting 9/11 responders, survivors, and their families and the urgency of passing this bill as soon as possible.

We recently remembered D-Day, a day when all Americans came together to defend democracy, liberty, and freedom. Though we are not Members of the greatest generation, our first responders have defended and many gave their lives for just those same values.

On September 11, this country was horrifically attacked killing exactly 2,997 innocent people. They were murdered, and a thousand more were injured in New York, Shanksville, Pennsylvania, and at the Pentagon simply for being American or being on American soil.

Yet, it still gets worse. The death toll from that terrible day continues to grow. In the years since 9/11, tens of thousands more men and women, including first responders, relief workers, local residents have lost their lives or gotten sick as a result of their exposure to toxic chemicals, pulverized glass, powdered cement at the crash sites even though the U.S. Government told them repeatedly over and over again that it was safe to work at the site.

Soon deaths from 9/11 diseases may outnumber those lost on that fateful day. 9/11 was an attack on America. In response, our Nation committed to finding those responsible and holding them accountable. The first veterans of the war on terror were the first responders, the volunteers, and the survivors of 9/11. Today, they live all over the country in 433 out of the 435 congressional districts. They are firefighters, police officers, construction workers, electrical engineers, volunteers from every single State who answered the call and traveled to New York or D.C. or Pennsylvania to help with the recovery.

We have a moral obligation to provide support and compensation to these heroes and their families. Not only did they come to our aid when we needed them, but many are sick because they trusted the Federal Government when it said that the air around Ground Zero was safe to breathe.

In October 2011, a 9-year fight, the James Zadroga 9/11 Health and Compensation Act of 2010 was signed into law, establishing the World Trade Center Health Program and reopening and revising the September 11 Victims Compensation Fund. These programs provide health monitoring and financial compensation to first responders, survivors, and their families.

In 2015, I am proud to say that Congress permanently reauthorized the health program. The Victims Compensation Fund will expire next year if we don't Act because it was only given a 5-year extension. Making matters worse, the special master of the fund announced in February that the fund would not make it to 2020 because of a funding shortfall partly due to the increase in cancer claims. To extend its life, the VCF was forced to cut all pending awards by 50 to 70 percent. This was devastating to the survivors and their families. For the last 3 1/2 months, they have not been getting the help they deserve, the help that our Nation owes them.

Since February 2019, more than 830 compensation recipients have received reduced awards from the VCF because of this shortfall. This is unacceptable, and we need to correct it. They shouldn't have to worry about the program running out of funding, and they should not have to come back to Congress every 5 years to beg for program reauthorization. That kind of uncertainty is unfair and unsustainable. Our legislation would make these families whole by requiring the special master to revisit these reduced claims and pay out the differences.

I must tell you that, as evidenced by the more than 300 cosponsors of the Never Forget the Heroes Act, this is not a Democrat or Republican issue or a New York issue. These are Americans of all political persuasions in every corner of our country who are counting on us. Our whole country owes them a debt, a debt that we can never fully repay.

Look at the people who are sitting here with us today. These are the heroes and the heroines, the reasons that we are fighting so hard for this program. I want to conclude by recognizing them and thanking them and their families for the hours that they have spent lobbying, working to get this program reauthorized. You will hear from a few of them today. They continue to be our inspiration every single day that we fight for their healthcare and their financial security.

As much as I love being with them and talking to them, they should not have to come back to Congress for another reauthorization. We are counting on you to make this program permanent, to reauthorize it. That is the least that we can do as a grateful Nation.

Thank you.

[The statement of Mrs. Maloney follows:]

PREPARED TESTIMONY OF HON. CAROLYN B. MALONEY

Chairmen Nadler and Cohen, Ranking Members Collins and Johnson, I want to thank you for inviting me to testify today on H.R. 1327, the Never Forget the Heroes: Permanent Authorization of the September 11th Victim Compensation Fund Act, which I introduced with Chairman Nadler, Congressman King, and 90 of our colleagues. Today, we are proud to have a strongly bipartisan bill, with 306 cosponsors, 79 of them Republicans. I am grateful that the Committee recognizes the importance of supporting 9/11 first responders, survivors, and their families and the urgency of passing this bill as soon as possible.

On September 11, 2001, our Nation was horrifically attacked. Nearly 3,000—exactly 2,997 innocent people were brutally murdered and thousands more were injured in New York City, Shanksville, Pennsylvania, and at the Pentagon simply for being American or being on American soil.

Yet, it still gets worse.

The death toll from that terrible day continues to grow. In the years since 9/11, tens of thousands more men and women, including first responders, relief workers, and local residents, have lost their lives or gotten sick as a result of their exposure to toxic chemicals, pulverized drywall, and powdered cement at the crash sites even though we, the U.S. Government, told them it was safe to be at the sites, to go back to work, to go to school.

Soon, deaths from 9/11 diseases may outnumber those lost on that fateful day.

9/11 was an attack on America and in response, our Nation committed to finding those responsible, and holding them accountable.

The first veterans of the War on Terror were the first responders, the volunteers and the survivors of 9/11.

Today they live all over the country—in 433 out of 435 congressional districts. There are firefighters, police officers, construction workers, electrical workers, and volunteers from every State who answered the call and traveled to DC, Pennsylvania and NY to help with the recovery.

There are those who lived, worked, and went to school near Ground Zero who are now trying to build lives all across the country.

We have a moral obligation to provide support and compensation to these heroes and their families. Not only did they come to our aid when we needed them, but many are sick because they trusted the Federal Government when it said the air around Ground Zero was safe to breathe.

In October 2011, after a 9-year fight, the James Zadroga 9/11 Health and Compensation Act of 2010 was signed into law, establishing the World Trade Center Health Program and reopening and revising the September 11th Victim Compensation Fund. These programs provide health monitoring and financial compensation to first responders, survivors, and their families.

In 2015, I am proud to say that Congress permanently reauthorized the health program, but the Victim Compensation Fund will expire next year if don't Act because it was only given a 5-year extension.

Making matters worse, the Special Master of the Fund announced in February that the fund would not make it to 2020 because of a funding shortfall, partly due to an increase in cancer claims. In order to extend its life, the VCF was forced to cut all pending awards by 50 to 70 percent.

This is devastating for first responders, survivors, and their families who depend on this compensation.

For the last three and a half months, they have not been getting the help they deserve, the help our Nation owes them.

Since February 25, 2019, more than 830 compensation recipients have received reduced awards from the Victim Compensation Fund because of a funding shortfall.

This is unacceptable, and we must Act now to correct this.

They shouldn't have to worry about the program running out of funding or need to come back to Congress every five years to beg for program reauthorization. That kind of uncertainty is unfair and unsustainable.

Our legislation would make these families whole by requiring the Special Master to revisit these reduced claims and pay out the difference. And it would permanently reauthorize the fund. The respiratory problems, cancers and other illnesses they face are permanent, and this program should be as well.

As evidence by the more than 300 cosponsors of the Never Forget the Heroes Act, this isn't a Democratic or Republican issue or a New York and New Jersey issue—here are Americans of all political persuasions in every corner of our country who are counting on us. Our whole country owes them a debt, a debt that we can never fully repay.

Allowing this fund to expire, or run out of the funding it needs, sets a dangerous precedent. If, god forbid, our Nation ever suffers an attack like this again, first responders must know that the Nation will support them and their families.

Look at who is sitting here with us today—these heroes are the reason we fight and I want to conclude by recognizing all the first responders, survivors, and family Members of victims who have spent countless hours advocating for this bill and the VCF.

You'll hear from a few of them during this hearing. We would never have been able to garner the support of our colleagues without their tireless dedication and hard work.

They continue to be my inspiration every single day since the fight for their healthcare and financial security began.

As much as I love my time with them, we would all rather they never have to come to DC or Congress again.

After 9/11, we vowed to never forget. With that promise, we committed to making sure these heroes never have to go without the support they need. I will tell this Committee what I've told many people before—I will not rest, the other people testifying before you today will not rest, until we have fully honored this commitment.

This is the very least we can do, as a grateful nation.

Chairman NADLER. Thank you.

Let me also note the presence here of another long-time and key supporter of the 9/11—of the Zadroga Act and their subsequent bills, Congressman Eliot Engel of New York.

Representative King, you may begin now.

TESTIMONY OF HON. PETER KING

Mr. KING. Thank you, Mr. Chairman. I issued my statement for the record.

I would just like to make a few remarks here on this vital, vital bill. I want to thank you. I want to thank your Ranking Member, Congressman Collins, Ranking Member Mr. Johnson, and also Steve Cohen. This is such a vital bill. It has a human aspect to it. I want to also just mention all of the FDNY, NYPD, Port Authority cops, EMS workers, court officers, construction workers, residents—your residents, Jerry—students, all of whom have suffered over the years.

We went through 6 months of wakes and funerals after 9/11, and we thought that was it. Now the last few years, those wakes and funerals have started again. Just last week in East Meadow, about 10 minutes from my home, a Port Authority lieutenant died from 9/11 illness. So, this is something that goes on and on and on. And

soon we will have more dying after 9/11 than actually died on 9/11. That shows how vital this is.

This is not a New York issue. It is not a New Jersey issue. It is definitely a national issue. I want to also take the time to thank the special master. I want to reemphasize what you had said. This program has been run exceptionally well. The fact that it is running out of funds is no reflection at all on the Administration of the program. Rather, it is a reflection of how deadly these illnesses are and how long they were dormant and latent and how deadly they are and how vicious they are.

All of us knows a friend, a neighbor, a constituent, friends of neighbors of constituents who are suffering or have died. People who are going back every 3 or 4 months for medical tests, taking 20, 30 medications a day, constantly going back in for biopsies. This is a real national tragedy, which did not end at all on September 11 or September 12.

Just the other day I got a call from a local radio reporter who was just diagnosed several months ago and just finished his chemotherapy. He was down there for weeks and months afterwards reporting, again, as to what had happened there, what was going on.

As brave as those men and women were who rushed in on September 11—and nobody can ever, ever question or even think of excelling the bravery they showed—but you said, Jerry, that too often we forget what went on those weeks and months afterwards when people were down there inhaling those toxic fumes involved in the recovery, involved in—doing what they could to find the remains of their loved ones. So, again, we owe it to all of them.

Let me give a special thanks to Jon Stewart. There is probably not that many issues that Jon Stewart and I would be agreeing on, but I have never seen anyone put himself into a cause more than this. Not just going on television. That is easy for him. What is tough is doing the grunt work of going door to door talking to Members of Congress. He has more patience than I would have in talking to some Members of Congress. He just goes in there. He just will talk and explain, tell you why this is a human issue, why it is not a Republican or Democrat issues. Again, he just does an excellent job. I really want to thank him. I don't think we would have been where we were back in 2015 or we would have been where we are now if it were not for Jon's efforts.

So, Jon, I want to thank you for that.

Also, I want to thank Lee Zeldin, Eliot Engel. Eliot has been there from the start. Lee has been there since—ever since he came to Congress. And he realizes the true impact of this.

Again, Ranking Member Johnson, I know you mentioned the issue of costs, and that has been to be addressed. On the other hand, we have to find a way to get it done. I am not saying it is simple, but in many ways, it is. We have an obligation to get this done. These are real people who are dying, and we have an obligation to them and to their families because they are there, not through any fault of theirs but because of their courage, because their bravery, because they—and Congressman Nadler, some of the residents just lived in the wrong place at the wrong time. They were told it was safe to continue living there. Students in Stuyvesant High School. These are innocent victims. They are the

first innocent victims of the first great war of the 21st century and we owe it to them. Also, we owe it to future generations. If something like this should, God forbid, happen in the future, we want people those people who are rushing into the buildings, those people who are taking care of the recovery, that they know, that they are assured that they will receive the compensation from the government that they deserve.

So, again, I am proud to be here today. I can't emphasize enough how vital this legislation is. Also to thank the men and women behind us who—you know, they are the ones who are suffering. Carolyn, you and I, we can talk about it. We can sort of argue on the floor of Congress about it. But that is nothing compared to what they are going through every day of their lives.

So, with that, I thank you for holding this hearing. I thank the Members for their attention. I thank the witnesses who are coming after us. I just say that September 11 showed the true bravery of the American people. The weeks and months after that showed the resilience and bravery of the American people. Also, I think if we can get this job done, it will show that Congress understands and respects and will always honor those who put their lives on the line for their country.

With that, I yield back.

Thank you, Mr. Chairman.

[The statement of Mr. King follows:]

PREPARED TESTIMONY OF REP. PETER T. KING

Thank you Chairman Nadler and Ranking Member Collins for holding today's hearing on the need to reauthorize the September 11th Victim Compensation Fund. It is a pleasure to appear today with Congresswoman Maloney and before Chairman Nadler, both of whom I have worked closely on this critical issue. I would also like to thank Ranking Member Collins for his support of this bill, as well as the more than 300 Members of the House—from both parties—who are cosponsors of this legislation.

The September 11th Victim Compensation Fund (VCF) was created in the aftermath of the horrific attacks on the World Trade Center, the Pentagon, and Shanksville, PA. Congress has since reopened and reauthorized it to provide for sick and injured first responders, survivors, and the families of those who have died from illnesses due to exposure to toxins during the rescue, recovery and cleanup operations at the crash sites.

This program has been a lifeline for my constituents, and for first responders and survivors in nearly every Congressional district. To date, the VCF has received over 48,000 eligibility claims from all fifty states and has made over 28,000 determinations since being reopened. The program has strong bipartisan backing and has been run effectively by the Bush, Obama and Trump Administrations. The application process is extremely rigorous and carefully monitored to prevent fraud.

H.R. 847, the *Never Forget the Heroes Act*, would achieve two critical objectives in support of the September 11th VCF: Extend it to 2090, which would effectively make it permanent, and backfill awards that have been reduced due to insufficient funding.

Each day, more and more first responders and survivors are getting sick and dying from their 9/11-related diseases, like cancer, respiratory illnesses and other chronic conditions. We already know from the 9/11 health programs that these illnesses have long latency periods and can decades to manifest. If the VCF is not extended past 2020, these men and women will lose the ability to seek compensation for these deadly conditions.

While Congress has previously extended this program for five years at a time, we must now make the VCF permanent and fully fund it. Cops, firefighters, recovery workers and survivors need to know that this program will provide for them and their families if and when they get sick. Again, cancers and chronic conditions linked to 9/11 toxins can take years to show up. They need certainty.

As it stands, the VCF has been forced to implement drastic cuts to awards due to insufficient funding. When the Fund was last reauthorized, it was based on the best available data. However, due to a surge in cancer claims and deaths, current funding is inadequate. Claimants are having their awards slashed by 50–70% before offsets are even deducted. Since the cuts were announced in February, 835 awards have already been reduced. This is a devastating blow to the 9/11 community. Congress should immediately pass H.R. 847 to reverse these cuts and make claimants whole.

Very soon, more people will have died from 9/11-related illnesses than were murdered on that day. The number of local, State and federal law enforcement officers who have died of 9/11 illnesses is already more than double that of those who died on September 11th. We must fulfill our promise to them to “never forget.”

Once again, I thank Chairman Nadler and Ranking Member Collins for holding today’s hearing. I look forward to working with you both to pass H.R. 847.

Chairman NADLER. Thank you, Representative King.

I obviously share those sentiments. I want to also note the presence of several the advocates who have fought so long for this legislation. John Field has been one of the leaders of them.

We will now hear from our second panel of witnesses. While they are getting seated, I will do the introductions. Rupa Bhattacharyya is the special master for the September 11th Victim Compensation Fund. She was appointed to that position by the Attorney General in July 2016. During her tenure as special master, she has overseen the award of over \$3.3 billion to more than 13,000 eligible claimants. She first joined the Department of Justice in 1996 through the Attorney General honors program as a trial attorney in the civil division and has spent most of her career there eventually rising to director of the torts branch prior to her appointment as special master. She received her J.D. from Harvard Law School, a master’s degree in international relations from the Fletcher School of Law and Diplomacy at Tufts University, and her bachelor’s degree from Tulane University.

Dr. Jacqueline Moline is professor of occupational medicine, epidemiology, and prevention, and internal medicine at the Donald and Barbara Zucker School of Medicine at Hofstra/Northwell. She is also the adjunct clinical associate professor of preventive medicine in Mount Sinai School of Medicine. In addition, she serves as a member of the World Trade Center Health Program steering committee. She received her M.D. from the University of Chicago Pritzker School of Medicine, her Master of Science degree in community medicine from Mount Sinai School of Medicine, and the B.A. from the University of Chicago.

Lila Nordstrom is a 9/11 survivor and was a Stuyvesant High School student on September 11, 2001. She currently serves as executive director of StuyHealth, a position she has held since May 2006. In that role, she creates and coordinates efforts to educate young adults about health services available to 9/11 survivors. Today, however, she is testifying in her personal capacity. She has also worked as a freelance writer and columnist. She received her B.A. with honors from Vassar College.

Anesta St. Rose Henry is the widow of a construction worker and 9/11 World Trade Center responder Candidus Henry, who was a member of the Laborers International Union of North America Local 79. Mr. Henry was working for a contractor at Ground Zero from February 2002 to June 2002. He died last month from a 9/11 related cancer.

Thomas Mohnal retired as a supervisory special agent after a 30-year career with the Federal Bureau of Investigations. On September 11, 2001, Mr. Mohnal witnessed American Airlines Flight 77 crash and explode into the Pentagon. He immediately responded to the crash site and continued working at the Pentagon for the next 2 months. As a result of this work, he incurred a serious illness. He received his bachelor's degree in criminal justice from Lycoming College.

Michael O'Connell retired as a lieutenant with the fire department of city of New York in 2009. From September 11 through September 18, 2001, he performed rescue and recovery work at the World Trade Center site. He was awarded the 9/11 survivor medal by the FDNY. He joined the FDNY in 1998 and later joined the FDNY—I am sorry. He joined the NYPD, the police department, in 1998, and later joined the fire department in 2001. As with several of our other witnesses, Mr. O'Connell incurred a serious illness as a result of his rescue and recovery work. He studied nursing at Molloy College and Nassau Community College.

Luis Alvarez is a retired bomb squad detective with the New York Police Department. He was a responder at the World Trade Center on September 11, 2001. Today, he suffers from 9/11-related liver cancer that has metastasized throughout most of his body, and he is about to have a 69th round of chemotherapy. Prior to joining the NYPD, he served in the United States Marine Corps. After retiring from the NYPD, Luis became an explosive ordnance disposal technician with the Transportation Security Administration at John F. Kennedy International Airport.

Jon Stewart is the former host of "The Daily Show" on Comedy Central. Of most relevance to today's hearing, he has been an outspoken advocate for 9/11 responders and survivors and for both the September 11th Victim Compensation Fund and the World Trade Center Health Program. He has been a tireless advocate in raising awareness about the treatment of 9/11 responders and survivors. To this end, he invited several of them onto the Daily Show, made numerous trips to Capitol Hill to advocate on their behalf. He is a graduate of the College of William and Mary.

We welcome our distinguished witnesses, and we thank you all for participating in today's hearing.

Now, if you would please rise and raise your right hand, I will begin by swearing you in.

Do you swear or affirm, under penalty of perjury, that the testimony you are about to give is true and correct to the best of your knowledge, information, and belief, so help you God?

The witnesses may be seated.

Let the record show the witnesses answered in the affirmative.

Please note that your written statements will be entered into the record in their entirety. Accordingly, I ask that you summarize your testimony in 5 minutes. To help you stay within that time, there is a timing light on your table. When the light switches from green to yellow, you have 1 minute to conclude your testimony. When the light turns red, it signals your 5 minutes have expired.

Ms. Bhattacharyya, you may begin.

TESTIMONY OF RUPA BHATTACHARYYA

Ms. BHATTACHARYYA. Chairman Nadler, Ranking Member Collins, Chairman Cohen, Ranking Member Johnson, and distinguished Members of the subcommittee, thank you for inviting me to testify about the September 11th Victim Compensation Fund, or the VCF.

Hearings like this remind us that September 11, 2001, marked only the beginning of an ongoing and evolving tragedy. To those of you who share the table with me who were there, who responded to the attacks, or would not allow terrorism to prevent you from returning to your schools, homes, or workplaces, thank you for your heroism and your sacrifice.

I have spent my career in public service, including more than 20 years at the Justice Department. Since the Attorney General appointed me as special master in 2016, I have been humbled by the responsibility of serving the strong and resilient 9/11 community.

I was privileged recently to attend the dedication of the Memorial Glade at the 9/11 museum in New York. I was reminded of the startling fact that the nearly 3,000 lives lost on September 11 may soon be overtaken by the number of lives lost in the years afterwards to illnesses that stem from exposure to toxins at all three attack sites.

While no amount of money can fully compensate for such losses, I am proud that the VCF has been able to provide some needed relief to those who have suffered for so long.

The VCF is an extraordinarily successful program. As of May 31, we have awarded almost \$5.2 billion to nearly 22,500 individuals who suffer physical health conditions, including to the families of more than 850 who have died as a result of their exposure in New York City, at the Pentagon, and in Shanksville. Those compensated include first responders, workers or volunteers in construction, cleanup and debris removal, and people who lived, worked, or went to school in the affected areas. The VCF has received claims from individuals in every State of the Nation, including those who came in from around the country as part of the response efforts and those who have relocated in the years since the attacks.

In my 3 years at the VCF, we have significantly improved efficiency and claim determination rates. The VCF now issues nearly as many awards each year as it did in total in its first 5 years. And the VCF under my leadership has not documented a single instance of fraud in a paid claim. We work diligently with the Department's Office of the Inspector General to ensure that any indicia of fraud are investigated and reconciled.

Despite its successes, however, the VCF faces a difficult situation. We received a record number of new claims in 2018, and we are on pace to exceed that number in 2019. The issue is basic math. Almost \$5.2 billion awarded to nearly 22,500 individuals, just over \$2 billion left with over 21,000 claims and amendments still needing a decision and thousands more expected to be filed before the VCF's December 18, 2020, deadline.

Several trends help us understand how we got here. Since reauthorization of the Zadroga Act in December of 2015, we have seen a dramatic increase in claims filed on behalf of those who have died as a result of their 9/11-related exposure, a significant increase in

cancer claims, and a marked increase in claims from survivors, meaning those who lived, worked, or went to school in the affected areas.

Taking account of these trends and the increasing rates of both claim submissions and award determinations, in February, I determined that the VCF had insufficient funding to compensate all pending claims and those projected to be filed under then existing policies. With that determination, I was required by law to modify VCF policies and procedures so that the VCF does not exceed its appropriated limit. This meant making significant reductions in awards.

In deciding how to do this, I felt strongly that I could not leave some claimants uncompensated or fail to make allowance for those who suffered the most. I concluded that the fairest solution was to apply a percentage reduction to all claims. Thus, depending on when the claim was submitted, calculated loss values are being reduced by either 50 or 70 percent with required offsets taken in full.

I wish to thank the Judiciary Committee and the Members of this Subcommittee for giving me the opportunity to speak to you about this successful and important program. Along with my dedicated staff and with the full support of the Justice Department, I remain strongly committed to serving the 9/11 community. We remain hopeful that our work continues to provide needed relief, and we stand ready, along with the Justice Department, to work with you to ensure that Congress has the information it needs to address appropriate legislative options.

Thank you.

[The statement of Ms. Bhattacharyya follows:]

PREPARED TESTIMONY OF RUPA BHATTACHARYYA

Chairman Nadler, Ranking Member Collins, Chairman Cohen and Ranking Member Johnson and distinguished Members of the Subcommittee, thank you for inviting me to testify before you today on behalf of the September 11th Victim Compensation Fund (the VCF or the Fund). I am very appreciative of the Committee's interest in the important work of the VCF and grateful for its attention to the needs of the 9/11 community, which includes the responders and survivors of that terrible day and of the weeks and months of rescue, recovery, and remediation efforts that followed. We all know that the world changed forever on September 11, 2001, but the work that I am privileged to do every day—and hearings like this one—remind us all that the events of September 11 marked only the beginning of an ongoing and evolving tragedy. I know that some of those who were there, who responded to the sites of the attacks, or were just living their lives only to be caught up in events beyond their control, are in the room, and I join the Members of the Committee in commending them for their heroism and their sacrifice. I have spent my career in public service, including more than 20 years at the Justice Department, but since the Attorney General appointed me to serve as Special Master for the VCF in 2016, I have been humbled by the responsibility of serving this strong and resilient community. I was privileged recently to attend the dedication of the Memorial Glade at the 9/11 Memorial and Museum in New York City and I was reminded again of the startling fact that the nearly 3,000 lives lost on September 11 may soon be overtaken by the number of lives lost in the years afterwards to the illnesses that stemmed from exposure to toxins at the three sites. While no amount of money can fully compensate for the losses that were suffered as a result of that day, I am proud that the VCF has been able to provide at least some measure of needed relief to those who have sacrificed so much and suffered for so long.

Background

By way of brief background, the VCF was originally created in 2001, immediately following the attacks, by Public Law No. 107-42 (Sept. 22, 2001), as amended by

Public Law No. 107-71 (Nov. 19, 2001), as an alternative to tort litigation, and was designed to provide compensation for any individual (or a personal representative of a deceased individual) who suffered physical harm or was killed as a result of the terrorist-related aircraft crashes of September 11, 2001, or the clean-up and debris removal efforts that took place in the immediate aftermath of those crashes. The original VCF (known as “VCF I”) operated from 2001–2004 under the direction of Special Master Kenneth Feinberg, and distributed over \$7 billion. VCF I concluded operations in June 2004, after compensating the families of over 2,880 people who died on 9/11 and 2,680 individuals who were injured.

In 2011, Congress passed and the President signed the James Zadroga 9/11 Health and Compensation Act of 2010 (“Zadroga Act”), Public Law No. 111-347 (Jan. 2, 2011), which reactivated the September 11th Victim Compensation Fund (known as “VCF II”), expanded its pool of eligible claimants, and appropriated \$2.775 billion to pay claims. VCF II opened in October 2011 and was originally authorized to accept claims for a period of five years, ending in October 2016. Prior to reaching the October 2016 claim filing deadline, however, in December 2015, Congress passed and the President signed the James Zadroga 9/11 Victim Compensation Fund Reauthorization Act, Public Law No. 114-113 (Dec. 18, 2015). The new Act extended the VCF for an additional five years, allowing individuals to submit claims until December 18, 2020, and appropriated an additional \$4.6 billion to pay claims, bringing the total appropriated amount for VCF II to \$7.375 billion.

VCF Progress and Operations

The VCF, as reconstituted under the Zadroga Act, as amended, is an extraordinarily successful program. As of May 31, 2019, the VCF has awarded over \$5.174 billion in compensation to nearly 22,500 individuals who have suffered physical health conditions (including the families of over 850 people who have died), as a result of their exposure to the terrorist attacks in New York City, at the Pentagon, and in Shanksville. Those compensated include first responders; people who worked or volunteered in rescue, recovery, clean-up, construction, or debris removal at the three sites; as well as people who lived, worked, or went to school in the affected areas of New York City and were exposed to toxins resulting from the attacks, the airline crashes, and the building collapses. The VCF has received claims from individuals in every State of the nation.

This includes those who traveled to New York City, the Pentagon, and Shanksville from all over the country as part of the response efforts, both in official capacities and as volunteers, and those who have relocated elsewhere in the intervening years since the attacks. In the three years since my appointment, moreover, the VCF has made significant strides in improving its efficiency and its claim determination rates: whereas the VCF issued just over 9,000 awards in the first five years of the program, the VCF now issues nearly 8,000 determinations on new claims and amendments annually.

The VCF operates with a dedicated team of 173 Justice Department employees and contractors, headed by Deputy Special Master Jordy Feldman, who serves as the Director of our New York Office, and Deputy Special Master Stefanie Langsam, who oversees all operations in the D.C. office. The staff includes attorneys and support personnel who process, evaluate, and/or adjudicate claims; contractors who are responsible for VCF operations, including our toll-free Helpline, correspondence, and payment processing; and information technology specialists who are responsible for designing, developing, testing, and maintaining the VCF’s claims management system, which allows for the filing of online claims. The VCF also has the strong support of the Department of Justice, and specifically, of the Department’s Civil Division, which provides operational and administrative support to the VCF, and I wish to thank the Attorney General, Civil Division Assistant Attorney General Jody Hunt, Civil Division Deputy Assistant Attorney General Tom Ward, and the Civil Division’s Executive Officer Catherine Emerson for their strong and unwavering support of the VCF.

The scale of the VCF’s operations is impressive. Each month, the VCF’s dedicated Helpline receives more than 3,000 incoming calls, we mail approximately 10,000 letters to claimants and their attorneys, we process an average of 3,000 pieces of incoming mail, and, on average, we receive nearly 700 new claims or amendments. It is important to note, when discussing VCF operations, that all of the VCF’s administrative funding comes from the VCF’s total appropriation, Public Law No. 112-10 (Apr. 15, 2011), and, as such, is part of the same pool of funds available for awards to claimants. For that reason, as Special Master, I am committed to keeping administrative costs down while also minimizing the burden placed on claimants and their representatives, and maximizing claims processing speed and efficiency.

As of December 31, 2018, the VCF's administrative costs are less than 3% of total awards issued.

VCF Claims Process

The VCF reviews claims in two phases: *Eligibility* and *compensation*.

- For *eligibility*, the VCF reviews the claim to determine whether the claimant is eligible to receive compensation under the Zadroga Act, including assessing whether: The claim was timely registered; the claimant has sufficiently proven that he or she was present at one of the attack sites or in the New York City Exposure Zone (Manhattan, south of Canal Street); the claimant suffers from an eligible physical injury or condition as certified or verified by the World Trade Center Health Program; and the claimant has properly complied with the Act's requirements that any 9/11-related lawsuit be properly settled or dismissed in order to qualify for compensation from the VCF.
- For *compensation*, all awards are individually calculated based on the specific circumstances of the claim. The VCF reviews eligible claims to determine the appropriate amount of non-economic loss (commonly referred to as "pain and suffering") based on the nature or severity of the individual's physical injury or condition. Non-economic loss awards are capped by statute at \$90,000 for non-cancer conditions and \$250,000 for a cancer condition. If a government entity or private insurer has formally determined that the claimant suffers a full or partial occupational disability as a result of an eligible 9/11-related physical injury or condition, the VCF generally also will calculate economic loss. This portion of the award can encompass a variety of components, including loss of income as well as loss of pension and other employment benefits; the VCF is required by law to cap annual gross income at \$200,000 when calculating economic loss. The VCF also awards, in limited and appropriate cases, reimbursement of out-of-pocket medical expenses, replacement services losses, and reimbursement for burial costs in deceased claims.

The VCF is required by law to subtract from the calculated award certain "collateral offsets," which are benefits paid to the claimant by other entities because of the eligible 9/11-related condition. These offsets may include disability benefits, settlements from 9/11-related lawsuits, and in the case of deceased claims, life insurance paid to the victim's beneficiaries.

The VCF reviews claims in first-in, first-out priority order, which is established by the date on which the claim or amendment for compensation was submitted. Claim determinations are highly individualized and, on average, it takes about 16–18 months for a claim to go from filing to determination, although some claims can be done sooner and some take longer, depending on the complexity of the claim and the extent of documentation required. The VCF is currently reviewing compensation claims and amendments submitted in mid-to-late 2017, and claims submitted in the early part of 2018 are expected to come under review soon. In addition, the VCF has an established process for expediting claims in cases involving terminal illness or significant financial hardship and is steadfast in ensuring that the criteria used to determine eligibility for this process are rigorously applied so that only those claimants with the most severe needs are allowed to jump the line. So far in 2019, the VCF has expedited 183 claims, which can move from filing to payment in as little as three weeks, and I wish to express our gratitude to the Department's Justice Management Division and the United States Department of the Treasury, which work closely with us to make sure that expedited payments are made as soon as possible. The circumstances that warrant expedition are truly saddening, and yet we are gratified to be able to issue these payments quickly and provide some sense of solace and financial security to claimants facing their darkest days.

In making eligibility and compensation determinations, the VCF works closely with our sister program under the Zadroga Act, the World Trade Center Health Program, operated by the Department of Health and Human Services' National Institute for Occupational Safety and Health, under the stellar leadership of Dr. John Howard, which provides medical monitoring and treatment for those affected by 9/11. The VCF also has established beneficial relationships and direct data exchanges with multiple federal and State entities, each of which provides information used by the VCF in assessing claims. These include the Social Security Administration, the Department of Veterans Affairs, the Department of Labor, the Office of Personnel Management, and the Department's own Office of Justice Programs' Public Safety Officers' Benefit Program, as well as the New York State Workers' Compensation Board, the Fire Department of New York, the New York Police Department, the New York City Employees' Retirement System, and various other New York city and State pension boards and unions.

By statute, claimants are limited to filing only one claim with the VCF, but VCF policy allows claims to be amended at any time before the program closes in 2020 if the claimant suffers a new injury or incurs a new and previously uncompensated loss. Claimants are also allowed to appeal in the case of an eligibility denial, or if the individual believes the award calculation did not properly account for the individual circumstances in the claim. Hearings are non-adversarial and provide an opportunity for claimants to tell us their story, and we have a dedicated staff of pro bono hearing officers (who operate under a special appointment from the Attorney General) who generously lend their expertise and gravitas to the VCF's administrative appeals process; in 2018, the VCF held 380 appeal hearings; so far in 2019, we have held 299. The law provides that the ultimate decisions of the Special Master on eligibility and compensation are final and unreviewable by any judicial authority, which is an extraordinary grant of discretion that I take extremely seriously.

The VCF also takes very seriously its role in ensuring that public funding is allocated only to those individuals who are suffering as a result of 9/11, and has a robust system of standards and procedures in place to prevent fraud. All claim form responses and information submitted to support a claim are subject to 18 U.S.C. 1001, the statute that criminalizes false statements made to the Federal Government. Moreover, key information used to establish eligibility and to calculate loss is independently verified with various third parties. Multiple internal checks take place throughout the claim review process to ensure that factual inconsistencies, data discrepancies, and other potential indicators of fraud are identified and resolved. In addition, the

Federal Bureau of Investigation (FBI or Bureau) provides a background check for every individual who is receiving a VCF payment, and the VCF receives dedicated assistance when needed through a strong partnership with the Department's Office of the Inspector General. The VCF also undergoes regular independent government audits and an annual financial audit. We are very proud of the fact that the VCF under the Zadroga Act has not documented any instance of fraud in a paid claim.

Current Status of the VCF

Under the Zadroga Act, as amended, the VCF is required to close to new claims and amendments on December 18, 2020. At the beginning of 2019, VCF projections showed that the \$7.375 billion in total funding was expected to be insufficient to pay all claims already pending and claims expected to be filed. The law passed by Congress when it reauthorized the VCF in 2015 recognized the possibility that funding might be insufficient and required the Special Master to annually reassess the VCF's policies and procedures to ensure that (1) funding is prioritized for those individuals who suffer from the most debilitating physical conditions; and (2) funds are not obligated in excess of the \$7.375 billion appropriation. Under the law, if, as a result of this annual reassessment, I determine that those requirements cannot be met, I am required to take actions or make modifications to VCF policies and procedures as necessary to achieve these statutory requirements. Thus, once I made the determination that funding was insufficient in February 2019, I did as the law required and modified VCF policies and procedures to reduce VCF award values for all pending and potential claimants to ensure that the VCF would stay within the appropriated limits while still continuing to prioritize the claims from the claimants with the most debilitating conditions. I would like to use the remainder of my time to explain how we got here and why I made the decision that I did.

The VCF was authorized with a limited amount of funding but, while the population of potential claimants is a finite set, its exact numbers are unknown. There is no accurate count of how many people might have been exposed to toxins stemming from the attacks, and there is considerable uncertainty about the number of individuals who ultimately will fall ill due to the long latency periods that can elapse before manifestation of the cancers determined to be related to 9/11 exposure. The VCF also has suffered from an information gap; in the early years of the program, many eligible individuals were not aware that the VCF was an available resource, assuming it was meant only for New York City first responders. In fact, even the FBI, which has lost at least 16 employees to 9/11-related illnesses, did not recognize until fairly recently that its employees might be eligible for VCF compensation. The efforts of Director Christopher Wray and his staff have been instrumental in ensuring that the Bureau and other federal law enforcement agencies are made aware of the programs that are available to help them.

As a result of increasing outreach, not only within the Federal Government but by victims' advocacy groups, many of which are represented here today, by the World Trade Center Health Program, and by the lawyers who represent over 80 percent of VCF claimants, but also as a harbinger of the increasing seriousness of 9/

11-related illnesses, the VCF received a record number of new claims in 2018 and is on pace to exceed that number in 2019. For perspective, in the first five years of the Fund, through December 31, 2016, roughly 19,000 compensation forms were filed. In the two years after that, through December 2018, almost 20,000 *additional* compensation forms were filed, with an additional 7,700 compensation forms filed so far in 2019 (see Chart A). We have awarded \$5.174 billion to nearly 22,500 individuals, some more than once due to an amendment or an appeal. Keeping in mind that we must maintain a funding reserve for administrative costs, we have just over \$2 billion left, with over 21,000 claims and amendments still needing a decision. While some number of those pending claims will be denied, and some number of amendments will not warrant any change to the original award, it is still clear that the VCF projects a shortfall.

Consistent with the reassessment mandate in the statute, each of the VCF's Annual Reports published since reauthorization in December 2015 has addressed the possibility of a funding shortfall. In the first reassessment conducted following Reauthorization, published March 13, 2017, as part of the VCF's *Fifth Annual Report*, the VCF projected that funding would be sufficient based on the data available at the time. We recognized, however, that there was considerable uncertainty in those projections and that the reauthorization of the VCF, with its new claim filing deadline and additional funding, provided opportunities for more people to benefit from the funding allocated to this important program. In the second reassessment, published with our *Sixth Annual Report* in February 2018, we projected that the VCF would remain just barely within its funding limit, projecting a total expenditure of \$7.295 billion out of the appropriated \$7.375 billion. Noting the relatively thin margin that existed, we indicated at that time that we would continue to monitor our projections over the course of the year to determine if changes would be needed prior to the following year's annual reassessment. In October 2018, following the anniversary of the September 11th attacks, and after internal projections done with August 2018 data suggested that the VCF, at the existing compensation levels, would exceed the available appropriated amount, the VCF published a *Notice of Inquiry* in the **Federal Register**, alerting the public of the possibility of a funding shortfall and seeking public comment on how to distribute the remaining funds in the most fair and equitable manner.

As we evaluated the comments received in response to the Notice and prepared the reassessment at the end of 2018, we were able to pinpoint several new trends, which reflect significant changes to the composition of the VCF's claimant population since Congress last examined this law in 2015, in terms of the types of claims filed, the types of conditions claimed, and the types of claimants filing claims. Since the Reauthorization of the VCF in December 2015, we have seen:

- A dramatic increase in deceased claim filings, meaning claims filed on behalf of those who have died as a result of their 9/11-related physical health condition. At the end of 2015, the VCF had received 610 deceased claims. As of May 31, 2019, we have received 2,252 (see Chart B), with more than a quarter of that total (676) filed year-to-date in 2019.
- A marked increase in cancer claims. In 2015, the Congressional Budget Office estimated that, should the VCF remain in operation through 2025, we would issue awards on a total of between 2,500 and 10,000 cancer claims. We have already found over 8,800 cancer claimants eligible, and already awarded compensation to 7,750 of these individuals (see Chart C). And we are a full six years away from 2025.
- A marked increase in claims from the survivor population, meaning those who lived, worked, or went to school in the area. At the time of Reauthorization in December 2015, not quite 14% of all VCF awards were paid to survivors. Today, just about 38% of claims filed are from this population (see Chart D).

When you take these trends, factor in that deceased claims and cancer claims tend to be higher value awards, and also consider the fact that we have made significant improvements to our processes which have significantly increased the rate at which awards are issued, the plain fact is that we are expending the available funds more quickly than assumed, and there are many more claims than anticipated.

Using data as of January 31, 2019, and in consideration of these trends, I determined in the third reassessment required by the law, published with our *Seventh Annual Report* in February 2019, that the VCF had insufficient funding to continue to compensate all pending claims and claims projected to be filed by December 18, 2020, under the VCF's then-existing policies and procedures. As described in that report, available at www.vcf.gov, the VCF projected, using a trend-based analysis, that, after considering all awards made through January 31, 2019, we would expect

to make a total of 28,185 *additional* original and revised awards, which would mean that, based on average award values, the VCF's total expenditures at program end (including necessary administrative costs) would require a total cumulative outlay of \$11.991 billion, \$4.616 billion more than the \$7.375 currently appropriated. Given my determination of insufficient funding, the law required me to modify VCF policies and procedures so as to ensure that the VCF does not obligate funds beyond its appropriation. This meant that the VCF needed to make significant reductions in awards.

In choosing how to go about this task, I attempted not only to adhere to the VCF's two statutory directives—not exceeding the available appropriation, and prioritizing funding for claimants with the most debilitating conditions—but also to meet three central policy goals: (1) Ensuring that all eligible claimants filing before the statutory deadline, December 18, 2020, would receive some compensation for their suffering (subject to applicable statutory offsets); (2) holding a reasonable amount of money in contingent reserve to ensure against further unanticipated increases in claim filings, and to be able to make increased awards in appropriate cases where claimants are suffering from extraordinarily severe conditions; and (3) minimizing operational and administrative implementation challenges to avoid a delay or outright halt in claim determinations.

After thoroughly evaluating every potential available option, I agreed with the clear majority of the commenters who responded to the VCF's published Notice of Inquiry and concluded that the fairest way to implement the required reduction of awards was to do so across the board, applying a percentage reduction to all awards. Other approaches would have had the effect of disproportionately affecting the claimants with the most debilitating conditions, which I believed to be inconsistent with the VCF's statutory mandate. Reducing the highest value awards, for example, or making changes to the way in which economic losses are calculated, would most affect those claimants whose 9/11-related physical health conditions are so severe that they are no longer able to work. Continuing to make VCF awards without any changes until the funding ran out would have meant that claimants with the most severe conditions whose claims had not yet been filed would be left entirely uncompensated. I could not abide a plan that would leave some claimants uncompensated or that would fail to make any allowance for the claimants who suffer the most.

Accordingly, all pending claims, regardless of when they were filed, are subject to the new policies put in place effective February 25, 2019, to address the insufficiency of funds, although we were able to make some accommodation for claimants whose claims were already pending as of February 1, 2019, as follows:

Effective for any award on which the VCF makes a determination on or after February 25, 2019:

- If the claim or amendment was submitted for compensation review *on or before February 1, 2019*, the calculated award will be reduced by 50 percent.
- If the claim or amendment was submitted for compensation review *on or after February 2, 2019*, the calculated award will be reduced by 70 percent.

By law, we cannot reduce the offsets applied to the award and so the offsets are subtracted in full from the calculated reduced award.

The reductions in awards have now been fully implemented. In the period between February 25, 2019, when the reductions became effective, and May 31, 2019, we have issued 835 awards that have been subject to reduction.

Conclusion

Taking action to reduce VCF awards to comply with the law was a challenge that I worked to ensure was solved in an equitable and transparent way, as I spend each and every day immersed in the stories of the individuals who make up the 9/11 community. Along with my talented and dedicated staff, I remain deeply committed to serving the needs of the 9/11 community, which we know to be strong and resilient. We are hopeful that the work that we do continues to provide some measure of needed relief. And, most importantly, we are grateful to this Committee and to Congress for re-examining the Zadroga Act and considering how best the Nation as a whole might be able to continue to help the Members of the 9/11 community.

Mr. Chairman, Ranking Member, thank you for the opportunity to speak here today about this successful and extraordinarily important program. To the extent that the Committee requires further information regarding the evaluation of claims, the unanticipated nature of the illnesses compensated by the VCF, and the projected numbers of those who may be eligible for compensation in the future, I, my staff, and the Department are fully committed to working with you to ensure that Congress has the information that it needs to address appropriate legislative options. Thank you.

VCF Supporting data through May 31, 2019

Chart A
Total Compensation Forms Submitted

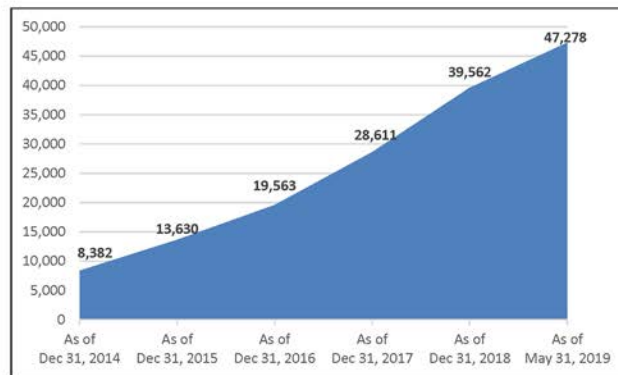


Chart B
Deceased Claim Filings

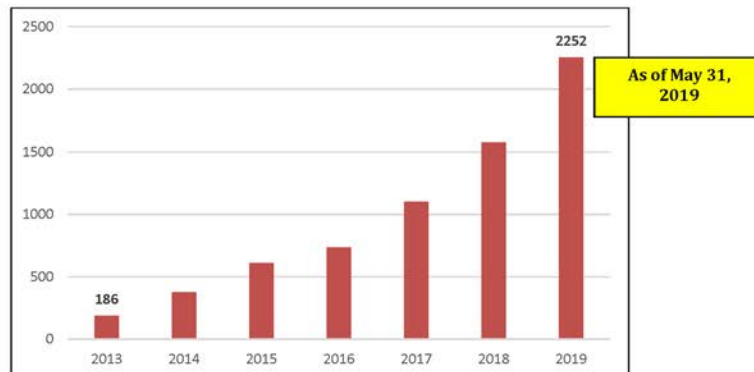


Chart C
Cancer/Non-Cancer – Initial Award Decisions

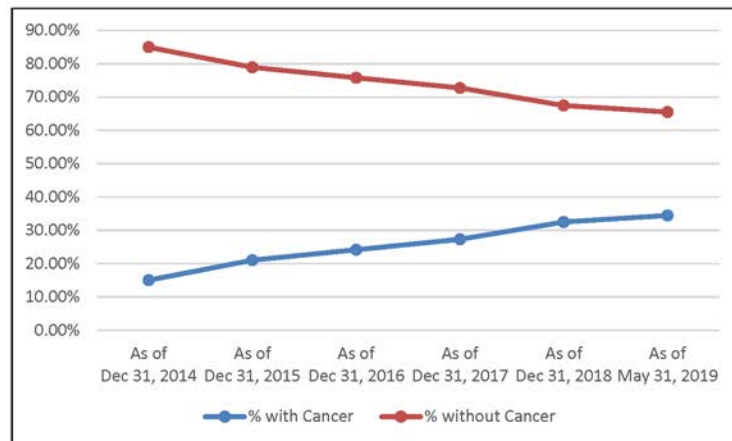
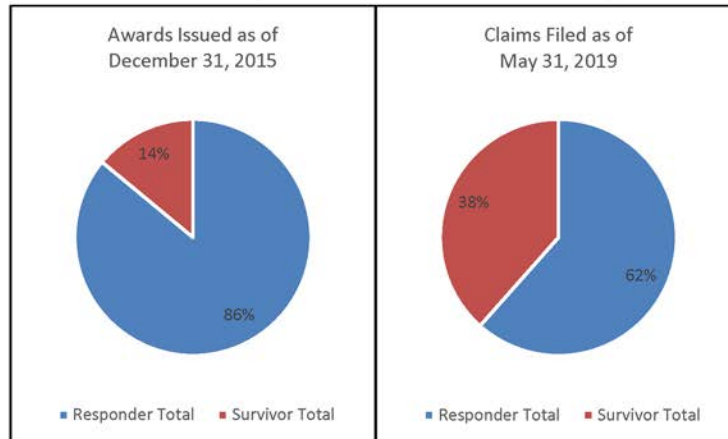


Chart D
Increase in Percentage of Claims from the Survivor Population



Chairman NADLER. Thank you.
Dr. Moline.

TESTIMONY OF JACQUELINE MOLINE, M.D.

Dr. MOLINE. Good morning Nadler, Chairman Cohen, Ranking Member Johnson, and Members of the committee. I am honored to be here this morning.

My name is Dr. Jacqueline Moline. I am the chairperson of the Department of Occupational Medicine, Epidemiology and Prevention at the Zucker School of Medicine at Hofstra University Northwell. And I am the director of the Northwell Queens World Trade Center Health Program. My specialty, occupational and environmental medicine, deals with the impact of hazardous substances on the health of individuals.

On September 11, I, like every person in New York, watched in shock and horror as our Nation was attacked. My colleagues at Mount Sinai where I was then working knew of the potential for health effects related to asbestos and other toxicants. We knew there would be disease in the short term and the long term. Our immediate concern was for those acute health effects, the first wave.

My colleagues and I have written extensively about this—extensively about this, and copies of some publications are attached to my testimony.

At Mount Sinai, we began seeing patients that month. Through the tremendous efforts of the New York congressional delegation and organized labor, in April 2002, we were given 1 year of funding to begin medical surveillance programs for rescue and recovery workers, construction workers, and volunteers exposed at the pile.

At the beginning, we could only evaluate patients and tell them their health conditions. We are not allowed to provide treatment. This program was extended 1 year, and we continued to partnership with SUNY Stony Brook, Queens College, New York University, and Rutgers to see patients in locations convenient for them. These surveillance programs continued, eventually including treatment and evolved into the World Trade Center Health Program authorized eventually by the James Zadroga Act of 2010.

After reauthorization in 2016, we had 75 years of funding for medical surveillance and care of World Trade Center related disorders as well as dedicated research. As of March 31, 2019, 95,320 first responders and survivors, the resident schoolchildren, and individuals who worked in Lower Manhattan who returned to their businesses had been evaluated.

Yes, the towers were in New York City, and the Pentagon is here in DC, but it was an attack on our Nation. Individuals from all over the country participated in this rescue and recovery effort. Over the past 18 years, some people who lived in the Metro New York area have moved to retire to other parts of the country. Due to these reasons, there is a national component to the World Trade Center program. As of May 2019, 16,684 individuals are enrolled in the national program in every State.

Downtown Manhattan, home to thousands of residents, was blanketed in thick dust. School children, like Lila sitting here, had been evacuated from their places of learning on September 11.

They returned to their schools, despite fires that continued to rage and amid dust that persisted through May 2002. The survivors are also covered by the Zadroga Act, and the number of survivors has increased by 327 percent in 8 years.

Medical conditions have persisted. That is the second wave. For example, over 50 percent of firefighters who worked the World Trade Center site had developed a persistent respiratory condition. Rates of asthma remain elevated along with a variety of other diseases.

Here we are nearly 20 years later. Unfortunately, we have moved into the third wave of diseases, those conditions that take years to develop. We don't a lot about the actual dust and fumes that enveloped Lower Manhattan. I would like to reiterate that, as medical professions, we never believed the air was safe to breathe. That is now amply clear.

The World Trade Center now collects additional data on diseases that have been classified as World Trade Center related. This is crucial since early data collection on who was exposed was lacking. Further research is ongoing to determine what new diseases might be added to the approved list.

Since 2012, when over 50 cancers were added to the list of World Trade Center conditions, there have been 11,824 World Trade Center certified cancers treated, including 2,614 prostate, 552 lung, 741 breast, including over 35 male breast cancers, 667 thyroid, 571 cases of lymphoma and hundreds more. Glioblastoma have occurred like the one that killed Candidus Henry, a patient at the Northwell program. You will hear from his widow in this session.

The survivor program has had 3,030 individuals with cancer. And in the national program, the number of cancer cases certified increased from 7 in 2013 to 708 in 2018. Nearly 20,000 children attended school below Houston Street and were exposed to over 150 toxicants in that deadly brew.

Overall, over 55,000 people have been certified for at least one World Trade Center related health condition in the responder and survivor programs and in the national programs. The effects from exposure of 9/11 have not only been measured in the number of deaths, cancers, lung transplants, and countless new cases of asthma, studies have shown the impact on employment disability and early retirement.

I would like to briefly tell you about the impact by telling you about a real person. Elli Engler, who is here today and has allowed me to give a brief description of her health issues, was a certified industrial hygienist in charge of health and safety for the United Federation of Teachers. She went into every school in Lower Manhattan, assessed the immediate health risk for staff and children. In 2008, she developed a second breast cancer, a condition she had fought and beat in 1985. She developed asthma shortly after 9/11, but it was under control. Recently, she has had severe asthma attacks that have required hospital visits. Elli, like so many in the World Trade Center community, fought these illnesses with courage.

After 2011, she also realized that all 500 staff at these schools in Lower Manhattan were eligible for the health program if they had World Trade Center conditions, and she began staff outreach.

She also advocates on behalf of the school children in Lower Manhattan who have now all graduated and moved throughout this country. Her clinical future, like so many others, is uncertain, and she will require close monitoring and care for the rest of her life. She is truly a hero.

On September 11, 2,973 people lost their lives, including firefighters, police officers, EMS workers, and people just going to work. Since then, an additional 204 police officers, 180 FDNY firefighters, and, in total, an estimated 2,000 responders and survivors have died as a result of 9/11 illnesses. With every day, these numbers increase. Soon the day will come when there are more people who died of World Trade Center related illnesses after 9/11 than perished on that horrible day.

Based on the trends we have seen in research; this third wave of 9/11 diseases will continue. Because of the monitoring program, we are able to identify new clusters of disease that will develop, such as neurological conditions, autoimmune disorders, and diseases we can't foresee.

I consider myself fortunate to have been in New York City on 9/11 so I could contribute to caring for the thousands of men and women who suffered from occupational and environmental exposures from the World Trade Center dust and fumes. Being able to serve my patients and our Nation as a physician involved in the World Trade Center Health Programs is one of the greatest honors of my life.

Thank you.

[The statement of Dr. Moline follows:]

FOR THE RECORD JACQUELINE MOLINE, M.D.



Jacqueline Moline, MD, MSc, FACP, FACOEM

Vice President and Chair
Occupational Medicine, Epidemiology and Prevention
Director, Northwell Health Queens World Trade Center Health Program
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Good morning Chairman Cohen, Ranking Member Johnson, Members of the Committee.

I am honored to be here this morning. My name is Dr. Jacqueline Moline. I am a board certified physician, specializing in Occupational and Environmental Medicine. I am currently the Chairperson of the Department of Occupational Medicine, Epidemiology and Prevention at the Zucker School of Medicine at Hofstra University/Northwell Health. I am the Director of the Northwell Health Queens World Trade Center Health Program. My specialty, occupational and environmental medicine, deals with the impact of exposures on the health of individuals. It is part of Preventive Medicine, since we know that individuals without these exposures would likely not be afflicted with the conditions they later develop.

Prior to my current position, I worked at the Mount Sinai School of Medicine, where I collaborated with amazing physicians who had dedicated their careers to the treating patients experiencing the health effects of asbestos exposure. I evaluated hundreds of workers who had been exposed to asbestos decades earlier; we know that the health effects from asbestos exposure take years to develop. On September 11th, I, like every person in New York City, watched in shock and horror as our nation was attacked. Shortly after the towers collapsed, I, along with all physicians in New York City, was called to the hospital as part of the all-hands-on deck coverage. Tragically, there was little we could do that day. However, based on our knowledge of the potential for health effects related to asbestos and the other 150 toxicants individuals were exposed on 9/11, we knew that there was potential for disease – in the short term, and the long term. We knew the air wasn't safe to breathe, but our immediate concern was for those with acute health effects, since we knew that other diseases would take years to develop.

At Mount Sinai, we began treating patients with World Trade Center related health conditions in September 2001. Through the tremendous efforts of the New York Congressional Delegation and organized labor, in April 2002 we were given one year of funding to begin the medical surveillance programs for rescue and recovery workers, construction workers and volunteers who were exposed at "the pile," and surrounding areas after 9/11. These surveillance programs later evolved into the WTC Health Program, authorized by the James Zadroga Act of 2010, which monitors and treats World Trade Center related health problems. Initially in 2002, we were only able to evaluate patients and tell them what their health conditions were – we were not given funding for and not allowed to provide treatment. This initial program was extended one year, and we continued our partnership with SUNY Stony Brook, Queens College, New York University, and Rutgers University to see patients in locations convenient for them. In 2004, we were awarded a five year contract to continue the medical screening program, and to have patients come back for repeat, or monitoring examinations. Similar contracts were awarded to the other four institutions. We were still not able to treat the patients we saw, even if they had World Trade Center related conditions; we had to refer them to other clinicians, or to a WTC treatment program we had started through philanthropic donations, not through government funding. As part of our contract, we were prohibited from collecting data using federal dollars. We could evaluate the patients, but we needed separate grants to be able to describe what we were finding in these patients. In 2006, on the fifth anniversary of the WTC disaster, the federal government allowed our programs to treat patients with World Trade Center conditions. This was a great day for

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our patients, and allowed us to provide the high quality care these men and women deserved, from clinicians who were experts in identifying World Trade Center related health diseases. The grant ended in 2009; then there were yearly scrambles, and many trips to Capitol Hill, that allowed continued appropriations for the WTC health programs to continue until 2011, when funding through the Zadroga Act became available. Seventy five years of funding for medical care for disorders related to the World Trade Center, as well as dedicated research into these diseases was provided. The Victim's Compensation Fund was re-established, but only for five years.

As of March 31, 2019, 95,320 first responders – including those first responders who came from every state in our nation, and survivors - those residents, school children and individuals who worked in lower Manhattan and returned to their offices and businesses - have been evaluated. There was a tremendous response throughout our country after we were attacked. Yes, it was an attack in New York City, but it was an attack on our nation, and individuals from every state participated in the rescue and recovery efforts. Over time, some individuals who initially lived in the metropolitan New York area have moved or retired to different parts of the country. As a result, as part of the WTC Health Program, there is a national program dedicated to monitoring the health of, and providing care for WTC responders and survivors who live outside of the New York metropolitan area. As of May 2019, 6,732 individuals have enrolled in the national program. Not only first responders were affected after the Towers fell. Downtown Manhattan, home to thousands of residents, was blanketed in thick dust. Individuals who worked in lower Manhattan, including the financial district, returned to work within a week of the disaster when the stock markets re-opened and businesses set about cleaning up and getting back to work. Residents returned to their homes, often inadequately cleaned, and began to rebuild their lives in an area devastated by the collapse of around 270 floors of buildings. School children, who had been evacuated from the places of learning on September 11th, returned to their schools, like Lila sitting here with me, despite fires that continued to rage at Ground Zero, and dust that was elaborated from the extensive recovery efforts that continued through May 30, 2002. Thankfully, these survivors, the neighborhood residents, school children and building re-occupants are also covered by the Zadroga Act, and the number of survivors entering the program has increased dramatically in the past several years. There has been extraordinary growth in the survivor program over the past eight years: an astonishing increase of 327%.

Exposures to the toxicants at the World Trade Center caused immediate health effects – we have all seen the pictures of dust laden first responders and building occupants – these conditions occurred whether you were a first responder, building re-occupant, school child, or construction worker. Many people developed immediate respiratory symptoms. This was the first wave of disease. As was outlined in the Environmental Health Perspectives by Dr. Mayris Webber and colleagues in 2009, 53% of firefighters developed a cough, and 41% developed gastroesophageal reflux disease within the first year after 9/11¹. In 2006, Dr. Robin Herbert and I, along with many of our colleagues, described the health effects for police officers, construction workers and other responders who had health problems 1-3 years after 9/11². Dr. Shao Lin, Dr. Joan Reibman and their colleagues described similar health findings among community residents who were exposed to the same toxicants, simply by living or working in the area for months after 9/11³. These conditions persist, and constitute the second wave

¹ Webber, M. P., J. Gustave, R. Lee, J. K. Niles, K. Kelly, H. W. Cohen and D. J. Prezant (2009). "Trends in respiratory symptoms of firefighters exposed to the World Trade Center disaster: 2001-2005." *Environmental Health Perspectives* 117(6): 975-980.

² Herbert, R., J. Moline, G. S. Skloot, K. Metzger, S. Baron, B. Luft, S. Markowitz, I. Udasin, D. Harrison, D. Stein, A. C. Todd, P. Enright, J. Mager Stellman, P. J. Landrigan and S. Levin (2006). "The World Trade Center disaster and the health of workers: Five-year assessment of a unique medical screening program." *Environmental Health Perspectives* 114(12): 1853-1858.

³ Lin, S., J. Reibman, J. A. Bowers, S.-A. Hwang, A. Hoerning, M. I. Gomez and E. F. Fitzgerald (2005). "Upper respiratory symptoms and other health effects among residents living near the World Trade Center site after September 11, 2001." *American Journal of Epidemiology* 162(2): 499-507.

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of diseases; the initial conditions improved for some, but for many people, they have continued to have health effects related to their 9/11 exposures. Dr. Juan Wisnivesky and others published a paper describing the lasting health effects from 9/11 in 2011⁴. Rates of asthma that developed following 9/11 were elevated, along with sinus disease, gastrointestinal issues, post-traumatic stress disease and other health problems. As my colleague Dr. Benjamin Luft and colleagues have described, for those individuals with both physical and mental health conditions related to their WTC exposures, these co-morbidities have contributed to worse health⁵. A copy of all these publications is attached to my written testimony.

Now here we are, nearly 20 years later. Unfortunately, we have moved into the third wave of diseases. For example, over 50% of firefighters who worked at the World Trade Center site have developed a respiratory condition. While people continue to suffer from aerodigestive disorders and mental health conditions, we are seeing additional diseases. As someone who specializes in occupational diseases, I am used to diseases with long latency – asbestos, that I discussed earlier in my testimony – is one of the most well-known examples of an exposure that can cause disease decades – 40, 50, 60 or more years after someone has had exposure. While we do know a lot about asbestos, we do not know a lot about the actual dust and fumes that enveloped lower Manhattan and thousands of people. There was inadequate measurement for fumes in the week after 9/11, so we do not have a good sense of what was in the air, and what we, as clinicians, should look out for. I would like to reiterate that as medical professionals, we did not think then, and it is amply apparent now, that the air was safe to breathe.

The WTC Health Program is now collecting additional data on diseases that have been classified as WTC-related. This is critical, since early data collection on who was exposed was lacking. Further research is ongoing to determine whether there will be sufficient evidence to add additional disorders to the list of conditions, which now includes respiratory conditions, mental health conditions, certain gastrointestinal conditions, and of course, cancer. Since 2012, when over 50 cancers were considered to be WTC-related, there have been 11,824 people with cancers certified by the program. This includes 2,614 prostate cancers, 552 lung cancers, 741 breast cancers, as well as over 35 male breast cancers, 667 thyroid cancers, and dozens more. The survivor program has had 3,030 individuals with cancers, and in the national program, there has been an increase in the number of cancer cases certified: from 7 in 2013 to 708 in 2018.

Blood cancers, such as leukemia, lymphoma, and multiple myeloma, were identified within several years of September 11th in responders, survivors and school children, but it is expected that more of these cancers will continue to occur in the future. To date, there have been 571 cases of lymphoma certified. Solid tumors, like lung cancer, prostate cancer, thyroid cancer, kidney cancer, and breast cancer, occur years if not decades after exposures. Given that those exposed at Ground Zero were exposed to over 150 toxicants in that deadly brew, there is concern for what is yet to come with respect to cancers. Nearly 20,000 children attended school below Houston Street on September 11, 2001, and were exposed to the toxic mixture. We do not know what World Trade Center diseases these now-young adults will develop. Overall, approximately 49,000 people have been certified for at least one WTC health conditions in the responder and survivor programs, and over 6,200 have been certified for WTC health conditions in the national program. The effects from exposures at 9/11 have not

⁴ Wisnivesky, J. P., S. L. Teitelbaum, A. C. Todd, P. Boffetta, M. Crane, L. Crowley, R. E. de la Hoz, C. Dellienbaugh, D. Harrison, R. Herbert, H. Kim, Y. Jeon, J. Kaplan, C. L. Katz, S. Levin, B. Luft, S. Markowitz, J. Moline, F. Ozbay, R. H. Pietrzak, M. Shapiro, V. Sharma, G. S. Skloot, S. Southwick, L. A. Stevenson, I. Udasin, S. Wallenstein and P. Landrigan (2011). "Persistence of multiple illnesses in World Trade Center rescue and recovery workers: a cohort study." *The Lancet* **378**: 888-897.

⁵ Luft, B., C. Schechter, R. Kotov, J. Brohier, D. Reissman, K. Guerrero, I. Udasin, J. Moline, D. Harrison, G. Friedman-Jimenez, R. Pietrzak, S. Southwick and E. Broment (2012). "Exposure, probable PTSD and lower respiratory illness among World Trade Center rescue, recovery and clean-up workers." *Psychological Medicine* **42**(5): 1069-1079.

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only been measured in the numbers of deaths, numbers of cancers, number of lung transplants, or countless cases of new asthma. Studies have shown the impact of 9/11 exposures, not only on health, but also on employment, as individuals with WTC related health conditions were more likely to retire before age 60⁶.

Sometimes it's easier to understand what the health impact of 9/11 is by learning about a real person, rather than hearing statistics and types of diseases that have occurred. I'd like to tell you about Ellie Engler, who is in the hearing room today and has allowed me to give a brief description of her health issues. She has had significant health problems since 9/11. Ellie, a certified industrial hygienist, was in charge of health and safety for the United Federation of Teachers on September 11, 2001. She went into every school in lower Manhattan and assessed the immediate health risks to staff and children in these schools. In 2008, she developed breast cancer – a second primary, since she has been cured of breast cancer in 1985, and this new tumor was of a different genetic signature than her first cancer. She has also had a worsening of her asthma, a condition she developed shortly after 9/11 but was under control. Recently, she has had recurrent asthma attacks that have been difficult to control. Ellie, like so many in the WTC community, has fought these illnesses with courage. She realized that all of the staff at these schools should enroll in the WTC health program if they had any WTC-related conditions and began outreach to over 500 teachers and school staff. In addition to ensuring that the staff were aware of the WTC health programs, she began to advocate on behalf of the 19,871 school children in lower Manhattan, highlighting the need for outreach to these students, who have now all graduated from high school and are all over the country. Her clinical future, like so many others, is uncertain, and she will require close monitoring and care for the rest of her life. She is my hero and the hero to many in the WTC community.

On September 11, 2001, we lost 343 members of FDNY, 23 members of NYPD⁷, 8 EMS workers from private emergency medical services⁸, 37 Port Authority police officers⁹, and countless others who were simply going to work, or were in lower Manhattan. 2,973 people lost their lives on that day⁷. Since 9/11, we have become aware of an additional 204 police officers⁹, 180 FDNY firefighters¹⁰, and in total, an estimated 2,000 responders and survivors who have died as a result of 9/11 illnesses. Soon, the day will come when there are more people who have died of WTC related illnesses after 9/11 than perished on that horrible day when our nation was attacked. As a doctor, I don't have a crystal ball, but based on the trends we have seen in the research, the numbers of affected individuals – those with life threatening injuries – will continue in this third wave of 9/11 diseases. Throughout our country, brave men and women who were exposed to the fallout from 9/11 will continue to develop cancers at rates above what might be expected absent these exposures. Because of the monitoring programs, we are able to identify new clusters of diseases that will develop – such as neurological conditions, auto-immune disorders, and other diseases we haven't thought of yet. The World Trade Center registry recently

⁶ Yu, S., K. Seil and J. Magsood (2019). "Impact of health on early retirement and post-retirement income loss among survivors of the 11 September 2001 World Trade Center disaster." *International Journal of Environmental Health Research and Public Health* 16(7): 2-12.

⁷ National Commission on Terrorist Attacks upon the United States, "The 9/11 Commission Report," <https://www.9-11commission.gov/report/>, accessed on June 3, 2019.

⁸ Wikipedia, "Emergency Workers Killed in the September 11 Attacks," https://en.wikipedia.org/wiki/Emergency_workers_killed_in_the_September_11_attacks, accessed June 3, 2019.

⁹ New York City Police Department, "9/11 Tribute," <https://www1.nyc.gov/site/nypd/about/memorials/9-11-tribute.page>, accessed on June 3, 2019.

¹⁰ Workers' Compensation Institute, "Death Toll from Cancer for 9/11 Responders Expected to Outnumber Victims of Attack," <https://www.wci360.com/death-toll-from-cancer-for-9-11-responders-expected-to-outnumber-victims-of-attack/>, accessed on June 3, 2019.

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reported that those who were injured on 9/11 had lower life satisfaction and more functional impairment after fifteen years¹¹. We expect this type of functional impairment to continue to grow in WTC exposed individuals.

I consider myself fortunate to have been in New York City on 9/11 – so that I could contribute to caring for the thousands of men and women who suffered occupational and environmental exposures from the World Trade Center dust and fumes. Being able to serve my patients, and our nation, as a physician involved in the WTC Health Programs is one of the greatest honors of my life.

I would be happy to take questions.

¹¹ Gargano, L., H. K. Mok, M. H. Jacobson, P. Frazier, S. K. Garrey, L. Petrspric, J. and R. M. Brackbill (2019). "Comparing life satisfaction and functioning 15 years after September 11, 2001 among survivors with and without injuries: a mixed-method study." Quality Life Research; [Epub ahead of print].



Comparing life satisfaction and functioning 15 years after September 11, 2001 among survivors with and without injuries: a mixed-method study

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Abstract

Purpose This study compares life satisfaction and limited activity days among 9/11 survivors with and without physical injuries using quantitative and qualitative approaches.

Methods The study population included World Trade Center Health Registry enrollees who reported being injured on 9/11 in 2003–2004 and a sample of non-injured enrollees who participated in a cross-sectional substudy. We used multivariable logistic regression to examine differences in life satisfaction and number of limited activity days in the last 30 days between those with and without injuries. The free-response section of the survey was analyzed qualitatively to compare themes of those with and without injuries.

Results The final sample consisted of 2821 adult enrollees. Compared to those who were not injured, those who were injured on 9/11 were more likely to report being unsatisfied with their life (adjusted odds ratio (AOR): 1.5, 95% confidence intervals (CI) 1.1–2.0) and have 14 or more limited activity days in the last 30 days (AOR: 1.4, 95% CI 1.0–1.9). Among those who were injured, being partially or completely prevented from working increased the odds of being unsatisfied with life and having 14 or more limited activity days. In qualitative analysis, the emotional trauma experienced from 9/11 was a major and common theme, regardless of injury status. Those with injuries were more likely to express anger/lack of recognition/appreciation, describe substance use/abuse, and have financial/health care access issues.

Conclusions More than 15 years after 9/11, those who were injured continue to be impacted, reporting lower life satisfaction and more functional impairment.

Keywords World Trade Center · Injury · Qualitative · Life satisfaction · Quality of life

Introduction

Exposure to disasters is associated with long-term sequelae including psychological, occupational, functional, and quality of life (QoL) impairments [1–3]. QoL refers to general well-being and satisfaction with various aspects of life, including physical health, family, education, employment,

and finances [4]. QoL among survivors of the terrorist attacks on the World Trade Center (WTC) on September 11, 2001 (9/11) is poorly understood, despite evidence that both physical [5–7] and mental health conditions [5, 8, 9] associated with the disaster can persist for years.

Despite using different definitions of QoL, 9/11-related chronic physical [5, 10, 11] and mental health conditions [5, 8, 12] consistently are associated with a diminished QoL. For example, one year after 9/11, QoL (measured with the Quality of Life Enjoyment and Satisfaction Questionnaire-short form) was inversely related to mental health symptoms among 9/11-exposed adults [12]. A study of New York City (NYC) firefighters found that, as the number of aerodigestive conditions increased, both physical and mental component summary scores from the SF-12 decreased, indicating a lower health-related QoL [10]. Finally, 10–11 years after

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9/11, exposed persons with persistent lower respiratory symptoms reported significantly lower life satisfaction and more poor physical and mental health days [11].

Outside of the disaster literature, traumatic injury, in particular, is associated with long-term negative outcomes, including poorer mental health and self-rated health, more functional limitations, and lower QoL [13–15]. Studies of disaster-related injuries have also found more adverse mental and physical health outcomes in those who were injured. For instance, injured survivors of the Oklahoma City bombing had higher rates of PTSD than those who were not injured [16]. Among survivors of the 1998 US embassy bombings in East Africa, injury was the only factor significantly associated with posttraumatic stress reactions [17]. Finally, studies of those injured on 9/11 have found an increased risk of PTSD and chronic physical health conditions up to 11 years after 9/11 [18, 19].

There is a paucity of literature on the long-term impact of injury on 9/11 on QoL (e.g., life satisfaction) as opposed to physical and mental health outcomes. A previous exploratory qualitative study of persons injured on 9/11 identified themes regarding long-term recovery and QoL issues, including poor ongoing health status, functional limitations and disabilities, lifestyle/economic impact, and lack of social support [20]. This exploratory qualitative study served as the basis for the development of the current quantitative survey.

The purpose of this study was to build upon these previous findings of decreased QoL in persons injured on 9/11 by exploring differences among 9/11 survivors with and without physical injuries using (1) quantitative analysis of self-reported life satisfaction and number of limited activity days and (2) qualitative analysis of free-response text. Because previous research has shown that persons injured on 9/11 have chronic mental and physical health problems [18, 19] and that these health conditions are associated with poorer QoL assessed using several different measures [5, 8, 10–12], we hypothesized that injured survivors would report lower life satisfaction and more days of limited activity compared to survivors without injuries. Similarly, we hypothesized that qualitative analysis of the free-response data would underscore the long-term effects of the 9/11 disaster for injured survivors compared to those without injuries.

Methods

Study design and sample

“The Health and Quality of Life 15 Years after 9/11 study” (HQoL study) sampled from the World Trade Center Health Registry (WTCHR), a cohort study of over 70,000 individuals exposed to the events of 9/11 in NYC [21]. The WTCHR has disseminated four extensive survey waves that included

questions on enrollees’ physical and mental health status: Wave 1 (W1; 2003–2004), Wave 2 (W2; 2006–2007), Wave 3 (W3; 2011–2012), and Wave 4 (W4; 2015–2016). The HQoL study population was restricted to enrollees who completed all prior WTCHR surveys. All enrollees who, on the W1 survey, reported being south of Chambers Street on the morning of 9/11 and an injury on 9/11 (at least one of the following: cut, abrasion, or puncture wound; sprain or strain; burn; broken bone, fracture, or dislocation; concussion; head injury, or knocked out by being hit on the head; or any other type of injury) were included ($n = 2701$) along with a simple random sample of those who were eligible but not injured ($n = 2598$). Data collection was from March to July 2017 by web or paper survey, with 4033 completed surveys (76.1% response rate), including 2038 injured (50.5%) and 1995 non-injured (49.5%) respondents. To be included in analyses regarding medical intervention sought after injury on 9/11, respondents needed to say “yes” to being injured on the HQoL survey. In addition, to reduce recall bias, those with inconsistent reporting of injury from the W1 and HQoL surveys ($n = 1212$) were excluded. The final sample size was 2821: 1003 (35.6%) were injured and 1818 (64.4%) were non-injured. The study protocol was approved by the NYC Department of Health and Mental Hygiene’s Institutional Review Board.

Quantitative analysis

Outcome measures

There were two QoL outcomes of interest. The first was life satisfaction which was assessed using the question: “In general, how satisfied are you with your life: very satisfied, satisfied, dissatisfied, or very dissatisfied?” Response categories were dichotomized into very satisfied/satisfied vs. dissatisfied/very dissatisfied, consistent with previous research [11, 22–24], because the distribution of responses, particularly at the extremes which had smaller numbers, was inadequate to detect associations. The second was the number of limited activity days: “For about how many days did poor physical or mental health keep you from doing your usual activities during the last 30 days?” [25] Responses were dichotomized into < 14 days versus ≥ 14 days, consistent with previous studies [25]. Scores on both of these measures have good validity and reliability [22, 25].

Injury measures

HQoL survey participants were asked if they were injured on 9/11 (Y/N). Among those who reported “yes,” we examined injury severity using responses from the HQoL survey. Injury severity was defined by the degree of medical intervention sought after the injury and was defined as a

three-level measure: severe (using a wheelchair in the week following the injury or having sought treatment at a hospital, emergency room, or doctor's office, and/or having surgeries due to their injury on 9/11), moderate (using a cane or crutch in the week following the injury, needing bed rest for at least 1 day, and/or needing physical therapy due to their injury on 9/11), and low (those who did not report any intervention or care) [26, 27]. We also examined whether the injury affected their ability to work. Work was defined as full or part-time employment including self-employment, housework, and/or being a college or university student. Participants were asked whether at any time since 9/11 their injury (1) completely prevented them from working (Y/N) or (2) partially restricted their ability to work (Y/N). If participants said yes to the first question, they were categorized as "injury completely prevented work," if they said no to question 1 but yes to question 2 they were categorized as "injury partially restricted work," and if they said no to both questions they were categorized as "injury did not prevent or restrict work."

Covariates

Sociodemographic variables included age at HQoL survey, gender, and race/ethnicity from W1, and income, employment status, and marital status at W4. Other WTC exposures collected at W1 included witnessing traumatic events (i.e., seeing planes hit the buildings, buildings collapsing, people falling or jumping from buildings, people injured, or people running), being caught in the dust cloud, and being a rescue/recovery worker (RRW). Probable 9/11-related PTSD was assessed at each survey Wave using a 9/11-specific PTSD Checklist-Civilian Version (PCL-17). The PCL-17 is a self-reported, 17-item scale corresponding to PTSD criteria in the DSM-IV. It is commonly used in epidemiological research and has good psychometric properties, with sensitivity ranging from 0.94 to 0.97, specificity from 0.86 to 0.99, and diagnostic efficiency from 0.83 to 0.96 [28, 29]. Cronbach's alpha in this sample was 0.95. Enrollees with a PCL score of ≥ 44 at any Wave were considered to have ever had probable PTSD [19]. Chronic health conditions were defined based on self-report at W4 of having ever received a physician diagnosis for angina, heart attack, asthma, diabetes, or non-neoplastic lung disease (chronic bronchitis, emphysema or COPD, reactive airway dysfunctions syndrome, sarcoidosis).

Analysis

Quantitative analysis Chi square tests were used to test for significant associations between outcome measures and selected sociodemographic characteristics, WTC exposures, 9/11-related PTSD, and 9/11-related injury. Cramer's V and phi coefficients were used to estimate effect sizes. Adjusted

odds ratios (AOR) were calculated using logistic regression to estimate the association between injury and life dissatisfaction or ≥ 14 limited activity days, adjusting for covariates found to be significant in the bivariate analysis. A separate analysis was conducted among the injured to estimate the associations between outcomes and injury severity and functional impairment. For the regressions, we used case-wise deletion. There was approximately 8% missing in each of the models, which still provided adequate statistical power to detect the effects of interest; therefore, we do not believe this had any practical effect on the outcome [30–32]. All data analyses were conducted using SAS version 9.4 (Cary, NC).

Qualitative analysis At the end of the HQoL survey, participants were given a free-response area, which followed the question: "Do you have any additional comments about your 9/11 experiences and health?" Content analysis, a systematic classification process of coding and identifying themes or patterns [33], was used to analyze these data using Microsoft Excel. Two team members (LMG and HKM) independently iteratively reviewed the data for themes and subthemes until meaningful patterns emerged. Recurrent themes were identified, and common themes were grouped together into categories. Discrepancies in coding were discussed and resolved by the two coders. A high level of interrater reliability was achieved after several rounds of discussion ($\kappa > 0.90$; $p < 0.01$). Quotes were used to illustrate final themes. Coders were blinded to participant injury status until all thematic coding was completed. Themes were then compared between participants with and without injuries.

Results

Quantitative results

Study population characteristics

Of the 2821 enrollees in this study, the largest proportions were male (56.3%), aged 45–64 years at the time of HQoL study (59.6%), non-Hispanic white (74.5%), had household incomes between \$75,000 to $\geq$ \$150,000 (34.8%), employed (63.3%), and married or living with a partner (68.3%) at W4 (Table 1). Just over one-third had ever had 9/11-related PTSD and 40.5% reported at least one chronic health condition. For the WTC exposures, over half witnessed three or more traumatic events, 44.8% were caught in the dust cloud, and 23.5% were RRW. Those who were male, 45–64 years of age, Hispanic, had an income of less than \$25,000, unemployed due to health, or divorced/separated were more likely to have been injured as were those who ever had 9/11-related PTSD, had at least one chronic health condition, witnessed 0–2 horrific events, were exposed to the dust cloud, or were RRW.

Table 1 Sociodemographic characteristics, mental and physical health, and World Trade Center (WTC) exposures by injury status among participants in the Health and Quality of Life 15 years after 9/11 study

	Total <i>N</i> (%) ^a	Injured <i>N</i> (%)	Non-injured <i>N</i> (%)	<i>p</i> value
Total	2821 (100)	1003 (35.6)	1818 (64.4)	
Gender				0.0001
Male	1589 (56.3)	614 (38.6)	975 (61.4)	
Female	1232 (43.7)	389 (31.6)	843 (68.4)	
Age (at HQoL survey)				< 0.0001
65 +	822 (29.1)	265 (32.2)	557 (67.8)	
45–64	1682 (59.6)	670 (39.8)	1012 (60.2)	
30–44	317 (11.2)	68 (21.5)	249 (78.6)	
Race/ethnicity				0.0011
White Non-Hispanic	2101 (74.5)	715 (34.0)	1386 (66.0)	
Black Non-Hispanic	267 (9.5)	112 (42.0)	155 (58.1)	
Hispanic	267 (9.5)	117 (43.8)	150 (56.2)	
Asian/other	186 (6.6)	59 (31.7)	127 (68.3)	
Income (W4)				< 0.0001
> 150K	883 (33.1)	236 (26.7)	647 (73.3)	
75K–< 150K	929 (34.8)	319 (34.3)	610 (65.7)	
50K–< 75K	366 (13.7)	134 (36.6)	232 (63.4)	
25K–< 50K	291 (10.9)	138 (47.4)	153 (52.6)	
< 25K	198 (7.4)	112 (56.6)	86 (43.4)	
Employment status				< 0.0001
Employed	1764 (63.0)	520 (29.5)	1244 (70.5)	
Unemployed—health	212 (7.6)	162 (76.4)	50 (23.6)	
Unemployed—others	826 (29.5)	310 (37.5)	516 (62.5)	
Marital status (W4)				< 0.0001
Married or living with partner	1909 (68.3)	624 (32.7)	1285 (67.3)	
Divorced or separated	360 (12.9)	182 (50.6)	178 (49.4)	
Widowed	106 (3.8)	50 (47.2)	56 (52.8)	
Never married	419 (15)	128 (30.6)	291 (69.5)	
9/11-related PTSD				< 0.0001
Ever	1008 (36.1)	650 (64.5)	358 (35.5)	
Never	1785 (63.9)	345 (19.3)	1440 (80.7)	
Chronic health conditions				< 0.0001
0	1679 (59.5)	434 (25.9)	1245 (74.2)	
1 +	1142 (40.5)	569 (49.8)	573 (50.2)	
WTC exposure				
Witness traumatic events				< 0.0001
0–2	1380 (48.9)	761 (55.1)	619 (44.9)	
3–5	1441 (51.1)	242 (16.8)	1199 (83.2)	
Dust				< 0.0001
No	1556 (55.2)	232 (14.9)	1324 (85.1)	
Yes	1265 (44.8)	771 (61)	494 (39.1)	
RRW				< 0.0001
No	2157 (76.5)	580 (26.9)	1577 (73.1)	
Yes	664 (23.5)	423 (63.7)	241 (36.3)	

^aMissing data: Income *n* = 154; Employment status *n* = 19; Marital status *n* = 27; 9/11-related PTSD *n* = 28**Quality of life**

Overall, 16.1% of respondents reported being dissatisfied/very dissatisfied with life and 16.8% reported having ≥ 14

limited activities days. Enrollees who were 45–64 years of age, Hispanic, had a household income of < \$25,000, unemployed due to health, divorced or separated, ever had 9/11-related PTSD, had a least one chronic health

condition, witnessed $\geq$ three traumatic events on 9/11, were caught in the dust cloud on 9/11, or were injured on 9/11 had a higher prevalence of reporting being dissatisfied/very dissatisfied with life and having $\geq$ 14 limited activity days (Table 2). In addition, having been a RRW was associated with greater limited activity days but not life satisfaction. The magnitude of the effect sizes for most of these associations was small to medium (Table 2).

In the logistic regression analyses, after adjusting for covariates—women (vs. men), 45–64 years of age (vs. 65 years or older), divorced or separated (vs. married or living with a partner), and unemployed due to health (vs. employed)—were more likely to report being dissatisfied/very dissatisfied with life (Table 3). There was a dose–response relationship between household income and life satisfaction—the lower the income the more likely enrollees were to report being dissatisfied/very dissatisfied with life (trend test $p < 0.01$). Those who were injured on 9/11 were 50% more likely to report being dissatisfied/very dissatisfied with life compared with those who were not injured (AOR: 1.5, 95% CI 1.1–2.0). Compared with those who never had 9/11-related PTSD, those who had ever had 9/11-related PTSD were 4.1 times more likely to report being dissatisfied/very dissatisfied (AOR: 4.1, 95% CI 3.1–5.4). RRWs were less likely to report being dissatisfied/very dissatisfied with life (AOR: 0.7, 95% CI 0.5–0.9). Similar patterns of associations with $\geq$ 14 limited activity days were observed, including a dose–response relationship between income and reporting $\geq$ 14 limited activity days. Those who were injured on 9/11 were 40% more likely to report $\geq$ 14 limited activity days compared with those who were not injured (AOR: 1.4, 95% CI 1.0–1.9).

Among those who were injured, 45.0% reported that their injury completely prevented them from working at some point after 9/11, and 13.7% reported that their injury partially restricted their ability to work at some point after 9/11 (Table 4). Almost two-thirds were categorized as severely injured. In adjusted analyses, those who reported that their injury completely prevented them from working were 3.3 times more likely to report being dissatisfied/very dissatisfied with life (95% CI 2.2–5.0) and 3.7 times more likely to report $\geq$ 14 limited activity days (95% CI 2.4–5.6) compared with those who reported no work restrictions because of their injury. Those who reported that their injury partially restricted them from working were 1.6 times more likely to report being dissatisfied/very dissatisfied with life (95% CI 0.9–2.9) and 2.0 times more likely to report $\geq$ 14 limited activity days (95% CI 1.1–3.5) compared with those who reported no work restrictions because of their injury. There was no significant associations between injury severity and either reporting being dissatisfied/very dissatisfied with life or $\geq$ 14 limited activity days.

Qualitative results

Of the 2821 enrollees who completed the study survey, 884 (31.3%) wrote responses in the free-response section. Of these, 451 (51.0%) were injured on 9/11 and 433 (49.0%) were not (Table 5). Thematic analysis yielded nine themes: (1) anger/lack of recognition or appreciation, (2) health issues/cancer/breathing issues, (3) emotional trauma/depressed/anxious, (4) financial/health care access issues, (5) gratitude to investigators, (6) worry/life disrupted, (7) substance use/abuse, (8) moved on, and (9) not impacted.

Thematic analysis

For both injured and non-injured respondents, the most common theme that emerged was emotional trauma/depressed/anxious. One enrollee wrote how after 9/11, “I find myself more emotional and nervous.” Another enrollee wrote of personal and loved ones’ emotional trauma, “The mental effects of 9/11 have worsened over time for me and my family.” Other enrollees wrote of avoiding the subject of 9/11, “I still get emotional when I think about 9/11... It’s been so many years and yet I can’t always talk about it.” A high number also reported health issues/cancer/breathing problems, with comments like, “[I] recently developed stomach cancer despite a healthy lifestyle. No cancer [history] in family. One of my doctors feels that it could [be] related to 9/11.” Others wrote about chronic health issues since 9/11, “Within 3 months of the event, I found it difficult to walk up the 3 flights of stairs to our home and had rashes. All these years later those conditions continue.” Comments around health and healthcare were also seen within the financial/healthcare access issues theme. For example, one enrollee wrote, “I was very disappointed that there was no compensation for [PTSD] which I am experiencing daily.” Another enrollee wrote of financial hardship, “[I am] financially not as successful [its] more of a struggle to maintain employment and normal life.”

To a lesser extent, enrollees expressed worry/life disrupted, especially a fear of the future: “Yes I am constantly concerned about getting some kind of cancer from 9/11 because I have lost about 6 fireman friends to post 9/11 cancers.” Some expressed anger or a lack of appreciation. One RRW wrote, “I wish it never happened - it ruined my life.... I never got any recognition or appreciation for what I did on 9/11 and for the next 6 years at ground zero.”

A smaller number wrote on the theme of substance use/abuse: “I took up daily marijuana use, a small amount, each evening. I had done this from time to time earlier in my life. After 9–11, it became daily. It works for me and doesn’t impact my professional life. It has some impact on my personal life—wife disapproves of daily intake.”

Table 2 Sociodemographic characteristics, mental and physical health, and World Trade Center (WTC) exposures by life satisfaction and limited activity days among participants in the Health and Quality of Life 15 years after 9/11 study

	Life satisfaction			Limited activity days		
	Very satisfied/satisfied	Very dissatisfied/ dissatisfied	Effect size	< 14 days	≥ 14 days	Effect size
	<i>N</i> (%)	<i>N</i> (%)	<i>V</i> or <i>φ</i>	<i>N</i> (%)	<i>N</i> (%)	<i>V</i> or <i>φ</i>
Total	2352 (83.9)	450 (16.1)		2314 (83.2)	468 (16.8)	
Gender						
Male	1333 (84.4)	246 (15.6)	0.01	1315 (84.0)	251 (16.0)	0.02
Female	1019 (83.3)	204 (16.7)		999 (82.2)	217 (17.9)	
Age (at HQoL survey)						
65+	711 (87.4)	103 (12.7)	0.09	676 (83.8)	131 (16.2)	0.10
45-64	1359 (81.3)	312 (18.7)		1348 (81.1)	314 (18.9)	
30-44	282 (89.0)	35 (11.0)		290 (92.7)	23 (7.4)	
Race/ethnicity						
White Non-Hispanic	1792 (85.7)	299 (14.3)	0.08	1751 (84.2)	328 (15.8)	0.07
Black Non-Hispanic	205 (78.2)	57 (21.8)		211 (81.2)	49 (18.9)	
Hispanic	204 (77.6)	59 (22.4)		196 (75.4)	64 (24.6)	
Asian/Other	151 (81.2)	35 (18.8)		156 (85.3)	27 (14.8)	
Income (W4)						
> 150K	817 (92.8)	63 (7.2)	0.29	813 (93.3)	58 (6.7)	0.28
75K-< 150K	809 (87.6)	115 (12.5)		783 (85.2)	136 (14.8)	
50K-< 75K	287 (79.1)	76 (20.9)		284 (78.0)	80 (22.0)	
25K-< 50K	198 (68.8)	90 (31.3)		199 (69.6)	87 (30.4)	
< 25K	112 (57.4)	83 (42.6)		106 (55.8)	84 (44.2)	
Employment status						
Employed	1542 (87.9)	213 (12.1)	0.29	1565 (89.7)	179 (10.3)	0.40
Unemployed—health	96 (46.2)	112 (53.9)		66 (31.6)	143 (68.4)	
Unemployed—others	699 (85.2)	121 (14.8)		668 (82.5)	142 (17.5)	
Marital status (W4)						
Married/living with partner	1663 (87.5)	238 (12.5)	0.16	1618 (85.9)	265 (14.1)	0.13
Divorced or separated	250 (70.8)	103 (29.2)		254 (71.4)	102 (28.7)	
Widowed	87 (82.9)	18 (17.1)		83 (79.8)	21 (20.2)	
Never married	333 (79.9)	84 (20.1)		343 (83.1)	70 (16.9)	
9/11-related PTSD						
Never	1660 (93.4)	118 (6.6)	0.35	1652 (93.5)	114 (6.5)	0.37
Ever	667 (66.9)	330 (33.1)		640 (64.7)	350 (35.4)	
Chronic health conditions						
0	1478 (88.4)	194 (11.6)	0.15	1489 (90.0)	166 (10.0)	0.22
1+	874 (77.4)	256 (22.7)		825 (73.2)	302 (26.8)	
WTC exposure						
Witness traumatic events						
0-2	1269 (88.7)	162 (11.3)	0.13	1255 (88.2)	168 (11.8)	0.14
3-5	1083 (79.0)	288 (21.0)		1059 (77.9)	300 (22.1)	
Dust						
No	1370 (88.6)	176 (11.4)	0.14	1376 (89.6)	160 (10.4)	0.19
Yes	982 (78.2)	274 (21.8)		938 (75.3)	308 (24.7)	
RRW						
No	1811 (84.5)	333 (15.5)	0.03	1810 (85.1)	317 (14.9)	0.09
Yes	541 (82.2)	117 (17.8)		504 (77.0)	151 (23.1)	
Injury						

Table 2 (continued)

	Life satisfaction			Limited activity days		
	Very satisfied/satisfied	Very dissatisfied/dissatisfied	Effect size	< 14 days	≥ 14 days	Effect size
	<i>N</i> (%)	<i>N</i> (%)	<i>V</i> or ϕ	<i>N</i> (%)	<i>N</i> (%)	<i>V</i> or ϕ
No	1634 (90.3)	176 (9.7)	0.23	1626 (90.6)	168 (9.4)	0.27
Yes	718 (72.4)	274 (27.6)		688 (69.6)	300 (30.4)	

Shaded cells are significant $p < 0.05$

The theme of having moved on also emerged: “I moved on very quickly from 9/11, probably just weeks after.” Some respondents wrote about not being impacted at all: “It never really changed me...”

Theme frequencies by injury status

Five of the nine themes were endorsed by similar proportions of injured and non-injured enrollees: health issues/cancer/breathing issues, emotional trauma/depressed/anxious, financial/health care access issues, gratitude to investigators, and worry/life disrupted (Table 5). Of those who reported on the theme of anger/lack of recognition/appreciation 62.9% were injured compared to 37.1% who were not injured. Those who reported on the theme of substance use/abuse 81.8% were injured compared to 18.2% for non-injured. Conversely, for the theme of “moved on”, 85.7% were not injured, while 14.3% were injured and for “not impacted”, 80.0% who reported this theme were not injured compared to 20.0% who were injured.

Discussion

Our two complementary analyses represent a longer-term, in-depth description of two aspects of QoL among both injured and non-injured persons exposed to the events of 9/11 in NYC, and support and deepen previous findings [20]. Specifically, we found that more than 15 years after the WTC attacks, those who were injured on 9/11 reported significantly diminished life satisfaction and more limited activity days, even after controlling for other factors such as PTSD, chronic health conditions, and unemployment due to health reasons. In addition, those whose injuries resulted in complete or partial restriction of work reported even lower life satisfaction and more limited activity days. Furthermore, a descriptive analysis of free-text responses demonstrated the depth of the psychological and physical consequences of 9/11 among those who both were injured and not injured 15 years after the event.

The long-term relationship between injury and QoL also has been documented in other populations. Combat-related

injuries have been shown to be associated with lower health-related QoL [34–37]. These studies examined specific and very severe injuries, including traumatic brain injury [34], amputation [35], and spinal cord injury [36]. However, one study of veterans with mild to severe bodily injuries found that injury was associated with lower health-related QoL up to 5 years after the injury [37]. Aside from studies of veterans, a study of Danish adults found that, compared with non-injured, injured participants had lower self-reported general health up to 10 years after the injury [14]. Further, a study of persons aged 65 years or older who were hospitalized for an injury found that, compared to age-adjusted norms, there was a significant decrement in seven of the eight SF-36 domains among those who were injured, including physical functioning, role-physical and role-emotional functioning, social functioning, mental health, vitality, and general health [38].

We did not find an association between injury severity and life satisfaction or limited activity days. Previous research on the relationship between injury severity and different QoL measures is mixed. Although several studies found that injury severity was unrelated to QoL [39, 40], one study of military personnel found that those with minor injuries had the highest health-related QoL, whereas those with the most severe injuries had the lowest health-related QoL [37]. One potential explanation is that each of these studies, including ours, have used different definitions of QoL. However, we did find that, among those who were injured, being partially or completely prevented from working due to the injury was associated with greater likelihood of being dissatisfied with life and ≥ 14 limited activity days compared with those whose ability to work was not affected. This is consistent with previous research showing that the ability to work is strongly associated with QoL after injury using various measures of QoL including health-related QoL and SF-36 [41–43]. These findings were supported by qualitative analysis of the free-response section with financial issues being one of the most commonly mentioned themes, especially among the injured. There was a high correlation in this study between injury severity and ability to work ($p < 0.0001$, data not shown). Despite this, only ability to work was associated with the outcomes in adjusted models.

Table 3 Adjusted odds ratios (AOR) for life dissatisfaction and ≥ 14 limited activity days

	Life dissatisfaction* (n = 2602)	≥ 14 limited activity days** (n = 2584)
	AOR (95% CI)	AOR (95% CI)
Gender		
Male	Ref.	Ref.
Female	1.3 (1.0, 1.8)	1.1 (0.9, 1.5)
Age (at HQoL survey)		
65+	Ref.	Ref.
45–64	1.8 (1.3, 2.5)	1.3 (0.9, 1.7)
30–44	1.2 (0.8, 2.1)	0.7 (0.4, 1.3)
Race/ethnicity		
White Non-Hispanic	Ref.	Ref.
Black Non-Hispanic	0.9 (0.6, 1.3)	0.6 (0.4, 1.0)
Hispanic	0.9 (0.6, 1.3)	1.0 (0.7, 1.4)
Asian/other	1.2 (0.7, 1.8)	0.8 (0.5, 1.3)
Income (W4)		
> 150K	Ref.	Ref.
75K–< 150K	1.4 (1.0, 2.0)	1.6 (1.2, 2.4)
50K–< 75K	2.2 (1.5, 3.4)	2.4 (1.5, 3.6)
25K–< 50K	2.9 (1.9, 4.5)	2.3 (1.5, 3.6)
< 25K	4.1 (2.5, 6.7)	4.1 (2.5, 6.8)
Employment status		
Employed	Ref.	Ref.
Unemployed—health	3.0 (2.1, 4.4)	6.1 (4.1, 9.0)
Unemployed—others	1.0 (0.8, 1.4)	1.3 (1.0, 1.8)
Marital status (W4)		
Married or living with partner	Ref.	Ref.
Divorced or separated	1.7 (1.3, 2.4)	1.4 (1.0, 2.0)
Widowed	1.1 (0.6, 2.0)	1.0 (0.6, 1.8)
Never married	1.2 (0.9, 1.8)	0.9 (0.6, 1.3)
9/11-related PTSD		
Never	Ref.	Ref.
Ever	4.1 (3.1, 5.4)	3.6 (2.7, 4.8)
Chronic health conditions		
0	Ref.	Ref.
1+	1.2 (0.9, 1.5)	1.8 (1.4, 2.3)
WTC exposure		
Witness traumatic events		
0–2	Ref.	Ref.
3–5	1.0 (0.7, 1.3)	1.1 (0.8, 1.5)
Dust		
No	Ref.	Ref.
Yes	1.1 (0.8, 1.4)	1.3 (1.0, 1.7)
RRW		
No	Ref.	Ref.
Yes	0.7 (0.5, 0.9)	1.0 (0.8, 1.4)
Injury		
No	Ref.	Ref.
Yes	1.5 (1.1, 2.0)	1.4 (1.0, 1.9)

*Adjusted for age at HQoL, race/ethnicity, income, employment status, marital status, 9/11-related PTSD, chronic health conditions, witnessing traumatic events, dust, and injury

**Adjusted for age at HQoL, race/ethnicity, income, employment sta-

Table 3 (continued)

tus, marital status, 9/11-related PTSD, chronic health conditions, witnessing traumatic events, dust, RRW, and injury

A potential explanation is that working full- or part-time bet-

Table 4 Adjusted odds ratios of life dissatisfaction and ≥ 14 limited activity days among injured

	Total	Life dissatisfaction* (n = 874)	≥ 14 limited activity days** (n = 871)
	N (%)	AOR (95% CI)	AOR (95% CI)
Injury preventing or restricting work*			
Not at all	399 (41.4)	Ref.	Ref.
Partially restricted	132 (13.7)	1.6 (0.9, 2.9)	2.0 (1.1, 3.5)
Completely prevented	434 (45.0)	3.3 (2.2, 5.0)	3.7 (2.4, 5.6)
Injury severity*			
Low	110 (11.7)	Ref.	Ref.
Moderate	237 (25.2)	1.3 (0.7, 2.6)	1.4 (0.7, 2.8)
Severe	593 (63.1)	1.4 (0.7, 2.6)	1.4 (0.8, 2.6)

*Run in separate models for each of the two outcomes (four models total)

*Adjusted for age at HQoL, race/ethnicity, income, employment status, marital status, 9/11-related PTSD, chronic health conditions, witnessing traumatic events, dust, and injury

**Adjusted for age at HQoL, race/ethnicity, income, employment status, marital status, 9/11-related PTSD, chronic health conditions, witnessing traumatic events, dust, RRW, and injury

Table 5 Free-text free response themes by frequency

	Injured N (%)	Non-injured N (%)
Total	451 (51.0)	433 (49.0)
Themes		
Anger/lack of recognition/appreciation	22 (62.9)	13 (37.1)
Health issues/cancer/breathing issues	132 (53.0)	117 (47.0)
Emotional trauma/depressed/anxious	136 (50.2)	135 (49.8)
Financial/health care access issues	36 (58.1)	26 (41.9)
Gratitude to investigators	80 (47.6)	88 (52.4)
Worry/life disrupted	31 (54.4)	26 (45.6)
Substance use/abuse	9 (81.8)	2 (18.2)
Moved on	3 (14.3)	18 (85.7)
Not impacted	2 (20.0)	8 (80.0)

Row %

ter meets a variety of needs (e.g., physiological, emotional, financial and social) [44] and provides the ability to be active in the community [43].

The descriptive analysis of the free-response section of the survey revealed a similar narrative of lower life satisfaction and more limited activity days among those who were injured on 9/11 compared with those not injured. Similar to another qualitative study conducted on persons injured on 9/11 [20], themes around poor ongoing mental and physical health, adverse economic impacts, and substance use emerged. However, regardless of injury, the survivors in our study reported that they struggled with the lasting impact of 9/11 on their physical and mental health. Similar to findings from a study comparing injured and non-injured survivors of The Station nightclub fire [45], the injury sustained on 9/11 was not the primary focus of the free text responses of those who were injured. Rather, the focus was mostly on emotional issues, health problems, and difficulties faced. These findings demonstrate the critical need for long-term follow-up of disaster survivors, regardless of injury status.

Proper treatment may be important, not only for the injury itself, but also for any long-term health effects of the injury. MacKenzie et al. compared adult patients with at least one lower-limb injury in hospitals with a level-I trauma center to those in a hospital without a trauma center and found that those in care at a trauma center had greater improvements in physical functioning and overall vitality at 1 year after the injury compared to those in care without a trauma center [46]. In addition, the known association between injury and mental health conditions [19, 35] and the current study's qualitative findings indicate that identification and treatment of mental health conditions early in the rehabilitation process may not only improve the mental health of injured individuals but also improve their QoL.

Limitations

The findings of this study are subject to several limitations. First, selection bias may be a concern because participants in the HQoL survey had to have completed all previous WTCNR survey waves. However, a previous study showed that, although those with PTSD symptoms were slightly less likely to continue to participate than those without, the degree of exposure to the WTC attacks, including sustaining an injury on 9/11, was not associated with participation over time [47]. Second, although we asked about treatment received after the injury, we lacked clinical information on treatment (e.g., type and duration of medication) that could have been included in the severity scale. Third, we did not have information on the length of time the person was out of work due to injury, which could have provided a more detailed analysis of the relationship between ability to work and the outcomes of interest. Fourth, we did not collect information on current disability status, which has been shown to be an important mediator between injury and QoL [48]. The analyses can therefore not differentiate whether

observed relationships are, for example, due to the trauma/injury in 2001 or due to current physical health problems, which might have their (partial) origin in the injury sustained in 2001. Fifth, the exclusion of those with inconsistent responses to being injured, while potentially reducing recall bias, may have biased the sample toward those with more severe injuries. Those who said they were injured at W1 were more likely to report that they were not injured on 9/11 in the HQoL survey compared with those who said they were not injured on 9/11 at W1. Among those at W1 who reported they were injured on 9/11, those with more severe or several injuries were less likely to have discrepant reports compared with those with more superficial injuries or just one injury type, respectively. Finally, participants who contributed to the free-response section did not differ statistically from those who did not by injury status, the main independent variable of interest, but did by sex, age, and income ($p < 0.01$). Also, among the injured, free-text respondents differed by sex and race/ethnicity ($p < 0.05$). These differences could limit the generalizability of the findings, although this is not the purpose of qualitative findings [49].

Conclusions

The use of quantitative and qualitative analysis provided a more nuanced picture of the long-term effects of being injured on 9/11. Early treatment for disaster-related injuries, as well as identification and treatment of co-morbid mental health conditions, may improve long-term QoL-related outcomes.

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The World Trade Center Disaster and the Health of Workers: Five-Year Assessment of a Unique Medical Screening Program

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BACKGROUND: Approximately 40,000 rescue and recovery workers were exposed to caustic dust and toxic pollutants following the 11 September 2001 attacks on the World Trade Center (WTC). These workers included traditional first responders, such as firefighters and police, and a diverse population of construction, utility, and public sector workers.

METHODS: To characterize WTC-related health effects, the WTC Worker and Volunteer Medical Screening Program was established. This multicenter clinical program provides free standardized examinations to responders. Examinations include medical, mental health, and exposure assessment questionnaires; physical examinations; spirometry; and chest X rays.

RESULTS: Of 9,442 responders examined between July 2002 and April 2004, 69% reported new or worsened respiratory symptoms while performing WTC work. Symptoms persisted to the time of examination in 59% of these workers. Among those who had been asymptomatic before September 11, 61% developed respiratory symptoms while performing WTC work. Twenty-eight percent had abnormal spirometry; forced vital capacity (FVC) was low in 21%; and obstruction was present in 5%. Among nonsmokers, 27% had abnormal spirometry compared with 13% in the general U.S. population. Prevalence of low FVC among nonsmokers was 5-fold greater than in the U.S. population (20% vs. 4%). Respiratory symptoms and spirometry abnormalities were significantly associated with early arrival at the site.

CONCLUSION: WTC responders had exposure-related increases in respiratory symptoms and pulmonary function test abnormalities that persisted up to 2.5 years after the attacks. Long-term medical monitoring is required to track persistence of these abnormalities and identify late effects, including possible malignancies. Lessons learned should guide future responses to civil disasters.

KEY WORDS: air pollution, disaster response, occupational lung disease, pulmonary function, September 11, spirometry, World Trade Center. *Environ Health Perspect* 114:1853–1858 (2006). doi:10.1289/ehp.9592 available via <http://dx.doi.org/> [Online 6 September 2006]

An estimated 40,000 men and women worked at Ground Zero, the former site of the World Trade Center (WTC) in New York City, and at the Staten Island landfill, the principal wreckage depository in the days, weeks, and months after 11 September 2001 (Levin et al. 2004). These workers and volunteers included traditional first responders such as firefighters, law enforcement officers, and paramedics, as well as a diverse population of operating engineers, laborers, ironworkers, railway tunnel cleaners, telecommunications workers, sanitation workers, and staff of the Office of the Chief Medical Examiner. These men and women carried out rescue-and-recovery operations, restored essential services, cleaned up massive amounts of debris, and in a time period far shorter than anticipated, deconstructed and removed remains of buildings. Many had no training in response to civil disaster. The highly diverse nature of this workforce posed unprecedented challenges for worker protection and medical follow-up.

Workers were exposed to a complex mix of toxic chemicals and to extreme psychological trauma. These exposures varied over time and by location (Landrigan et al. 2004; Liroy et al. 2002). Combustion of 90,000 L of jet fuel immediately after the attacks created a dense plume of black smoke containing volatile organic compounds (including benzene), metals, and polycyclic aromatic hydrocarbons. The collapse of the twin towers (WTC 1 and WTC 2) and then of a third building (WTC 7) produced an enormous dust cloud containing thousands of tons of coarse and fine particulate matter (PM), cement dust, glass fibers, asbestos, lead, hydrochloric acid, polychlorinated biphenyls (PCBs), organochlorine pesticides, and polychlorinated dioxins and furans (Clark et al. 2003; Landrigan et al. 2004; Liroy et al. 2002; McGee et al. 2003). U.S. Environmental Protection Agency (EPA) estimates of airborne dust ranged from 1,000 to > 100,000 µg/m³ (U.S. EPA 2002). The high

content of pulverized cement made the dust highly caustic (pH 10–11) (Landrigan et al. 2004; Liroy et al. 2002).

Dust and debris gradually settled, and rains on 14 September further diminished the intensity of outdoor ambient dust exposure. However, rubble-removal operations repeatedly re-aerosolized the dust, leading to continuing intermittent exposure for many months. Fires burned both above and below ground until December 2001 (Banauch et al. 2003; Chen and Thurston 2002; U.S. EPA 2003). Air levels of certain contaminants remained elevated well into 2002, with spikes in benzene and asbestos levels occurring as late as March and May 2002, respectively (U.S. EPA 2003).

Workers began noting symptoms soon after September 11, most commonly involving the aerodigestive tract (upper and lower respiratory tract and esophagus) (Banauch et al. 2006; Salzman et al. 2004; Szeinuk et al. 2003). New York City Fire Department (FDNY) firefighters experienced persistent cough, termed the “World Trade Center

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cough," which was accompanied by respiratory distress and bronchial hyperreactivity (Prezant et al. 2002). A sample of FDNY firefighters who had sustained extreme exposures on September 11 was nearly 8 times more likely to manifest bronchial hyperreactivity than firefighters with lower exposures when examined after 6 months (Banauch et al. 2003). Laborers and ironworkers manifested new-onset cough, wheeze, and sputum production (Geyh et al. 2005; Sldoot et al. 2004), likely attributable to respiratory inflammation caused by the highly alkaline dust (Chen and Thurston 2002).

Other reported pulmonary effects included cough, asthma, and reactive airway dysfunction syndrome (Balmes 2006; Banauch et al. 2006). Chronic rhinosinusitis, vocal cord inflammation, and laryngitis (de la Hoz et al. 2004) and case reports of eosinophilic pneumonia (Rom et al. 2002), granulomatous pneumonia, and bronchiolitis obliterans (Mann et al. 2005; Safirstein et al. 2003) were also reported.

Although New York has an extensive hospital network and strong public health system, no existing infrastructure was sufficient for providing unified and appropriate occupational health screening and treatment in the aftermath of September 11. Local labor unions, who made up the majority of responders, became increasingly aware that their members were developing respiratory and psychological problems; they initiated a campaign to educate local elected officials about the importance of establishing an occupational health screening program. In early 2002, Congress directed the Centers for Disease Control and Prevention (CDC) to fund most of the WTC Worker and Volunteer Medical Screening Program (MSP), an action largely attributable to the collaborative efforts of organized labor and elected officials. The goals of the program were as follows:

- To rapidly build a regional and national consortium of occupational medicine clinics to conduct geographically convenient standardized medical evaluations
- To identify WTC responders, notify them about this program, and encourage participation
- To provide clinical examinations for eligible individuals to identify WTC-related physical and/or mental health conditions
- To coordinate referral for follow-up clinical care for affected individuals
- To educate workers and volunteers about exposures and associated risks to their health
- To advise affected individuals about available benefit and entitlement programs
- To establish "baseline" clinical status for individuals exposed at or near Ground Zero for comparison with future clinical assessments.

In April 2002, the Irving J. Selikoff Center for Occupational and Environmental Medicine (COEM) at Mount Sinai was

awarded a contract by the National Institute for Occupational Safety and Health (NIOSH) to establish and coordinate the MSP. The Bellevue/New York University Occupational and Environmental Medicine Clinic, the State University of New York Stony Brook/Long Island Occupational and Environmental Health Center, the Center for the Biology of Natural Systems at Queens College in New York, and the Clinical Center of the Environmental & Occupational Health Sciences Institute at UMDNJ-Robert Wood Johnson Medical School in New Jersey were designated as the other members of the regional consortium. The Association of Occupational and Environmental Clinics was designated to coordinate a national examination program for responders who did not live in the New York/New Jersey area.

In this article we describe the design and implementation of the MSP and the prevalence of selected clinical findings from screening examinations conducted between July 2002 and April 2004 in those from whom informed consent and HIPAA (Health Insurance Portability and Accountability Act 1996) authorization were obtained. Mental health service provision and findings will be presented in a separate paper.

Materials and Methods

Establishing the cohort: identification and outreach. The target population was approximately 18,000 WTC responders not eligible to participate in other federally funded programs (e.g., FDNY, federal workers, New York State workers). Because responders came from many sectors, a high proportion as unpaid volunteers, no systematic roster of names and contact information was available. An MSP outreach unit was therefore established and staffed by people experienced in occupational health and familiar with key organizations, primarily labor unions representing responders.

The MSP executive steering committee. To ensure key stakeholder input into all aspects of program development and oversight, an executive steering committee (ESC) was established; the ESC included representatives from each of the consortium clinics, representatives from labor unions, employers, and technical experts from relevant fields.

The ESC advised the program directors on all program decisions and on basic components of the medical examination, eligibility criteria, and the outreach plan. An advisory council of > 100 people was created several months after the start of the program to broaden stakeholder involvement and to tap into the enthusiasm and creativity of responder organizations. Generally 40–50 responder representatives attended quarterly advisory council meetings. The ESC and advisory council helped maintain open lines of communication

with representatives of the program's diverse responder population.

Examination eligibility. To be eligible to receive an examination, a responder must have fallen into one of two categories: For the first category, the responder must have been a rescue, recovery, debris-cleanup and related support services worker, or volunteer in *a*) lower Manhattan (south of Canal St.), *b*) the Staten Island Landfill, and/or *c*) the barge loading piers, and must have worked and/or volunteered on-site for 4 hr on 11–14 September 2001, for at least 24 hr during the month of September, or for at least 80 hr during the months of September, October, November, and December combined.

To fall into the second category, the responder must have been an employee of the Office of the Chief Medical Examiner (OCME), involved in the examination and processing of human remains, or other morgue worker who performed similar post-September 11 functions for OCME staff; a worker in the Port Authority Trans-Hudson Corporation tunnel through 1 July 2002 for a minimum of 24 hr; or a vehicle-maintenance worker with post-September 11 functions within the requisite timeframes and exposed to WTC debris while retrieving, driving, cleaning, repairing, and maintaining contaminated vehicles.

Development of the examination protocol. The clinical consortium partners, supplemented by experts in psychiatry, pulmonary medicine, otolaryngology, industrial hygiene, and epidemiology, collaborated in protocol development to provide high quality standardized occupational health screening examinations and gather information for a research database to enable scientific assessment of the full health impact of the disaster. Early in protocol planning it was decided that direct clinical services had priority where clinical protocols conflicted with collection of research data.

Standardized medical examination. Responders received a clinical screening evaluation consisting of medical, mental health, and exposure-assessment questionnaires; a standardized physical examination; and pre- and postbronchodilator spirometry, complete blood count, blood chemistries, urinalysis, and chest radiograph. Participants received both immediate and final letters with examination results and a face-to-face physician consultation at the end of the examination day. Participants were provided referrals for evaluation and treatment for physical or mental health conditions identified in the screening examination.

A trained health care practitioner administered a medical questionnaire on selected diagnoses and prior upper and lower respiratory conditions (e.g., chronic sinusitis and asthma),

occurrence of symptoms in the year before 11 September 2001, during the period the subject worked at the WTC site, for the month before the screening examination, and whether preexisting symptoms and diagnoses worsened during their WTC work. A questionnaire also asked about smoking history. Where possible, questions were adapted from standardized instruments (e.g., Burney et al. 1989; European Community Respiratory Health Survey 1994; Miller et al. 2005; National Center for Health Statistics 1996; NIOSH 2006; Piccirillo et al. 2002).

We used an interviewer-administered survey instrument to obtain pre- and post-September 11 occupational and environmental exposure histories, including dates that responders reported for first working or volunteering for September 11-related duties and, for those present on September 11, whether they were exposed to the cloud of dust from the building collapses. We constructed the ordinal date-related categories shown in the tables as a rough measure of relative dust exposures, and also categorized workers by location where they spent the majority of their time when first working at Ground Zero. We also obtained data on respirator type and use during the first week of the WTC recovery; those data will be reported in subsequent analyses.

Eligible responders were invited for clinical examinations irrespective of their willingness to provide consent to have data aggregated. Only data from responders providing institutional review board consent and HIPAA authorization (on or after 14 April 2003) are included in data analyses.

Spirometry. Spirometric examination employed the EasyOne spirometer (nidd Medical Technologies, Chelmsford, MA) using standard techniques (Miller et al. 2005). We compared spirometry results to age-, sex-, and ethnic-specific reference values derived from the third phase of the National Health and Nutrition Examination Survey (NHANES III) (Hankinson et al. 1999). Interpretation followed the recently combined American Thoracic Society and European Respiratory Society guidelines (Pellegrino et al. 2005). Only spirometry of acceptable quality, as defined by international guidelines (Miller et al. 2005), was included in the analysis ($n = 8,384$). Airway obstruction was defined as forced expiratory volume/forced vital capacity (FEV_1/FVC) below the lower limit of normal (LLN) with a normal FVC. Spirometry with $FVC < LLN$ but $FEV_1/FVC \geq LLN$ was categorized as "low FVC." Obstruction and low FVC was defined as $FEV_1/FVC < LLN$ and $FVC < LLN$. A significant bronchodilator response was defined as an increase in FEV_1 or FVC of $\geq 12\%$ and 200 mL. Comprehensive spirometry quality assurance was an integral aspect of this program.

Data analysis. We used SAS software (version 9.1; SAS Institute, Inc., Cary, NC) for all analyses. Categorization of occupational sector was based on the union and/or organization to which the responder reported belonging during work on the WTC effort. We categorized prevalence of specific health outcomes by date of arrival and exposure to the dust cloud and used the Cochran-Armitage trend test to assess significance of trends in prevalence across exposure categories.

Results

The MSP began examining responders in July 2002, 3 months after receipt of federal funding. Of the 16,528 responders meeting eligibility criteria, we examined 11,095 responders in the New York/New Jersey regional clinical consortium and 645 elsewhere between 16 July 2002 and 16 April 2004. In the New York/New Jersey consortium, 9,442 of these responders provided appropriate consent to be included in this report.

Demographics. The responders screened in this program were predominantly male (87%) and white (66%), with a median age of 42 years (range, 18–82 years) (Table 1). More than 92% lived in the tristate (New York, New Jersey, Connecticut) area, 54% from New York City and 15% on Long Island; 86% were union members; 34% were construction workers; and 29% worked in law enforcement. We conducted > 14% of the examinations in languages other than English.

Time of arrival and location. Of the > 40% of the responders who first arrived for work at the site on September 11, 49% reported having been engulfed in the building-collapse dust cloud (Table 1). Another 30% first arrived on 12 or 13 September. Irrespective of date of arrival, 35% of responders began working on the pile or in the pit at Ground Zero; another 55% worked adjacent to the pile; and the remaining 10% worked at other sites. The reported average duration of exposure (the time between the first and last days of work on the WTC effort) was 171 days (range, 1 day to ≥ 2.5 years). The average time between first work day and the MSP examination was 20 months.

Symptoms. Most of the 9,442 responders examined reported being asymptomatic in the year prior to September 11 for lower respiratory tract symptoms (85%), and a large majority (66%) were asymptomatic for upper respiratory tract symptoms (Table 2). In the previously asymptomatic group, 44% reported developing lower respiratory symptoms and 55% developed upper respiratory symptoms while engaged in WTC-related work. These new symptoms were persistent in many; at the time of exam, 32% reported current lower respiratory symptoms and 44% reported current upper respiratory symptoms (Table 2). Fully

69% of all responders reported having had at least one worsened or newly incident respiratory symptom while performing WTC response work (63% upper airway and 47% lower airway symptoms, with overlap between the groups) (Table 3). Respiratory symptoms persisted to the time of examination in 59% of the population.

Early arrival at the WTC site was significantly associated with an increased reported prevalence of both newly incident and worsened respiratory symptoms (Table 3). We observed the highest prevalence among those who arrived on September 11 and were exposed to the dust cloud (54% lower respiratory and 66% upper respiratory symptoms). Those who began work on September 11 but who were not directly exposed to the dust cloud had the next highest prevalence (47% lower respiratory and 62% upper respiratory

Table 1. Demographic and exposure characteristics of the WTC MSP study population ($n = 9,442$).

	No. (%)
Sex	
Male	8,186 (86.7)
Female	1,256 (13.3)
Race	
White	6,203 (65.7)
Black	1,060 (11.2)
Asian	121 (1.3)
Other	253 (2.7)
Unknown	1,805 (19.1)
Hispanic ethnicity	
Yes	2,249 (23.8)
Language of exam	
English	8,114 (85.9)
Spanish	984 (10.4)
Polish	311 (3.3)
Other	33 (0.3)
Union member	
Yes	8,075 (86.0)
Union/organization affiliation	
Construction	3,209 (34.0)
Law enforcement	2,776 (29.4)
Public sector (blue collar)	739 (7.8)
Technical and utilities	683 (7.2)
Transportation	516 (5.5)
Cleaning/maintenance	258 (2.7)
Volunteers	245 (2.6)
Firefighters*	138 (1.5)
Health care	83 (0.9)
News agencies	81 (0.9)
Office/administration/professional	50 (0.5)
Other	664 (7.0)
Time first began WTC-related work	
11 September 2001	3,812 (40.5)
In dust cloud	1,878 (20.0)
Not in dust cloud	1,934 (20.5)
12–13 September 2001	2,801 (29.8)
14–30 September 2001	2,133 (22.7)
On or after 1 October 2001	666 (7.1)
Location of majority of work	
On the pile/in the pit	3,215 (34.0)
Adjacent to pile/pit	5,074 (54.0)
Landfill	313 (3.4)
Barges/loading pier	106 (1.1)
OCME	77 (0.8)
Elsewhere south of Canal St.	466 (5.0)

*Does not include active-duty New York City firefighters.

symptoms). We found a continuing statistically significant downward trend (although the prevalence remained high) in the incidence of reported symptoms for later arrival dates. Even those responders who arrived at the site on or after 1 October had a 41% prevalence of lower respiratory symptoms, nearly three times the percentage who had reported lower respiratory symptoms in the year prior to September 11, and nearly twice of the percentage who reported prior upper respiratory symptoms.

Of the 8,384 participants with acceptable quality pulmonary function exams, 28% had abnormal prebronchodilator spirometry results (Table 4). A low FVC was the most common abnormality (21%), whereas obstruction occurred in 5% and a mixed pattern (obstruction and low FVC) in 2%. We also documented a significant response to bronchodilator in 910 (11%) of participants including 33% of those with obstruction, 56% with a mixed pattern, and 18% of those with a low FVC.

Compared with a U.S. general population sample of employed, adult, white males (Mannino et al. 2003), the 4,641 participants who had never smoked had a higher prevalence of abnormalities on spirometry (27% vs. 13%). The difference was mainly attributable to a higher prevalence of tests with a low FVC (20% vs. 4%).

We observed a statistically significant association between time of arrival and low FVC, with a higher prevalence of abnormality in those who arrived earlier (Table 5). There was no significant difference in the prevalence of obstruction based on onset of exposure.

Thirty-one percent of the sample reported having received medical care for WTC-related respiratory conditions. A total of 17% of examinees reported missing work because of WTC-related health problems. Of the 1,973 workers with a self-reported diagnosis of sinusitis, 40% were seen by a doctor for this condition during the 6 months after September 11, compared to only 13% in the 6 months before September 11. Similar

increases were reported in the numbers of responders who sought medical help for acute bronchitis (45% vs. 18%) and pneumonia (10% vs. 1%).

Discussion

Two principal lessons emerge from our experiences with the WTC MSP. First, the prevalence rates of respiratory and other symptoms, and the prevalence of pulmonary function abnormalities in the nearly 10,000 WTC workers and volunteers whom we examined clinically between 2002 and 2004 were very high, and they are persistent. Health effects were most frequent in responders who sustained the most intense exposures. In the aftermath of future civil disasters, hospitals and health care providers will need to anticipate and prepare for the severe health consequences that inevitably result from the extreme exposures sustained by workers in these situations.

Second, in the event of future disasters, it is likely that existing health care facilities and public health programs will not be sufficiently robust or flexible to deal with the special needs and complex health problems sustained by responders and victims. It will likely be necessary to establish large, multicenter medical follow-up programs such as were needed in New York. The more rapidly such programs can be established and funded, the more quickly essential services will be provided (Rosner and Markowitz 2006).

Abnormal spirometry was still evident in almost one-third of all WTC workers and volunteers 1–2.5 years after 11 September 2001. The most common spirometric abnormality seen was a low FVC, which had also been found in the first 1,138 participants from this group (Levin et al. 2004). Low FVC was about 5 times more prevalent among nonsmokers than expected in the general U.S. population, based on NHANES III data (Mannino et al. 2003). Prevalence of low

Table 2. Prevalence of lower and upper respiratory symptoms among the WTC MSP study population (*n* = 9,442).

	Reported symptoms in year before September 11 [no. (%)]	Did not report symptoms in year before September 11 New symptoms while working at WTC site [no. (%)]	Symptoms still present in month before exam [no. (%)]
Lower respiratory symptoms			
Dry cough	362 (3.9)	2,541 (28.3)	1,534 (17.1)
Cough with phlegm	325 (3.5)	1,183 (13.1)	742 (8.2)
Shortness of breath	344 (3.7)	1,477 (16.5)	1,266 (14.1)
Wheeze	557 (6.0)	1,232 (14.1)	749 (8.6)
Chest tightness	464 (5.1)	1,258 (14.6)	933 (10.8)
Any lower respiratory symptom	1,451 (15.4)	3,486 (43.8)	2,535 (31.9)
Upper respiratory symptoms			
Sinus-related ^a	2,169 (23.1)	2,219 (30.7)	1,863 (25.8)
Nasal-related ^b	1,967 (20.9)	3,254 (43.8)	2,536 (34.1)
Throat-related ^c	887 (9.4)	3,579 (42.0)	2,450 (28.8)
Any upper respiratory symptom	3,148 (33.5)	3,453 (55.2)	2,772 (44.3)
Any respiratory symptom	3,767 (40.0)	3,443 (61.0)	2,846 (50.4)

^aFacial pain or pressure, head or sinus congestion, or postnasal discharge. ^bBlowing your nose more than usual, stuffy nose, sneezing, runny nose, or irritation in nose. ^cThroat irritation, hoarseness, sore throat, or losing your voice (laryngitis).

Table 3. Prevalence of new or worsened respiratory symptoms among WTC workers by date of arrival for work at WTC site and by exposure to the dust cloud (*n* = 9,442).

	All responders (<i>n</i> = 9,442) [no. (%)]	Arrived on 11 September In dust cloud (<i>n</i> = 1,878) [no. (%)]	Not in dust cloud (<i>n</i> = 1,934) [no. (%)]	Arrived 12–13 September (<i>n</i> = 2,801) [no. (%)]	Arrived 14–30 September (<i>n</i> = 2,133) [no. (%)]	Arrived on or after 1 October (<i>n</i> = 666) [no. (%)]	Trend test <i>p</i> -value ^a
Lower respiratory symptoms							
Dry cough	2,688 (28.7)	640 (34.2)	587 (30.6)	777 (28.0)	538 (25.5)	140 (21.3)	< 0.001
Cough with phlegm	1,320 (14.1)	328 (17.6)	256 (13.4)	373 (13.5)	275 (13.0)	84 (12.7)	< 0.001
Shortness of breath	1,613 (17.3)	390 (20.9)	298 (15.6)	471 (17.1)	339 (16.1)	109 (16.6)	0.001
Wheeze	1,408 (15.1)	339 (18.3)	296 (15.5)	403 (14.6)	281 (13.4)	85 (13.0)	< 0.001
Chest tightness	1,393 (15.4)	334 (18.5)	268 (14.4)	384 (14.3)	311 (15.2)	91 (14.1)	0.003
Any lower respiratory symptom	4,371 (46.5)	1,017 (54.2)	912 (47.2)	1,232 (44.2)	930 (43.8)	271 (40.8)	< 0.001
Upper respiratory symptoms							
Sinus-related ^b	510 (37.3)	785 (41.9)	712 (36.9)	1,020 (36.6)	783 (37.0)	200 (30.1)	< 0.001
Nasal-related ^c	4,552 (48.4)	982 (52.4)	939 (48.6)	1,334 (47.9)	981 (46.3)	300 (45.1)	< 0.001
Throat-related ^d	4,128 (43.9)	885 (47.2)	847 (43.9)	1,199 (43.1)	923 (43.6)	264 (39.7)	0.001
Any upper respiratory symptom	5,883 (62.5)	1,233 (65.8)	1,205 (62.4)	1,719 (61.7)	1,316 (62.1)	394 (59.2)	0.001
Any respiratory symptom	6,479 (68.8)	1,376 (73.4)	1,345 (69.7)	1,878 (67.3)	1,435 (67.7)	429 (64.5)	< 0.001

^aOne-sided *p*-values using the Cochran-Armitage trend test. ^bFacial pain or pressure, head or sinus congestion, or postnasal discharge. ^cBlowing your nose more than usual, stuffy nose, sneezing, runny nose, or irritation in nose. ^dThroat irritation, hoarseness, sore throat, or losing your voice (laryngitis).

FVC was higher in responders who arrived at the disaster site closer to the time of the collapse of the twin towers than in those who arrived on or after 1 October.

There are several possible explanations for the high rates of low FVC observed in this group: *a*) true restriction due to parenchymal lung disease (e.g., interstitial lung diseases such as sarcoidosis, idiopathic pulmonary fibrosis, pneumoconiosis); *b*) true restriction due to physical factors such as obesity or chest wall abnormalities; *c*) "pseudorestriction" due to air trapping (e.g., airways obstruction) or submaximal inspiratory and/or expiratory effort (typically the result of chest pain/tightness or in an attempt to reduce coughing during the test); or *d*) our selection of the reference value used to define the lower limit of the normal range for FVC.

It is likely that, in some responders, the observed increase in low FVC is due to air trapping in the lungs, possibly due to inhalation of caustic dust and airborne pollutants in the course of their WTC work. A finding that supports this explanation is our observation of an increase in FVC after administration of a bronchodilator, seen in 18% of WTC workers and volunteers with this pattern.

Another possible explanation for our observed abnormalities in pulmonary function is our choice for the lower reference limit of the normal range for FVC. In our analysis we chose to use the Hankinson pulmonary reference values derived from NHANES III (Hankinson et al. 1999), because we considered them to be most appropriate for an ethnically diverse population such as this workforce. In previous studies of workers, several spirometry reference equations other than those from NHANES III have been used (Crapo et al. 1981; Knudson et al. 1983; Miller et al. 1983; Morris et al. 1973). Although the mean predicted values calculated from these five studies are very similar for whites, differences in the lower limits of the normal range provide large differences in spirometry abnormality rates when testing large, ethnically diverse groups of workers. For example, when using the equations from Crapo et al. (1981), substantially higher rates of obstruction but lower rates of spirometric restriction (low FVC) were found in whites in our cohort. It is also possible that

some responders have developed true restrictive lung disease due to their WTC-related exposures. We anticipate that these issues will become clearer with continuing prospective follow-up of this cohort.

The MSP faced many challenges, and similar challenges are likely to arise in future major civil disasters. We faced organizational challenges in coordinating work at five clinical sites in the New York/New Jersey metropolitan area, as well as in the national program. There was no systematic roster of responders. We found that a broad and vigorous outreach program to systematically identify responders and persuade them of the importance of undergoing examination was essential. Most of these workers, many of whom had volunteered their services after September 11, were unable to take paid time off to be screened, and many were not in the position to forfeit a day's wages. We needed to schedule the examinations at times and in locations that respected those difficulties. The examination content needed to be relevant and acceptable to the responders and at the same time sufficiently standardized to permit interpretation of aggregated clinical data. Translation was one of the more challenging aspects of program coordination. More than 14% of responders required non-English examinations and written materials.

The need for follow-up medical treatment and for provision of social benefits in the event of future civil disasters must be anticipated, and federal funds must be provided early on to support such programs. There was substantial social and economic disruption to

the lives of many of the responders, and benefits counseling became an urgent need and an integrated component of the MSP. Many responders needed follow-up treatment for physical or mental health illnesses, and many lacked health insurance. We were obliged to secure private funding from philanthropic organizations to develop and implement treatment programs for responders. Federal funding for treatment of these workers is anticipated to begin in fall 2006.

Several limitations in these data should be noted. We do not have pre-September 11 clinical information on our cohort. It may be that responders who were sicker were more likely to participate, leading to an overestimation of risk. Conversely, we may be underestimating risk because most responders were likely to have been fit workers (healthy worker effect). In this article we do not consider the psychological consequences, which we already know to be serious (Smith et al. 2004). Subsequent papers will address responder mental health.

Conclusions

The workers and volunteers who served New York City and the nation through their heroic service in the aftermath of September 11 need continuing medical surveillance and follow-up, especially because some diseases, such as cancer, are of long latency. Malignant mesothelioma resulting from exposure to asbestos, for example, may not become evident for 30–50 years. These biological facts plus the magnitude and complexity of the exposures indicate that WTC responders should be monitored for at least 20–30 years,

Table 4. Spirometry results (prebronchodilator) among the WTC MSP study population (*n* = 8,384).^a

	National population ^b		WTC MSP population		
	Never smoker (%)	Never smoker [no. (%)]	Former smoker [no. (%)]	Current smoker [no. (%)]	All [no. (%)]
Normal	87.1	3,396 (73.2)	1,541 (72.8)	1,047 (67.1)	6,031 (71.9)
Obstruction ^c	8.0	237 (5.1)	97 (4.6)	114 (7.3)	451 (5.4)
Low FVC ^d	4.4	940 (20.3)	431 (20.3)	336 (21.5)	1,721 (20.5)
Obstruction and low FVC ^e	0.6	68 (1.5)	49 (2.3)	63 (4.0)	181 (2.2)
Total	NA	4,641 (55.4)	2,118 (25.3)	1,560 (18.6)	8,384 (100.0)

NA, not applicable.

^aOnly acceptable quality spirometric examinations are included, as described by Miller et al. (2005). ^bGeneral U.S. population sample of employed, adult, white males 17–69 years of age who never smoked (Mannino et al. 2003; NHANES III). ^cFEV₁/FVC ratio less than 5th percentile of predicted value and normal FVC. ^dFVC less than 5th percentile of predicted value and a normal FEV₁/FVC ratio. ^eFEV₁/FVC ratio less than 5th percentile of predicted value and FVC less than 5th percentile of predicted value.

Table 5. Spirometry results (prebronchodilator) by date of arrival for work at WTC site and exposure to the dust cloud among the WTC MSP study population (*n* = 8,384).^a

	Arrived on 11 September		Arrived 12–13 September [no. (%)]	Arrived 14–30 September [no. (%)]	Arrived on or after 1 October [no. (%)]	Trend test <i>p</i> -value ^b
	In dust cloud [no. (%)]	Not in dust cloud [no. (%)]				
Normal	1,160 (68.5)	1,222 (69.9)	1,781 (71.6)	1,397 (75.3)	453 (78.6)	—
Obstructive ^c	81 (4.8)	96 (5.5)	140 (5.6)	104 (5.6)	28 (4.9)	0.418
Low FVC ^d	408 (24.1)	400 (22.9)	506 (20.3)	318 (17.1)	84 (14.6)	< 0.001
Obstruction and low FVC ^e	44 (2.6)	29 (1.7)	61 (2.5)	36 (1.9)	11 (1.9)	0.095

^aOnly acceptable quality spirometric examinations are included, as described by Miller et al. (2005). ^bOne-sided *p*-values using the Cochran-Armitage trend test. ^cFEV₁/FVC ratio less than 5th percentile of predicted value and normal FVC. ^dFVC less than 5th percentile of predicted value and a normal FEV₁/FVC ratio. ^eFEV₁/FVC ratio less than 5th percentile of predicted value and FVC less than 5th percentile of predicted value.

so that long-term effects are detected early, when treatment would be most beneficial.

Federal leadership is needed to bring together a wide range of civilian and military experts to prepare for the complex physical and mental health issues and the environmental issues certain to arise in future disasters. Future disaster response must incorporate rapid establishment of both diagnostic and treatment programs, and state and federal leadership must make a firm commitment for the long-term follow up of exposed workers. Finally, there is a need to ensure strong and active participation by worker representatives and local citizens. Their local knowledge is unique, and it will not become available to state and federal planners unless these vital stakeholders are invited to take an active role in the planning and implementation of responses to future disasters.

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ORIGINAL CONTRIBUTIONS

Upper Respiratory Symptoms and Other Health Effects among Residents Living Near the World Trade Center Site after September 11, 2001

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The authors investigated changes in respiratory health after September 11, 2001 ("9/11") among residents of the area near the World Trade Center (WTC) site in New York City as compared with residents of a control area. In 2002, self-administered questionnaires requesting information on the presence and persistence of respiratory symptoms, unplanned medical visits, and medication use were sent to 9,200 households (22.3% responded) within 1.5 km of the WTC site (affected area) and approximately 1,000 residences (23.3% responded) in Upper Manhattan, more than 9 km from the site (control area). Residents of the affected area reported higher rates of new-onset upper respiratory symptoms after 9/11 (cumulative incidence ratio = 2.22, 95% confidence interval (CI): 1.88, 2.63). Most of these symptoms persisted 1 year after 9/11 in the affected area. Previously healthy residents of the affected area had more respiratory-related unplanned medical visits (prevalence ratio = 1.73, 95% CI: 1.13, 2.64) and more new medication use (prevalence ratio = 2.89, 95% CI: 1.75, 4.76) after 9/11. Greater impacts on respiratory functional limitations were also found in the affected area. Although bias may have contributed to these increases, other analyses of WTC-related pollutants support their biologic plausibility. Further analyses are needed to examine whether these increases were related to environmental exposures and to monitor long-term health effects.

asthma; environmental pollution; New York City; respiratory tract diseases; terrorism

Abbreviations: CI, confidence interval; CIR, cumulative incidence ratio; WTC, World Trade Center.

Editor's note: An invited commentary on this article appears on page 508, and the authors' response appears on page 511.

The destruction of the World Trade Center (WTC) on September 11, 2001 ("9/11") resulted in the release of large amounts of pollutants into the surrounding areas. These

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pollutants included particulate matter, asbestos, metals, and organic compounds (1). Initially, smoke and debris came from the fires that erupted when the planes struck the buildings, followed by the release of airborne dust and debris from the collapse of the buildings. Subsequently, the fires that burned at the site for several months and clean-up activities released particulates. In many cases, dust from the collapse infiltrated homes and apartments at a depth of up to several inches (2). As people returned to their residences, settled dust was redispersed into the air.

One of the immediate public health concerns was the effect of this intensive exposure to these air pollutants on the health of local residents. Analyses of settled dust samples collected 5–6 days after the disaster indicated that 1–4 percent by weight were particles that can be inhaled deeply into the lungs (3) and are associated with respiratory diseases. Adverse health effects could have arisen from both acute high-level exposures and prolonged low-level exposures. Moreover, it is unknown whether the adverse respiratory effects, if they existed, were transient or persistent. Studies of asthmatic Lower Manhattan residents found worse symptoms and increases in medical care utilization and asthma medication prescriptions after 9/11 (4, 5). To our knowledge, these studies of persons with asthma are the only published studies of the respiratory health of residents near the site of the former WTC (“Ground Zero”). The pollution from the WTC disaster may have also caused new disease among previously healthy residents of New York City. Additionally, local residents complained about upper respiratory and other symptoms consistent with exposure to irritants. Since there are large residential communities around Ground Zero, the potential for respiratory health effects from exposure to these agents deserves investigation.

The goals of the present study included 1) determining whether there was an increase in the incidence of new-onset and persistent upper and lower respiratory symptoms in residents living near Ground Zero as compared with residents of a control area and 2) investigating whether there was an increase in symptom exacerbation among asthmatic residents living near Ground Zero as compared with a control area. Additionally, subgroups of residents with new-onset persistent symptoms and asymptomatic persons were identified and followed for assessment of chronic respiratory health effects, including symptom persistence and physiologic abnormalities as measured by spirometry. In this paper, we discuss the results pertaining to upper respiratory symptoms.

MATERIALS AND METHODS

Study design and study population

This retrospective cohort study was started 8 months after 9/11 (May 2002). The cumulative incidence of reported new-onset and persistent new-onset upper respiratory tract symptoms and unplanned medical visits/medication use among residents living near Ground Zero (the affected area) was compared with the incidence in a control population. Potential study buildings were selected so as to include major population areas below Canal Street in Lower Manhattan. These buildings were then stratified by housing character-

istics (e.g., low- or high-income rentals, cooperatives or condominiums, public housing complexes) and selected to include a range of these characteristics. Finally, 2000 US Census data were examined to ensure that the final study buildings were representative of the range of socioeconomic characteristics present in the underlying population of Lower Manhattan.

The area defined as the affected area is located within 1.5 km of the former WTC site and includes 49 buildings in Lower Manhattan with approximately 9,200 households. A control area was used for comparison, because the health histories of residents living near the WTC prior to 9/11 were not available and respiratory diseases usually have a strong seasonal component. The prevailing wind direction was considered in selecting the control area. Therefore, areas south, east, and west of the WTC that were impacted by the plume, including Brooklyn, New Jersey, and Staten Island, were excluded from the control area. Efforts were made to identify control buildings in census blocks with similar characteristics as the affected area. The control area consisted of approximately 1,000 households in five Upper Manhattan apartment buildings more than 9 km from the WTC site. To obtain a large, representative sample in the affected area, we oversampled the population of the affected area at a 9:1 ratio (affected area:control area). Figure 1 shows the study areas and the prevailing wind directions at John F. Kennedy International Airport for September 11–30, 2001.

All residents of the identified affected and control buildings were eligible to participate in the study. Up to four residents in each household were asked to complete the questionnaire. To eliminate confounding effects due to residential mobility and to minimize potential misclassification due to occupational exposure, we excluded persons meeting any of the following criteria: 1) born after 9/11; 2) temporarily moved out of the residence after 9/11 and returned on or after January 1, 2002; 3) did not reside at the current address on 9/11; or 4) lived in the control area but worked in the affected area.

Study materials and procedures

A study packet containing a cover letter, consent forms, questionnaires, and a stamped, addressed envelope was mailed to all apartments in the study buildings. The study packets also contained information about Project Liberty (a federally sponsored program providing free crisis counseling services to those affected by the WTC disaster) for persons who experienced anxiety while reviewing the materials. To accommodate the needs of the large populations of non-English speakers in the study areas, translations of the study materials were available for Spanish- and Chinese-speaking residents.

The questionnaires included a household questionnaire and four individual questionnaires. An adult resident was asked to complete the household questionnaire by providing information on the age, gender, and asthma status of all household members. The household questionnaire also asked about the condition of the apartment immediately after 9/11, the duration and frequency of odors or dust in the apartment, and any cleaning, sampling, or inspections that were performed.

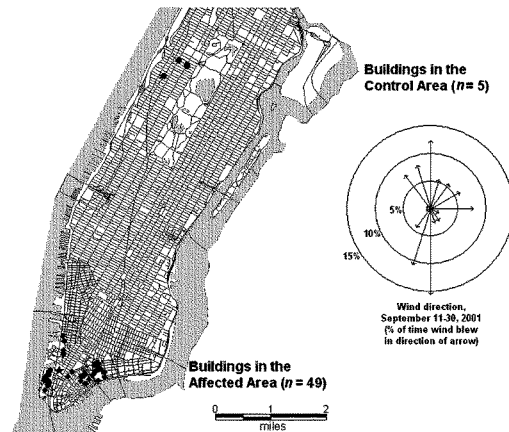


FIGURE 1. Locations of study buildings in the affected and control areas, World Trade Center Health Survey, New York City, 2002. (1 mile = 1.61 km).

In households with more than four persons, two adult residents and the two oldest residents under age 18 years were asked to complete the individual questionnaire. For children younger than age 12, a parent or legal guardian completed the questionnaire. The individual questionnaire was primarily designed to estimate the prevalence and incidence of asthma and respiratory symptoms. This questionnaire was derived from the International Union Against Tuberculosis and Lung Diseases questionnaire and the International Study of Asthma and Allergies in Childhood questionnaire, both of which have been validated and used in epidemiologic studies to detect symptoms associated with asthma and bronchial hyperresponsiveness (6–9).

For questions about upper and lower respiratory symptoms and irritation symptoms, the resident was asked whether the problem had occurred in the past 12 months, whether it started after 9/11, whether it worsened after 9/11, and, depending on the type of symptom, either the average frequency or the perceived severity of the symptom during the past 4 weeks. Additional questions assessed unplanned medical visits (outpatient visits, emergency department visits, and hospitalizations), physician diagnoses of asthma and other respiratory disorders, use of asthma medication, and respiratory functional status. The questionnaire also included questions related to sociodemographic factors, smoking history, temporary residence changes after 9/11, and employment location. After receipt of a completed questionnaire, a Metro Card with a value of \$6 was mailed to the participant to acknowledge participation.

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The study packets were initially distributed 1 year after 9/11 (± 4 months) via bulk mail. Because of inconsistencies in the handling of this material, additional deliveries were made to each residence by hand. Where access could not be gained to make hand deliveries, the packets were left in building lobbies. Finally, in addition to the bulk mailing, a first-class mailing of the packets was made to all households, followed by a reminder postcard. After distribution of the packets, field-workers spent time in the buildings to encourage participation, provide additional copies of the study materials, and answer questions. The days and times of these outreach activities were varied to maximize the numbers and types of persons encountered. Posters advertising the study were placed in and around the buildings. Further publicity about the study was generated through notices in local newspapers and building newsletters, as well as by staff in attendance at meetings of community boards and tenant organizations and local health fairs. To estimate potential selection bias, we selected one building in the affected area (440 apartments) and two buildings in the control area (240 apartments) to receive additional outreach. These intensive outreach activities included additional mailings, advertisements, and time spent in the buildings by field-workers.

Outcome definitions

Health outcomes were defined on the basis of reported respiratory symptoms, unplanned medical visits, physician diagnoses, medication use, respiratory functional limitation, and

the time period in which symptoms occurred. "New-onset" symptoms were defined as upper respiratory symptoms that began after 9/11. A "persistent new-onset" symptom was a new-onset symptom that had bothered the respondent "some" or "a lot" in the 4 weeks prior to completing the survey.

Statistical analysis

Because of variations in the number of persons residing in each apartment and the lack of information about the number of persons in nonresponding households, the response rate was calculated using the number of responding households as a numerator. Packets that were returned marked "vacant" were omitted from this calculation.

The demographic characteristics of participants in the affected and control areas were compared using the χ^2 test. For new-onset respiratory health outcomes, we computed cumulative incidence by dividing the number of participants with a new-onset outcome after 9/11 by the total number of participants. However, the denominators for unplanned medical visits, new diagnoses of asthma, and medication use were based on the subgroup of participants who were "previously healthy" (i.e., free of a physician's diagnosis of asthma, emphysema, chronic obstructive pulmonary disease, and chronic bronchitis prior to 9/11). Cumulative incidence ratios (CIRs) comparing the affected and control areas were computed, and 95 percent confidence intervals were used to estimate the precision of the CIRs. For respiratory functional status (before and after 9/11), prevalence rates (the number of persons in a disease status category divided by the total number of participants in each area) and prevalence ratios and their 95 percent confidence intervals were computed. Finally, the χ^2 test was used to compare data for the self-described breathing statements.

Unconditional logistic regression analysis was used to compute adjusted odds ratios while controlling for potential confounders, including age, gender, education, race, and smoking. Education was used as a surrogate for socioeconomic status, because information about education was more complete (11 percent missing data) than information for income (25.3 percent missing data), and education and income were highly correlated. Because respiratory diseases are not rare events, adjusted odds ratios from logistic regression tend to consistently overestimate the CIRs. Therefore, the crude CIRs and 95 percent confidence intervals are presented in the tables, and adjusted results were used only to determine whether the results were still statistically significant after controlling for confounders.

RESULTS

A total of 9,168 survey packets were sent to residences in the affected area, and 962 packets were sent to residences in the control area. After exclusion of apartments that were definitely vacant, household response rates were 22.3 percent in the affected area and 23.3 percent in the control area. Among the buildings targeted for increased outreach, the response rates were 43.8 percent and 40.3 percent in the affected and control areas, respectively. A total of 553 respondents (17.3 percent) were excluded from the analysis on

TABLE 1. Demographic characteristics (%) of residents of the affected area ($n = 2,362$) and the control area ($n = 291$), World Trade Center Health Survey, New York City, 2002

Characteristic	Affected area	Control area	p value (χ^2 test)
Gender			0.35
Male	38.0	41.0	
Female	62.0	59.0	
Age (years)			<0.0001
0–34	23.4	23.8	
35–64	51.0	35.3	
≥65	25.6	40.9	
Annual household income			<0.0001
<\$24,999	34.7	19.9	
\$25,000–\$49,999	18.8	19.9	
\$50,000–\$99,999	23.6	30.5	
≥\$100,000	22.9	29.6	
Race/ethnicity*			
Hispanic	14.1	7.6	0.003
Asian	16.3	3.3	<0.0001
African-American	8.4	11.6	0.08
White	61.0	79.4	<0.0001
Other	4.8	4.7	0.95
Education			0.0002
Not a high school graduate	20.3	11.0	

* Race/ethnicity groups were not mutually exclusive; therefore, percentages do not add up to 100%. For calculation of p values, instead of an overall χ^2 test, paired χ^2 tests were performed for each race/ethnicity group versus the other groups combined.

the basis of the four criteria described in Materials and Methods, giving us a total of 2,362 participants in the affected area and 291 in the control area.

Although we attempted to make the residents of affected and control areas demographically comparable, differences remained. The affected area had distributions of age and household income that were significantly different from those of the comparison area (table 1). In paired χ^2 tests, there were significantly higher proportions of Hispanics, Asians, and residents with less education (i.e., not high school graduates) but lower proportions of African Americans and Caucasians from the affected area as compared with the control area. In general, these demographic differences are similar to differences in the underlying populations according to 2000 US Census data. Since low socioeconomic status is associated with asthma, these variables were considered potential confounders and were controlled for in the multivariate analyses.

Table 2 describes the relation between residence in the affected area and upper respiratory and irritation symptoms. Rates of all new-onset symptoms were significantly higher in the affected area after we controlled for potential confounders (CIRs were 3.00–4.23). Residents of the affected area reported a significantly higher rate of at least one of

TABLE 2. Incidence of upper respiratory symptoms after September 1, 2001, and associated cumulative incidence ratios among residents of the affected area ($n = 2,362$) versus the control area ($n = 291$), World Trade Center Health Survey, New York City, 2002

Symptom(s)	New-onset				New-onset persistent			
	No.	%	CIR*	95% CI*	No.	%	CIR	95% CI
Eye irritation or burning	1,143	52.9	3.22	2.45, 4.25†	501	21.2	3.43	2.18, 5.40†
Nose irritation or burning	896	41.3	4.23	2.92, 6.11†	432	18.3	3.80	2.26, 6.38†
Nasal congestion	864	40.7	3.12	2.26, 4.31†	486	20.6	4.28	2.55, 7.17†
Hoarse throat or other throat irritation	1,142	53.1	3.41	2.56, 4.55†	543	23.0	3.34	2.18, 5.14†
Sinus congestion	719	34.2	3.11	2.18, 4.44†	425	18.0	4.76	2.65, 8.55†
Nose bleeding	310	13.7	3.47	1.92, 6.24†	101	4.3	2.49	1.02, 6.06
Recurring headaches	720	33.3	3.00	2.12, 4.26†	449	19.0	5.03	2.80, 9.03†
One or more of the above symptoms	1,696	71.8	2.22	1.88, 2.63†	1,031	43.7	3.02	2.28, 4.02†

* CIR, cumulative incidence ratio; CI, confidence interval.

† The effect was still statistically significant ($p < 0.05$) after adjustment for age, gender, education, race, and smoking.

these new-onset symptoms (71.8 percent) than did controls (32.3 percent), an increase of 121 percent (CIR = 2.22, 95 percent confidence interval (CI): 1.88, 2.63). Furthermore, the persistence of these new-onset symptoms was significantly higher in the affected area. CIRs ranged from 2.49 to 5.03, with the highest CIRs being for congestion symptoms and recurring headaches. Affected-area residents also reported a significantly higher incidence of at least one persistent new-onset symptom (43.7 percent) than did controls (14.4 percent)—a 200 percent elevation (CIR = 3.02, 95 percent CI: 2.28, 4.02).

Data on medical visits and medication use after 9/11 among previously healthy participants are presented in table 3. The incidence of unplanned medical visits for respiratory problems was significantly increased in the affected area (14.5 percent) over the control area (8.4 percent; CIR = 1.73, 95 percent CI: 1.13, 2.64) after we controlled for potential confounders. A significantly higher proportion of affected-area residents started using respiratory medication after 9/11 (18.0 percent) in comparison with controls (6.2 percent)

(CIR = 2.89, 95 percent CI: 1.75, 4.76). By examining medication use in the past 4 weeks as an indication of disease persistence, we found that affected-area residents reported significantly higher rates (15.1 percent) than controls (6.2 percent) (prevalence ratio = 2.44, 95 percent CI: 1.48, 4.02). In particular, use of fast-relief (9.7 percent) and controller (10.4 percent) asthma medications was significantly higher in the affected area. The rates of new diagnosis of asthma and use of more medication after 9/11 were not statistically significantly different between two areas.

We examined three indicators characterizing different degrees of shortness of breath with exertion before and after 9/11 (table 4). Before 9/11, data for all three indicators were similar in the two areas. However, after 9/11, these indicators pointed to greater increases in the degree of shortness of breath in the affected area (prevalence ratios were 1.51–1.83). When the participants were asked to describe their breathing in the past 4 weeks (data not shown), approximately 16 percent of respondents in the affected area reported that they had “regular trouble with breathing, but it always got

TABLE 3. Incidence of medical consultations, asthma diagnoses, and use of respiratory medication after September 11, 2001, among previously healthy* residents of the affected area ($n = 2,362$) versus the control area ($n = 291$), World Trade Center Health Survey, New York City, 2002

	Affected area		Control area		Cumulative incidence ratio	95% confidence interval
	No.	%	No.	%		
Unplanned medical visit(s) for respiratory problems in past 12 months	286	14.5	21	8.4	1.73	1.13, 2.64†
Physician diagnosis of asthma after September 11	101	18.0	6	12.0	1.50	0.69, 3.24
Started using respiratory medication after September 11	340	18.0	15	6.2	2.89	1.75, 4.76†
Used more respiratory medication after September 11	62	3.3	3	1.3	2.64	0.83, 8.34
Used respiratory medication in past 4 weeks	285	15.1	15	6.2	2.44	1.48, 4.02†
Used fast-relief‡ asthma medicine in past 4 weeks	178	9.7	9	3.8	2.55	1.32, 4.91†
Used controller§ asthma medication in past 4 weeks	191	10.4	10	4.3	2.44	1.31, 4.55†

* No diagnosis of asthma, chronic obstructive pulmonary disease, chronic bronchitis, or other lung disease before September 11, 2001.

† The effect was still statistically significant ($p < 0.05$) after adjustment for age, gender, education, race, and smoking.

‡ Asthma medication that induces rapid bronchodilation of the airways.

§ Asthma medication that can either prevent inflammation or maintain bronchodilation.

TABLE 4. Self-reported prevalence of shortness of breath with varying levels of exertion before and after September 11, 2001, among residents of the affected area ($n = 2,362$) versus the control area ($n = 291$), World Trade Center Health Survey, New York City, 2002

Level of exertion	Affected area		Control area		Prevalence ratio	95% confidence interval
	No.	%	No.	%		
Shortness of breath when hurrying on level ground or walking up a slight hill						
Before September 11	541	26.1	61	24.0	1.09	0.86, 1.37
After September 11	1,075	53.8	71	32.0	1.68	1.38, 2.05*
Shortness of breath when walking with other people of one's own age on level ground						
Before September 11	325	15.9	38	14.8	1.08	0.79, 1.47
After September 11	730	38.6	47	21.1	1.83	1.41, 2.38*
Having to stop for breath when walking at one's own pace on level ground						
Before September 11	303	14.4	39	15.1	0.95	0.70, 1.30
After September 11	653	32.9	50	21.7	1.51	1.18, 1.95*

* The effect was still statistically significant ($p < 0.05$) after adjustment for age, gender, education, race, and smoking.

completely better" as compared with 10 percent in the control area ($p < 0.05$). Furthermore, significantly more residents of the affected area reported that their "breathing was never quite right" (21 percent) as compared with residents of the control area (9 percent) ($p < 0.05$).

DISCUSSION

Respiratory outcomes

In the current study, we found that incidence rates of at least one new-onset upper respiratory symptom and all individual symptoms were significantly increased by 122 percent and over 200 percent, respectively, among affected-area residents. Additionally, almost half of residents in the affected area reported persistence of these symptoms, and the rate of persistent new-onset symptoms was increased by 200 percent. Prezant et al. (10) reported that among firefighters with high or moderate levels of exposure, 54 percent had nasal congestion and 41 percent had nasal drip after 9/11. Eighty-two percent of the firefighters who had high levels of exposure experienced sore throat after 9/11. Banauch et al. (11) reported persistence of symptoms and bronchial hyper-reactivity among these firefighters 6 months after 9/11.

Among previously healthy residents in the affected area, we found a 73 percent increase in unplanned medical visits and a 189 percent increase in new medication use for respiratory problems after 9/11. Moreover, there was a 144 percent increase in the use of respiratory medication in the past 4 weeks, including use of fast-relief and controller medicines, among previously healthy affected-area residents. Additionally, the self-described respiratory functional status of affected-area residents was impacted more than that of control-area residents. Shortness of breath with varying levels of exertion was significantly higher in affected-area residents than in the controls. Self-reported descriptions of breathing during the past 4 weeks also indicated significantly higher levels of breathing trouble in the affected area.

Szema et al. (5) found that visits to a health clinic for asthma and prescriptions for asthma medication both increased among pediatric asthma patients after 9/11. All of these findings suggest that residents near Ground Zero experienced a significant increase in respiratory diseases related to the WTC disaster and that these symptoms were still persistent in a significant portion of the residents after 1 year.

Our study was one of the earliest of the few studies to estimate the incidence of respiratory disease among residents of Lower Manhattan after 9/11. Both Fagan et al. (4) and Szema et al. (5) studied residents of Lower Manhattan; however, their populations were restricted to persons with asthma. Although residents near Ground Zero were probably not exposed to air pollution levels as high as those of the firefighters involved in WTC rescue, recovery, and clean-up activities, we have shown that residents of the affected area did report significantly more upper respiratory symptoms than residents of the control area.

Ambient air quality after 9/11

The New York City Department of Health and Mental Hygiene (12) measured the levels and composition of outdoor and indoor surface and airborne dust from November 4 to December 11, 2001, in residential areas near Ground Zero and in a comparison area. That study found a greater percentage of synthetic vitreous fibers, asbestos, quartz, calcite, portlandite, and gypsum in settled dust in Lower Manhattan than in the comparison area. The Environmental Protection Agency collected dust samples at various locations in the immediate vicinity of the WTC site 1–2 days after 9/11 (2). The WTC samples of particulate matter less than 2.5 μm in diameter were alkaline and composed primarily of calcium-based compounds such as calcium sulfate (gypsum) and calcium carbonate (calcite). Gypsum and calcite can irritate the mucus membranes of the eyes, nose, throat, and upper airways (13), and calcium carbonate dust can cause coughing, sneezing, and nasal irritation (14).

Although smoke or debris might have contributed to the increase in adverse respiratory health outcomes in this study, psychological stress might also have played an important role in these effects (15). In the current study, we could not determine whether environmental factors, psychological distress, or both contributed to the increase in respiratory symptoms, since psychological factors were not examined.

Strengths and limitations

This study is an important first step in identifying the acute and chronic respiratory health impact of the WTC disaster. Of the few studies that have investigated respiratory health among residents of Lower Manhattan after 9/11, it is one of the largest. This study responded to local residents by examining specific symptoms of concern to the community. The design and analysis used in this study allowed for the control for seasonal and socioeconomic confounding effects. In addition, the use of a cohort design allowed for examination of multiple health outcomes.

Although intensive outreach activities were implemented as described in Materials and Methods, we obtained low response rates. This may have been due to the emotional aftermath of the disaster—residents might not have been willing to answer questions that would provoke an emotional reaction. In addition, at the time of this study, the residents of Lower Manhattan were inundated with forms from government agencies and other organizations. The amount of information requested during this time was probably overwhelming. In addition, residents may have thought they had already completed a questionnaire when in fact they had not. New York City also has a history of lower response rates. The 2000 Census only recorded a final response rate of 55 percent in New York City, despite intense advertising and door-to-door follow-up. More importantly, a significant number of residents moved out of the affected area after 9/11. For this reason, if the denominator for calculating the household response rate was overestimated (despite attempts to identify vacant households), the actual response rate would have been underestimated.

The low response rates, although similar between the two study areas, may have introduced selection bias. That is, residents who experienced symptoms, especially those who lived in the affected area, might have been more likely to participate than those who did not. This could have caused the incidence of new-onset symptoms to be overestimated, particularly in the affected area. To minimize this bias, we emphasized the importance of participation for people with and without breathing problems during recruitment activities. In addition, general terms such as “breathing or lung problems” rather than specific terms like “asthma” were used.

To examine possible selection bias due to low response rates, we compared results for the buildings targeted for increased outreach and the nontargeted buildings. Results from the targeted buildings, in which higher response rates were achieved, are assumed to be more accurate and representative. If there was selection bias, we would expect to find a weaker exposure-disease association in the targeted buildings. Instead, we found that the risk estimates for new-onset and new-onset persistent symptoms were consistently higher in

the targeted buildings than in the nontargeted buildings (see appendix table 1). These results suggest that any selection bias was in the opposite direction than we would have expected (i.e., the true association may have been underestimated).

Another potential problem with this study is reporting bias. Affected-area participants may have recalled or reported more symptoms than the controls. To prevent such reporting bias, we asked symptom questions not only qualitatively but also quantitatively, by including questions on specific time frames, severity, and frequency, which are less prone to recall bias. To estimate potential reporting bias, we compared rates of self-reported physical disability (which should not have been related to WTC exposures) between the affected area and the control area. The similar rates in the two areas (14.7 percent and 13.1 percent, respectively) indicate no significant reporting bias due to residence area. A participant responding affirmatively about every symptom may have been affected by recall bias ($n = 10$). Minimal changes were observed when these persons were excluded from the analysis. We believe recall of unplanned medical visits, including emergency department visits and hospitalizations, is more likely to be accurate than recall of symptoms, since such events are more likely to be memorable, and we solicited information on the reason for and exact month and year of the visit. Among respondents reporting a specific respiratory symptom, we compared the proportions who had unplanned medical visits. We found that the proportions were similar in the affected and control areas for most symptoms. If there was overreporting in the affected area, the proportion of persons reporting a specific symptom who also had unplanned medical visits should have been lower in the affected area than in the control area. Therefore, there is no clear evidence of reporting bias on the basis of our limited assessment. In general, reporting bias can be minimized by using objective indicators (e.g., medical records) rather than self-reported information. In this study, it was not feasible to review medical records. Additionally, an analysis of medical records would probably have underestimated or completely missed the less severe symptoms included in our survey.

One final area of concern is the possibility of exposure misclassification. As described above, we excluded persons with evidence of residential mobility and exposures unrelated to their area of residence in order to minimize this bias. However, an unidentified group of affected-area residents may have altered their behavior, spending less time at home in the aftermath of 9/11. Thus, their actual exposure may have been overestimated. On the other hand, it is also possible that control-area residents were impacted by the WTC plume in unforeseen ways.

Conclusion

This study suggests that residents who lived near Ground Zero on 9/11 reported significantly more upper respiratory and irritation symptoms, unplanned medical visits, and use of respiratory medications and decreased respiratory functional status after 9/11. In a significant portion of the residents, these symptoms persisted 1 year after 9/11. Although we cannot rule out the possibility that selection and

reporting bias may have contributed to these increases, chemical analyses of WTC-related pollutants by other researchers support the biologic plausibility of these findings. Further analyses are needed to examine whether increases in reported respiratory disease can be related to differences in exposure and to monitor the potential long-term health effects of the 9/11 disaster in this population.

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Conflict of interest: none declared.

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APPENDIX TABLE 1. Incidence of new-onset and persistent new-onset upper respiratory symptoms after September 11, 2001, among residents of the affected area versus the control area, by level of outreach (targeted areas and nontargeted areas), World Trade Center Health Survey, New York City, 2002

Symptom(s)	New-onset symptoms				Persistent new-onset symptoms			
	Targeted area		Nontargeted area		Targeted area		Nontargeted area	
	CIR*	95% CI*	CIR	95% CI	CIR	95% CI	CIR	95% CI
Eye irritation or burning	4.50	2.72, 7.45	2.76	1.99, 3.85	4.28	2.02, 9.10	3.22	1.81, 5.74
Nose irritation or burning	8.96	4.07, 19.73	3.19	2.11, 4.83	5.68	2.33, 13.82	3.35	1.76, 6.37
Nasal congestion	5.47	2.89, 10.38	2.50	1.72, 3.62	9.24	3.45, 24.69	3.32	1.81, 6.09
Hoarse throat or other throat irritation	4.62	2.81, 7.61	3.06	2.15, 4.36	4.22	2.19, 8.15	3.42	1.92, 6.08
Sinus congestion	6.42	3.09, 13.35	2.40	1.61, 3.59	6.53	2.70, 15.82	4.83	2.19, 10.65
Nose bleeding	10.56	2.60, 42.89	2.41	1.26, 4.59	5.09	1.20, 21.47	2.18	0.69, 6.81
Recurring headaches	5.19	2.73, 9.89	2.48	1.64, 3.75	8.16	3.04, 21.91	4.41	2.12, 9.16
One or more of the above symptoms	3.46	2.49, 4.82	1.83	1.51, 2.21	3.69	2.37, 5.74	3.01	2.07, 4.37

* CIR, cumulative incidence ratio; CI, confidence interval.

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Exposure, probable PTSD and lower respiratory illness among World Trade Center rescue, recovery and clean-up workers

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Background. Thousands of rescue and recovery workers descended on the World Trade Center (WTC) in the wake of the terrorist attack of September 11, 2001 (9/11). Recent studies show that respiratory illness and post-traumatic stress disorder (PTSD) are the hallmark health problems, but relationships between them are poorly understood. The current study examined this link and evaluated contributions of WTC exposures.

Method. Participants were 8508 police and 12333 non-traditional responders examined at the WTC Medical Monitoring and Treatment Program (WTC-MMTP), a clinic network in the New York area established by the National Institute for Occupational Safety and Health (NIOSH). We used structural equation modeling (SEM) to explore patterns of association among exposures, other risk factors, probable WTC-related PTSD [based on the PTSD Checklist (PCL)], physician-assessed respiratory symptoms arising after 9/11 and present at examination, and abnormal pulmonary functioning defined by low forced vital capacity (FVC).

Results. Fewer police than non-traditional responders had probable PTSD (5.9% *v.* 23.0%) and respiratory symptoms (22.5% *v.* 28.4%), whereas pulmonary function was similar. PTSD and respiratory symptoms were moderately correlated ($r=0.28$ for police and 0.27 for non-traditional responders). Exposure was more strongly associated with respiratory symptoms than with PTSD or lung function. The SEM model that best fit the data in both groups suggested that PTSD statistically mediated the association of exposure with respiratory symptoms.

Conclusions. Although longitudinal data are needed to confirm the mediation hypothesis, the link between PTSD and respiratory symptoms is noteworthy and calls for further investigation. The findings also support the value of integrated medical and psychiatric treatment for disaster responders.

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Key words: 9/11, disaster responders, exposure, mediate, post-traumatic stress disorder, respiratory conditions, risk factors, World Trade Center.

Introduction

The September 11, 2001 (9/11) terrorist attack on the World Trade Center (WTC) was an extraordinary

environmental disaster with unprecedented physical hazards to rescue and recovery workers from the disintegrated structure and contents of the WTC buildings, the combustion of 90 000 liters of jet fuel from the hijacked planes, and the smoldering debris fire under the 'pile' (Gavett, 2003; McGee *et al.* 2003; Landrigan *et al.* 2004; Liou & Georgopoulos, 2006). At the same time, responders were exposed to extreme trauma from the loss of colleagues and friends, witnessing

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death and destruction, handling dead bodies, body parts, fluids and personal effects, and inhaling the caustic odor of burning and decomposing bodies and debris.

As a consequence, respiratory ailments and post-traumatic stress disorder (PTSD) became the two persistent, signature health problems among WTC rescue, recovery and clean-up workers. Specifically, elevated rates of respiratory symptoms, asthma and abnormal lung function were reported from 3 months to 9 years later (Levin *et al.* 2002; Prezant *et al.* 2002; CDC, 2004; Herbstman *et al.* 2005; Tapp *et al.* 2005; Brackbill *et al.* 2006, 2009; Herbert *et al.* 2006; Wheeler *et al.* 2007; Aldrich *et al.* 2010; Niles *et al.* 2011; Wisnivesky *et al.* 2011). One year after the disaster, nearly half of the workers evaluated at the WTC Medical Monitoring and Treatment Program (WTC-MMTP) reported incident WTC-related upper (49.6%) and lower (39.5%) respiratory symptoms, and 31% of non-smokers had abnormal spirometry findings (CDC, 2004); by 9 years, the cumulative incidence of spirometric abnormalities was 41.8% (Wisnivesky *et al.* 2011). Being in the dust cloud with its airborne toxins and longer duration of time working at the site significantly elevated the risk of respiratory problems (e.g. Aldrich *et al.* 2010).

High rates of probable PTSD assessed with self-report measures such as the PTSD Checklist (PCL) have also been reported for responder cohorts (Perrin *et al.* 2007; Bills *et al.* 2008; Farfel *et al.* 2008; Stellman *et al.* 2008; Brackbill *et al.* 2009; Berninger *et al.* 2010; Niles *et al.* 2011; Wisnivesky *et al.* 2011). For example, a study of firefighters found annual rates for the first 4 years after 9/11 of about 10% per year (Berninger *et al.* 2010). Similarly, the rate for the WTC-MMTP cohort, assessed from 10 to 61 months after 9/11, was 11.1% (Stellman *et al.* 2008). Among responders in the WTC Health Registry, the rate of probable PTSD was three times higher in unaffiliated volunteers (21.2%) than in police (6.2%) (Perrin *et al.* 2007). Similar to respiratory symptoms, exposure to the dust cloud and longer duration of work were significant risk factors for PTSD (e.g. Brackbill *et al.* 2009).

Studies of combat veterans (Hoge *et al.* 2007), general population samples (Goodwin *et al.* 2003; Eaton, 2005; Scott *et al.* 2009; Spitzer *et al.* 2009; Von Korff *et al.* 2009) and primary care patients (Yellowlees & Kalucy, 1990; Üstün & Sartorius, 1995; Weisberg *et al.* 2002) have consistently found a strong relationship between physical and mental health in general, and between respiratory symptoms and PTSD specifically (e.g. Engel, 2004; Spitzer *et al.* 2009), including in two recent studies of WTC responders (Niles *et al.* 2011; Wisnivesky *et al.* 2011). There are at least three explanations for this link. First, the association between respiratory symptoms and PTSD symptoms may be

coincidental, being the result of the same exposures contributing to both conditions. Second, PTSD is associated with immunologic dysregulation (McEwen & Stellar, 1993; Chrousos, 1995; Delahanty *et al.* 1997; Ironson *et al.* 1997; Boscarino & Chang, 1999; Schnurr & Jankowski, 1999), which may increase pulmonary inflammation and autonomic dysregulation resulting in respiratory abnormalities (Blechert *et al.* 2007). Furthermore, the cognitive and attentional processes associated with PTSD may increase perception and reporting of respiratory symptoms (Dales *et al.* 1989; Yellowlees & Kalucy, 1990; Üstün & Sartorius, 1995; Schnurr & Green, 2004; North *et al.* 2009). For these reasons, Spitzer *et al.* (2009) argued that PTSD can mediate the effects of trauma on chronic respiratory disease. Third, chronic respiratory symptoms could serve as recurrent reminders of the horrors of a traumatic event and elevate PTSD rates (Yellowlees & Kalucy, 1990); that is, pulmonary problems may mediate effects of trauma on PTSD.

The present study explores the associations of WTC exposures with probable PTSD, respiratory symptoms and lung function abnormality in rescue, recovery and clean-up workers participating in the WTC-MMTP. The cohort is composed of workers trained in disaster response (e.g. police; $n=8508$) and non-traditional responders in other occupations (e.g. building trades, maintenance, communications, transportation, health care, and other volunteers; $n=12333$). Previous research documented that professional responders to disasters report fewer mental health symptoms than volunteers with no previous disaster training (Perrin *et al.* 2007; Thormar *et al.* 2010). We thus stratified the cohort into police and non-traditional responders both to compare the rates of PTSD and respiratory symptoms and to examine the associations among these conditions. We explored three alternative hypotheses: (1) PTSD statistically mediated the association of exposure with pulmonary health; (2) respiratory problems mediated the association of exposure with PTSD; or (3) their co-morbidity was due to shared risk factors.

Method

The sample

Data come from patients evaluated at the WTC-MMTP, which comprises seven clinics in New York and New Jersey. The program is available to WTC responders who (a) had qualifying involvement in the WTC clean-up and recovery effort; and (b) were not eligible to participate in other federally funded programs offered to the New York City Fire Department or to federal or state employees (Herbert *et al.* 2006).

WTC responders were recruited to the program through an extensive outreach effort that included union meetings, mailings, media articles, and some 50 000 telephone calls in multiple languages. The data for the current study were derived from the initial examinations that took place on average 4 years after 11 September 2001, between 16 July 2002 and 11 September 2008.

Institutional Review Boards of each affiliated site approved and monitored compliance with procedures for obtaining informed consent and protecting human subjects. More than 90% of clinic patients provided written informed consent for their data to be used for research purposes ($n=22\,894$ participants). Complete data on all study variables were available for $n=20\,841$. The excluded group was within two percentage points of the analysis sample on all study variables except working in law enforcement (34.1% of excluded *versus* 40.8% of the analysis sample), long work on site (22.4% *v.* 25.1%) and probable PTSD (20.5% *v.* 16.0%).

Measures

WTC exposures

WTC exposure was assessed with two indices previously found to be significantly associated with both mental and physical health (e.g. Brackbill *et al.* 2006): dust cloud exposure (DiGrande *et al.* 2011), which occurred among responders who arrived on 11 September 2001 and worked on or near the debris pile; and long duration of work at Ground Zero, the Fresh Kills landfill (where debris from the disaster was brought), or the Office of the Chief Medical Examiner. The median duration of work was 633 h (interquartile range 191–1353 h). Long duration was defined as being in the top quartile (>1353 h).

Probable PTSD

Probable WTC-related PTSD was measured using the PCL (Weathers *et al.* 1993), a 17-item self-report measure assessing the criterion symptoms listed in DSM-IV. Participants were asked to rate problems they were bothered by in the past month 'in relation to 9/11' on a scale of '1=not at all' to '5=extremely'. The scale was summed, and a score of ≥ 50 was used to indicate probable PTSD (Terhakopian *et al.* 2008). Item no. 5 asks about 'having physical reactions (e.g. heart pounding, trouble breathing, sweating) when something reminded you of the disaster'. To test whether this item influenced the association between PTSD and respiratory symptoms, we also scored PTSD by summing the other 16 items and applying a prorated cut-point of 47.

Lower respiratory symptoms

Lower respiratory symptoms were rated by WTC-MMTP physicians using questions selected from standard sources (Burney *et al.* 1989; National Center for Health Statistics, 1996; NIOSH, 2006). Seven lower respiratory symptoms were assessed: shortness of breath (under a variety of circumstances and times of day), wheezing, chest tightness, exercise intolerance, dry cough, hemoptysis, and productive cough. We focused on the development of one or more new symptoms after 11 September 2001 that persisted in the month before examination.

Pulmonary function

Pulmonary function was evaluated using the EasyOne™ spirometer (ndd Medical Technologies, USA) following standard techniques (Miller *et al.* 2005; Enright *et al.* 2008). Consistent with previous reports on WTC responders (Herbert *et al.* 2006; Skloot *et al.* 2009), we focused on restrictive breathing pattern as measured by tests of forced vital capacity (FVC) and forced expiratory volume in one second (FEV1). Abnormal pulmonary function was based on the trial yielding the largest sum of FVC+FEV1 and defined as scoring below *versus* within/above the age-sex-race-height-specific lower limit of normal (Hankinson *et al.* 1999).

Additional risk factors

Other established risk factors, such as body mass index (BMI) and current tobacco use (e.g. Eaton, 2005; Von Korff *et al.* 2009), were adjusted in all multivariate analyses. Current age, sex and time (in years) from 9/11 to assessment were also adjusted when the bivariate analysis indicated that they were significantly related to the health variables.

Analysis methods

We first compared police and non-traditional responders on the study variables using χ^2 tests for categorical data and t tests for continuous variables. To evaluate bivariate associations among the variables, we used polychoric correlations when continuous variables were involved and tetrachoric correlations when both variables were dichotomous to produce equivalent estimates for continuous variables, dichotomous variables, and a mix of the two. Polychoric and tetrachoric correlations have a clear interpretation, with $r=0.10$ conventionally considered a small effect, $r=0.30$ a medium effect and $r=0.50$ a large effect (Cohen, 1988).

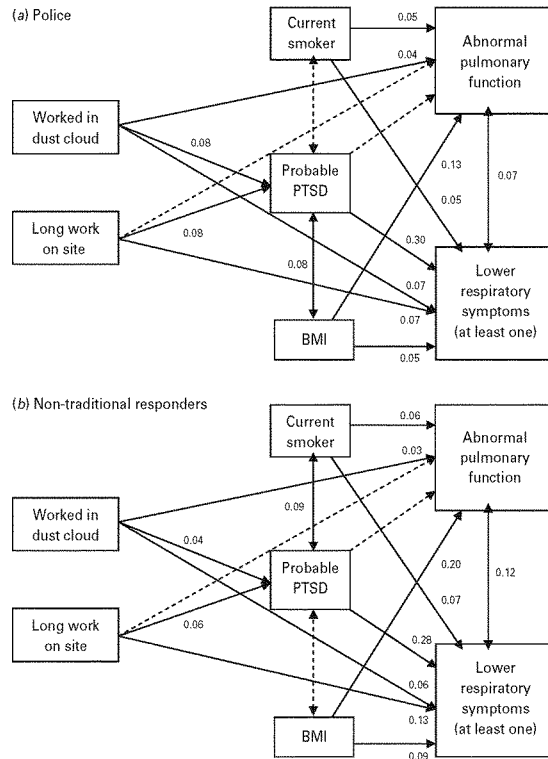


Fig. 1. Best-fitting structural equation models for (a) police and (b) non-traditional responders. Values are standardized path coefficients. Non-significant ($p > 0.05$) coefficients are not shown, and the corresponding paths are shown as broken lines. Correlations among covariates are not shown. Analyses adjusted for age, gender and time to assessment (not shown) whenever they were significantly correlated with the outcome (Table 2). Age, gender and time to assessment had paths to probable post-traumatic stress disorder (PTSD); age and gender had paths to pulmonary function; time to assessment had a path to lower respiratory symptoms. Directional arrows indicate regression paths; double-headed arrows indicate correlations. BMI, Body mass index.

Structural equation modeling (SEM), a system of multiple regressions that are estimated simultaneously (Kline, 2011), was used to explore the plausibility of the three alternative hypotheses about the pathways from exposure to PTSD and respiratory conditions. In the first model, WTC exposures were associated with PTSD and respiratory problems, and these conditions were correlated but independent. In the second model, associations between exposure and respiratory problems were statistically mediated in part by PTSD. Hence, in addition to direct paths, we included paths that went from exposures to PTSD and then from PTSD to respiratory problems

(Fig. 1). In the third model, associations between exposure and PTSD were mediated in part by respiratory conditions. In the latter two analyses, we tested the statistical significance of the indirect paths. In each model, we adjusted for smoking status and BMI in addition to the other risk factors that were significantly associated with the health outcome in the bivariate analyses. The analyses were performed using Mplus version 6.1 (Muthén & Muthén, 2010). We used the maximum likelihood robust (MLR) estimator, which can handle non-normal distributions. In evaluating the model, we considered two absolute and three relative fit indices available in Mplus (Akaike, 1974;

Table 1. Comparison of police and non-traditional responders on study variables^a

	Police (n = 8508)	Non-traditional responders (n = 12 333)	p value
Years from 9/11 to assessment, mean (s.d.)	4.1 (1.8)	3.4 (1.9)	<0.001
Current age (years), mean (s.d.)	40.8 (6.6)	44.4 (9.9)	<0.001
Sex: female, %	15.0	13.9	<0.05
Worked in dust cloud, %	28.9	12.7	<0.001
Long work on site, %	22.8	26.8	<0.001
BMI, mean (s.d.)	30.0 (4.9)	29.3 (5.3)	<0.001
Current cigarette smoker, %	10.2	20.3	<0.001
Probable WTC-related PTSD, %	5.9	23.0	<0.001
Abnormal pulmonary function, %	23.7	22.1	<0.05
Lower respiratory symptoms, %	22.5	28.4	<0.001

BMI, Body mass index; WTC, World Trade Center; PTSD, post-traumatic stress disorder; s.d., standard deviation.

^a Dichotomous variables were compared using the χ^2 test. Continuous variables were compared using the *t* test.

Kass & Raftery, 1995; Burnham & Anderson, 2002; Marsh *et al.* 2004).

Results

Sample characteristics

The police cohort differed significantly ($p < 0.001$) from the non-traditional responders on most study variables (Table 1). Police were less likely to have probable WTC-related PTSD (5.9% *v.* 23.0%) and to have respiratory symptoms (22.5% *v.* 28.4%). However, the proportion with abnormal pulmonary function was similar (~23%). With regard to exposure, more than twice as many police (28.9%) compared to non-traditional responders (12.7%) were exposed to the dust cloud, but more non-traditional responders (26.8%) than police (22.8%) spent prolonged time working at the site. In addition, most of the police ($n = 7898$; 92.8%) and non-traditional responders ($n = 10489$; 85.0%) reported working during September, 2001. Among them, 40.0% of police and 33.1% of non-traditional responders reported spending the majority of their time on or in the debris pile or pit; a further 42.5% of police and 58.9% of non-traditional responders worked in adjacent areas. The remainder were at the landfill, medical examiner's office, loading piers, and elsewhere.

With respect to background characteristics, police officers were younger, had slightly higher BMI, were less likely to smoke cigarettes, and were examined somewhat later than non-traditional responders.

Bivariate associations

Table 2 shows the bivariate associations among the study variables. Overall, the associations among the health variables were similar in the two groups.

Abnormal lung function was only modestly correlated with respiratory symptoms ($r = 0.09$ in police and 0.13 in the non-traditional group) and was not significantly associated with probable PTSD. By contrast, lower respiratory symptoms were substantially associated with probable PTSD ($r = 0.28$ and 0.27 respectively). The associations were the same to the second decimal when we substituted the revised PTSD variable that excluded PCL item no. 5.

WTC exposures showed notable associations with lower respiratory symptoms (range $r = 0.14$ – 0.24), less so with probable PTSD ($r = 0.07$ – 0.12), and were only weakly associated with lung function. Indeed, for PTSD and respiratory symptoms, the odds ratios (ORs) among police ranged from 1.4 [95% confidence interval (CI) 1.2–1.8] for dust cloud exposure with probable PTSD to 1.6 for dust cloud exposure and long hours worked with respiratory symptoms (95% CI 1.5–1.8 and 1.4–1.8 respectively). Among non-traditional responders, the ORs ranged from 1.2 for both dust cloud exposure and long hours worked with probable PTSD (95% CI 1.1–1.4 for each) to 2.0 (95% CI 1.8–2.2) for long hours worked with respiratory symptoms.

Among the other risk factors, higher BMI was significantly associated with pulmonary abnormality, and smoking was most strongly associated with respiratory symptoms. The other risk factors were significantly associated with at least one health variable and hence were adjusted in the multivariate models.

Path models

Each of the three models examined with SEM fit the data well (Supplementary Table S1, available online). However, the model in which associations between exposures and respiratory problems were mediated

Table 2. Correlations among study variables in police (below diagonal) and non-traditional responders (above diagonal)

	Time to assessment	Age	Female	Worked in dust cloud	Long work on site	BMI	Current smoker	Probable PTSD	Pulmonary function	Lower respiratory symptoms
Time to assessment	–	0.14	0.04	0.00	–0.14	0.06	–0.05	0.08	0.04	–0.22
Age	0.17	–	–0.03	0.04	–0.05	0.06	–0.14	0.02	0.13	0.00
Female	0.06	–0.01	–	–0.08	–0.06	–0.18	–0.16	0.19	–0.15	0.01
Worked in dust cloud	–0.14	0.01	–0.06	–	0.09	0.07	–0.01	0.07	0.08	0.14
Long work on site	–0.06	–0.01	0.03	0.18	–	0.03	0.11	0.07	–0.02	0.24
BMI	0.04	0.06	–0.26	0.02	0.05	–	–0.08	–0.02	0.21	0.07
Current smoker	–0.08	–0.04	0.13	0.00	0.00	–0.15	–	0.12	0.07	0.15
Probable PTSD	0.11	0.14	0.05	0.11	0.12	0.08	0.06	–	0.03	0.27
Pulmonary function	–0.02	0.02	–0.22	0.06	0.01	0.15	0.05	0.03	–	0.13
Lower respiratory symptoms	–0.17	0.04	0.06	0.17	0.16	0.08	0.11	0.28	0.09	–

BMI, Body mass index; PTSD, post-traumatic stress disorder.

Correlations involving continuous variables are polychoric; all others are tetrachoric. Correlations >0.03 are significant at $p < 0.05$ level.

Noteworthy associations ($r \geq 0.15$) are shown in bold.

in part by PTSD showed better absolute fit in both responder groups. The relative fit indices indicated that support for this pathway was much stronger (odds in favor of it were over 100:1) than for the alternatives. This model is presented in Fig. 1; significant paths are shown with solid lines, along with the coefficients, and non-significant paths are given with dashed lines, without coefficients. Time to assessment, age and sex were adjusted in these models whenever these variables were significantly correlated with the outcome (paths not shown). The results were similar for the two occupational groups except that, in police, BMI but not smoking was associated with probable PTSD, whereas among the non-traditional responders, smoking but not BMI was associated with PTSD. Overall, both WTC exposures were associated modestly but significantly with probable PTSD (range $\beta = 0.04$ – 0.08), which in turn was substantially associated with respiratory symptoms ($\beta = 0.28$ and 0.30). Independent of this pathway, WTC exposures contributed directly to respiratory symptoms ($\beta = 0.06$ – 0.13), and smoking and BMI also showed weak but significant associations. We tested the indirect contributions of each WTC exposure to lower respiratory symptoms and found all of them to be significant ($p < 0.002$), indicating that these associations were partially mediated by PTSD. With regard to lung function, the exposures were weakly associated in both groups, and none of the indirect associations was significant, indicating that the links of exposures to lung function abnormality were independent of PTSD.

Discussion

Consistent with prior studies of WTC responder cohorts, abnormal pulmonary function, lower respiratory symptoms, and probable WTC-related PTSD were common an average of 4 years after the disaster. Specifically, nearly one-quarter of police and one-third of non-traditional responders had lower respiratory symptoms that emerged after 9/11 and were present in the month prior to examination, and 22–24% had abnormal lung function findings. As expected, the prevalence of probable WTC-related PTSD in non-traditional responders without emergency response training (23.0%) was considerably higher than among police responders (5.9%). Consistent with prior studies (e.g. Perrin *et al.* 2007; Brackbill *et al.* 2009), dust cloud exposure and greater number of hours worked were associated with PTSD, and there was a significant association between probable PTSD and respiratory symptoms. Most importantly, our results suggested an indirect association of exposure with respiratory problems through PTSD, a finding that mirrors research conducted with Vietnam veterans (Schnurr & Jankowski, 1999). Moreover, the associations observed in the final model were similar in both police and non-traditional responders. Thus, the current results both extend our understanding of the health of WTC-MMTP responders and add to a growing body of data on the link between PTSD and respiratory problems.

This study cannot determine whether PTSD mediates the direct effects of WTC exposures on

respiratory symptoms or if it serves to mediate the chronicity, rather than the onset, of respiratory symptoms. Longitudinal data and a rigorous diagnosis of PTSD are needed to disentangle these possibilities. Future studies should also include direct measures to test possible biological (e.g. immunologic dysregulation) and cognitive (e.g. increased attention to somatic symptoms) mechanisms underlying the observed link.

There are other limitations that should be noted when drawing inferences from the results. The current sample is composed of volunteers, and prevalence estimates from this and responder cohorts in previous reports must be treated with caution (Savitz *et al.* 2008). It is also possible that PTSD increased the participation of individuals with respiratory symptoms and WTC exposures. Longitudinal research using data from subsequent visits will determine whether PTSD increased retention of individuals with these symptoms and exposures, but we have no way of assessing this bias with data from the initial visit. To enhance reliability, we focused on incident respiratory symptoms that appeared after 9/11 rather than symptoms that started before 9/11. Thus the rates reported here are lower than those in studies combining incident and prevalent cases (e.g. Farfel *et al.* 2008). We also limited the analysis to two reasonably independent exposures based on prior WTC findings. Future research should also consider other specific exposures. With regard to probable PTSD, the analysis sample had a somewhat lower rate than the excluded sample. Thus the prevalence estimates are conservative. As noted elsewhere, police officers may have under-reported PTSD symptoms because of concerns about retaining their employment. Despite these limitations, our results clearly confirm that respiratory and PTSD conditions were common and co-morbid, and suggest that PTSD may be mediating the exposure-respiratory symptom relationship in both professional and non-traditional WTC responders.

Shortly after 9/11, WTC rescue and recovery workers began to report a variety of symptoms involving the lower respiratory system, including dyspnea, chest discomfort, and chronic cough. These reports were first noted among New York City Fire Department workers who developed cough and bronchial hyperactivity (WTC cough; Prezant *et al.* 2002). These findings were predominantly attributable to airway abnormalities. Intense exposure and early development of bronchial hyperactivity predicted persistence of reactive airway dysfunction 6 months later. Physiologically, there was a bronchodilator response and hyper-reactivity; radiographically, there was air trapping and thickening of the bronchial wall without evidence of parenchymal changes (Izbicki *et al.* 2007;

Prezant, 2008). However, the protean nature of the respiratory symptoms and the lack of physical or physiologic correlates of disease in some patients raised the possibility that the symptoms resulted from multiple etiologies. This notion received support in the present study, as we found that lower respiratory symptoms had a weak association with pulmonary function, and, consistent with Niles *et al.* (2011), their associations with probable PTSD were much stronger.

We initially expected that responders with intense and extensive exposure would display more severe pulmonary illness and higher levels of PTSD symptoms. We were therefore surprised not to find a correlation between abnormal spirometry results and PTSD. However, a one-time spirometry assessment is known to have low sensitivity and specificity for episodic respiratory illnesses. The link between respiratory symptoms and PTSD, although well documented in general, clinical and veteran populations, is not well understood. Further studies are needed to elucidate the precise biological and psychological mechanisms involved in populations with different exposure experiences. The stratification of our analysis by occupational status revealed that the police and the non-traditional responders differed with respect to WTC exposures and prevalence of probable PTSD. The latter may be explained by the characteristics of police officers, including the selection, training, previous exposure to traumatic events, 9/11 exposure differences and reporting biases, in addition to the availability of social support and mental health services during and after the disaster. Although PTSD was less common in police than non-police, the link between probable PTSD and lower respiratory symptoms (and the absence of an association with abnormal spirometry results) was similar in the two groups.

The results have important implications for understanding illness burden on responders following large-scale disasters. Respiratory illness, in particular, is multi-faceted and can be attributed to structural abnormalities, functional syndromes and somatization. The presence of probable PTSD may provide an important signal for clinicians regarding the etiology or persistence of such symptoms presented by the responders. As shown here, there is a substantial association between PTSD and respiratory symptoms. Regardless of which came first, PTSD or respiratory symptoms, our findings emphasize that mental health screening is as essential as screening for respiratory symptoms. Of course, a clinical diagnosis of PTSD and objective testing for physical conditions provide the most crucial evidence about co-morbidity, and longitudinal data are needed to validate the mediation results. Nonetheless, the current findings support

treatment strategies that integrate physical and mental health targets (Von Korff *et al.* 1997).

The current results also support previous findings that the health and mental health effects of the WTC disaster are enduring (Wisnivesky *et al.* 2011). Understanding why some responders are at higher or lower risk for developing persistent health problems following a large-scale disaster is important for designing disaster preparedness and long-term treatment programs for health problems that may develop into more chronic conditions. The health consequences of disaster recovery and clean-up could be improved by a better understanding of the prior training and experiences of the responders who altruistically assist under the worst possible conditions and by providing non-traditional responders with some level of preparation before they go on site. A qualitative study by Johnson *et al.* (2005) found that non-traditional WTC responders felt ill-prepared for the recovery and clean-up work. Specifically, they felt overwhelmed by the clean-up duties and did not feel that they had proper protective equipment. In our study, this group reported significantly higher rates of probable PTSD than police. This finding suggests that better preventive interventions must be put in place for non-traditional responders who volunteer to participate in disaster-related activities (Reissman & Howard, 2008). Providing psychological first-aid soon after the exposure is recommended to protect against the development of chronic stress-related disorders (Ursano *et al.* 2007).

In our age, the number of toxic events in which relatively large populations are exposed to concomitant physical and psychological traumas has increased dramatically. In the sample of WTC responders who participated in this study, there was a striking correlation between PTSD and respiratory symptoms, with evidence that PTSD might play a mediating role in the exposure-symptom relationship. The associations reported in this paper have set the stage for further research to elucidate the pathways for the development and maintenance of respiratory problems using a longitudinal design, a diagnostic measure of PTSD, and additional risk and protective factors. Scott *et al.* (2009) demonstrated that mental-physical comorbidity has both additive and synergistic effects on disability, underscoring the importance of disentangling the association of PTSD and respiratory symptoms in addition to the provision of integrated general medical and psychiatric care for disaster responders.

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Note

Supplementary material accompanies this paper on the Journal's website (<http://journals.cambridge.org/psm>).

Declaration of Interest

None.

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Trends in Respiratory Symptoms of Firefighters Exposed to the World Trade Center Disaster: 2001–2005

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BACKGROUND: Respiratory symptoms, either newly reported after the World Trade Center (WTC) disaster on 11 September 2001 (9/11) or increased in severity, have been well documented in WTC-exposed workers and New York City residents. However, considerable uncertainty exists over the persistence of symptoms.

OBJECTIVES: In this study, our goals were to describe trends in post-9/11 respiratory and gastroesophageal reflux disease (GERD) symptoms in WTC-exposed firefighters and to examine symptom progression in the cohort that completed both year 1 and year 4 questionnaires.

METHODS: We analyzed questionnaire responses from 10,378 firefighters in yearly intervals, from 2 October 2001 to 11 September 2005, defining exposure based on arrival time at the WTC site. For the cohort of 3,722 firefighters who completed the two questionnaires, we also calculated exposure duration summing months of work at the site.

RESULTS: In cross-sectional analyses, the prevalence of dyspnea, wheeze, rhinosinusitis, and GERD remained relatively stable, whereas cough and sore throat declined, especially between 1 and 2 years post-9/11. We found a dose-response relationship between arrival time and symptoms in all years ($p < 0.01$). Logistic models of symptoms at year 4 in the cohort demonstrated independent effects of earlier arrival and longer work duration: each additional month of work increased the odds of symptoms 8–11%.

CONCLUSIONS: Prolonged work exposures increased the odds of respiratory and GERD symptoms 4 years later. In most large disasters, exposures may be unavoidable during the rescue phase, but our data strongly suggest the need to minimize additional exposures during recovery and cleanup phases.

KEY WORDS: disaster medicine, firefighters, gastroesophageal reflux disease (GERD), occupational medicine, rescue workers, respiratory symptoms, World Trade Center. *Environ Health Perspect* 117:975–980 (2009). doi:10.1289/ehp.0800291 available via <http://dx.doi.org/> [Online 11 February 2009]

The collapse of the World Trade Center (WTC) on 11 September 2001 (9/11) and subsequent recovery efforts released large amounts of particulate dust, combustion particles, gases, fumes, and other noxious materials, some of which will remain incompletely characterized [Banauch et al. 2006; Centers for Disease Control and Prevention (CDC) 2002a; Edelman et al. 2003; Landrigan et al. 2004; Lioy et al. 2002; McGee et al. 2003; Mendelson et al. 2007], particularly the gaseous component (Lioy et al. 2002). After the initial dust cloud settled, fires continued to be a major source of ongoing airborne contamination for months after the attack. The Fire Department, City of New York (FDNY), operated a continuous rescue/recovery effort at the site that lasted until July 2002 (Fireman et al. 2004; Prezant et al. 2002) and involved > 15,000 rescue workers (firefighters and emergency medical service (EMS) workers).

In the first 6 months after 9/11, the Bureau of Health Services (BHS) of FDNY identified 332 firefighters with “World Trade Center cough,” defined as a persistent cough that developed after exposure to the site and that was severe enough to require extensive medical leave (Prezant et al. 2002). In the same report, a range of frequent coexistent symptoms were

identified, including dyspnea, wheeze, nasal congestion/drip, and acid reflux, that were consistent with asthma, rhinosinusitis, and gastroesophageal reflux disease (GERD). Increased bronchodilator responsiveness and bronchial hyperactivity were often noted in this and other studies (Banauch et al. 2003, 2005a; Prezant et al. 2002). A later study involving 12,079 FDNY rescue workers documented a decline in pulmonary function during the first year post-9/11 that was 12 times that found pre-9/11 (Banauch et al. 2006). An exposure-response gradient, based on arrival time at the WTC (Prezant et al. 2002), was consistently demonstrated for symptoms, bronchodilator responsiveness, bronchial hyperactivity, and declines in pulmonary function. Respiratory symptoms, either newly reported post-9/11 or increased in severity, have also been documented in other exposed workers (Herbert et al. 2006; Herbstman et al. 2005; Salzman et al. 2004; Tao et al. 2007; Wheeler et al. 2007) and residents (CDC 2002b; Lin et al. 2005; Reibman et al. 2005; Szema et al. 2004).

Considerable uncertainty exists over the persistence of respiratory symptoms among WTC-exposed individuals because of a lack of long-term follow-up data. One earlier study reported on respiratory symptoms at

three time points (pre-9/11, while working at the site, and 10–31 months post-9/11), but the first two time points were collected retrospectively and therefore were potentially subject to recall bias (Herbert et al. 2006). Another study evaluated symptom persistence at 1 and 20 months post-9/11 but focused exclusively on lower respiratory symptoms (LRS) in a convenience sample of 471 police officers (Buyantseva et al. 2007). The present study is the first to report the evolution of WTC respiratory symptoms in a large, highly exposed, homogeneous (similar firefighting job tasks) group ($n = 10,378$), with prospective follow-up over the first 4 years. We describe temporal trends in the prevalence of post-9/11 aerodigestive symptoms [upper respiratory symptoms (URS), LRS, and GERD] through 11 September 2005. We further analyzed the progression of symptoms in those firefighters ($n = 3,722$) that completed questionnaires during both the first and fourth years, thereby enabling assessment of four symptom patterns: early onset/resolved, early onset/persistent, delayed onset, and asymptomatic initially and after 4 years (Buyantseva et al. 2007).

Methods

Since 1997, the FDNY BHS has performed periodic health evaluations on FDNY members approximately every 18 months; these evaluations include physician examinations and, since 2001, self-administered health questionnaires. The questionnaires are programmed on touch-screen computers, with trained personnel available to answer questions. Participation in the study required written informed consent and was

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Study participants. The original sample consisted of 14,380 firefighters and EMS workers who were hired before 25 July 2002 (the date the WTC site closed). We excluded 1,636 firefighters who arrived after day 14 or were never present (because of demographic differences between them and earlier arrivals); 369 who did not complete questionnaires; and 1,997 EMS workers (because of differences in their job tasks and because they had less stringent preemployment health requirements). The final sample for cross-sectional analysis consisted of 10,378 firefighters.

Data sources. We obtained demographics from the FDNY employee database. Symptoms, exposure status, mask/respirator use, and smoking history were collected from the questionnaires.

Symptom prevalence. The questionnaire asked participants about LRS and URS: "Since the disaster, have you had any of the following new or worsening respiratory symptoms?" For LRS, possible answer choices included "no respiratory symptoms," "wheezing," "shortness of breath," and "daily cough"; for URS, possible answers included "no nose or throat symptoms," "nasal drip," "nasal congestion," "sore throat," and "hoarse throat with change or loss of voice." Multiple answers were allowed. We estimated GERD symptoms based on a positive response to "chest tightness or pain" or "stomach upset or heartburn." Follow-up questionnaires asked participants if they had any of the above symptoms, and affirmative answers were qualified as to their presence during "the last 4 weeks." We obtained information on symptoms pre-9/11 from the participant's first post-9/11 questionnaire, which asked: "Prior to the disaster did you commonly suffer from any of the following: daily cough, nasal congestion or drip, wheeze, shortness of breath, chest tightness or pain." Multiple answers were allowed.

WTC exposure. The FDNY-WTC exposure intensity index (Pezant et al. 2002) categorized exposure based on first arrival at the WTC site as follows: group 1 (the most severely exposed) arrived on the morning of 9/11 and were present during the tower collapses; group 2 arrived during the afternoon of 9/11; group 3 arrived on day 2 (12 September 2001); and group 4 (least exposed) arrived on days 3–14.

In addition to arrival group, we created two duration variables. The first used information from questions in which participants reported which months they worked at the site, on or off duty, from September 2001 through July 2002. We used the sum of the number of months participants worked on the site as a continuous variable in multivariate models. We created the second variable, based

on both work duration and mask/respirator use, by multiplying each month the participant reported working at the site by 1.0, 0.75, or 0.25, depending on the reported mask/respirator use frequency of "never," "rarely," or "mostly" during that month (Wheeler et al. 2007). The sum of the number of mask-use-weighted months was tested as a continuous variable in multivariate models.

Smoking history. "Current smokers" reported smoking cigarettes during any year post-9/11. "Former smokers" reported smoking before 9/11 but did not report current smoking in any post-9/11 questionnaire. "Never smokers" consistently reported not smoking pre- and post-9/11.

Time periods. In this study we include data from 17,447 questionnaires analyzed cross-sectionally in 1-year periods based on the date administered: year 1, 2 October 2001 to 11 September 2002; year 2, 12 September 2002 to 11 September 2003; year 3, 12 September 2003 to 11 September 2004; and year 4, 12 September 2004 to 11 September 2005. Within each year, if persons completed more than one questionnaire, we used data only from the earliest one.

Cohort for analysis of symptom patterns over time. To identify symptom patterns and their relative frequency, we also analyzed a cohort ($n = 3,722$) that completed questionnaires during both the first and fourth years according to four reported symptom patterns: early onset/resolved, early onset/persistent, delayed onset, and asymptomatic initially and at 4 years (Buyantseva et al. 2007).

Statistical analyses. Bivariate analyses of categorical variables used the chi-square test with odds ratios (ORs) and 95% confidence intervals (95% CIs). We assessed continuous variables using the t -test or analysis of variance. In cross-sectional analyses, we used marginal logistic regression models fitted with generalized estimating equations to assess differences in the annual prevalence of symptoms by arrival group, and McNemar's test for trend to assess the relation of arrival group to symptoms.

In the cohort, we tested the linear trend of symptom prevalence over time by arrival group using the Cochran-Armitage test for trend. We used multiple logistic regression analyses with backward elimination to predict outcomes of any LRS, URS, or GERD at follow-up. Variables tested in all models included age and years of FDNY service on 9/11, arrival group, duration of work at the WTC site in months and weighted for mask/respirator use, symptoms before 9/11, symptoms reported on initial questionnaire, smoking status (current, former, or never), and elapsed time between initial and follow-up questionnaires. We individually tested three interaction terms in each model: arrival group and smoking history,

arrival group and months of work, and mask/respirator use and months of work. Variables remained in the model based on a p -value of ≤ 0.05 and assessment of their impact on other variables in the model. Goodness of fit was assessed using the Hosmer-Lemeshow test. Data were analyzed using SAS, version 9.1 (SAS Institute Inc., Cary, NC).

Results

We collected 17,447 questionnaires from 10,378 WTC-exposed firefighters over the 4-year period from 2 October 2001 to 11 September 2005. During the study, firefighter compliance with scheduled periodic evaluations every 18 months, including questionnaire completion, was 85%. Most participants were male (99.8%), were white (93.6%), and never smoked (73.1%). The number of participants in each year of the serial cross-sectional analyses was 8,920 in year 1; 1,197 in year 2; 2,889 in year 3; and 4,441 in year 4. By arrival group, 16.2% (1,683) arrived during the morning on 9/11, 63.7% (6,611) during the afternoon of 9/11, 11.7% (1,215) on day 2, and 8.4% (869) on days 3–14. The overall mean ($\pm$ SD) duration of work at the WTC site was 4.4 ± 2.8 months, which differed significantly by arrival group: 4.7 ± 3.0 , 4.4 ± 2.8 , 3.9 ± 2.5 , and 3.3 ± 2.3 months for arrival groups 1–4, respectively ($p < 0.0001$). Comparing the group of 10,378 with the cohort of 3,722, we found small statistically significant differences in mean age (39.2 years vs. 37.3 years; $p < 0.01$) and percent Caucasian (93.6% vs. 94.7%; $p < 0.01$), whereas percent male (99.8%) and percent arrival group 1 (16.2%) were the same.

Prevalence of symptoms in cross-sectional analyses. Before 9/11, participants had rarely reported LRS: frequent cough was reported by 4.1%, dyspnea by 2.5%, and wheeze by 1.2%. In the first year (2 October 2001 to 11 September 2002), the most common LRS was frequent cough, reported by 54.2%. By year 2, the rate of frequent cough declined to 16.9%, remaining close to that level to affect 15.7% during year 4. In contrast, dyspnea and wheeze showed little change: dyspnea was reported by 40% during year 1 and 38.8% during year 4, and wheeze was reported by 34% throughout all 4 post-9/11 years.

Before 9/11, reports of URS were also rare, with frequent sore throat reported by 3.2% and frequent rhinosinusitis by 4.4%. During year 1, the most common respiratory symptom was sore throat, reported by 62.4%. By year 2, the rate of sore throat declined to 36.0%, plateauing to affect 37.0% in year 4. In contrast, rhinosinusitis showed little change, varying from 45.1% to 47.8% during years 1 and 4, respectively. Before 9/11, symptoms consistent with GERD were reported by 5.2%. GERD symptoms were reported by 41.8% during

year 1 and remained between 40% and 45% during all 4 post-9/11 years (Figure 1).

Prevalence by arrival group in cross-sectional analyses. For all symptoms, earlier arrival was associated with higher prevalence in all years (all $p < 0.01$). For cough, dyspnea, wheeze, sore throat, and rhinosinusitis, those in arrival groups 3 and 4 experienced a greater proportion of decline over time compared with changes in earlier arrival groups (Table 1, Figure 2).

Symptom progression in the cohort. A total of 3,722 firefighters completed both year 1 and year 4 questionnaires. In year 1, the mean ($\pm$ SD) number of reported symptoms per person was 2.6 ± 2.0 , which significantly declined to 2.2 ± 2.0 ($p < 0.0001$) in year 4.

On the initial questionnaire, 64.1% reported one or more LRS, 69.7% one or two URS, and 38.4% GERD. At year 4, the prevalence of any LRS declined significantly to 49.5%, largely attributable to the 69.0% decline in cough, because both dyspnea and wheeze significantly increased from 35.2% to 39.4% and from 28.9% to 34.6%, respectively ($p < 0.001$ for both). Similarly, we found a significant decline ($p < 0.001$) in any URS to 57.3%, primarily attributable to a 37.4% decline in sore throat, because rhinosinusitis significantly increased from 44.1% to 48.7% ($p < 0.001$). The prevalence of GERD also increased from 38.4% to 43.8% ($p < 0.001$).

Factors associated with symptom patterns in the cohort. We explored the relationship between arrival group and symptom patterns in the cohort with year 1 and year 4 questionnaires ($n = 3,722$). Earlier arrival group was consistently related to symptom persistence for LRS, URS, and GERD. Comparing earliest arriving participants (arrival group 1) with all others, arrival group 1 members were more likely to have LRS (OR = 1.8; 95% CI, 1.5–2.2), URS (OR = 1.5; 95% CI, 1.3–1.8), and/or GERD (OR = 1.9; 95% CI, 1.5–2.2) at year 4. This held true for each individual symptom as well. For LRS, persistent cough (OR = 1.7; 95% CI, 1.3–2.1), persistent

dyspnea (OR = 2.0; 95% CI, 1.7–2.4), and persistent wheezing (OR = 1.8; 95% CI, 1.5–2.3) were all more likely among arrival group 1 members. A similar pattern was apparent for those with persistent URS: persistent rhinosinusitis (OR = 1.3; 95% CI, 1.1–1.6) and persistent sore throat (OR = 1.6; 95% CI, 1.3–1.9). In contrast, asymptomatic status was consistently related to later arrival status ($p < 0.0001$; Table 2).

The prevalence of smoking in the cohort was 13.5%, 11.1%, and 75.4% for current, former, and never smokers, respectively. Current and former smokers were generally

overrepresented among those with persistent symptoms. We also carried out analyses comparing persons with persistent symptoms with those who recovered. We found that current smoking compared with never smoking was associated with persistent wheeze (OR = 1.5; 95% CI, 1.1–2.1), cough (OR = 1.5; 95% CI, 1.1–2.0), and GERD (OR = 1.6; 95% CI, 1.2–2.3). Former smoking compared with never smoking was not significantly associated with individual symptoms but was associated with persistent LRS (OR = 1.3; 95% CI, 1.0–1.8) and URS (OR = 1.3; 95% CI, 1.0–1.7).

Table 1. Annual prevalence of symptoms in 10,378 firefighters by arrival group (%).^a

Symptom	Arrival group	Year ^b				Percent change, years 1–4 ^c	p-Value ^d
		1 (n = 8,920)	2 (n = 1,197)	3 (n = 2,889)	4 (n = 4,441)		
Cough	1	64.3	25.9	24.3	20.0	-68.9	<0.0001
	2	54.8	16.1	16.9	16.1	-70.6	<0.0001
	3	48.4	13.7	12.6	12.7	-73.8	<0.0001
	4	37.4	8.4	10.7	6.0	-84.0	<0.0001
Dyspnea	1	54.4	57.7	54.3	50.1	-7.9	0.554
	2	39.2	42.3	43.2	39.6	1.0	0.002
	3	32.5	31.3	34.9	28.7	-11.9	0.273
	4	25.0	20.0	26.6	19.2	-23.2	0.269
Wheeze	1	44.2	51.2	48.4	43.5	-1.5	0.090
	2	33.7	38.5	38.7	35.5	5.6	<0.0001
	3	29.7	31.3	32.7	23.2	-21.9	0.034
	4	21.5	22.1	23.7	17.9	-16.7	0.514
Rhinosinusitis	1	50.6	50.2	53.9	54.4	7.4	0.193
	2	45.5	41.8	48.4	49.1	7.9	<0.0001
	3	42.4	37.4	40.9	39.6	-6.6	0.416
	4	35.5	24.2	31.6	32.5	-8.5	0.079
Sore throat	1	70.4	48.8	48.9	45.6	-35.1	<0.0001
	2	63.2	35.5	39.2	38.2	-39.6	<0.0001
	3	58.5	32.1	28.6	26.3	-55.1	<0.0001
	4	45.9	18.9	26.6	21.5	-53.1	<0.0001
GERD	1	53.7	51.2	53.6	53.9	0.4	0.845
	2	41.5	39.4	45.9	43.2	4.1	<0.0001
	3	35.6	39.7	35.5	35.0	-1.7	0.847
	4	28.3	30.5	27.7	28.5	0.7	0.781

^ap-Values all < 0.01, by McNemar's test for trend between symptom prevalence and arrival group. ^bIndividuals in each year may not be the same. ^cCalculated as year 4 – year 1/year 1 $\times 100$. ^dp-Values from marginal logistic regression model fitted with generalized estimating equations, with an exchangeable within-individual correlation.

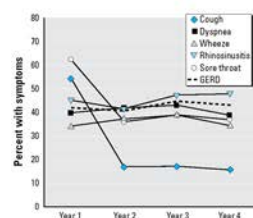


Figure 1. Trends in the prevalence of symptoms in 10,378 firefighters from 2001 through 2005.

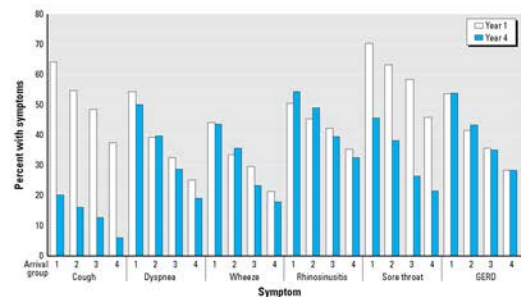


Figure 2. Trends in the prevalence of symptoms in 10,378 firefighters during year 1 (2001–2002) and year 4 (2004–2005) by arrival group.

Multivariate analyses. Multivariate logistic regression models in the cohort predicting symptoms at year 4, either persistent or delayed onset were carried out separately for LRS, URS, and GERD outcomes. Arrival group, initial symptoms, age on 9/11, and months of work (either modified by mask/respirator use or unmodified) were independently associated with symptoms at follow-up in all models. We used the unmodified duration variable because results did not differ from those using the modified variable. Elapsed time between year 1 and year 4 questionnaires remained significant only in the LRS model. Three interaction terms—months of work and arrival group, smoking and arrival group, and months of work and mask/respirator use—were not statistically significant (all $p > 0.05$). The overlap between LRS, URS, and GERD was apparent, especially in the model predicting GERD, where the addition of terms for initial LRS and rhinosinusitis symptoms greatly improved the model fit. All

models satisfied Hosmer-Lemeshow goodness of fit tests (Tables 3–5).

Discussion

In this study we describe the prevalence of respiratory symptoms in a well-characterized group of 10,378 WTC-exposed firefighters who worked, on average, four times longer at the WTC site (Wheeler et al. 2007) and were followed more than twice as long (4 years) as workers in most previous reports (Buyantseva et al. 2007; Tao et al. 2007; Wheeler et al. 2007). We found that cough, previously characterized in air pollution studies as the most sensitive indicator of lower respiratory insult (Dockery and Pope 1994), similarly served as a sentinel indicator in WTC-exposed firefighters. In our study, cough was one of the earliest-appearing and earliest-resolving symptoms, declining sharply between 1 and 2 years post-9/11 to affect 16% of firefighters by the study's end. Despite this sharp decline, cough rates during the final period were

approximately four times their pre-9/11 rate. Other LRS rates after 9/11 remained relatively constant, and by study's end, wheeze and dyspnea were reported at 28.6 and 15.5 times their pre-9/11 rates, respectively.

For URS, the prevalence of sore throat declined by 41%, whereas rhinosinusitis symptoms increased by 6%. The final rates were 10.7 and 10.6 times their pre-9/11 rates, respectively. GERD symptoms increased by 3.2% during the study, with a final rate 8.2 times its pre-9/11 prevalence. We are confident that comparing rates during the final study period with pre-9/11 rates is valid even though the latter were collected retrospectively at the first post-9/11 questionnaire, because these data are comparable with information collected during FDNY periodic medical evaluations obtained pre-9/11.

Analyses of the cohort of 3,722 enabled us to examine reported-symptom progression in the group of firefighters who completed questionnaires in both the first and

Table 2. Symptom progression [no. (%) by arrival group in the cohort ($n = 3,722$) at year 4.

Symptom pattern	Arrival group				Total ($n = 3,722$)	p -Value ^a
	1 ($n = 603$)	2 ($n = 2,504$)	3 ($n = 384$)	4 ($n = 231$)		
Cough						
Early onset /recovery	260 (43.1)	1,014 (40.5)	136 (35.4)	67 (29.0)	1,477 (39.7)	< 0.0001
Persistent	104 (17.3)	297 (11.9)	39 (10.2)	9 (3.9)	449 (12.1)	< 0.0001
Delayed onset	20 (3.3)	105 (4.2)	13 (3.4)	7 (3.0)	145 (3.9)	0.77
Asymptomatic	219 (36.3)	1,088 (43.5)	196 (51.0)	148 (64.1)	1,651 (44.4)	< 0.0001
Wheeze						
Early onset /recovery	64 (10.6)	284 (11.3)	48 (12.5)	25 (10.8)	421 (11.3)	0.64
Persistent	156 (25.9)	446 (17.8)	42 (10.9)	11 (4.8)	655 (17.6)	< 0.0001
Delayed onset	103 (17.1)	445 (17.8)	51 (13.3)	35 (15.2)	634 (17.0)	0.15
Asymptomatic	260 (46.4)	1,329 (53.1)	243 (63.3)	160 (69.3)	2,012 (54.1)	< 0.0001
Dyspnea						
Early onset /recovery	81 (13.4)	319 (12.7)	43 (11.2)	22 (9.5)	465 (12.5)	0.09
Persistent	207 (34.3)	558 (22.3)	63 (16.4)	19 (8.2)	847 (22.8)	< 0.0001
Delayed onset	95 (15.8)	441 (17.6)	54 (14.1)	31 (13.4)	621 (16.7)	0.23
Asymptomatic	220 (36.5)	1,186 (47.4)	224 (58.3)	158 (68.8)	1,789 (48.1)	< 0.0001
Any LRS						
Early onset /recovery	138 (22.9)	602 (24.0)	107 (27.9)	50 (21.7)	897 (24.1)	0.58
Persistent	315 (52.2)	1,016 (40.6)	112 (29.2)	45 (19.5)	1,488 (40.0)	< 0.0001
Delayed onset	40 (6.6)	245 (9.8)	42 (10.9)	29 (12.6)	356 (9.6)	0.004
Asymptomatic	110 (18.2)	641 (25.6)	123 (32.0)	107 (46.3)	981 (26.4)	< 0.0001
Rhinosinusitis						
Early onset /recovery	91 (15.1)	395 (15.8)	63 (16.4)	36 (15.6)	585 (15.7)	0.71
Persistent	202 (33.5)	722 (28.8)	95 (24.7)	39 (16.9)	1,058 (28.4)	< 0.0001
Delayed onset	126 (20.9)	520 (20.8)	63 (16.4)	44 (19.1)	753 (20.2)	0.17
Asymptomatic	184 (30.5)	867 (34.6)	163 (42.5)	112 (48.5)	1,326 (35.6)	< 0.0001
Sore throat						
Early onset /recovery	184 (30.5)	771 (30.8)	128 (33.3)	60 (26.0)	1,143 (30.7)	0.60
Persistent	229 (38.0)	748 (29.9)	80 (20.8)	36 (15.6)	1,093 (29.4)	< 0.0001
Delayed onset	49 (8.1)	208 (8.3)	26 (6.8)	22 (9.5)	305 (8.2)	0.93
Asymptomatic	141 (23.4)	777 (31.0)	150 (39.1)	113 (48.9)	1,181 (31.7)	< 0.0001
Any URS						
Early onset /recovery	132 (21.9)	583 (23.3)	104 (27.1)	51 (22.1)	870 (23.4)	0.35
Persistent	332 (55.1)	1,182 (47.2)	148 (38.5)	61 (26.4)	1,723 (46.3)	< 0.0001
Delayed onset	57 (9.5)	272 (10.9)	44 (11.5)	38 (16.5)	411 (11.0)	0.008
Asymptomatic	82 (13.6)	467 (18.7)	88 (22.9)	81 (35.1)	718 (19.3)	< 0.0001
GERD						
Early onset /recovery	80 (13.3)	335 (13.4)	42 (10.9)	28 (12.1)	485 (13.0)	0.35
Persistent	217 (36.0)	628 (25.1)	71 (18.5)	27 (11.7)	943 (25.3)	< 0.0001
Delayed onset	110 (18.2)	461 (18.4)	70 (18.2)	47 (20.4)	688 (18.5)	0.59
Asymptomatic	196 (32.5)	1,080 (43.1)	201 (52.3)	129 (55.8)	1,606 (43.2)	< 0.0001

^a p -Values from Cochran-Armitage test for trend.

fourth postexposure years, thereby allowing differentiation between symptom patterns of persistence, delayed onset, resolution, and never symptomatic at year-4 follow-up. It also allowed us to explore the evolution of symptoms within individuals, as opposed to tracking change over time in the larger population. Multivariate analyses of the cohort data yielded one of our major findings. After adjusting for other variables in the model, we found that each month worked at the WTC site increased the odds of symptoms at follow-up by 11% for both LRS and GERD and by 8% for URS. At the maximum duration of 10 months, the odds of symptoms in year 4 were 2.8 times greater for LRS and GERD and 2.2 times greater for URS. In fact, 10 months of work at the site was much more strongly associated with year 4 symptoms than even the earliest arrival time. Most studies have not reported on work duration (Banauch et al. 2005a; Buyantseva et al. 2007; Fireman et al. 2004; Landrigan et al. 2004; Oppenheimer et al. 2007). Of those that did, one found an association with new-onset asthma (Wheeler et al. 2007); another reported associations with respiratory symptoms at 20 months (Buyantseva et al. 2007), although it did not control for early arrival at the WTC site; and a third found no association with post-9/11 symptoms (de la Hoz et al. 2008). Our data strongly suggest that the impact of protracted WTC work exposure was of critical importance and should be considered in future disaster plans.

Another important finding of the cohort analyses was that cough resolution did not mean that persons were free of LRS. Of those with resolved cough, half (50.9%) reported persistent or delayed-onset dyspnea, wheeze, or both at follow-up. Furthermore, because cough may arise from either lower or upper respiratory problems, we looked at URS in those with resolved cough and found that 61.3% of former coughers reported sore throat, rhinosinusitis symptoms, or both at follow-up. Thus, our data confirm our clinical impression

that persons with resolved cough should not be considered symptom-free (Buyantseva et al. 2007). Similarly, among persons with URS, those with resolved sore throat had a 36.3% prevalence of rhinosinusitis symptoms, persistent or delayed in onset, during year 4.

Consistent with initial reports by this group (Banauch et al. 2005a, 2005b; Prezant et al. 2002) and others (de la Hoz et al. 2008; Herbert et al. 2006), we found considerable overlap of LRS, URS, and GERD symptoms. Adding terms for symptoms of the other respiratory groups at the initial period improved all multivariate models. Describing cough as an LRS simplifies analyses but may misclassify cough, which can also be due to rhinosinusitis symptoms (congestion/drip), sore throat, and/or GERD (Irwin et al. 1993). In fact, we found that about 30% of the cohort reported at least one LRS, one URS, and GERD symptoms during both initial and follow-up times (data not shown).

Cigarette smoking is a modifiable risk factor increasing the likelihood of LRS and GERD by approximately 50% at follow-up. This is but one of many reasons for supporting aggressive efforts to promote nonpunitive tobacco cessation programs and counseling services, available without cost at FDNY since 9/11 (Bars et al. 2006).

This study's primary limitation was its lack of access to information about treatment, which precluded estimating the effects of treatment on reported symptoms over time. We also acknowledge that both arrival group and months of work are only crude measures of exposure to the WTC site, which would better be measured by knowing specific hours and days an individual worked on-site. However, our arrival group measure was independently corroborated by others who described the intensity of outdoor exposures based on days post-9/11 (Lioy et al. 2002). Symptom reporting could have been biased because of issues related to workers' compensation, retirement disability, and civil litigation; it could also have been affected by recall bias or by the wording of our questions, which asked about symptoms since 9/11. However, in a previous

study (Banauch et al. 2006) we reported that objective spirometric measurements correlated with clinical complaints, and each additional respiratory symptom was associated with an additional decrement in forced expiratory volume in 1 sec. Despite potential limitations, we found significant exposure-response gradients for symptoms at all time points. We believe the strengths of this study outweigh its limitations. First, we examined secular trends in > 10,000 firefighters and were able to study symptom progression in the cohort of 3,722 based on their questionnaire responses at both years 1 and 4. Compared with other published studies, this represents a larger group of highly exposed individuals, all with similar firefighting job tasks, and the most years of follow-up. Second, we asked about the prevalence of symptoms pre-9/11, which enabled us to compare pre- and post-9/11 symptoms in individuals whom we knew to be extremely healthy pre-9/11. Finally, we explored the data in several ways. For example, we initially selected the cohort based on persons with two or more visits at least 1 year apart to increase the number of participants, but ultimately selected only those with first- and fourth-year questionnaires to allow the maximum time for symptoms to resolve, either spontaneously or through treatment. Using either cohort did not change findings.

Conclusion

We found that cough and sore throat were the most sensitive indicators of initial respiratory insult early after 9/11, but that the other symptoms (wheeze, dyspnea, rhinosinusitis, and GERD) were more sensitive indicators at follow-up. In year 4, even cough, the symptom with the greatest decline rate, was still reported at four times the pre-9/11 level, and the other symptoms were reported at levels from 8.2 to 28.6 times their pre-9/11 rates. We found a significant exposure-response gradient based on arrival time for all symptoms. In the cohort we found that each month worked at the site conferred a substantial and highly significant increase in the odds of symptoms at follow-up. For LRS,

Table 3. Multiple logistic regression models in the cohort of 3,722 firefighters [OR (95% CI)] for LRS at year 4.

Variable	OR (95% CI)
Any URS, year 1 questionnaire	1.45 (1.21–1.73)
GERD, year 1 questionnaire	1.27 (1.07–1.51)
Cough, year 1 questionnaire	1.62 (1.38–1.90)
Dyspnea, year 1 questionnaire	2.34 (1.94–2.82)
Wheeze, year 1 questionnaire	1.91 (1.59–2.30)
Current smoking	1.56 (1.26–1.93)
Age on 9/11 (years)	1.03 (1.02–1.04)
Arrival group 1 ^a	1.66 (1.16–2.37)
Arrival group 2 ^a	1.49 (1.08–2.04)
Arrival group 3 ^a	1.13 (0.77–1.64)
Months of work at WTC site	1.11 (1.08–1.14)
Days between questionnaires	0.999 (0.998–1.00)

^aReference is arrival group 4 (arrival at WTC site 3–14 days post-9/11).

Table 4. Multiple logistic regression models in the cohort of 3,722 firefighters [OR (95% CI)] for URS at year 4.

Variable	OR (95% CI)
Any LRS, year 1 questionnaire	1.53 (1.29–1.80)
Rhinosinusitis, year 1 questionnaire	2.06 (1.77–2.39)
Sore throat, year 1 questionnaire	1.73 (1.49–2.04)
Arrival group 1 ^a	1.63 (1.17–2.28)
Arrival group 2 ^a	1.40 (1.04–1.88)
Arrival group 3 ^a	1.09 (0.77–1.55)
Age on 9/11 (years)	1.011 (1.00–1.02)
Months of work at WTC site	1.08 (1.05–1.11)

^aReference is arrival group 4 (arrival at WTC site 3–14 days post-9/11).

Table 5. Multiple logistic regression models in the cohort of 3,722 firefighters [OR (95% CI)] for GERD at year 4.

Variable	OR (95% CI)
Any LRS, year 1 questionnaire	1.71 (1.45–2.03)
Rhinosinusitis, year 1 questionnaire	1.20 (1.03–1.39)
GERD, year 1 questionnaire	3.48 (2.96–4.05)
Current smoking	1.49 (1.22–1.83)
Arrival group 1 ^a	1.49 (1.05–2.11)
Arrival group 2 ^a	1.15 (0.84–1.58)
Arrival group 3 ^a	1.03 (0.71–1.49)
Age on 9/11 (years)	1.02 (1.01–1.03)
Months of work at WTC site	1.11 (1.08–1.14)

^aReference is arrival group 4 (arrival at WTC site 3–14 days post-9/11).

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5 months of work exposure conferred a risk equivalent to arriving at the WTC site during the morning of 9/11, and 10 months of work was associated with an almost 3-fold risk of symptoms at follow-up. The importance of this finding cannot be overemphasized. In any disaster, exposures will be difficult to avoid in the first weeks when the potential for successful rescues are time-limited and the environment may be difficult to control. However, during subsequent recovery and cleanup phases, it is reasonable to expect appropriate protection from potential environmental hazards; our data strongly suggest the need to develop and implement strategies that include guidelines for respirator use to minimize additional exposures during these phases.

CORRECTION

In the original manuscript published online, affiliations were incorrect for M.P.W. and J.K.N. They have been corrected here.

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Persistence of multiple illnesses in World Trade Center rescue and recovery workers: a cohort study

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Summary

Background More than 50 000 people participated in the rescue and recovery work that followed the Sept 11, 2001 (9/11) attacks on the World Trade Center (WTC). Multiple health problems in these workers were reported in the early years after the disaster. We report incidence and prevalence rates of physical and mental health disorders during the 9 years since the attacks, examine their associations with occupational exposures, and quantify physical and mental health comorbidities.

Methods In this longitudinal study of a large cohort of WTC rescue and recovery workers, we gathered data from 27 449 participants in the WTC Screening, Monitoring, and Treatment Program. The study population included police officers, firefighters, construction workers, and municipal workers. We used the Kaplan-Meier procedure to estimate cumulative and annual incidence of physical disorders (asthma, sinusitis, and gastro-oesophageal reflux disease), mental health disorders (depression, post-traumatic stress disorder [PTSD], and panic disorder), and spirometric abnormalities. Incidence rates were assessed also by level of exposure (days worked at the WTC site and exposure to the dust cloud).

Findings 9-year cumulative incidence of asthma was 27.6% (number at risk: 7027), sinusitis 42.3% (5870), and gastro-oesophageal reflux disease 39.3% (5650). In police officers, cumulative incidence of depression was 7.0% (number at risk: 3648), PTSD 9.3% (3761), and panic disorder 8.4% (3780). In other rescue and recovery workers, cumulative incidence of depression was 27.5% (number at risk: 4200), PTSD 31.9% (4342), and panic disorder 21.2% (4953). 9-year cumulative incidence for spirometric abnormalities was 41.8% (number at risk: 5769); three-quarters of these abnormalities were low forced vital capacity. Incidence of most disorders was highest in workers with greatest WTC exposure. Extensive comorbidity was reported within and between physical and mental health disorders.

Interpretation 9 years after the 9/11 WTC attacks, rescue and recovery workers continue to have a substantial burden of physical and mental health problems. These findings emphasise the need for continued monitoring and treatment of the WTC rescue and recovery population.

Funding Centers for Disease Control and Prevention and National Institute for Occupational Safety and Health.

Introduction

More than 50 000 people worked on the rescue and recovery effort that followed the terrorist attack on the World Trade Center (WTC) on Sept 11, 2001 (9/11).¹ This population was highly diverse; it included first responders such as firefighters, police officers, and paramedics, but also included operating engineers, iron workers, railway tunnel workers, telecommunications workers, sanitation workers, medical examiner staff, and volunteers, many of whom had no training in response to civil disasters.¹ These individuals were involved in rescue-and-recovery operations and clean-up of debris and restoration of essential services. They worked at Ground Zero, the WTC site, and also at barge-loading piers, vehicle cleaning stations, the landfill destinations for debris, and the medical examiner's office.

WTC rescue and recovery workers were exposed to a complex mix of airborne toxins.¹ Burning jet fuel from the hijacked airliners released a dense plume of black

smoke containing benzene, other volatile organics, metals, and polycyclic aromatic hydrocarbons. The collapse of the towers pulverised building materials and created a dense cloud of dust that contained particulates, glass fibres, asbestos, lead, hydrochloric acid, polychlorinated biphenyls, organochlorine pesticides, and polychlorinated dioxins and furans.⁴ These workers were also exposed to psychological stressors: long work shifts, fear for personal safety, and exposure to body parts.²

Several studies have described the health problems that developed in rescue and recovery workers in the first months and years after 9/11. These problems included sinusitis, new-onset cough, wheeze, gastro-oesophageal reflux disease, depression, post-traumatic stress disorder (PTSD), panic disorder, and other pulmonary illnesses.³⁻¹⁰

Despite this abundance of information on short-term and mid-term physical and mental health disorders in WTC rescue and recovery workers,^{4,10,11} additional data on the long-term trajectories of these disorders are

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unknown. We aimed to assess the cumulative incidence and current prevalence of physical and mental health disorders over the 9 years since the WTC attacks, examine their associations with occupational exposures, and quantify comorbidities within and between physical and mental health problems. Such information is needed to guide the care of WTC rescue and recovery workers and to plan responses to future disasters.

Methods

Study population

In this longitudinal cohort, the study population consisted of 27449 WTC rescue and recovery workers who participated in the WTC Screening, Monitoring, and Treatment Program. Workers included in this analysis (ie, those who worked in protective services or military, construction, electrical or telecommunication repair, transportation or material moving, other occupations, or were unemployed or retired) were enrolled between July 16, 2002, and Sept 11, 2010. Eligible WTC responders were those who had worked or volunteered in lower Manhattan, or the Staten Island landfill or barge-loading piers for 4 h or more from 9/11 to Sept 14, 2001, 24 h or more during September, 2001, or 80 h or more from September, 2001, to December, 2001. Members of the Office of the Chief Medical Examiner who processed human remains were also eligible, as were workers from the Port Authority Trans Hudson Corporation who were engaged in cleaning tunnels for 24 h or more from 9/11 to July 1, 2002 (additional details of the programme have been described previously).¹² Members of the Fire Department of the City of New York (FDNY) were assessed by a parallel programme¹³ and thus, not represented in our cohort. Similarly, the New York City Department of Health established a registry with interview data gathered from rescue and recovery workers and lower Manhattan residents, schoolchildren, building occupants, and passers-by; these data are not included in our study.¹⁴ Although New York City firefighters and local residents are not represented in our cohort, the WTC Screening, Monitoring, and Treatment Program is unique in that it contains interview and physical examination data for a large and diverse group of non-firefighter rescue and recovery workers.

Procedures

Recruitment into our cohort was done by extensive outreach and publicity in partnership with organised labour, community, and volunteer organisations, legislative and governmental agencies, and public media outlets. Participation was voluntary and involved a comprehensive baseline examination, including medical, mental health, and exposure-assessment questionnaires, and a standardised physical examination plus spirometry. Follow-up assessments were offered every 12 to 18 months.

Presence of asthma, sinusitis, and gastro-oesophageal reflux disease was established by rescue and recovery

workers' self-report of physician diagnosis. Workers also reported the date of diagnosis and, for pre-existing disorders, whether these disorders had recurred after 9/11. Mental health screening was undertaken with standardised methods to assess for symptoms of depression (patient health questionnaire [PHQ]), PTSD (PTSD symptom checklist-specific version, which includes questions about symptoms in reference to the 9/11 attacks) and panic disorder (PHQ).^{15,16} Rescue and recovery workers were classified as having symptoms consistent with depression, PTSD, or panic disorder with validated algorithms.¹⁵⁻¹⁷

To assess lung function, rescue and recovery workers underwent spirometric examination at each visit done at different sites by uniformly trained technicians and with standard techniques.¹⁸ Spirometric results were compared with reference values dependent on age, sex, race and ethnic origin, and interpreted with established guidelines.¹⁹ Pulmonary obstruction was defined as forced expiratory volume in one second (FEV₁)/forced vital capacity (FVC) below the lower limit of normal. Spirometry with FVC lower than the lower limit of normal but FEV₁/FVC at the lower limit of normal or higher was categorised as low FVC. Rescue and recovery workers with pulmonary obstruction and low FVC were classified as having mixed airway disease.

Four exposure groups were created: very high, high, intermediate, and low. Group assignment of rescue workers was based on the total time spent working at the WTC site, exposure to the cloud of debris from the collapse of the WTC buildings, and work on the pile of debris. The very high exposure group consisted of those who worked more than 90 days, were exposed to the dust cloud, and worked at least some time on the pile. The high group was comprised of rescue workers who were exposed to the dust cloud but either worked less than 90 days or did not work on the pile. The intermediate group was comprised of workers not exposed to the dust cloud and who either worked between 40 days and 90 days or did not work on the pile. The lowest exposure group included those who worked less than 40 days, were not exposed to dust from the collapse, and did not work in the debris pile.

Statistical analysis

We used Kaplan-Meier estimates to calculate the cumulative incidence and number of individuals at risk for asthma, sinusitis, and gastro-oesophageal reflux disease. On the basis of the Kaplan-Meier curves, we estimated time from 9/11 to the first date that the responder reported a physician diagnosis of each disorder. Results were censored at the date of the last follow-up visit before Sept 11, 2010. Cumulative incidence of these disorders before 9/11 is shown at the intercept of the cumulative incidence curve (figure 1).

PHQ and PTSD-symptom-checklist scores were not available before the rescue and recovery workers' first

visit to the programme. Workers were interval-censored between the visit date of their first positive screening for a particular mental health disorder and their previous visit; those who screened positive at the first visit were

left-censored. Cumulative incidence was calculated with an algorithm for interval censored data.²⁰ Previous research has shown a lower prevalence of mental health disorders in police officers than in other rescue and recovery workers.^{21,22} Thus, the cumulative incidence of these disorders was assessed separately for New York City police officers versus other workers. We also used methods for interval-censored data to assess the incidence

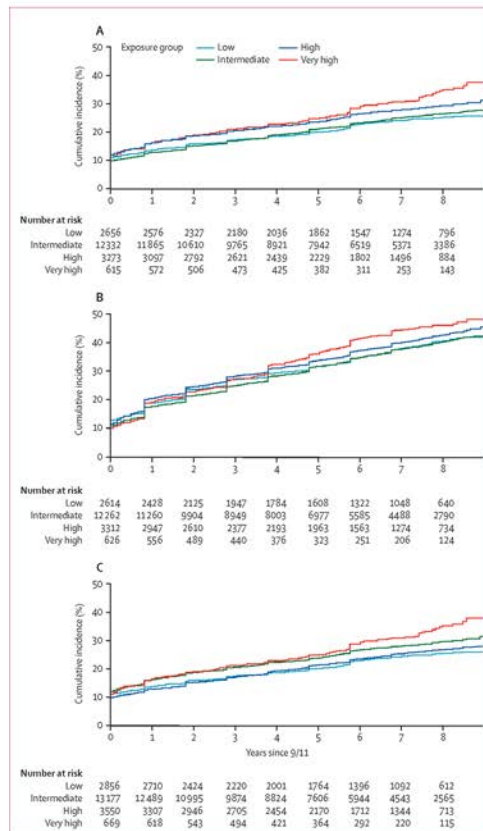


Figure 1: Cumulative incidence of physical disorders in the World Trade Center Screening, Monitoring, and Treatment Program study population

Cumulative incidence of asthma (A). Cumulative incidence of sinusitis was similar in the intermediate and low exposure groups (B). Incidence of gastro-oesophageal reflux disease was increased only in the very-high-exposure group compared with other groups (C). 9/11–September 11, 2001.

Participants (N=27 449)	
Median age (years)*	38 (33–44)
Sex	
Male	23 468 (86%)
Race	
White	15 657 (57%)
Black	2963 (11%)
Asian	373 (1%)
Other	755 (3%)
Unknown	7701 (28%)
Hispanic†	6475 (31%)
Smoking‡	
Current	4054 (15%)
Former	6315 (24%)
Never	15 897 (61%)
Occupation§	
Protective services or military	12 273 (48%)
Construction	5956 (23%)
Electrical or telecommunication repair workers	1794 (7%)
Transportation or material movers	1128 (4%)
Other occupations	4025 (16%)
Unemployed or retired	477 (2%)
Union member	22 558 (83%)
Working status at the site¶	
Worker	21 287 (81%)
Volunteer	2768 (11%)
Worked and volunteer	2127 (8%)
WTC exposure category	
Low	3235 (14%)
Intermediate	14 769 (65%)
High	4019 (18%)
Very high	749 (3%)
Directly exposed to the dust cloud from collapse	5059 (21%)
Started working on 9/11	12 041 (44%)
Year of enrolment into the programme¶¶	
≤2004	11 296 (41%)
2005–07	9509 (35%)
≥2008	6643 (24%)

Data are number (%) or median (IQR). 9/11–Sept 11, 2001. WTC=World Trade Center. *Age on 9/11. †Data missing for 6206 rescue and recovery workers who did not answer the question about ethnic origin. ‡Data missing for 1183 rescue and recovery workers. §Data missing for 1796 rescue and recovery workers. ¶Data missing for 1267 rescue and recovery workers. ||Data missing for 4677 rescue and recovery workers.

Table 1: Baseline demographic characteristics of the World Trade Center Screening, Monitoring, and Treatment Program study population

of spirometric abnormalities. Rescue and recovery workers were categorised as having normal or abnormal (obstructive, low FVC, or mixed patterns) spirometric findings. This grouping is consistent with data that showed that most rescue and recovery workers with low FVC had obstructive lung disease.¹¹ To assess the annual risk of developing each disorder, we estimated conditional incidence rates (ie, the risk of developing a disorder in a specific year) by dividing the increment in the cumulative incidence during each year of follow-up by the cumulative incidence rate at the start of the year.

The prevalence of active asthma, sinusitis, and gastro-oesophageal reflux disease 9 years after exposure was calculated as the ratio of the number of rescue workers who reported being under physician care, taking drugs, or having had an acute episode of a specific disorder during the month before the follow-up visit, to the number of rescue workers examined during that year. The proportion of rescue and recovery workers who had symptoms consistent with depression, PTSD, panic disorder, or abnormal spirometry during the 9th year of the programme was also calculated.

To assess associations of health disorders with exposures after 9/11, we examined the cumulative incidence of each physical and mental health diagnosis and spirometric abnormality by exposure group. To assess the extent to which WTC rescue and recovery workers suffered from multiple physical or mental health

problems, we constructed Venn diagrams. Analyses were done with SAS (version 9.1). The study was approved by the Institutional Review Board of Mount Sinai School of Medicine and all participants provided signed consent to use their data.

Role of the funding source

The sponsor of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Most rescue and recovery workers in our cohort were male, white, and had a median age of 38 years on 9/11 (table 1). The most common occupations were protective service or military and construction (table 1). Over a tenth of rescue workers were in the low WTC exposure category, about two-thirds were intermediate category, about a fifth were in the high category, and only a few were in the very high category (table 1). The overall distribution of baseline characteristics was relatively similar across the four exposure groups; except that males and protective service or military personnel were over-represented in the very high exposure category.

Rates of rescue and recovery worker follow-up were 71% (17 224) for the first visit, 61% (9681) for the second,

	Pre-exposure	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Physical health										
Asthma	10.5% (24 985)	13.7% (22 360)	15.8% (21 496)	17.5% (19 505)	19.3% (18 227)	21.1% (16 897)	23.4% (15 317)	25.0% (12 809)	26.4% (10 744)	27.6% (7027)
Sinusitis	10.7% (25 041)	18.0% (22 357)	21.8% (20 476)	25.2% (18 238)	28.3% (16 709)	31.2% (15 204)	34.4% (13 537)	37.3% (11 100)	39.8% (9109)	42.3% (5870)
Gastro-oesophageal reflux disease	5.8% (25 539)	10.7% (24 055)	14.4% (22 741)	17.9% (20 343)	21.5% (18 603)	25.4% (16 828)	29.9% (14 796)	33.6% (11 896)	37.1% (9423)	39.3% (5650)
Mental health symptoms										
New York City police										
Depression	–	1.7% (9573)	2.0% (8734)	2.3% (8026)	3.7% (7510)	4.2% (6999)	4.2% (6097)	6.2% (5420)	7.0% (3648)	
PTSD	–	2.5% (9866)	2.5% (9679)	4.0% (9424)	4.6% (8624)	5.7% (8155)	6.3% (7597)	7.4% (6537)	8.4% (5601)	9.3% (3761)
Panic disorder	–	2.3% (9820)	2.6% (9691)	3.1% (8928)	4.4% (8186)	4.4% (7659)	5.6% (7158)	5.7% (6271)	7.0% (5591)	8.4% (3780)
Other rescue and recovery workers*										
Depression	–	10.8% (15 062)	12.7% (14 105)	15.3% (11 620)	17.0% (9855)	17.4% (8847)	19.0% (8205)	22.3% (7138)	24.6% (6229)	27.5% (4200)
PTSD	–	12.8% (16 054)	13.5% (14 641)	17.1% (12 306)	19.8% (10 762)	22.6% (9785)	24.2% (8956)	27.2% (7682)	29.7% (6473)	31.9% (4342)
Panic disorder	–	5.0% (15 995)	5.7% (15 302)	8.1% (12 880)	12.8% (10 964)	12.8% (10 083)	13.7% (9446)	14.2% (8302)	18.5% (7349)	21.2% (4953)
Abnormal spirometry	–	23.7% (24 566)	24.9% (22 174)	27.1% (19 105)	28.5% (16 542)	29.1% (14 378)	32.4% (12 700)	34.9% (10 883)	37.9% (8949)	41.8% (5769)

Data are % (number at risk). Number of individuals at risk is estimated from cumulative incidence curves. PTSD=post-traumatic stress disorder. *All workers except New York City police officers.

Table 2: Cumulative incidence before and after 9/11 of physical disorders, mental health symptoms, and spirometric abnormalities in the World Trade Center Screening, Monitoring, and Treatment Program study population

and 55% (4410) for the third. Cumulative incidence of asthma increased from 10.5% (number at risk: 24985) at baseline to 13.7% (22360) at year 1, 21.1% (16897) at year 5, and 27.6% (7027) at year 9 (figure 1 and table 2). Annual incidence was highest during the 1st year after 9/11 and then remained stable in subsequent years at about 2% (table 3). Cumulative incidence of sinusitis increased from 10.7% (number at risk: 25041) before 9/11 to 18.0% (22357) at year 1, 31.2% (15204) at year 5, and 42.3% (5870) at year 9 (table 2). Highest incidence of sinusitis occurred during the first year after WTC exposure, and thereafter, was about 4% (table 3). For gastro-oesophageal reflux disease, cumulative incidence was 5.8% (number at risk: 25539) at baseline and cumulatively increased to 10.7% (24055) at year 1, 25.4% (16828) at year 5, and 39.3% (5650) at year 9 (table 2). Annual incidence ranged from 4–6% in all follow-up years. At year 9, prevalence of active asthma was 18.1% (1893), of sinusitis was 20.0% (2042), and of gastro-oesophageal reflux disease was 32.6% (3195).

Overall, 272 (1%) of rescue and recovery workers reported a history of physician diagnosed PTSD before 9/11 and 696 (3%) reported a previous diagnosis of depression. Cumulative incidence of PTSD, depression, and panic disorder was substantially lower in New York City police officers than in other rescue and recovery workers (table 2). PTSD was the mental health disorder

with the highest cumulative incidence in both groups at all time intervals (table 2). Among police officers, annual incidence of PTSD peaked in the 4th year after 9/11 and then stabilised at about 1–2% per year (table 3). The annual incidence of PTSD for other rescue workers also peaked in the 4th year of follow-up and remained at about 3–4% in subsequent years (table 3).

Cumulative incidence of depression in New York City police officers was 1.7% (number at risk: 9573) at year 1, 3.7% (7510) at year 5, and 7.0% (3648) at year 9; in other rescue and recovery workers cumulative incidence was 10.8% (15062) at year 1, 17.4% (8847) at year 5, and 27.5% (4200) at year 9 (table 2). Cumulative incidence of panic disorder in police officers was 2.3% (number at risk: 9820) at year 1 and increased to 4.4% (7659) at year 5 and 8.4% (3780) at year 9. For other rescue and recovery workers, cumulative incidence rates of panic disorder were 5.0% (number at risk: 15995) at year 1, 12.8% (10083) at year 5, and 21.2% (4953) at year 9 (table 2). At year 9, prevalence of depression in police officers was 4.5% (171), PTSD 5.0% (198), and panic disorder 4.8% (191); in other rescue workers, prevalence of depression was 17.9% (953), PTSD 19.2% (1141), and panic disorder 12.3% (727).

Cumulative incidence rates of abnormal spirometry were 23.7% (number at risk: 24566) at year 1, 29.1% (14378) at year 5, and 41.8% (5769) at year 9

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Physical health									
Asthma	3.4% (22360)	2.5% (21496)	2.0% (19505)	2.2% (18227)	2.2% (16897)	2.9% (15317)	2.1% (12809)	1.8% (10744)	1.8% (7027)
Sinusitis	8.0% (22357)	4.7% (20476)	4.2% (18238)	4.2% (16709)	4.0% (15204)	4.6% (13537)	4.4% (11100)	4.0% (9109)	4.3% (5870)
Gastro-oesophageal reflux disease	5.0% (24055)	4.3% (22741)	4.0% (20343)	4.4% (18603)	4.9% (16828)	6.0% (14796)	5.3% (11896)	5.0% (9423)	4.1% (5650)
Mental health symptoms									
New York City police									
Depression	– ^a	0.3% (9467)	0.3% (8734)	1.4% (8026)	0.0% (7510)	0.5% (6999)	0.0% (6097)	2.0% (5420)	0.9% (3648)
PTSD	–	0.1% (9679)	0.0% (9124)	1.8% (8624)	0.8% (8155)	1.3% (7597)	0.4% (6537)	1.8% (5601)	1.0% (3761)
Panic disorder	–	0.2% (9691)	0.4% (8928)	1.5% (8186)	0.0% (7659)	0.7% (7158)	0.5% (6271)	1.3% (5591)	1.7% (3780)
Other rescue and recovery workers									
Depression	–	3.6% (14105)	2.9% (11620)	2.0% (9855)	0.4% (8847)	1.9% (8205)	4.2% (7138)	2.9% (6229)	3.9% (4200)
PTSD	–	0.3% (14641)	3.5% (12306)	4.4% (10762)	3.3% (9785)	2.3% (8956)	4.0% (7682)	2.8% (6473)	3.7% (4342)
Panic disorder	–	1.3% (15302)	1.4% (12880)	3.9% (10964)	2.3% (10083)	0.9% (9446)	0.6% (8302)	4.9% (7349)	2.9% (4953)
Abnormal spirometry	–	1.6% (22174)	1.0% (19105)	3.9% (16542)	0.8% (14378)	2.5% (12700)	5.8% (10883)	4.7% (8949)	6.2% (5769)

Data are % (number at risk). Number of individuals at risk estimated from cumulative incidence curves. PTSD=post-traumatic stress disorder. ^aNo rate was estimated for year 1 because no data on mental health symptoms was available before 9/11. 9/11–Sept 11, 2001.

Table 2: Annual conditional incidence after 9/11 of physical disorders, mental health symptoms, and spirometric abnormalities in the World Trade Center Screening, Monitoring, and Treatment Program study population

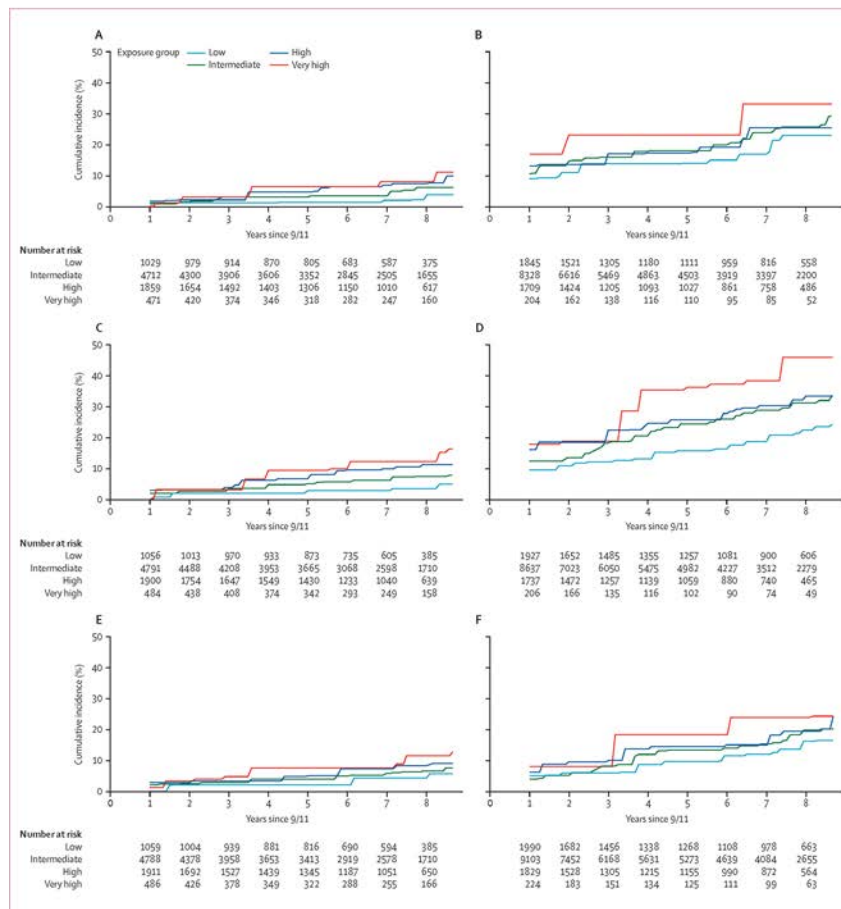


Figure 2: Cumulative incidence of mental health disorders in New York City police officers and other rescue and recovery workers in the World Trade Center Screening, Monitoring, and Treatment Program study population. Symptoms of depression in police officers were similar in the very-high and high-exposure categories (A). Symptoms of depression in other rescue and recovery workers were similar in the high and intermediate exposure categories (B). Symptoms of post-traumatic stress disorder (PTSD) were more common in police officers with higher exposure (C). Higher levels of exposure were associated with increased rates of PTSD symptoms in other responders (D). Symptoms of panic disorders were more common in police officers with higher levels of exposure (E). High exposure levels were associated with increased rates of panic-disorder symptoms in other rescue and recovery workers (F). 9/11–September 11, 2001.

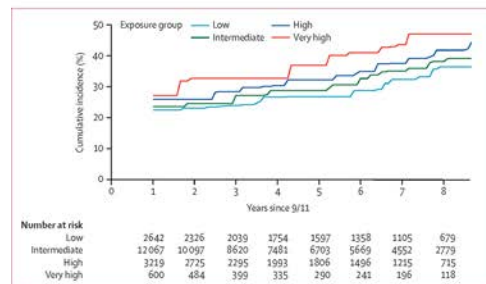


Figure 3: Cumulative incidence of abnormal spirometry in the World Trade Center Screening, Monitoring, and Treatment Program study population 9/11–September 11, 2001.

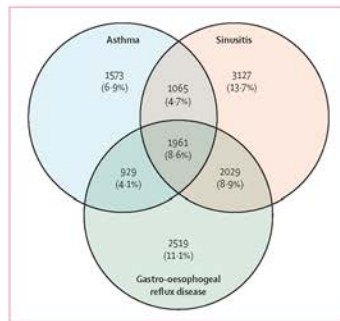


Figure 4: Physical comorbidities in the World Trade Center Screening, Monitoring, and Treatment Program study population. The Venn diagram shows the extent of comorbidity in World Trade Center rescue and recovery workers who reported ever having asthma, sinusitis, or gastro-oesophageal reflux disease.

(table 2). Annual incidence of new abnormalities in lung function was about 1–2% in the initial years after exposure and then increased to 5–6% in the latter years of follow-up. At year 9, prevalence of obstructive pulmonary disease in rescue and recovery workers was 4.4% (399), low FVC 21.8% (1992), and mixed abnormalities 2.1% (188).

In analyses of exposure-stratified cumulative incidence rates, we noted that risk of asthma, sinusitis, and gastro-oesophageal reflux disease was greatest in workers with the highest levels of exposure (figure 1A–C). Overall, we reported similar findings for mental health disorders (figure 2A–F) and spirometric abnormalities (figure 3).

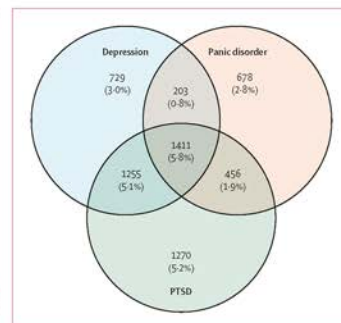


Figure 5: Mental health comorbidities in the World Trade Center Screening, Monitoring, and Treatment Program study population. High number of rescue and recovery workers had symptoms consistent with several of the mental health disorders assessed during the 9-year follow-up. PTSD = post-traumatic stress disorder.

We identified extensive comorbidities associated with physical and mental health disorders. Overall, nearly a tenth of rescue and recovery workers reported physician diagnosis of three disorders: asthma, sinusitis, and gastro-oesophageal reflux disease (figure 4). About 18% of rescue and recovery workers reported diagnoses of two disorders (figure 4). The proportion of rescue and recovery workers with symptoms consistent with PTSD, depression, and panic disorder are shown in figure 5. The proportion of those with symptoms of both depression and PTSD were also reported (figure 5). Substantial comorbidity across physical and mental health disorders was also reported: 1459 (48.3%) rescue and recovery workers with asthma, 2006 (38.2%) with sinusitis, and 2348 (42.7%) with gastro-oesophageal reflux disease reported at least one mental health disorder. Similarly, 2806 (69.6%) with PTSD, 2153 (70.4%) with depression, and 1129 (72.4%) with panic disorder reported a physician diagnosis of at least one physical disorder.

Discussion

We reported that about 10–30% of rescue and recovery workers still had persistent medical disorders 9 years after the WTC attacks. More than a fifth had multiple physical and mental health problems. Most health disorders were more common in rescue and recovery workers with highest levels of exposure to dust and smoke than in those with lower levels of exposure (panel).

Our finding of upper and lower airway injury in WTC rescue and recovery workers is consistent with data from studies that have shown high rates of respiratory disease and declines in pulmonary function after exposure to WTC dust.^{4,10,11} A study of New York City firefighters who

responded to WTC attack showed a striking decline in FEV₁ in the 12-month period after 9/11.²⁰ Airway obstruction with air trapping seemed to be the main physiological mechanism underlying this reduction in lung function.²¹ Similarly, data from the WTC registry, which tracks diagnoses in rescue and recovery workers and residents of lower Manhattan, showed high rates of new onset asthma after the attacks.⁴ We noted that annual incidence of abnormal spirometry in rescue and recovery workers was higher in the later years of follow-up than in earlier years. A possible explanation for this unanticipated finding is that some workers who had early subclinical loss of lung function after 9/11 crossed the threshold of abnormality only several years later as the result of further pathological or age-related decline in lung function. However, other factors, including temporal biases in the study population, cannot be excluded.

Inhalation of toxic, highly alkaline dust (pH 10–11) is the probable cause of upper and lower respiratory injury in rescue and recovery workers. The dust generated by the collapse of the WTC towers and the diesel exhaust fumes produced by rescue and recovery machinery might have caused inflammation of responders' airways, which could have led to irritant-induced rhinosinusitis, pharyngitis, and asthma. Previous studies in occupational settings have shown that comparable levels of exposure to airborne pollutants are associated with reactive airway disease.^{22,23} Furthermore, animal studies have shown that exposure of the respiratory tract to high levels of fine particulate matter obtained from the WTC site has been associated with development of pulmonary inflammation and airway hyper-responsiveness.²⁷ Collectively, these findings underscore the importance of providing rescue workers with access to respiratory protection and enforcing its use while responding to disasters.

Previous studies have shown that New York City police officers were at lower risk than some responders for developing mental health disorders after the WTC attacks.^{24,25} Possible reasons for these findings include training, previous experience in dealing with similar stressors, self-selection of individuals with high resilience during recruitment into the workforce, and possible under-reporting of psychological symptoms because of perceived job-related repercussions. We report here that PTSD and depression are the most common mental health disorders in police officers and other individuals involved with the WTC rescue and recovery efforts, a finding consistent with research showing that most WTC rescue and recovery workers with depression had comorbid PTSD.²⁶

We established that rates of panic disorder remained raised up to 9 years after 9/11. These findings could have been due, in part, to anxiety symptoms that existed before WTC exposure or because some patients with generalised anxiety disorder could have been included by use of our screening method. These mental health problems occurred most commonly in rescue and

Panel: Research in context

Systematic review

We searched Medline from September, 2006, to May, 2011, without language restrictions, for original studies and reviews assessing long-term illnesses in WTC rescue and recovery workers and volunteers. We used the search terms: "illnesses", "September 11", and "World Trade Center attacks". We identified five original studies and one review that summarised some of the illnesses reported by WTC rescue and recovery workers and volunteers at 5–7 years after 9/11.

Interpretation

The high prevalence of physical and mental health disorders in WTC rescue and recovery workers 9 years after the WTC disaster underscores the importance of continual provision of adequate health monitoring and treatment for these individuals. These data suggest that the clinical management of the health consequences of WTC exposures will require coordinated physical and mental health care. Planning for future disasters should anticipate the probability of persistent physical and mental illness in rescue and recovery workers.

WTC, World Trade Center 9/11; September 11, 2001.

recovery workers exposed to the dust cloud, which is consistent with previous findings of post-disaster psychopathological research.^{1,13,28–31}

We assessed overall rates of mental health disorders in rescue and recovery workers without undertaking further analyses to stratify the sample by established risk factors such as age, sex, race or ethnic origin. Thus, our overall results might underestimate or overestimate the actual rates of mental health disorders in specific subgroups of workers. Similarly, data for ethnic origin were missing for some responders (table 1). Previous studies, for example, have shown that Hispanic WTC rescue and recovery workers have a high risk for PTSD. Consequently, the rate of PTSD seen in our study could have been underestimated, if a substantial proportion of workers with missing data for ethnic origin were Hispanics.

We do not know exactly how representative our study cohort is of the entire population of WTC first responders, because participation in our programme was voluntary. This potential shortcoming is compounded by the fact that comprehensive records of participation in the WTC rescue and recovery effort were not maintained. Therefore, neither the total number of rescue and recovery workers nor the proportion of them participating in our programme is known.

Estimates of the size of the WTC rescue and recovery worker population have varied. Calculations that need a minimal worker involvement and time undertaking rescue and recovery work suggest that the true number of workers is more than 50 000.¹ The number of WTC workers enrolled in our programme and in the parallel programme done by the FDNY is more than 40 000.¹

Hence, these two programmes combined are assessing a substantial proportion of the rescue and recovery workers. As a result of the staggered and voluntary enrolment of individuals into our programme, we do not have information from each responder at every follow-up time. However, we used robust statistical methods to estimate unbiased rates of physical and mental health disorders in the absence of complete data and to provide information on the number of rescue and recovery workers at risk at each year after 9/11. Nonetheless, self-selection of workers into our programme on the basis of WTC exposure, perceived risk, or presence of physical or mental health disorders could have occurred, which might reduce the generalisability of our findings to all WTC rescue and recovery workers.

Recruitment into our programme was staggered with some rescue and recovery workers joining in the last 3 years of the study. Although the sociodemographic characteristics of early and recent enrollees was relatively similar, we cannot exclude the possibility of recall bias or self-selection of workers at increased risk for physical or mental health disorders in late enrollees. Incidence and prevalence of most physical disorders were similar in our cohort and the FDNY cohort, which suggests that workers with medical problems have not enrolled in disproportionate numbers in our programme. By contrast with our cohort, participation in the FDNY programme was mandatory for all active duty New York City firefighters and paramedics. Therefore, the possibility of selection bias in the FDNY cohort is minimal.

We did not use an external control population to compare the rates of physical and mental health disorders in WTC rescue and recovery workers. Identification of an appropriate control group was difficult because of the unique nature of the population of workers and the possibility of a healthy worker effect in the study cohort (ie, workers commonly having lower rates of disease than the general population because severely ill and disabled individuals are less likely to be employed).¹²

We established the presence of physical disorders with self-reported information. However, objective lung function data were available from spirometry and we used validated methods to assess the presence of mental health disorders. Thus, incidence rates and prevalence of these disorders should be minimally affected by reporting bias.

We categorised each worker's level of exposure solely on the basis of three factors: exposure to the dust cloud, total time spent working at the WTC site, and work on the debris pile. These exposures have been consistently associated with risk of illnesses in WTC rescue and recovery workers and we identified positive dose-response relations in our analyses similar to those reported in other studies.¹⁴ We did not, however, assess the extent to which other exposure factors, such as use of respiratory protection, personal hygiene measures, or

exposure to body parts, might have influenced the observed risk of physical or mental health disorders.

Our findings show a substantial burden of persistent physical and mental disorders in rescue and recovery workers who rushed to the site of the WTC and laboured there for weeks and months 10 years ago. Many of these individuals now suffer from multiple health problems. The findings of this study emphasise the need for continued monitoring and treatment of the rescue and recovery worker population and underscore the importance of providing adequate health monitoring and treatment for these individuals. Planning for future disasters should anticipate the probability of persistent physical and mental illness in rescue and recovery workers.

Contributors

JPW and PJJ had overall responsibility for the study. JPW, ST, ACT, PJJ, and SW contributed to the study design. SM, LC, REBH, DH, RH, SL, MS, GS, JMM, LAS, IU, CK, VS, FO, and MC contributed to data collection. LS, ST, CD, CL, YJ, JK, MS, and HK contributed to data analysis. JPW, ST, AT, PB, RH, JM, RP, SS, LS, SW, and PJJ contributed to the interpretation of the data. All authors wrote this Article.

Conflicts of interest

JPW is a member of the research board of EHE International. All other authors declare that they have no conflicts of interest.

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Article

Impact of Health on Early Retirement and Post-Retirement Income Loss among Survivors of the 11 September 2001 World Trade Center Disaster

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Abstract: The health consequences of the 9/11 World Trade Center (WTC) terrorist attacks are well documented, but few studies have assessed the disaster's impact on employment among individuals exposed to the disaster. We examined the association between 9/11-related health conditions and early retirement among residents and workers who resided and/or worked near the WTC site on 9/11, and the association between such conditions and post-retirement income loss. The study included 6377 residents and/or area workers who completed the WTC Health Registry longitudinal health surveys in 2003–2004 and 2006–2007, and the 2017–2018 Health and Employment Survey. Logistic regression models were used to examine the associations. We found that 9/11-related health conditions were significantly associated with the likelihood of early retirement. Residents and/or area workers with more physical health conditions, especially when comorbid with posttraumatic stress disorder (PTSD), were more likely to retire before age 60 than those with no conditions. For retirees, having PTSD or PTSD comorbid with any number of physical conditions increased the odds of reporting substantial post-retirement income loss. Disaster-related outcomes can negatively impact aging individuals in the form of early retirement and income loss. Long-term effects of major disasters must continue to be studied.

Keywords: 9/11 impact; retirement; chronic disease; PTSD; disaster; income loss

1. Introduction

Many studies have documented the short-term health impacts of the World Trade Center (WTC) 11 September 2001 attacks, while longer-term observations of various chronic physical and mental health conditions continue to be reported among individuals exposed to the disaster [1–3]. However, relatively few studies have assessed the economic impact of the 9/11 attacks. It was noted that New York City (NYC) earnings at an aggregate level had \$2.8 billion losses in the first three months post-9/11 [4]. For NYC industries, losses ranged from \$3.6 to \$6.4 billion in the nine months following the disaster [5]. Despite the well-established association between disaster exposure and impaired health among the 9/11-exposed population, few studies have examined the economic impact of 9/11-related poor health. One such study found that during the seven years after 9/11, nearly half of accidental disability retirements for NYC firefighters were for 9/11-related injuries or illnesses [6]. Another study conducted by the WTC Health Registry found a significant association between 9/11-related poor health and early retirement or job loss [7].

Unlike our first published work that focused on the 9/11 economic impact for non-uniformed rescue and recovery workers [7], this analysis concentrated on retirement and post-retirement well-being for residents and area workers who resided and/or worked near the WTC site on 9/11.

Previous research showed that different groups of survivors, such as rescue and recovery workers, local residents, area workers, passersby, and students and school staff, may have had different health outcomes, both physical and mental, due to their varying levels of disaster exposure [1,8,9]. Consequently, health-related retirement may also differ for different groups of survivors. Furthermore, retirement options available to rescue and recovery workers, especially uniformed workers, as compared to residents and area workers, can be a key factor in making retirement decisions and must be linked to the subsequent economic outcome [10–13].

Retirement trends were shifting during the mid-1990s into the 2000s irrespective of the effects of the 9/11 disaster, as fewer people were retiring at younger ages compared to the 1970s and 1980s [14]. Trends of employer pension plans becoming rarer, a healthier population overall, fewer labor-intensive jobs, less employer-sponsored health benefits for retirees under age 65, and an older full retirement age for Social Security have resulted in people retiring at older ages than earlier generations [15]. In tandem, retirement patterns have become more complex with many individuals transitioning from full-time to part-time work or working again after retirement [15]. Early retirement, therefore, is an important factor to consider for economic assessments, as it can strongly affect one's well-being (such as post-retirement income) for the remainder of one's life.

Poor health has been linked to early retirement in numerous studies for different population groups or countries. Self-perceived poor health was a risk factor for early exit from the labor force through early retirement, unemployment, or both [16–20]. Other studies found an association between a variety of health conditions, such as respiratory, cardiovascular, musculoskeletal diseases, cancer, and other chronic conditions, and premature labor force exit [16,17,19,21–23]. However, health problems are not the only factor that impacts decisions about early retirement; one's financial situation is another key factor in this decision-making process [24,25]. Experiencing a layoff or having a spouse who retires early increases one's likelihood of retiring early whereas being able to take a new job that requires fewer hours or offers higher pay is protective against retiring early [26]. Multiple studies have concluded, however, that health, even a subjective assessment of health, is the most important predictor of early retirement [24–26].

Previous studies of 9/11 health impact showed elevated prevalence of many chronic physical conditions, posttraumatic stress disorder (PTSD), and physical-mental comorbidity among disaster survivors [1,9,27–32]. We examined 9/11-related health conditions and PTSD comorbidity in the current analysis of health's impact on early retirement. We also went one step further and assessed whether or not those physically and/or mentally affected by the disaster continued to experience decline in their well-being after retirement in terms of substantial income loss.

In 2017–2018, the WTC Health Registry conducted an in-depth study on health and employment for a sub-sample of its enrollees. Detailed information on employment, retirement, health insurance, and other economic indicators collected from this survey, coupled with detailed health data collected from the Registry's longitudinal surveys administered in waves since 2003, provided an opportunity to further investigate the impact of 9/11-related health on retirement and post-retirement well-being. As in our previous study [7], the number of 9/11-related chronic physical health conditions and PTSD were used to measure post-9/11 health status. We hypothesized that the more 9/11-related health conditions an individual had, the more likely he or she would be to retire before age 60. Furthermore, for those who had already retired, the number of post-9/11 conditions they suffered was associated with the degree of their post-retirement income loss.

2. Materials and Methods

2.1. Study Population

The WTC Health Registry maintains a longitudinal cohort that was established in 2002 following the 11 September 2001 terrorist attacks with the aim of monitoring the long-term health outcomes in individuals exposed to the events of 9/11 in NYC. In 2003–2004, the Registry enrolled 71,426 rescue or

recovery workers, Lower Manhattan residents, area workers, passersby, and students or school staff by conducting its first health survey (Wave 1). Eligible enrollees have since been invited to participate in three additional health surveys in 2006–2007 (Wave 2), 2011–2012 (Wave 3), and 2015–2016 (Wave 4) as well as a number of in-depth studies. Previous Registry publications provide a more detailed description of this cohort [1,8].

From September 2017 to March 2018, the Registry conducted the Health and Employment Survey (HES) with a sample pool of English-speaking enrollees under 75 years of age (as of 2017) who completed at least Waves 1 and 2. Enrollees who reported retirement or unemployment due to disability/health at any of the three follow-up surveys (Waves 2–4) were invited to participate in the HES study along with a roughly equivalent number of not-yet retired age-matched enrollees. In total, 23,036 enrollees were invited to complete the HES, and the response rate reached 65%. The US Centers for Disease Control and Prevention (3793) and the NYC Department of Health and Mental Hygiene (02058) institutional review boards approved the Registry protocol and the HES protocol (17047), including the use of the data.

This study used data collected from the HES and was limited to those who lived or worked near the WTC site on 11 September 2001. During analyses, the HES data were merged with the Registry's four waves of health survey data to obtain 9/11-related health information for the study sample. We excluded 341 enrollees who had retired before the 9/11 disaster, as our focus was on the link between 9/11-related health and retirement. The final study sample was 6377 enrollees, which included 3486 retired and 2891 not-yet-retired enrollees. Of the 3486 retirees, 1234 retired before age 60, 2143 retired at or after age 60, and 109 did not report time of retirement. Additionally, 2395 enrollees reported post-retirement income loss.

2.2. Study Outcomes: Early Retirement and Post-Retirement Income Loss

In the HES, enrollees were asked if they were currently retired and, if retired, for the month and year of retirement. This information was used to calculate retirement age. In the analytical model, a dichotomous outcome variable was created for early retirement which was defined as having retired before reaching the age of 60.

Those self-reporting retirement in the HES were also asked if their total post-retirement personal income after taxes changed as compared to pre-retirement and in which direction; if they responded that their income had decreased, a follow-up question asked for the percentage of decrease (<25%, 25% to 50%, >50%). A dichotomous outcome variable for post-retirement income loss was created for those who reported substantial income loss which was defined as having over 50% of income decrease.

2.3. Chronic Physical Health Conditions and PTSD Measure

Starting in Wave 1, Registry enrollees were asked in each of the follow-up wave surveys whether they had ever been told by a doctor or other health professional that they had any of more than a dozen listed health conditions and the year of first diagnosis if diagnosed. For this study, asthma, heart disease (coronary heart disease, angina, heart attack, or other heart disease), stroke, lung disease (emphysema, chronic bronchitis, reactive airways dysfunction syndrome, sarcoidosis, pulmonary fibrosis, or other lung disease), diabetes, gastroesophageal reflux disease, and autoimmune disease (multiple sclerosis or amyotrophic lateral sclerosis, rheumatoid arthritis, or other autoimmune disease) were selected, as all have been reported to be elevated among 9/11 exposed individuals [27,33–39]. If an enrollee reported a diagnosis for any of the seven selected types of conditions in or after 2001, we categorized them as having a 9/11-related chronic physical health condition. Probable PTSD was assessed at every wave of the Registry survey via a 9/11-specific PTSD Checklist-Civilian Version (PCL-17) scale. A cut-off score of 44 or greater at any wave was used to define probable PTSD as in prior published Registry studies [1]. Co-occurrence of any of the seven selected types of physical conditions and probable PTSD was then defined as 9/11-related physical-mental comorbidity in this study.

The total number of chronic physical conditions, comorbid with PTSD or not, was used as the health indicator in the analytical models.

2.4. Sociodemographic Characteristics and Other Covariate Measures

Sociodemographic characteristics of the study sample were measured by sex, age at 11 September 2001, race/ethnicity, household income, education, and marital status. A quantitative 9/11 exposure measure was also included in the analysis as it is closely associated with PTSD [1]. The exposure measure combines disaster information, such as dust cloud exposure, injury, witnessing horror, bereavement, and home evacuation experience, collected from both Waves 1 and 2 into a 12-item score that was collapsed into four categories: 0–1 as no/low exposure, 2–3 as medium, 4–5 as high, and six or greater as very high exposure.

2.5. Statistical Analyses

Two logistic regression models were used to calculate the adjusted odds ratio (AOR) and 95% confidence intervals (95% CI) to measure the association between 9/11-related health conditions and our study outcomes. The equation for these models is

$$\text{logit}(p) = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k \quad (1)$$

where p is the probability of our outcome occurring, β_0 is the intercept, $\beta_1, \dots, \beta_k$ are the regression coefficients, and $X_1, \dots, X_k$ are the predictors or covariates included in the model (described above). The adjusted odds ratio was estimated by taking the exponential of the regression coefficients in the model.

The first model included 4125 non-retired enrollees and early retirees, and aimed to demonstrate the relationship between poor health (measured by the number of 9/11-related health conditions with and without PTSD) and the likelihood of retiring before age 60, while adjusting for sociodemographic factors and disaster exposure.

The second model included 2395 enrollees who reported income loss after retirement and investigated the association between 9/11-related health conditions and substantial post-retirement income loss while adjusting for disaster exposure and all sociodemographic characteristics included in the first model except for age at 11 September 2001. Even though post-retirement income decreases are common and subject to lower tax rates and less work-related expenses [40], this analysis aimed to reveal that substantial income decrease (percentage of decrease larger than 50%) was associated with health.

The analyses for this study were conducted in SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

3. Results

Among 4125 residents and area workers who lived or worked near the WTC site on 9/11, 1234 (29.9%) reported having retired before age 60 (Table 1). Sociodemographic characteristics that were significantly associated with early retirement included age, race/ethnicity, total household income, marital status, and education. Not surprisingly, younger enrollees were less likely to report that they had retired under age 60, as they may have not yet retired at all. Compared to non-Hispanic white residents and area workers, non-Hispanic black and Hispanic residents and area workers both had higher odds of reporting early retirement (AOR = 1.7, 95% CI: 1.3–2.1; AOR = 1.3, 95% CI: 1.0–1.7). Enrollees who were in the three higher household income groups (\$50,000–<\$75,000, \$75,000–<\$150,000, and $\geq$ \$150,000) each had higher likelihoods of experiencing early retirement. Those in the highest income group ($\geq$ \$150,000) were more than twice as likely as those in the lowest income group (<\$25,000) to have early retirement (AOR = 2.2, 95% CI: 1.5–3.2). On the contrary, the likelihood of reporting early retirement dropped by about 40% (AOR = 0.6, 95% CI: 0.4–0.7) and 70% (AOR

= 0.3, 95% CI: 0.3–0.4), respectively, for those with a college or post-graduate degree compared to those with high school and below education. Enrollees who were widowed had a higher likelihood of experiencing early retirement compared to those who were married or living with a partner (AOR = 1.5, 95% CI: 1.0–2.3). Sex and 9/11-related disaster exposure did not show significant association with early retirement for residents and area workers.

Table 1. Early retirement, chronic physical health conditions and post-traumatic stress disorder (PTSD) comorbidity, and other characteristics among non-retired and early retired enrollees.

Sample Characteristics	Retirement Status		Likelihood of Early Retirement			
	Not Retired (N, %)	Retired Early (N, %)	AOR ^a		95% CI ^b	
	2891	70.1	1234	29.9		
Sex						
Female	1481	68.1	693	31.9	Ref	
Male	1410	72.3	541	27.7	1.0	0.8, 1.1
Age on 9/11						
0–24	31	93.9	2	6.1	0.1	0.0, 0.6
25–44	1089	79.1	287	20.9	0.5	0.4, 0.6
45–64	1771	65.2	945	34.8	Ref	
Race/ethnicity						
Non-Hispanic white	2085	72.1	805	27.9	Ref	
Non-Hispanic black	304	59.3	209	40.7	1.7	1.3, 2.1
Hispanic	253	64.4	140	35.6	1.3	1.0, 1.7
Non-Hispanic Asian	155	77.9	44	22.1	0.9	0.6, 1.3
Other race or multi-racial	94	72.3	36	27.7	0.9	0.6, 1.4
Total household income in 2002, \$						
<25,000	167	72.3	64	27.7	Ref	
25,000 to <50,000	473	70.0	203	30.0	1.1	0.8, 1.6
50,000 to <75,000	477	68.3	221	31.7	1.6	1.1, 2.3
75,000 to <150,000	924	71.2	373	28.8	1.6	1.1, 2.3
≥150,000	564	71.4	226	28.6	2.2	1.5, 3.2
Education						
High school diploma or lower	335	54.1	284	45.9	Ref	
Some college or college graduate	1583	70.0	677	30.0	0.6	0.4, 0.7
Post-graduate	964	78.2	268	21.8	0.3	0.3, 0.4
Marital status						
Married or living with partner	1852	69.8	803	30.2	Ref	
Divorced or separated	415	69.5	182	30.5	0.9	0.7, 1.1
Widowed	57	53.8	49	46.2	1.5	1.0, 2.3
Never married	552	74.1	193	25.9	0.9	0.7, 1.2
Disaster exposure						
Low/none	630	70.6	262	29.4	Ref	
Medium	1264	70.9	520	29.1	0.9	0.8, 1.1
High	784	70.8	323	29.2	0.8	0.7, 1.1
Very high	213	62.3	129	37.7	1.1	0.8, 1.5
Number of chronic conditions ^c without PTSD						
0	1289	76.8	390	23.2	Ref	
1	527	68.7	240	31.3	1.5	1.2, 1.8
2	193	67.2	94	32.8	1.4	1.1, 1.9
≥3	61	59.8	41	40.2	1.9	1.2, 3.0
Number of chronic conditions ^c with PTSD						
0	324	73.6	116	26.4	1.2	0.9, 1.6
1	238	65.2	127	34.8	1.7	1.3, 2.2
2	153	57.1	115	42.9	2.5	1.9, 3.4
≥3	106	48.8	111	51.2	3.4	2.4, 4.7

^a AOR: Adjusted odds ratio and was adjusted for all factors listed in this table. ^b 95% CI: 95% confidence interval.

^c Chronic physical health conditions include asthma, heart diseases, stroke, lung diseases, diabetes, gastroesophageal reflux disease (GERD), and autoimmune diseases.

Having chronic 9/11-related physical health conditions without PTSD was found to be significantly associated with early retirement in a dose-response manner with the odds of reporting early retirement increasing as the number of conditions increased (AOR = 1.5, 95% CI: 1.2–1.8; AOR = 1.4, 95% CI: 1.1–1.9; AOR = 1.9, 95% CI: 1.2–3.0 for those with one, two, and three or more conditions without PTSD, respectively) (Table 1). When chronic physical conditions were comorbid with PTSD, the likelihood of experiencing early retirement increased further and also in a dose-response manner. For example, for residents or area workers who had three or more 9/11-related physical conditions and PTSD, their odds of reporting early retirement were more than three times higher than those who did not have any of the selected conditions or PTSD (AOR = 3.4, 95% CI: 2.4–4.7). Interestingly, having PTSD alone did not significantly increase one's odds of early retirement as compared to those who did not have any physical conditions (AOR = 1.2, 95% CI: 0.9–1.6). To test the robustness of the association of 9/11-related health and early retirement, we performed a sensitivity analysis using an Ordinary Least Squares model by replacing the dichotomous early retirement outcome variable with a continuous variable measuring actual age at retirement. Our results showed findings consistent with the early retirement model results: The coefficients for enrollees who suffered one, two, or three or more physical conditions comorbid with PTSD (coefficients = -1.82 , -2.89 , and -2.92 , respectively, and all with $p < 0.0001$) were all significant with the retirement age decreasing by an average of two to three years compared to those who did not have any 9/11-related chronic conditions (results not shown).

Approximately 73% of retirees in the study sample reported that their post-retirement income had decreased as compared to their pre-retirement income, while 19% reported no significant income changes, and 8% reported increased post-retirement income. Although post-retirement income loss seemed to be a norm for retirees regardless of their retirement age, among those who reported decreased income, a significantly higher proportion (45.9% vs. 33.7% in Table 2) of early retirees reported an income decrease of more than 50% ($p < 0.0001$). Because of the significant association of 9/11-related poor health and early retirement demonstrated in Table 1, we further tested if 9/11-related poor health was directly linked to retirees' post-retirement financial status.

Table 2. Percentage of post-retirement income loss among retirees reporting decreased income.

Retirement Age (Years)	Post-Retirement Income Loss, %		Total, N
	≤50% (N = 1437)	>50% (N = 889)	2326
<60	54.1	45.9	859
≥60	66.3	33.7	1467

Table 3 presents results on the association between 9/11-related health and the likelihood of having more than 50% of income decrease after retirement among enrollees who reported decreased income. Only three sociodemographic characteristics were associated with substantial post-retirement income loss: race/ethnicity, total household income, and education. More specifically, non-Hispanic black residents and area workers were 30% less likely to report income loss greater than 50% as compared to non-Hispanic white residents and area workers (AOR = 0.7, 95% CI: 0.6–1.0). Other racial/ethnic groups did not show significantly higher or lower odds of experiencing substantial income loss compared to non-Hispanic whites. Compared to the lowest income group (<\$25,000), the three middle income groups (\$25,000–<\$50,000, \$50,000–<\$75,000, and \$75,000–<\$150,000) were less likely to have substantial income loss (AOR = 0.5, 95% CI: 0.3–0.8; AOR = 0.6, 95% CI: 0.3–0.9; AOR = 0.6, 95% CI: 0.4–1.0, respectively); however, the highest income group (≥\$150,000) did not show significantly higher or lower odds of experiencing substantial income loss. Enrollees with some college experience or a college degree had a significantly higher likelihood of substantial income loss compared to enrollees with lower education attainment (AOR = 1.2, 95% CI: 1.0–1.6). Each level of 9/11-related disaster exposure was highly associated with post-retirement income loss in

a dose-response manner. The highest level of exposure increased the odds of having substantial income loss by 2.5 times compared to those with little or no exposure (AOR = 2.5, 95% CI: 1.7–3.6).

Table 3. Post-retirement income loss, chronic physical health conditions and post-traumatic stress disorder (PTSD) comorbidity, and other characteristics among retirees reporting decreased income.

Sample Characteristics	Post-Retirement Income Loss more than 50%				Likelihood of Substantial Income Loss	
	No (N, %)		Yes (N, %)		AOR ^a	95% CI ^b
	1469	61.3	926	38.7		
Sex						
Female	787	63.3	456	36.7	Ref	
Male	682	59.2	470	40.8	1.0	0.8, 1.2
Race/ethnicity						
Non-Hispanic white	990	59.1	685	40.9	Ref	
Non-Hispanic black	234	69.6	102	30.4	0.7	0.6, 1.0
Hispanic	145	66.5	73	33.5	0.8	0.5, 1.1
Non-Hispanic Asian	57	58.8	40	41.2	1.1	0.7, 1.7
Other race or multi-racial	43	62.3	26	37.7	1.0	0.5, 1.7
Total household income in 2002, \$						
<25,000	46	47.9	50	52.1	Ref	
25,000 to <50,000	255	68.5	117	31.5	0.5	0.3, 0.8
50,000 to <75,000	280	67.3	136	32.7	0.6	0.3, 0.9
75,000 to <150,000	499	64.4	276	35.6	0.6	0.4, 1.0
≥150,000	226	48.3	242	51.7	1.3	0.8, 2.1
Education						
High school diploma or lower	299	65.9	155	34.1	Ref	
Some college or college graduate	780	60.0	521	40.0	1.2	1.0, 1.6
Post-graduate	380	60.8	245	39.2	1.0	0.8, 1.4
Marital status						
Married or living with partner	961	60.7	623	39.3	Ref	
Divorced or separated	236	59.9	158	40.1	1.2	0.9, 1.6
Widowed	66	71.0	27	29.0	0.7	0.4, 1.1
Never married	195	63.1	114	36.9	1.0	0.8, 1.4
Disaster exposure						
Low/none	362	71.7	143	28.3	Ref	
Medium	653	63.6	373	36.4	1.4	1.0, 1.7
High	360	55.8	285	44.2	1.7	1.2, 2.2
Very high	94	42.9	125	57.1	2.5	1.7, 3.6
Number of chronic conditions ^c without PTSD						
0	546	65.7	285	34.3	Ref	
1	316	64.6	173	35.4	1.1	0.9, 1.5
2	129	68.6	59	31.4	0.9	0.6, 1.3
≥3	59	62.8	35	37.2	1.4	0.9, 2.2
Number of chronic conditions ^c with PTSD						
0	118	53.2	104	46.8	1.7	1.2, 2.5
1	114	53.0	101	47.0	1.8	1.2, 2.5
2	104	55.9	82	44.1	1.6	1.1, 2.3
≥3	83	48.8	87	51.2	1.9	1.3, 2.7

^a AOR: Adjusted odds ratio and was adjusted for all factors listed in this table. ^b 95% CI: 95% confidence interval.

^c Chronic physical health conditions include asthma, heart diseases, stroke, lung diseases, diabetes, gastroesophageal reflux disease (GERD), and autoimmune diseases.

Substantial post-retirement income loss was also significantly associated with the number of 9/11-related health conditions but only for those who suffered from PTSD alone or PTSD comorbid with physical conditions. In other words, enrollees without PTSD who only had chronic physical health conditions did not have higher odds of losing more than 50% of their income post-retirement compared to those who had no health conditions. Once enrollees had PTSD, their likelihood of having

substantial income loss increased significantly as compared to those without any health conditions (e.g., AOR = 1.7, 95% CI: 1.2–2.5). PTSD comorbid with one or more physical health conditions had a similar effect on enrollees' odds of experiencing substantial income loss as PTSD alone.

4. Discussion

The impact of the 9/11 disaster on early retirement and post-retirement well-being among survivors has rarely been studied until now. This study examined the association of 9/11-related health and early retirement for residents and area workers who resided and/or worked near the WTC site on 9/11. Furthermore, we assessed the longer-term impact of 9/11-related health on post-retirement income loss among survivors.

Sixteen years after the 9/11 disaster, among the 3486 retired residents and area workers in our study sample, about 35% had retired before reaching 60 years of age. Early retirement was found to be significantly associated with chronic 9/11-related physical health conditions in a dose-response manner, and a sensitivity analysis estimating the magnitudes of the effects in terms of years of work lost found consistent results. More specifically, the likelihood of reporting early retirement versus not-yet retired grew as the number of physical health conditions increased. The odds of reporting early retirement increased further when these conditions were comorbid with PTSD but not when PTSD was reported in the absence of any 9/11-related physical conditions. These findings suggest that residents or area workers who suffered from 9/11-related PTSD but not other chronic physical conditions were not more likely to retire early due to this mental health condition alone; several explanations may clarify this. One reason is that PTSD may not severely impact daily working life, especially if the PTSD is mild. Only 6% of the early retirees in this study sample reported having Accidental Disability Retirement (ADR), a benefit available to members of certain plans if they become permanently physically or mentally incapacitated and are unable to perform the duties of their job due to an accident that took place on the job [41]. The percentage of early retirees with ADR and PTSD but no other chronic condition is even lower (4%), which suggests the proportion of enrollees with severe PTSD alone is low. Another potential reason is that stigma associated with a mental health condition such as PTSD may prevent one from recognizing the condition, let alone coping with it by retiring early.

Despite the fact that PTSD alone did not show a significant association with reporting early retirement, this study found that residents and area workers with PTSD alone or PTSD comorbid with any number of physical conditions were significantly more likely to experience substantial income loss post-retirement. PTSD comorbid with one or more physical health conditions had a similar effect, in terms of significance and magnitude, on the odds of experiencing substantial income loss as PTSD alone. Having any number of physical conditions (including three or more conditions) in the absence of PTSD was not significantly associated with substantial post-retirement income loss, which suggests PTSD is the key and driving factor in this association. The economic impact of 9/11-related PTSD, although not directly reflected in the form of early retirement, tended to be stronger in the long-term as individuals suffering PTSD were less likely to assume income-generating activities that could ultimately lead to significant income loss. Like having PTSD alone, disaster exposure did not show a significant association with early retirement but was highly related to post-retirement income loss. The absence of exposure's effect in the model for early retirement is likely a result of having the 9/11-related health measure in the same model absorbing its effect. We re-ran our model for Table 1 without the health measure and found that disaster exposure at a very high level was significantly associated with 50% higher likelihood of early retirement (AOR = 1.5, 95% CI: 1.1–2.0, results not shown) compared to those who had low or no exposure during the disaster. This finding implies that the health measure we chose for this study represented the impact of this disaster well. A closer look at the data suggested that enrollees in the highest category of the 9/11 exposure scale were most likely to have suffered PTSD or PTSD comorbid with physical health conditions (results not shown) which made their comparable associations with the two outcomes unsurprising.

Similar to the findings in our earlier study [7], those with higher household income or lower education were more likely to report early retirement than staying in the labor force as compared to the low income group or higher education achievers. This seemingly contradictory impact of high income and low education reflects the complexity of the retirement decision-making process. For residents and area workers with 9/11-related poor health, having a higher income may have allowed them to voluntarily retire early or made them more likely to afford early retirement without considerable additional financial concern compared to having a lower income. On the other hand, the early retirement decision for the lower education group was less likely to be a “choice”, as their low education (usually accompanied with low income) and poor health may not have allowed them to maintain their work, especially when the work was more physical or manual in nature. The association of lower socioeconomic status and higher risk of involuntary labor force exit was also found in previous studies [42,43].

This study provided evidence of a strong association between 9/11-related poor health and early retirement among survivors who lived and worked near the WTC site. Furthermore, with additional information collected from the HES, we demonstrated, for the first time, the significant impact of 9/11-related PTSD and 9/11-related physical–mental comorbidity on substantial post-retirement income loss. Our findings suggest that after labor force exit, poor health, especially PTSD, continued to adversely affect survivors’ overall well-being in the form of considerable income reduction. The compromised post-retirement well-being as a result of poor health did not come as a surprise because many of the affected people could have involuntarily experienced early retirement before securing their full retirement benefits; or, they might be less likely to participate in any income-generating activities, particularly if they experienced mental health or physical–mental comorbidity issues after retirement. This lasting effect of poor health, along with the fact that certain race/ethnicity (Hispanic and non-Hispanic black) and low education groups are more likely to retire early, should direct future 9/11-related resources by placing a greater focus on limiting sharp income loss and providing adequate and affordable health care services to retirees from various vulnerable groups to maintain a certain level of quality of life.

One notable advantage of this study is that we directly assessed the relationship between 9/11-related health and post-retirement income loss using statistical modeling. This investigation provides the first look at one aspect of survivors’ well-being beyond retirement and will lead to additional exploration of the economic impact of 9/11, such as the relationship between substantial income loss and worsening health and its associated high medical cost, poor health reducing survivors’ ability to re-enter the workforce to compensate for post-retirement income loss, and how survivors’ retirement plans directly affect their post-retirement well-being. In addition, future research should also assess other aspects of post-retirement well-being such as retirees’ current health status or health-related quality of life (as in an ongoing study by our group) and insurance coverage. These results will not only give us a broader picture of retirees’ overall well-being but also help estimate the realistic gap on health care access in terms of making policy recommendations.

5. Conclusions

This study found that 9/11-related health conditions were significantly associated with the likelihood of early retirement among residents and area workers who survived the 9/11 attacks. The likelihood of reporting early retirement increased as the number of health conditions increased. Having PTSD alone was not associated with early retirement; however, PTSD was the driving factor out of all 9/11-related health conditions studied that was linked to substantial income loss post-retirement. For future studies of 9/11 economic impact, our findings emphasize the key role that PTSD may play in the longer-term.

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Chairman NADLER. Thank you, Dr. Moline.
Ms. Nordstrom.

TESTIMONY OF LILA NORDSTROM

Ms. NORDSTROM. Thank you to Chairman Nadler, Chairman Cohen, and Ranking Member Johnson, and the Members of the Committee for holding a hearing on this incredibly important issue.

My name is Lila Nordstrom. And on September 11, I was a 17-year-old student at Stuyvesant High School, which is a public school that is three blocks from the World Trade Center. On the morning of 9/11, I was in class with windows facing south, and my classmates and I watched as planes hit the Twin Towers. We watched dozens of people jumping to their deaths. We watched thousands of evacuees stream out of the area. Then the first tower fell, and a dust cloud rushed our building. We couldn't see anything.

I was one of the first people out of Stuyvesant when we finally got evacuation orders. The moment I stepped outside, the second tower collapsed, and everybody took off in a run.

I walked 10 miles that day. I couldn't reach my parents. I didn't end up even going home. I ended up walking all the way to Queens.

After the attacks, we were sent to a school in Brooklyn temporarily. The Stuyvesant building was used as a morgue and a command center for the cleanup effort at Ground Zero because of its proximity.

Unfortunately, after EPA Administrator Christine Todd Whitman told the residents of downtown and New Yorkers that the air was safe to breathe, government officials made the decision to return us to our school building. We went back on October 9, which is less than a month after the attacks.

Ground Zero was still on fire and would be for another 4 months. The smell of smoke was suffocating every day. Despite assurances from officials, very little got done to clean the school for students. No hazmat team got called in. The filters in our ventilation system were not replaced until January. The air vents, which were filled with World Trade Center dust, were not cleaned until the following summer. The auditorium's contaminated upholstery was not actually replaced fully until 2014, which you can see on the image above.

The school was also continually recontaminated by trucks that were carting toxic debris from the World Trade Center site past our school and dumping it into barges that were parked next to the air intake system. Testing of the air outside of our school showed that on many days it was actually as bad as the air at Ground Zero itself. You can see where the barge was located. That picture is taken from the doors of our school.

In total, more than 19,000 public school students returned to school downtown during the cleanup as did thousands of teachers and school staff. 10s of thousands of students and professors from Borough's Manhattan Community College and Pace University and NYU, downtown residents and office workers were actively encouraged to return, even those that had small children at home. And

many of them got left to clean up dangerously contaminated spaces without much guidance.

Federal dollars even got spent by the Lower Manhattan Development Corporation to encourage new residents to move into the area because, unsurprisingly, they began to face really high vacancy rates.

Through all of this, the EPA knew that the air was not safe down there, but they did not tell us.

NIOSH has now linked more than 68 cancers to the World Trade Center toxins. I haven't even had my 20th high school reunion yet, but I already have five former classmates with lymphomas that I just know personally. My friend Michele is in remission from thyroid cancer. Other classmates of mine have been diagnosed with rare bone cancers, testicular cancers, melanomas. There is even a male breast cancer survivor among us, as Dr. Moline was talking about earlier.

Classmates are also starting to die now. Just a couple of months ago, Cathy Choy, who graduated just a year after me, passed away at aged 33 of a 9/11-linked gastric cancer. Her VCF award has not been paid yet. When it is paid to her husband, it will be cut by 50 or 70 percent.

That is just my school. BMCC students are sick, as are students from Pace, and as are many younger children from the area.

Beyond cancer, plenty of us are already suffering from chronic 9/11-related conditions, myself included. I am personally certified with asthma, with GERD, with chronic rhinosinusitis, and with PTSD.

So, these serious illnesses that are emerging now are just the tip of the iceberg. If the VCF is allowed to close, a lot of my classmates will not find out they are sick in time to make a claim at all.

Women have special reason to be concerned, because most of the research that has been done on 9/11 health impacts has been done on the responder population, which is largely male. That means that a lot of women's health issues will not actually be linked to the attacks in time to ever be compensable through the VCF.

The youngest 9/11 survivors now, we live all over the Nation, and we have, you know, 70 or 80 years to live with these exposures, in the case of the youngest exposed. Cancer does not respect arbitrary funding deadlines. If the VCF is allowed to reduce payouts and expire, this resource that was meant to ease our suffering is going to become just another symbol of how we were sacrificed by a government that thought a quick return to normalcy after a tragic event was more important than the health and safety of the children who lived through it.

In 2011 and 2015, the government did the right thing and enacted and then reauthorized the Zadroga Act, and Congress should do the right thing one more time and fully fund and extend the VCF. My friends who get sick in 2027 deserve the same help they would have received if they had gotten sick in 2017, and so do I.

Thank you.

[The statement of Ms. Nordstrom follows:]

PREPARED TESTIMONY OF LILA NORDSTROM

Thank you to Chairman Nadler, Ranking Member Collins, and the rest of the Committee for holding a hearing on this incredibly important issue.

My name is Lila Nordstrom. On September 11th, 2001 I was 17 years-old and a student at Stuyvesant High School, a New York City public school with 3,000 students just three blocks from the World Trade Center.

The morning of 9/11 I was in a class on the tenth floor with windows facing the Twin Towers. My classmates and I saw two planes hit the World Trade Center and watched in horror as dozens of people jumped to their deaths and thousands of people evacuated. We were still in class when the first building collapsed. As a dust cloud rushed towards our windows, we were ordered to go to our homerooms, then, eventually, to evacuate the building.

I was one of the first people to evacuate Stuyvesant. The instant that I stepped outside, the second WTC tower collapsed and everybody began to run. I eventually ran out of breath and a gym teacher named Ms. Luczak, herself only two years out of college, found me and began to walk with me. People had parked along the Hudson River to play radio news for evacuees, so as we walked we heard reports that many unidentified planes were still in the air and that the entire island of Manhattan could be evacuated. We were far from any bridges and thought we might end up having to swim. I told her that I didn't know how, so she told me she could swim me across the Hudson River if we got trapped. We slowly found other students as we walked and eventually one of my friends joined the group. I was too afraid to go home, having heard on the radio that a plane was headed for the Empire State Building, only a few blocks from where I lived, so I walked across the 59th Street Bridge with her instead. We eventually made it on foot to Astoria, Queens, ten miles in total, and I spent the night at her house.

When classes resumed, Stuyvesant students were told to report to a high school in Brooklyn. At the time our school building was being used as a command center and morgue for the WTC cleanup effort because of its proximity to Ground Zero. Less than a week after the attacks, however, Christine Todd Whitman, the head of the Environmental Protection Agency, assured New Yorkers that the air downtown was "safe to breath." Based on this reassurance, government officials made the decision to send Stuyvesant students back to lower Manhattan on October 9th, less than a month after the attacks.

On the day that Stuyvesant students returned to lower Manhattan, Ground Zero was still burning and would continue to burn for another three months. It was the early days of the cleanup so the neighborhood wasn't yet open to the public, and every morning, students had to pass through multiple police checkpoints just to get into the school. Once there, we were given cryptic warnings not to drink out of the water fountains or leave during the day for any reason.

The acrid smell of a smoke permeated the building every day by noon, and the school was constantly re-contaminated by a continuous line of trucks carrying hazardous debris from the WTC site to the barge docked next to the building. From the third floor students could watch as clouds of dust spiraled into the air while truck after truck dumped loads of toxic pulverized debris right next to our air intake system. The happened all day, every day. The trucks were uncovered and as they drove by they also left a trail of dust behind them that settled on every surface outside. Testing of the air around the school showed that on many days there were the same levels of toxic dust in the air around Stuyvesant as there were at Ground Zero itself. Government agencies were repeatedly asked to at least hose down the truckloads of debris, but by the time they started doing so winter had set in and they had to stop because the debris was freezing.

It was only after our return that we learned how haphazard and incomplete the cleaning of our building had been as it transitioned from morgue back to school. No HazMat team was called in to clean Stuyvesant. The highly publicized one million dollars reportedly spent to clean the building was not used to replace the contaminated filters in our ventilation system, which remained until the end of January, after months of stalling by the Board of Education. The money was also not used to clean the building's air vents, which were still packed with WTC dust when I graduated that spring. The money was certainly not used to replace the contaminated carpeting and fabric in our auditorium, either. That room, where we held our first meeting upon returning and the school's most popular event that spring, was not fully reupholstered until 2014, more than ten years later.

Suffice it to say my lungs suffered, and I certainly was not alone. As soon as Stuyvesant students returned there were widespread reports of nosebleeds, coughs that just wouldn't go away, chronic headaches, and students suffering from a slew of worsening respiratory issues.

That was layered on top of the trauma of the attacks themselves, and the continuing trauma of living with the cleanup. One day we arrived to find the mangled remainder the sphere statue that sat between the Twin Towers parked in front of our school, a horrifying reminder for us to ponder as we started the day. We also had fire drills in our first days back that showed us our new emergency route, which was, for some reason, to run towards Ground Zero. The area was still closed off to the public and was populated by with National Guardsmen in heavy duty dust masks. It turned out that our usual evacuation route was being blocked by the debris barge. We were sandwiched between the fire and the dust.

Unfortunately, Stuyvesant was not the only school in Lower Manhattan to send children downtown before it was safe. There were some 19,000 public school students in the contamination zone between the fall of 2001 and spring of 2002, including thousands of elementary-aged kids. There were, in fact, two public elementary schools just across the street from Stuyvesant, both within two blocks of the barge operation. There were also students attending private schools in the area, as well as thousands of children living downtown who either weren't old enough for school or went to school outside the zone.

Thousands of teachers and school staff were also exposed when these schools reopened, as were tens of thousands of college students and professors at Borough of Manhattan Community College and PACE University, and hundreds of NYU students living in downtown housing.

Beyond the schools, lower Manhattan is also one of the busiest and most densely populated neighborhoods in the U.S., and roughly 25,000 residents and 325,000 office workers also returned to the area before it was safe. Many were left to clean up contaminated homes and offices themselves, given only dangerously inadequate guidance, which they followed unaware of the great risk to their health. Many of these spaces were continually re-contaminated by the cleanup process anyway. At the same time, government dollars were spent to entice unsuspecting new residents, including young families, to the area. The Lower Manhattan Development Corporation, facing vacancy rates as high as 50% in some areas, used this public money to fund major rent subsidies for new residents. Meanwhile, survivors spent long months in the center of a toxic stew as government officials told them any symptoms they experienced were in their heads or would disappear as soon as the fires went out.

What the EPA knew, but we didn't, was that the air was not safe. Now, in addition to the illnesses and deaths we're seeing among responders, the death toll from 9/11-related illnesses is also mounting among survivors and new people continue to fall ill, many of them my age or younger.

Like many survivors I now suffer from 9/11-related health conditions. Many of these conditions are chronic. My entire 20s was dominated by financial panic because even asthma and GERD can be quite expensive to treat under our current health care system. Adding to that stress is the fact that doctors in California, where I live, have often never seen a 9/11 survivor and don't understand the unique health risks I face. The World Trade Center Health Program has meaningfully changed my life. More specifically the Nationwide Provider Network has been a huge advantage for the thousands of lower Manhattan students who went away to college or started their adult lives elsewhere. I used to stockpile asthma medicine and "wait it out" when I should have gone to the doctor. Thanks to the WTC Health Program, I don't have to do those things anymore.

Unfortunately my future, and that of my classmates, is looking a little more scary than chronic-but-hopefully-manageable health conditions. Back in January 2006, when James Zadroga became the first responder to have his death directly linked to his exposures on 9/11, an autopsy revealed ground glass, asbestos, chromium, lead and benzene in his lung tissue. Responders were not the only people exposed to these known carcinogens. So were we.

NIOSH has now linked more than 68 cancers to the WTC toxins. Not surprisingly, many former students from the schools south of Canal Street, as well as Members of the community and people who worked in the area, are now being diagnosed with the same cancers as the first responders.

I already can say that I went to school with more cancer survivors than anybody I know, and I haven't even had my 20th high school reunion yet. Just in my limited personal network from Stuyvesant I know at least five people who have been diagnosed with lymphomas, my friend Michele is in remission from thyroid cancer, and another classmate from my year is in remission from testicular cancer. Other Stuyvesant alumni from those years have been diagnosed with rare bone cancers, melanoma, and there's even a male breast cancer survivor among us.

Now our classmates, people still in their 20s and early 30s, are starting to die. Just a couple of months ago a classmate of mine, Cathy Choy, passed away at age

33 from 9/11-linked gastric cancer. Her Victim Compensation Fund award has not yet been paid. When her husband finally receives it, it will be reduced by either 50% or 70%.

Stuyvesant students are not the only ones getting sick. Rozaliya Yarusska was a 22-year-old Pace University student on 9/11 and has been diagnosed with nasal cancer and eye cancer. Magdali Vergara-Martinez was a 17-year-old BMCC student. She's been diagnosed with thyroid cancer. Her VCF award will be cut 50%. The growing number of cancer cases has had an affect on all of us, even those that aren't sick. With each new cancer report I also hear from classmates consumed by fears about what's around the bend and wondering what we can do to protect ourselves.

The fact that people our age are only starting to get sick and die now is not surprising. We were younger when exposed, so the latency periods for our illnesses have been longer. For us, and for our families, our concern is compounded by the fact that the Victim Compensation Fund is closing. While those who are sick now will receive drastically reduced awards, many of my friends won't find out they're sick in time to make any claim at all.

Women have even more reason to be concerned. Much of the early research on 9/11's health impacts was done on the disproportionately male responder population. Many women's health conditions won't make it onto the list of covered conditions in time to be compensable through the VCF. Breast cancer has just now surpassed prostate cancer as the most commonly diagnosed cancer among survivors, but there still isn't much data on women's reproductive health or conditions such as autoimmune disorders that disproportionately affect women. We've seen the surge in breast cancers in the news, of course, but only because an unusual number of these cases are in men. One of these men, as I mentioned before, is a classmate of mine.

Young adults are also especially at risk of losing out on the VCF because we face some big obstacles to even finding out about the 9/11 health services. Like me, many of us no longer live in New York City and don't have access to local information about the VCF, don't see it reported on in local media, and don't have local advocates. This often seems to get lost in the conversation about who needs this program and why. Stuyvesant alumni alone live in locales from rural Tennessee, to coastal Oregon, to Texas and beyond. Thousands of other New York City kids have begun their adult lives in other parts of the country as well.

Unfortunately, cancer does not respect arbitrary funding deadlines. Right now there are thousands of 17 and 18 year-olds, just beginning their adult lives, who will have to live with the results of their WTC exposures for another 70 or 80 years. The older exposed kids, people my age, are learning of our increasingly terrifying health prospects just as many of us are starting families or are planning to in the next few years. When we get sick, when we have to take leave from work to recover or god forbid pass away from a serious illness with a young child at home, who is going to help our families fill in the financial gap? A responder or a survivor who gets sick in 2027 deserves the same help that they would've have received if they got sick in 2017.

Those of us exposed to the toxic dust at Ground Zero as kids had our health put at risk before we were old enough to understand the risks or give informed consent. Upon our return to Stuyvesant we were even paraded in front of news cameras to show how "safe" it was downtown. Essentially, were conscripted into a massive PR effort that encouraged the rest of the community to return to a dangerous place even as the Federal Government knew the air might make all of us sick. If the VCF is allowed to reduce payouts and expire, a resource meant to ease our suffering will become yet another symbol of how we were sacrificed by a government that thought a quick return to normalcy after a tragic event was more important than the health and safety of the children who lived through it, the responders who cleaned up the mess, and the thousands of area workers and residents who were lied to and compelled to put their health on the line without their knowledge or consent.

As health concerns begin to overwhelm us, we hope the Federal Government will have our backs. In 2011, and again in 2015, the Government did the right thing by enacting, and then re-authorizing, the Zadroga Health and Compensation Act. Congress must do the right thing one more time and fully fund and extend the VCF.

Chairman NADLER. Thank you, Ms. Nordstrom.

We have been joined by a number of the firefighters who were first responders, and I want to welcome them, and by Congressman Max Rose, who is a cosponsor of this bill.

Let me just say, before I recognize the next witness, in response to what Ms. Nordstrom just said, as I said before, there are really

two moral responsibilities. Plenty of people got sick and will get sick because of what the terrorists did on 9/11, but plenty of people got sick and will get sick because of what the Federal Government did in the days following.

I remember very clearly the EPA Administrator saying, "Go back to work. Let's get things back to normal. Everything is fine." I remember the mayor at the time saying, "Reopen Stuyvesant," *et cetera*. I was calling for parents not to send their kids back to Stuyvesant. I was telling people not to go back to Wall Street, not to go back to work, because it was very evident that it wasn't clear.

The Federal Government bears a heavy moral responsibility for what happened. This bill is only a—if we pass it—when we pass it, I hope—would be a very, very small partial repayment for that moral obligation.

Ms. Henry?

TESTIMONY OF ANESTA MARIA ST. ROSE HENRY

Ms. HENRY. Thank you, Mr. Chairman.

Chairman NADLER. Can you use your mike, please?

Ms. HENRY. Okay. Thank you.

Thank you, ladies and gentlemen. My name is Anesta St. Rose Henry.

My husband died a few weeks ago of 9/11-related brain cancer. My husband, Candidus, was only 52 years old when he died. He missed our son's prom, which was last week, and he missed out on our frantic search for a jacket because the one we bought was too small and too short.

Oh, my God.

So, after that, we were able to get the jacket for our son. I just miss my husband because we would have a good laugh at that jacket, the way it fit him.

Candidus was the—oh, God—he was the life of my family. Oh, God. He won't be there for my son's graduation, which will be on the 19th of this month. Many of the kids his age that lost their parents, their parents will not be there for that. Also my daughter, his only daughter's wedding, we do not know what date is that, but he will not be there to walk her down the aisle.

So not to have to make that—oh, God. Oh, God. So not only do I have to make up for his missing presence, but I have to be worried about whether we will have enough money for our son's college and living expenses. The reason I have to worry is because Congress thinks it is okay for my husband's life to be worth at least 70 percent less than other construction workers that have died or become sick from being at Ground Zero.

If he died 2 years ago, everything would be okay. I feel horrible for those that live—oh, God. I feel horrible for those that will die 2 years from now because their family will get nothing.

Candidus was a construction worker and a proud man, husband, father, son. He went to work every day. When he was assigned to Ground Zero, he was also a proud American.

His job at Ground Zero was to wash the dust and debris from the trucks before they left for the barges and to make sure everything was secure, and nothing was sticking out. They wanted to be sure human remains were not going to fall off the trucks on the way to

the barges. While his job may not sound glorious, he was proud of it and proud to say he worked at Ground Zero.

After his time at Ground Zero ended, he worked every day as a construction laborer, and we raised our family. We are not rich, and we lived from paycheck to paycheck, always with some sort of credit card bill.

Although he left Ground Zero in 2002, 15 years later, Ground Zero came back to him. Candidus was diagnosed with glioblastoma, a rare brain cancer. We were told it was extremely rare. We then learned that there are many 9/11 responders with the same cancer.

Glioblastoma is a death sentence, and while it took 2 years, it eventually killed Candidus. It took his mind a few months before his death, and while we took care of him for the last few months, he was already gone. My son would come home from school and my daughter from work and would say, "Hi, Dad," and there was only a gaze, and sometimes there was nothing. He only wanted to talk to his dad about his day, and that was gone.

When Candidus got sick, that ended the paycheck and benefits. Thankfully, the World Trade Center Health Program picked up all of the expenses for his care and treatment. They were wonderful at the Queens Program, and we wouldn't have survived without them.

We were also able to get some help from the VCF and received an award for his cancer. They worked so quickly to get that for us because they knew he was dying. Thank you to them for that. Please do not cancel them. They are very good. They helped us very well.

Now that Candidus is gone, we do not know what is going to happen. We do not have life insurance. We do not have a pension or any benefits from his job. Not even his death benefit we got. Our only hope was the VCF, and now we do not know if there will be much from them now. Because he died after February 2—which was also his birthday—2019, we will get at least 70 percent less than others that died sooner.

My husband was a proud man and never looked down on others or thought that he was better, or his life was worth more than that, but I can tell you that his life is not worth less than anyone else.

I know my husband would be proud to be here in person and talking to you, because we should have to recognize these people are worth more than that because they are more important than anything else. They were the ones who picked up everything else. Now that he is gone, we do not know what we are going to do without him.

Thank you, everyone.

[The statement of Ms. Henry follows:]

PREPARED TESTIMONY OF ANESTA MARIA ST. ROSE HENRY

Good Morning Ladies and Gentleman—

My name is Anesta St. Rose Henry and my husband died 2 weeks ago of 9/11 related brain cancer. Candidus was 52 years old when he died. He missed our son's prom last week and missed out on the frantic search for a jacket for him hours before the prom because the one he initially got turned out to be too small. So after we were able to get the jacket and our son went to his senior prom Candidus wasn't there for me to laugh with about the jacket. He will not be there for his high school

graduation or to walk his daughter down the aisle when she gets married. So not only do I have to make up for his missing presence, but now I have to be worried about whether we will have enough money for college and living expenses.

The reason I have to worry is because Congress thinks its ok for my husband's life to be worth at least 70% less than other construction workers that have died or become sick from being at Ground Zero. If he died 2 years ago everything would be ok. I feel horrible for those that will die 2 years from now because their families will get nothing.

Candidus was a construction worker and a proud man, husband and father. He wanted to work every day. When he was assigned to work at Ground Zero he was also a proud American. His job at Ground Zero was to wash the dust and debris off the trucks before they left for the barges and to make sure everything was secure and nothing was sticking out. They wanted be sure human remains were not going to fall out of the trucks on their way to the barges. While his job may not sound glorious, he was proud of it and proud to say he worked at Ground Zero.

After his time at Ground Zero ended he worked every day as a construction laborer and we raised our family. We are not rich and we lived pay check to pay check, always with some sort of credit card bill. Although he left Ground Zero in 2002, 15 years later Ground Zero came back to him. Candidus was diagnosed with Glioblastoma, a rare brain cancer. We were told it was extremely rare. We then learned that there are many 9/11 responders with the same cancer.

Glioblastoma is a death sentence and while it took 2 years, it eventually killed Candidus. It took his mind a few months before his death and while we took care of him for the last few months, he was already gone. My son would come home from school and say "Hi Dad" and there was only a gaze sometimes and sometimes there was nothing. He only wanted to talk to his dad about his day, and that was gone.

When Candidus got sick that ended the paychecks and benefits. Thankfully the World Trade Center Health Program picked up all of the expenses for his care and treatment. They were wonderful at the Queens Program and we wouldn't have survived without them. We were also able to get some help from the VCF and received an award for his cancer. They worked so quick to get that for us because we they knew he was dying. Thank you to them for that.

But now that Candidus is gone we don't know what is going to happen. We do not have life insurance. We do not have a pension or any benefits from his job. Our only hope was the VCF and now we don't know if there will be much from them now. Because he died after February 2, 2019, we will get at least 70% less than others that died sooner. My husband was a proud man and never looked down on others or thought that he was better or his life was worth more than others. BUT I can tell you that his life is NOT worth less than anyone else.

Chairman NADLER. Thank you, Ms. St. Rose Henry. Let me say that we are here today to help make sure that Congress does not think it is okay that your husband's life is worth 70 percent less than other construction workers or than anyone else's. I thank you for your testimony. It will help in that goal.

Mr. Mohnal?

TESTIMONY OF THOMAS J. MOHNAL

Mr. MOHNAL. Good morning, Mr. Chairman and Members of the committee. Thank you for allowing me to testify today.

My name is Thomas Mohnal, and I began my career with the Federal Bureau of Investigation on January 3, 1980, and retired on May 30, 2010, as a supervisory special agent explosive and hazardous device examiner in the Explosives Unit of the FBI Laboratory.

In the moments after the Pentagon was attacked, I became what is known as a 9/11 first responder. Just like others sitting with me today, we did our job, and we did it well beyond 100 percent. We did everything we could do to rescue those that were trapped, and we did everything we could to find those who were missing so their families could have the closure that they desperately needed.

Like everyone else here today and all other first responders, I will never forget 9/11, and I always knew it would be with me. What I didn't know was what that would mean some 15 years later to me and my family.

On 9/11, I was working FBI headquarters in Washington, DC, and after the second plane hit the World Trade Center, I was directed to go to New York City in response to the FBI Laboratory. I departed headquarters en route to my residence in Manassas, Virginia, and I was traveling on I-395 South.

When I was directly across from the Pentagon in stopped traffic, at approximately 9:37 a.m., I witnessed American Airlines Flight 77 crashing into the Pentagon. I immediately notified our headquarters that a plane had crashed into the Pentagon and immediately responded to the crash site and started lending assistance to victims in the area.

FBI agents and Members of the evidence response teams from Washington field office began arriving very quickly, fully aware that the lifesaving and investigative activities that they would undertake in response to this terrorist attack could put their lives in danger. Evidence response teams from Baltimore, Richmond, Norfolk, Charlotte, and Atlanta also deployed to the Pentagon.

On August 4, 2016, I was diagnosed with follicular non-Hodgkin's lymphoma. I was certified by the World Trade Center Health Program and received excellent care and regular physicals through that excellent program.

I am here today to ask Congress why they believe that my life is not worth the same as those that became sick before me and how my life could be worth more than those that will most certainly become ill after me.

It doesn't care who you are, what you did, or when you did it. The guidelines are fair and based on the exposure and your illness, and then the compensation is based on the economic loss and of that particular illness.

The Special Master over the years has done a great job on managing a program fairly and equally in the face of illness, death, and despair. Now, because so many people are becoming sick and the funds are running out, the Special Master is being forced to look at cases through different lenses based on when the forms were filed. That means that our lives and illnesses now have a different value and meaning.

I have had the pleasure to come to the Capitol on several occasions now with the FealGood Foundation to walk the halls of Congress to ask for support for the 9/11 first responders and the Victim Compensation Fund. I have learned that every Member in Congress has praised the work of first responders and the 9/11 first responders. I have learned that on September 11 every Member of Congress pauses in remembrance of those that were lost that day and those that we will continue to lose. I have also learned that every Member of Congress promises to never forget.

I am here to support our colleagues that have become sick in the past and those who will become sick in the future. There are people in this room right now that will become sick from their 9/11 exposure and die. Their families will need the support beyond the words "never forget."

Congress has the ability to fix this problem. Nearly every FBI evidence response team in the country deployed to one of the attack sites to sift through thousands of tons of contaminated debris, looking for any shred of evidence that may lend assistance in this investigation.

Passport fragments were found of the hijackers, to include the knives that were actually used in the attack were recovered from crash sites. This shows the extreme dedication the workers had while sifting through contaminated debris, knowing all along that this could possibly affect their health.

Many thousands of Americans, first responders, firefighters, police officers, and volunteers have been diagnosed with severe health conditions, including cancer, in the wake of the attacks. Knowing the type of individuals that sacrificed their health and in many cases their lives, they would all do the same job all over again for this country.

This is a nationwide issue, and it must be fixed by our leaders in Congress together, as there are no State lines for a 9/11 illness.

Thank you for your time.

[The statement of Mr. Mohnal follows:]

PREPARED TESTIMONY OF THOMAS J. MOHNAL

Good morning Mr. Chairman and Members of the committee:

My name is Thomas J. Mohnal and I began my career with the Federal Bureau of Investigation (FBI) on January 3, 1980 and retired on May 30, 2010 as a Supervisory Special Agent—Explosive and Hazardous Device Examiner in the Explosives Unit of the FBI Laboratory. On June 1, 2010, I began employment with Bode Cellmark Forensics as an Explosive and Hazardous Device Contractor for the Explosives Unit of the FBI Laboratory, Quantico, Virginia.

As an Explosives and Hazardous Device Examiner in the FBI Laboratory my principal role was to examine evidence pertaining to the criminal/terrorist use of explosives and improvised explosive devices (IEDs). I have been responsible for the supervision, management, and/or coordination of forensic examinations and have provided technical and investigative support for several hundred highly complex bombing/terrorism investigations, to include: The 1993 World Trade Center bombing, bombing of the Oklahoma City Federal Building, the bombing at the 1996 Atlanta Olympics, the 1998 bombing of the U.S. Embassy in Nairobi, the 9/11 terrorist investigation, several Vehicle-Borne IEDs in Beirut, Lebanon, the UNABOM series from 1982–1996, and the 2005 assassination attempt on President Bush in Tbilisi, Georgia.

In the moments after the Pentagon was attacked, I became what is now known as a 9/11 First Responder. Just like the others sitting with me we did our job and we did it well beyond 100%. We did everything we could to rescue those that were trapped and, just as important, we did everything we could to find those that were missing so that their families could have the closure they so desperately wanted. We also made sure that the entire world knew that we would never back down to terrorism and we would move forward, albeit a “post 9/11 world.” My life was certainly worth no more or less than the other First Responders that came to the Pentagon and whether it is Shanksville, the World Trade Center or the Pentagon, we were one then and we are one now as we sit before you. Like everyone else here today and all other first responders, I would never forget 9/11 and I always knew it would be with me. What I didn’t know was what that would mean some 15 years later, when 9/11 took on a whole new personal aspect to me and my family.

On 9/11/2001 I was working at FBIHQ in the Explosives Unit, Laboratory Division and after the second plane hit the World Trade Center I was directed to go to New York City in response for the FBI Laboratory. I departed FBIHQ enroute to my residence in Manassas, Virginia, traveling on I–395 south. When I was directly across from the Pentagon in stopped traffic, at approximately 9:37 a.m., I witnessed American Airlines Flight 77 crashing into the Pentagon. I immediately notified FBI Headquarters that a plane just crashed into the Pentagon and I immediately responded to the crash site and started lending assistance to victims in the area. The entire section of the crash site was engulfed in a tremendous fire supported from the jet fuel. I’ve done a lot of testing with large amounts of explosives,

to include gas-enhanced explosions, but I can't even describe to you how big and intense the fireball was when the plane crashed into the Pentagon. It pretty much encompassed the majority of the Pentagon. I spent the entire day at the Pentagon providing immediate assistance and on the early morning of 9/12/2001 I reported back to the Pentagon to begin assisting with the recovery operation and the terrorist investigation. I worked the day shift, 10–12 hour days, 5–7 days per week, from 9/11/2001 until approximately 11/19/2001.

FBI agents and Members of the Evidence Response Team from the Washington Field Office began arriving at the Pentagon quickly after the impact, fully aware that the life-saving and investigative activities they would undertake in response to the terrorist attack could put their lives in danger. Evidence Response Teams from Baltimore Maryland, Richmond Virginia, Norfolk Virginia, Charlotte North Carolina, and Atlanta Georgia also deployed to the Pentagon to assist in this terrorism investigation. It should be noted that the FBI Evidence Response Teams are made up from FBI Special Agents and FBI Professional Staff.

The jet fueled fires continued until the evening of 9/12/2001, with fires continuing for approximately a week or so. The environment during the first several days featured strong odors, fumes from jet fuel, and smoldering debris, which included plastics, fiberglass, aluminum, and due to the extreme temperature of the fires, even some types of metals. Most FBI employees remained outside the building on the first day due to the extreme hazards inside, although the smoky haze extended well outside the Pentagon's walls.

Early in the first week, I specifically remember being inside the Pentagon on the first floor collecting human remains into red Hazmat bags, and looking for other potential evidence. We would have been inhaling contaminated air from the fire, including dust from the building and chemicals from the plane to include the jet fuel. During this very crucial first week of evidence recovery, fires continued to re-ignite from the extreme heat of the original jet fueled fires. This made the recovery task very difficult and dangerous from the contaminated air and dust filled building.

I also have a very specific memory of walking through the Pentagon, from the outer ring to the inner ring, with Members of the Evidence Response Teams to spend time searching for evidence near the nose of the plane. We were often leaning down over the water, breathing close to the water, to reach for something in or under the water. This water and mud contained all sorts of toxins, including but not limited to airline fuel and chemicals, as well as dust, debris and chemicals from the building, and human remains.

Later in the following weeks, I have a specific memory of working in the debris fields of the parking lots surrounding the Pentagon with Members of the Evidence Response Teams. We would rake through the debris field on the ground, then squat or kneel down over it and sift through it with tools or our hands to look for human remains or smaller bits of evidence. The smallest fragments of evidence, such as an identification card of the hijackers would have provided valuable information for this investigation. This debris field would have been filled with chemicals, debris, human remains and dust from the building and airplane.

Supervisory Special Agents from the FBI Laboratory, Explosives Unit, were deployed to all three (3) of the terrorist attack sites to lend their expertise in processing major crime scenes and provide assistance to the Evidence Response Teams. Considering I witnessed one of the worst terrorist attacks on United States soil, I had an obligation to myself as well as the FBI to continue working at the Pentagon crash site until the completion and to provide as much assistance and my expertise in this terrorist investigation as I possibly could.

The last couple weeks at the Pentagon migrated into a clean-up operation, however, evidence recovery was still a major part of the this process. As contaminated debris was removed from the interior of the Pentagon, a sifting operation took place. Virtually every pile of debris was systematically searched for any possible shred of evidence.

The Explosive Unit was in charge of the evidence from all three of the crash sites. I supervised the photographing of the evidence sent into the FBI Laboratory from the Pentagon, from the World Trade Center Towers, including all evidence recovered from the land fill in New York, and evidence recovered from the Shanksville, Pennsylvania crash site. This project took place in FBIHQ and at off-site locations in Northern Virginia where some of the evidence was stored. The photography, review and physical bench notes of the evidence recovered from the three attacks took several months to complete. Special Agent Bomb Technician's from many FBI Field Offices around the country also provided assistance in this tremendous task.

On August 4, 2016, I went to the emergency room with extreme stomach pains expecting to find out I had appendicitis. In the normal course of care the doctors had ordered a CT scan to assess the situation. The CT scan verified that I had a

ruptured appendix, and also indicated three (3) tumors that were consistent with Lymphoma. My appendix was surgically removed and I was later diagnosed with Follicular Non-Hodgkin's Lymphoma. Over the last 2½ years I had 18 cycles of chemotherapy treatment and currently on a maintenance treatment every 8 weeks. I had two bone marrow biopsies, and nine PET/CT scans, with my most recent PET scan indicating a moderate increase in size and activity in the tumors. I was certified by the World Trade Center Health Program on October 3, 2017 and have received excellent care and regular physicals through this program.

I am here today to ask why Congress believes that my life is not worth the same as those that became sick before me and some how my life is worth more than those that will most certainly come after me. The September 11th Victim Compensation Fund is not a beauty contest. It doesn't care who you are, what you did or when you did it. The guidelines are fair and based on your exposure and your illness and then compensation is supposed to be based on the illness and economic loss. It is not a lottery ticket or a get rich quick scheme. The Special Master over the years has done a great job of managing a program fairly and equally in the face of illness, death and despair. Now, because so many people are becoming sick and the funds are running out the Special Master is being forced to look at cases through different lenses based on when it was filed. That means that our lives and illnesses now have different values and meanings. THAT IS ABSURD.

One thing is certain, THE SPECIAL MASTER DOES NOT HAVE THE POWER TO FUND THE PROGRAM, I DO NOT HAVE THE POWER TO FUND THE PROGRAM, NOBODY AT THIS TABLE HAS THE POWER TO FUND THIS PROGRAM. ONLY YOU & THE COMMITTEE MEMBERS HAVE THE ABILITY GET THE FUNDING TO KEEP THIS PROGRAM RUNNING. ONLY YOU!

I have had the pleasure to come to the Capitol on several occasions now with the FEALGOOD FOUNDATION to walk the halls of Congress to ask for support of the 9/11 first responder in the VCF. What I have learned was quite eye opening, even given my exceptionally unique career in law enforcement. I have learned that every member of Congress has praised the work of first responders and 9/11 first responders. I have learned that every September 11 that every member of Congress pauses in remembrance of those lost that day and those that we continue to lose. I have learned that every member of Congress promises to "Never Forget." Despite all that I have learned from coming here I do not understand why WE have to be here today.

I am here to support my colleagues that have become sick in the past and those that will become sick in the future. There are people in this room right now that will become sick from their 9/11 exposures and die. Their families will need the support beyond the words "Never Forget." Their lives are worth less than mine because they got sick later than I did. I do not really think about those that may receive a higher award than my family does. I don't know why, but I just do not. HOWEVER, I DO THINK ABOUT THOSE THAT WILL GET LESS THAN I DO and it's a HORRIBLE FEELING.

YOU ARE PUTTING US IN A POSITION WHERE WE HAVE TO SEE OTHERS WITH THE SAME ILLNESSES GET LESS. THAT'S A HORRIBLE FEELING. MANY OF US ALREADY DEAL WITH THE QUESTION OF WHY WE DIDN'T PERISH THAT DAY OR OF ILLNESSES SINCE. THAT'S HEAVY ENOUGH. NOW WE HAVE TO THINK THAT WE MAY HAVE RECEIVED MORE THAN SOMEONE ELSE? THAT'S NOT A GOOD FEELING.

CONGRESS has the ability to fix this problem. While we all may have somewhat different 9/11 experiences, we were all together then, now and in the future. My agency is an example of how people came from all over the country to assist at the disaster sites. It is also an example of how the illnesses did not care where you responded to or where you were from. We have lost at least 16 Members of the FBI to 9/11 illness from their duty at The Pentagon, Shanksville and Ground Zero. This is a nationwide issue and it must be fixed by our leaders in Congress together, as there are NO STATE LINES for 9/11 illnesses and deaths.

It should also be noted that nearly every FBI Evidence Response Team in the country deployed to one of the attack sites to sift through thousands of contaminated metric tons of debris looking for any shred of evidence that may lean assistance in this investigation. Passport fragments of the Hijackers, to include the knives that were used in the attack were recovered from the crash sites. This shows the extreme dedication the Members of the Evidence Response Teams had while sifting through tons of contaminated debris, knowing all along that this could possibly affect their health.

As the years have passed, the survivors and first responders of that day have had to deal with another challenging reminder of our nation's tragedy. Many thousands of Americans, First Responders, Fire Fighters, Police Officers and Volunteers have

been diagnosed with severe health conditions, including cancer, in the wake of the attacks. Knowing the type of individuals that sacrificed their health and in many cases their lives, including myself, would all do the same job all over again for this country.

Chairman NADLER. Thank you.
Mr. O'Connell?

TESTIMONY OF MICHAEL O'CONNELL

Mr. O'Connell. Good morning.

Chairman NADLER. Actually, Lieutenant O'Connell.

Mr. O'Connell. My name is Michael O'Connell, and I am a retired lieutenant from the New York City Fire Department.

I want to personally thank Chairman Nadler, Ranking Member Collins, and the Committee Members for allowing me to be here today at this hearing to tell my story, which is really no different from the thousands of others who suffer from their heroic actions.

Today, I can say thank you to the countless selfless heroes, volunteers, survivors, and those affected at the three terrorist sites because I get the best healthcare treatment and I have been compensated by the September 11th Victim Compensation Fund.

I was just a 25-year-old probationary firefighter on that beautiful Tuesday morning of the 11th without a clue as to what was happening. I had just transferred from the NYPD in May of 2001 and was not even graduated from the FDNY Fire Academy on that horrific day.

When the towers were struck, I was home on Long Island and immediately raced into Ladder 129 in Flushing, Queens, where I was doing my field training. Within minutes of my arrival, we started to respond to Lower Manhattan.

During our response, we were notified of the collapse of the south tower of the World Trade Center, and a fellow firefighter turned to me and said, "Do you realize how many guys we just lost?" The truth was I didn't have a clue, but I would learn quickly.

Upon arrival, we went to work right away in the war zone later known as Ground Zero. We were given many tasks and tried our best to search for human life, but unfortunately, we weren't very successful. Countless hours we spent digging by hand.

To this day, there is only one memory etched into my brain and one that still haunts me to this day and every night. As firefighters, we wear Scott packs that are equipped with pass alarms. Pass alarms are meant to go off when a firefighter is laid motionless, making a screeching sound so you can go find them. Well, for the first few minutes of our arrival and the countless hours that passed, that is all we heard. That was our brothers trapped beneath the pile of concrete and steel, and we could not get to them.

It is a difficult memory but one that keeps me going. It reminds me that those men and women who gave their lives that day were selfless. I try my best to live my life to that standard every day.

In the midst of the chaos and loss of life, I can tell you that there is another thought that I had: I would not want to be anywhere else in the world at that moment. We were there to help, and I was part of something that showed the world that we would not back down to anyone. We helped bring closure to families that just wanted something tangible, some part that remained to bury.

Now it is your turn. You were not there on the pile with us, but what you do in this moment is as important as what we did at Ground Zero.

I had worked the pile for days and weeks that followed, with very little protection in the dust cloud, and I would later pay the ultimate price. The change came on January 1 of 2007 when I woke up and instantly knew something was wrong. I couldn't get out of bed, and it felt like somebody came into the room that night and beat me up with a baseball bat. My ankles, my legs, my feet were so swollen it made it difficult to even walk to the car to get to the doctor.

I was put through a series of tests, and from what the doctors had seen, the prognosis did not look good. My wife Rebecca, who was 6 months pregnant with our first child, was escorted to a conference room, where a team of doctors waited for us to give us the news and told us that this looked like an advanced case of lymphoma and that I most likely didn't have much time to live.

At this point, all I wanted to do was make it long enough to see the birth of my first child. It is obvious, since I am testifying here today, and by the grace of God, I am able to be here to tell my story. I am a proud father of three beautiful children named Aidan, Colton, and Alexandra, all of which witnessed their father battle 9/11 illnesses from the time they were born.

I was very fortunate that the original prognosis was wrong, and I was actually diagnosed with a rare autoimmune disease called sarcoidosis. I was one of the youngest and first firefighters diagnosed with sarcoidosis, but hundreds more have been diagnosed since. I spent the next few months in recovery, and with the proper treatments, I was able to get back on my feet. Sadly, I cannot say that about others.

My career in the FDNY that I was so passionate about was cut short, and 9/11 ensured I would be unable to continue as a full-duty firefighter, as I was deemed disabled. I was on pace to advance through the FDNY as a senior officer, but I was unable to finish that dream of protecting the greatest city in the world.

I ask you all respectfully, how is it fair that I was duly compensated but others that are now sick and dying from their exposure will not be? It seems unfair that I was unlucky enough to get sick but lucky that I got sick early enough so that I could avoid potential cut or, worse, having no VCF as of December 2020.

How is my family financially safe for a lifetime but the families of those not diagnosed are left hanging? These people are getting sick 18 years later and are not going to receive the same benefits as those who got sick before them because they were unlucky to get sick at a time when the VCF is running out of funds.

I speak today in tribute to the 343 firefighters, the 23 NYPD, and the 37 Port Authority Police officers that didn't make it out on September 11, 2001, and to the thousands who are still sick and who are dying, and especially for my brother, Ray Pfeiffer from the FDNY, who is no longer with us.

I promised myself to keep fighting for my family and for those who are sick or have passed and yet to be compensated, because one day I might not be here to tell my story. There will be someone

else to follow and continue the tradition—a tradition that is rich in history and a tradition where no one is left behind.

In closing, I have made countless trips to the Hill with the men and women who sit behind me. We came together to join forces on the FealGood Foundation team from all walks of life—cops, firefighters, construction workers, correction officers, civilians, lawyers, students, widows—with one common goal. We are simply imploring this Committee to extend and refund the VCF so that thousands of people across this great Nation get the help that they deserve and they have earned.

Thank you for your time today, Chairman, Ranking Member, and the committee. God bless you, God bless all those sitting behind me, and God bless America.

[The statement of Mr. O'Connell follows:]

PREPARED TESTIMONY OF MICHAEL O'CONNELL

My name is Michael O'Connell and I am a retired Lieutenant from the Fire Department of the City of New York. I want to personally thank Chairman Nadler, Ranking Member Collins, and the Committee Members for allowing me to be here today at this hearing to tell my story, which is really no different from the thousands of others who suffer from their heroic actions.

Today, I can say thank you to those countless selfless heroes, volunteers, survivors, and those affected at the three terrorist sites because I get the best health care treatment and I have been compensated by the September 11th Victim Compensation Fund.

I was just a twenty-five year old probationary firefighter on that beautiful Tuesday morning of the 11th, without a clue as to what was happening. I had just transferred from the New York City Police Department in May of 2001, and was not even graduated from the FDNY Fire Academy on that horrific day.

When the towers were struck, I was home on Long Island and immediately raced into the Ladder 129 Fire House in Flushing, Queens where I was doing my field training. Within minutes of my arrival, we started to respond to Lower Manhattan.

During our response we were notified of the collapse of the south tower of the World Trade Center and a fellow firefighter turned to me and said, "do you realize how many guys we just lost?" The truth was that I didn't have a clue, but I would learn quickly.

Upon arrival, we went to work right in the war zone later known as "Ground Zero." We were given many tasks and tried our best to search for human life, but unfortunately, we were not very successful. Countless hours we spent digging by hand.

To this day, there is only one true memory etched into my brain, and one that still haunts me when I put my head on the pillow at night. As firefighters, we wear Scott packs that are equipped with pass alarms. A pass alarm is meant to go off and make a loud screeching sound in the likelihood that a firefighter is stuck and is motionless. For the first few minutes of our arrival, and the countless hours that passed, that is all we heard. Our brothers were trapped beneath that pile of concrete and steel and we could not get to them. It is a difficult memory, but one that keeps me going. It reminds me that those men and women who gave their lives that day were selfless, and I try my best to live my life to that standard.

In the midst of the chaos and loss of life, I can tell you that there is another thought that I had. I would not want to be anywhere else in the world at that moment. We were there to help, and I was part of something that showed the world that we would not back down to anyone. We helped bring closure to families that just wanted something tangible, some part that remained, to bury. Now it is your turn, you were not there on the Pile, but what you do in this moment is just as important as what we all did at Ground Zero.

I had worked the pile for the days and weeks that followed, with very little protection in that dust cloud, and I would later pay the ultimate price. That change came on January first of 2007, when I woke up, and instantly knew something was wrong. I couldn't get out of bed, and it had felt like someone came in my room that night, and beat me up with a baseball bat. My legs, ankles and feet were so swollen, it made it very difficult to walk to the car to get to the doctor. I was put through

a series of tests that day, and from what the doctors had seen, the prognosis did not look good.

My wife Rebecca, who was six months pregnant with our first child, was escorted to a conference room where the team of doctors gave us the news: that this looked like an advanced case of lymphoma, and that I most likely did not have much time left. At this point, all I wanted to do was make it long enough to see the birth of my first child.

It is obvious that, since I am testifying here today, and by the grace of God, we know what happened. I am a proud father of three beautiful children named Aidan, Colton, and Alexandra, who have witnessed their father battle 9/11 illnesses since they were born.

I was very fortunate that the original prognosis was wrong. I was actually diagnosed with a very rare autoimmune disease called sarcoidosis. I was one of the youngest and first firefighters diagnosed with sarcoidosis. Hundreds more have been diagnosed since.

I spent the next few months in recovery, and with the proper treatments, I was able to get back on my feet. Sadly, I cannot say that about others.

My career in the FDNY that I was so passionate about was cut short, and 9/11 ensured I would be unable to continue as a full duty firefighter. I was on pace to advance throughout the FDNY as a senior officer, but I was unable to finish that dream of protecting the greatest city in the world.

I ask you all, respectfully, how is it fair that I was duly compensated, but others that are now sick and dying from their exposure will not be? It seems unfair that I was unlucky to get sick, but lucky in that I got sick early, so that I could avoid a potential cut, or worse, having no VCF after December 2020?

How is my family financially safe for a lifetime, but the families of those not yet diagnosed are left hanging? These people are sick eighteen years later, and are not going to receive the same benefits as those who got sick before them, because they are unlucky to get sick at a time when the VCF is running out of funds.

I speak today in tribute to the 343 firefighters, the 23 NYPD, and the 37 PAPD that didn't make it out on September 11, 2001, and to the thousands who are still sick, and who are dying, and especially for my brother firefighter Ray Pfeiffer of the FDNY and who is no longer with us. I promised myself to keep fighting for my family, and for those who are sick or who have passed and have yet to be compensated. Because one day, I might not be here to tell my story, but there will be someone else to follow and continue that tradition, a tradition that is rich in history, and a tradition where we leave no one behind.

In closing, I have made countless trips to the hill with the men and women behind me. We are simply imploring this Committee to extend and re-fund the VCF, so that thousands of people across our great Nation get the help that they deserve and they have earned.

Thank you for your time today, Chairman, Ranking Member, and the Committee. God bless you and God bless those behind me, and God bless America.

Chairman NADLER. Thank you very much, Lieutenant.
Detective Alvarez?

TESTIMONY OF LUIS ALVAREZ

Mr. ALVAREZ. Good morning, ladies and gentlemen. My name is Luis Alvarez, and I am a retired NYPD detective from the bomb squad and a proud military veteran.

Less than 24 hours from now, I will be starting my 69th round of chemotherapy. Yeah, you heard that correct. I should not be here with you, but you made me come. You made me come because I will not stand by and watch as my friends with cancer from 9/11, like me, are valued less than anyone else because of when they get sick or they die.

I have been lucky enough to have had 68 rounds of chemo. Yeah, you heard me right—68 rounds. Many others haven't had the opportunity to have five, and some have had none. Their families would love to have the time with them that mine has had with me.

I have been lucky enough to have the pain and suffering of 69 rounds of chemo and countless other treatments and surgeries, it

is my goal and it is my legacy to see that you do the right thing for all 9/11 responders.

Please understand that we are not here for anything for ourselves. We became police officers, firefighters, paramedics to help others. We went to Ground Zero, the Pentagon, and Shanksville to help people first and then help their families bury someone or something. We were there with one mission, and we left after completing that mission.

I have been to many places in this world and done many things, but I can tell you that I did not want to be anywhere else but Ground Zero when I was there. We were part of showing the world that we would never back down from terrorism and that we could all work together—no races, no colors, no politics.

Now the 9/11 illnesses have taken many of us, and we are all worried about our children and spouses and our families if we are not here. The VCF has done a wonderful job and treated my family with greatest respect. My life isn't worth more than the next responder to get cancer. My family's needs are not worth less than any others who have already died.

This fund is not a ticket to paradise. It is there to provide for our families when we can't. Nothing more.

You all said you would never forget. Well, I am here to make sure that you don't. You made me come down here the day before my 69th round of chemo, and I am going to make sure that you never forget to take care of the 9/11 responders.

Thank you for your time.

[The statement of Mr. Alvarez follows:]

PREPARED TESTIMONY OF LUIS ALVAREZ

Good Morning Ladies and Gentleman—

My name is Luis Alvarez and I am a retired NYPD Detective from the Bomb Squad and proud military veteran. Less than 24 hours from now I will start my 69th Round of Chemotherapy. Yes that's correct 69th Round.

I should not be here today but YOU made me come. YOU made me come because I will not stand by and watch as my friends with cancer from 9/11 like me are valued less than anyone else is because of when they get sick or die.

I have been lucky enough to have 69 rounds of chemo. Yes i said lucky. Many others only had 5 and some had none. Their families would love to have had the time with them that mine has had with me. So because I have been lucky enough to have the pain and suffering of 69 rounds of chemo and countless other treatments, it is my goal and will be my legacy to see that YOU do the right thing for all 9/11 responders.

Please understand that we do not want ANYTHING for ourselves. We became police officers, fire fighters, paramedics to help others. We went to Ground Zero, the Pentagon and Shanksville to help people first and then to help their families bury something. We were there together with one mission and we left after completing the mission.

I have been to many places in this world and done many things but I can tell you that I did not want to be anywhere else but Ground Zero when I was there. We were part of showing the world we would never back down from terrorism and that we could all work together. No races, no colors and no politics.

Now the 9/11 illnesses have taken many of us and we are all worried about our children, our spouses and our families and what happens if we are not here. The VCF has done a wonderful job and treated my family with great respect. But my life isn't worth more than the next responder to get cancer. My family's needs are not worth less than others that have already died.

This fund is not a lottery ticket to paradise. It is there to provide for our families when we can't. Nothing more.

Those of us that were at Ground Zero, the Morgue, Fresh Kills Landfill, the Pentagon and Shanksville WILL NEVER FORGET. Every single member of Congress

has said they will NEVER FORGET and they say NEVER FORGET every September 11th. Its NOT one day per year for many of us, it's ever day.

You all said you would "Never Forget." Well I am here to make sure that you don't. I am here because others cannot get here. I would rather be back at Ground Zero again than be here, working together.

YOU MADE ME COME HERE THE DAY BEFORE MY 69th ROUND OF CHEMO and I am going to make sure you NEVER FORGET to take care of the 9/11 Responders.

I am going to leave you with this I will complete my 69th round of chemo tomorrow . . . for a moment I want you to think about how many tens of thousands of rounds of chemo the 9/11 first responders have completed so far and how many tens of thousands are still come

WE DID THAT FOR YOU & WE WILL KEEP DOING IT PLEASE DO NOT DISRESPECT US & MAKE US BEG FOR OUR FAMILIES.

Chairman NADLER. Thank you, Detective Alvarez.
Mr. Stewart?

TESTIMONY OF JON STEWART

Mr. STEWART. I want to thank Mr. Collins and Mr. Nadler for putting this together, but as I sit here today, I can't help but think what an incredible metaphor this room is for the entire process that getting healthcare and benefits for 9/11 first responders have come to: Behind me, a filled room of 9/11 first responders; and in front of me, a nearly empty Congress.

Sick and dying, they brought themselves down here to speak—to no one. It is shameful. It is an embarrassment to the country, and it is a stain on this institution. You should be ashamed of yourselves, for those that aren't here, but you won't be, because accountability doesn't appear to be something that occurs in this chamber.

We don't want to be here. Lu doesn't want to be here. None of these people want to be here. They are not here for themselves. They are here to continue fighting for what is right.

Lu is going to go back for his 69th chemo. The great Ray Pfeiffer would come down here, his body riddled with cancer and pain to where he couldn't walk. The disrespect shown to him and to the other lobbyists on this bill is utterly unacceptable.

I would be so angry at the latest injustice that is done to these men and women and another business card thrown our way as a way of shooing us away like children trick-or-treating rather than the heroes that they are and will always be. Ray would say, "Calm down, Johnny. Calm down. I got all the cards I need." He would tap his pocket where he kept the prayer cards of 343 firefighters.

The official FDNY response time to 9/11 was 5 seconds. Five seconds. That is how long it took for FDNY, for NYPD, for Port Authority, for EMS to respond to an urgent need from the public. Five seconds.

Hundreds died in an instant. Thousands more poured in to continue to fight for their brothers and sisters.

The breathing problems started almost immediately, and they were told they weren't sick, they were crazy. Then, as the illnesses got worse and things became more apparent, "Well, okay, you are sick, but it is not from the pile." When the science became irrefutable, "Okay, it is the pile, but this is a New York issue. I don't know if we have the money."

I am sorry if I sound angry and undiplomatic, but I am angry. You should be too. They are all angry as well, and they have every justification to be that way.

There is not a person here, there is not an empty chair on that stage that didn't tweet out: Never forget the heroes of 9/11, never forget their bravery, never forget what they did, what they gave to this country.

Well, here they are. Where are they?

It would be one thing if their callous indifference and rank hypocrisy were benign, but it is not. Your indifference cost these men and women their most valuable commodity: Time. It is the one thing they are running out of.

This should be flipped. This hearing should be flipped. These men and women should be up on that stage, and Congress should be down here answering their questions as to why this is so damn hard and takes so damn long and why, no matter what they get, something is always pulled back and they have to come back.

Mr. Johnson, you made a point earlier, and it was one that we have heard over and over again in these halls, and I couldn't help but to answer to it—you guys are obviously heroes, and 9/11 was a big deal, but we have a lot of stuff here to do. We have to make sure there is money for a variety of disasters—hurricanes and tornadoes.

This wasn't a hurricane and this wasn't a tornado. By the way, that is your job anyway. We can't fund these programs. You can.

Setting aside that no American in this country should face financial ruin because of a health issue, certainly 9/11 first responders shouldn't have to decide whether to live or to have a place to live.

The idea that you can only give them 5 more years of the VCF because you are not quite sure what is going to happen 5 years from now? Well, I can tell you, I am pretty sure what is going to happen 5 years from now: More of these men and women are going to get sick, and they are going to die.

I am awfully tired of hearing that it is a 9/11 New York issue. Al-Qaida didn't shout "Death to Tribeca." They attacked America. These men and women and their response to it is what brought our country back. It is what gave a reeling Nation a solid foundation to stand back upon, to remind us of why this country is great, of why this country is worth fighting for. You are ignoring them and you can end it tomorrow.

Why this bill isn't unanimous consent and a standalone issue is beyond my comprehension. I have yet to hear a reasonable explanation for why. It will get stuck in some transportation bill or some appropriations bill and get sent over to the Senate, where a certain someone from the Senate will use it as a political football to get themselves maybe another new import tax on petroleum. Because that is what happened to us in 2015. We won't allow it to happen again.

Thank God for people like John Feal, thank God for people like Ray Pfeiffer, thank God for all these people who will not let it happen. They responded in 5 seconds. They did their jobs with courage, grace, tenacity, humility. Eighteen years later, do yours.

Thank you.

[The statement of Mr. Stewart follows:]

PREPARED TESTIMONY OF JOHN STEWART

Chairman Nadler, Ranking Member Collins and Members of the Committee, thank you for letting me join these 9/11 responders and survivors, these heroes, today on this panel.

Thank you for this hearing today on the September 11th Victim Compensation Fund and the legislation Never Forget the Heroes: Permanent Authorization of the September 11th Victim Compensation Fund—that would fully fund the program and extend its authorization.

You have just heard in agonizing detail why you need to Act on this legislation. Many talk about 9/11 and how the country responded to it, but frankly the response on the impact of the toxins at Ground Zero, as these men and women have outlined, has not been as good as it should have been—to say the least.

First, the issues these heroes face is squarely the fault of terrorists. But in the rush to get Wall Street open again and move people back in, mistakes were made.

People—local residents, students and commuters into the area (as well as responders)—were told that the air was safe. But it was not. Children were brought back to school next to a toxic pit—and then it was denied—for years—that there was a health problem. Those who responded and worked in the pit—and had the most exposure—were of course the first to feel the effects. Soon residents became ill, too—with persistent coughs or rare cancers.

So, for many years since 9/11, these responders and residents had to walk the halls of Congress, looking to see if “Remember 9/11” is more than a cheap twitter slogan senators and representatives use to nod in the direction of empathy without having to do anything.

They had to work to get Congress to provide Health care for these injuries from toxins; they had to work to get compensation for the injuries so that their families would not suffer.

First responders, firefighters, police, construction workers, Red Cross volunteers, transit workers, FBI agents and schoolteachers have had to go door to door down your gold- and marble-lined hallways, because 17 years after the attacks on 9/11, they and their families are still dealing with the impact of the toxins at Ground Zero.

They are in every State and 433 out of 435 Congressional Districts.

The fact that they have had continue to do this is beyond my comprehension.

I have to say that my impression of Washington might be changing.

Some things are getting done.

Just a few weeks ago I said that the Trump Justice Department was doing a good job running the program, I would never have thought that I would say it, but I did because it is true.

The fact that this hearing is happening in this Committee today is heartening. I understand there has been some recent unpleasantness.

This legislation has over 300 bipartisan sponsors. 300 Members of the House agreeing to take action is pretty good.

I want to thank Ranking Member Collins for his support today; he and Mr. Nadler have set an example that the parties can come together. All of the support gives me some hope.

There seems to be a general understanding and agreement that compensating the 9/11 heroes through this bill needs to happen. I thank all of you—Republicans and Democrats—for that.

These people can't wait—the cuts to them or their survivors are happening now.

I know that this is going to cost a lot, but you need figure out how to pay for it.

It is not their job to tell you how to pay for it—they did their job.

I ask you to move this bill and get it to the floor.

Two weeks ago, I was at Ground Zero for the dedication of the National September 11th Memorial, for the dedication of a new memorial glade, with ragged stone monoliths that honor those who have become ill and those that have died from 9/11 related illnesses.

The space will never bring closure to those who have lost so much and continue to suffer so deeply, but it recognizes the great courage and strength they gave so willingly and the price they continue to pay.

But they need this bill. Please help them.

Chairman NADLER. Thank you, Mr. Stewart.

We will now proceed under the 5-minute Rule with questions, and I will begin by recognizing myself for 5 minutes.

Ms. Bhattacharyya, what are some of the factors that have led to the increase in the number of claims that the VCF has seen over the last year? And how should these factors influence Congress' decision-making as it determines whether and how best to reauthorize the VCF?

Ms. BHATTACHARYYA. Thank you, Mr. Chairman. I appreciate the question.

There have been, I think, four major changes in the VCF over the last few years from what Congress saw when it last reauthorized this bill in 2015 and allocated the \$7.375 billion.

The first is that the total number of claims that have been filed has increased significantly. In the first 5 years of the fund, from 2011 to 2016, we had just over 19,000 compensation forms filed. In the last 2-1/2 years, we have received 28,000 more.

The reasons for those, I think, are three. The first is that there is a significant increase in the number of claims being filed on behalf of victims who have died as a result of their 9/11-related conditions as we get further away from the attacks. As the seriousness of the illnesses become more apparent, we see more and more of these claims. At the end of 2015, we had just 600 deceased claims. We now have well over 2,000 of them.

The second thing is that the number of claimants with cancer conditions continues to increase. We have found over 8,800 claimants eligible because of a cancer condition, and we have made over 7,500 awards due to cancers. In 2015, we had seen only a fraction of that number.

The third is that we are seeing a substantial increase in claims filed by the survivor community, those who lived, worked, or went to school in the area. In the first 5 years of the program, survivor claims were just 14 percent of the awards that were made. Now they account for almost 40 percent of the claims that are being filed.

We think that is due to two things. The first are the increase in cancer rates, and the second is that the VCF suffered from a significant information gap in the early years of the program. Many people in the New York area were under the assumption that the program was only for first responders, and as we have been able to do more outreach, as the World Trade Center Health Program has been able to do more outreach, partly because of the reauthorization of the bill in 2015, we have been able to reach more people who are sick, more people who are dying, and those claims are now coming in.

Chairman NADLER. Thank you.

In your written testimony, you note that, in determining the amount of noneconomic loss for a claimant, collateral offsets must be subtracted in full from any reduced award amount.

In light of this, is it possible that some claimants may, in fact, end up with no money despite the fact that they are legally entitled to money from the VCF?

Ms. BHATTACHARYYA. So, yes, Congressman, that is possible.

Chairman NADLER. Thank you.

Dr. Moline, how many more people do you think would be at risk of developing 9/11-related illnesses, including cancers, in the next

25 to 50 years? Is it possible to know the exact number of people who will develop illnesses at this point in time?

Dr. MOLINE. It is not possible to know the exact number, but based on the rates that are increasing, there are going to be 10,000 to 20,000 more cancers, I would estimate.

Chairman NADLER. 10 thousand to 20,000 more cancers?

Dr. MOLINE. Yes.

Chairman NADLER. Plus, other diseases?

Dr. MOLINE. Plus, other diseases. As we heard about sarcoidosis, which is a fairly rare disease but is common in World Trade Center-exposed individuals.

We are going to see folks who have lung diseases that may require lung transplants. There have already been a number of individuals in the World Trade Center Health Programs that have required lung transplants due to scarring of the lungs from the glass and the concrete and everything else that caused a reaction in their lungs.

Chairman NADLER. So, as an order of magnitude, you said about 30,000, 40,000, maybe?

Dr. MOLINE. You know, it is hard to predict, but based on the rates and the number of folks that were exposed, that number is accurate.

Chairman NADLER. Thank you.

Ms. Nordstrom, while the terrorists who carried out the attacks against the United States on 9/11 bear the ultimate responsibility for all the harms caused by the attacks, you note the Federal Government's responsibility in heightening the risk to responders and Members of the community in the days after the attacks.

In particular, the EPA at the time gave false assurances that the air around Ground Zero was, quote, "safe to breathe," assurances for which the then-EPA Administrator has since apologized and acknowledged were wrong.

As a matter of moral responsibility, do you agree that Congress, as representatives of the American people, should help to give some measure of compensation to victims for the harms they have suffered that were exacerbated by the government's own actions at the time?

Ms. NORDSTROM. I think they absolutely should.

I mean, I am sitting before you as someone who was present on 9/11 but I was not caught in the dust cloud. There is no reason that my respiratory health or my gastrointestinal health should have been impacted by the events of 9/11. I only have these conditions because I was sent back. I was only sent back because the Federal Government assured New Yorkers that the air downtown was safe to breathe.

I was a child at the time; I was in no position to make that decision for myself. I was not only following the wishes of the adults in my life, but also the wishes of the government, which at every level, seemed to assure us that we were going to be fine in an environment where we were surrounded by dust and debris and fires that would burn for another 4 months.

Chairman NADLER. Thank you.

My time has expired.

Mr. Johnson?

Mr. JOHNSON of Louisiana. Thank you, Mr. Chairman.

Thank all of you. There are too few issues today that draw everybody in Congress together. This is one of them.

Mr. Stewart, what you said is exactly right. I would not interpret some of the empty chairs as indifference. By virtue of its jurisdiction, this is a Subcommittee of House Judiciary. If it were the full committee, you would have many more Members here. Because we are a subcommittee, sometimes the scheduling gets crossed with other larger full Committee hearings. Some of them are there this morning and they send their regrets.

We are going to make them all watch this tape, because the testimony was so compelling. I have been in politics a while. I can't recall being so moved by testimony as I was today. I cried through most of this. All of us did. It is just incomprehensible, what the terrorists did to our Nation and the harm that it continues to inflict.

So, if it is any comfort to you all, we know this bill is going to pass with an overwhelming landslide majority of the House. It may be unanimous, or close to it as it should be.

[Applause.]

Mr. JOHNSON of Louisiana. Yeah, I will. I will.

As I said in my opening statement, I mean, I am the son of a disabled, permanently injured first responder myself. My dad was a fire captain. So, I get it. I know what you have been through. That is why it was so painful to hear your personal stories, because I have lived it myself. So, I get that.

I said in the opening remarks, just as we do with everything, we want to do the fair and just thing, we want to compensate everyone. But we also have a fiscal responsibility thing that we have to be mindful of the whole time, and that is the only question.

So, I just have one question.

Ms. Bhattacharyya, the CBO can't give us a score on this. They won't. We are marking it up tomorrow. It is going to pass committee. I think it is going to sail through, but has your office done any kind of estimate on the total cost of what this will be ultimately?

Ms. BHATTACHARYYA. So, Congressman, we have done projections about what we expect the total cost would have been had we not done reduced awards for claims expected to be filed through December 18, 2020, which is the current sunset date. We believe that we would need about \$12 billion to compensate all the claims expected to be filed by that date, which is about \$5 billion more than we currently have.

We have not done any projections beyond that closing date.

Chairman NADLER. Would the gentleman yield for a moment?

Mr. JOHNSON of Louisiana. Sure.

Chairman NADLER. I just want to say, CBO is scoring the bill.

Mr. JOHNSON of Louisiana. They are?

Chairman NADLER. They are scoring it. We don't know and they don't know when they will have a score, but they are scoring it.

Mr. JOHNSON of Louisiana. It will be after the fact, but that is fine.

Mr. STEWART. I don't know how to do this, but can I add to that—

Mr. JOHNSON of Louisiana. I will yield to you.

Mr. STEWART. —if I may?

Mr. JOHNSON of Louisiana. Sure.

Mr. STEWART. Thank you for yielding.

Mr. JOHNSON of Louisiana. We have to, Jon. We have to.

Mr. STEWART. I bend the knee to you.

You know, when we talk about the price, the attacks on 9/11 have been used in our government to justify all measure of policy and spending, to the tune of trillions of dollars.

Just recently, there was a farm bill that was \$25 billion that helps farmers that are in need based on policies that are beyond their control. I believe our government should do that. This is less than half of that, a third of that.

There was a corporate tax cut that was made by our Congress.

So, it is very difficult for us to hear, “Geez, I don’t know. You know, we are tight on money right now.” It is a little cruel, because it is hard for me to understand that Exxon has a more urgent need than our first responder community.

Mr. JOHNSON of Louisiana. No, nobody believes that, Jon. I mean—

Mr. STEWART. But it is—

Mr. JOHNSON of Louisiana. Yeah.

Mr. STEWART. When you talk about fiscal responsibility, you talk about priorities. Priorities mean actions and not deeds. The priority of words from this Congress is always that character and patriotism are the priority and that we all must be willing to pay the price of freedom.

This is the price. When we show up with the bill, you cannot take a proverbial knee.

Mr. JOHNSON of Louisiana. No, you are right.

Look, I have 30 seconds left. Let me reclaim the time because that is what we do under this procedure.

Mr. STEWART. Yes, sir.

Mr. JOHNSON of Louisiana. I agree with you. I am telling you that the action is going to follow the rhetoric, and you are going to get it from—

Mr. STEWART. We should have to be here.

Mr. JOHNSON of Louisiana. No, you are right. You shouldn’t have to be here. You should not have to be here.

The only question is, if we authorize it to 2090, do we have any idea what that is going to cost. Just because we need to know because we are doing budgeting, not because it is not the top priority and should be, Jon.

We are just saying, to be good fiscal stewards of all this, do we even have an idea of what that ultimate number might be. I will leave it—that is the final question.

Ms. BHATTACHARYYA. You know, the problem is, I think as Dr. Moline has described, there is no way for us to know how many people were exposed. CBO originally estimated somewhere between 685 and 500,000 people. There is no way for us to know how many of those exposed will actually get sick, partly because of the latency periods associated with cancer.

So, unfortunately, we have not been able to make those projections beyond December 18, 2020.

Mr. JOHNSON of Louisiana. I just want to say, even if it is—I am done, Mr. Chairman. I am out of time. Even if it is an astronomical number, it is a responsibility of the government. We know that. The question is, can we just figure out what that number is, and that is it.

I will yield back. I am out of time. Thank you.

Chairman NADLER. I thank the gentleman for yielding.

Let me just point out on time I will assume, the terrorists declared war on us. When we declare war on somebody, whether it is Japan in 1941 or Al-Qaida now, we don't have a cost estimate. We don't have a time estimate; we don't have a cost estimate. We just say we have to do it.

We will have some sort of a cost estimate. It may not be accurate. Who knows? I mean, when you are talking about—but this is part of a war that was declared on us, and we have to do it.

The cost estimate may follow, may not. CBO will guess. They will give us a cost. It will be a pure guess. I don't know how accurate that will be; they don't know either. It doesn't matter. This is part of a war, and it is part of something we have to do, and we will do it.

The gentleman from Tennessee, Chairman of the subcommittee, Mr. Cohen.

Mr. COHEN. Thank you, Mr. Chair.

I appreciate each and every one of you who have worked on this issue and worked at 9/11. Your testimony, Mr. Alvarez, Lieutenant O'Connell, everybody here, has been touching. It has told a story. It will be relayed to Members of Congress and to the public through the media and through word of mouth.

This is an American tragedy. It was attack on America and you did your jobs. Thank you.

The New York Fire Department is an institution that I think we all in America hold in high regard. NYFD hats are everywhere because people respect what the fire department did, going into those towers and sacrificing their lives and continuing to go through the debris and look for survivors.

So, it will be done. Mr. Johnson well expressed the fact that we will pass this bill and we will get it done.

I am going to defend an institution that is sometimes not easy to defend but is the bulwark of democracy, and that is the United States Congress. The United States Congress is a good body that represents people in their districts and comes together. It doesn't always come together and express itself in policies that I agree with, and I don't get everything I want, but you get something. You work together.

This is a Subcommittee of a committee. My subcommittee, every single member on my side, which is eight of us, have been here today. Like Ms. Garcia said, I have a Financial Services Committee. We have other committees at the same time. Some Members are in their offices, busy with constituents, where they may be watching on television, because this is broadcast.

The Subcommittee is only eight Members, including Mr. Nadler, who is ex officio of all the subcommittees, on my side, and I think five on Mr. Johnson's side. I know Mr. Collins was here, and he is a sponsor of the bill.

Our attendance was pretty good. All these empty chairs, that is because this is for the full of committee. It is not because of disrespect or lack of attention to you. That is not true. We will respond, and we will see that this is funded.

Now, Mr. Stewart, I appreciate what you have done, what you do, and what you said. The Congress will respond, in spite of the fact that we spent trillions of dollars on tax breaks for corporations and the wealthiest people in this country, many of whom are on the Upper East Side, many of whom are living in expensive, expensive places and didn't need the tax cut. That is where the money should be.

There is a lot of money that ought to go into research on diseases at the National Institutes of Health to keep all of us alive that we are not giving because we are spending it on defense projects, some of which are not necessary, because they are being spent for the producers of the weapons and not to defend America.

We need budget priorities and budget sense, but it comes together in a majority. There is an issue that Mr. Johnson raised about fiscal responsibility. We gave it away last year when we passed that tax bill. We gave the upper one-half of 1 percent money they didn't need—people who you were fighting to protect and work for.

So, I am not happy with Congress with that bill. I voted against it. I called it a tax scam, and I believe it was.

I will work for you, and I will work for people who have sickness and disease and who fight for others and sacrifice themselves and don't make six-figure salaries. Because we need to look upon people who are just getting from day to day and trying to help others, and the police and the fire departments do that.

To Mr. Alvarez, thank you so much for being here, and God bless you. God bless you.

I yield back the balance of my time.

Chairman NADLER. The gentleman from Maryland, Mr. Raskin.

Mr. RASKIN. Thank you, Mr. Chairman.

The first thing I want to say is that the title of the legislation is "Never Forget the Heroes: Permanent Authorization of the 9/11 Victim Compensation Fund." I am delighted to be a strong supporter of the legislation, a cosponsor of the legislation.

I am especially delighted, after hearing the incredibly powerful and poignant testimony of our witnesses today, that the word "permanent" is in there. Because the people in this room today made a permanent, lifelong commitment to the community of America when they went to rescue, to help, and to assist. We need to make a permanent, lifelong commitment to the people in this room—not for 5 years, not 10 years, but for as long as we have them with us, we must be committed to them.

Something that Mr. Stewart said reminded me of this essay that I once read by George Orwell, who contrasted patriotism and nationalism. He said patriotism is about a true devotion to your community, neighbors, friends, family, to the values, your Constitution, and to the community. That is what patriotism is. Nationalism is just about sinking your individuality into some mythic, military hole to go to war against people from other countries.

The people in the room today are real patriots. We have to be patriots too, Mr. Chairman. We must pass this legislation to demonstrate that we really do take care of our own people and we are devoted to the community, that is America.

Maybe they were victims of misfortune the day that those 18 hijackers, most of them Saudis, pumped up with religious hatred and extremism and zealotry, came to attack our country. So maybe they were victims of misfortune. If today they are not getting the healthcare that they need, they are not just victims of misfortune, they are victims of an injustice perpetrated by our government.

Life is hard enough on our people, with all of the misfortunes, with the sicknesses, illnesses, injuries, and accidents, that the government should not be compounding the misfortunes of life with the injustice of denying people the healthcare that they need and they should be receiving in the richest society that ever existed at the richest moment that it was ever in existence.

So, we are going to make this happen.

Ms. Nordstrom, I want to ask you a question. Your story is very poignant to me. You are describing what happened to schoolchildren who were sent back to the neighborhood when it was no longer safe. Now you describe how many of your classmates are coming down with asthma, cancer, and fatal diseases. You have already lost some of them as you described being at your 20th reunion? Is that right?

Ms. NORDSTROM. Not even my 20th reunion.

Mr. RASKIN. Not even.

Ms. NORDSTROM. That is in a few years.

Mr. RASKIN. Okay. How does America or how does the city keep track of people in your situation? Who reached out to you? I assume that the fire departments and the police departments have a way of communicating with people, but who is keeping track of people in your situation?

Ms. NORDSTROM. That has been incredibly challenging. One of the reasons that this fund closing, when it does, will really be harmful for us is that a lot of people in my situation are not aware that they qualify for these services.

A lot of the coverage of these services gets directed at responders, and because of that, a lot of survivors, especially those outside of the city—and we live nationally dispersed. I live in California. I do not live in New York City. I haven't for 12 years.

A lot of us don't have local advocates on this issue. There is no local press coverage of this issue. So, there is a large group of people that may already be sick who just aren't aware that these services are available to them, who aren't familiar with how to apply to them. We really rely on word of mouth pretty extensively.

Considering that a lot of the students who were present in Lower Manhattan during the cleanup were not actually residents of the neighborhood—Stuyvesant has 3,000 students, and most of them do not live in Lower Manhattan. There is a similarly large high school who also doesn't serve a resident population a couple blocks away. There are a lot of specialized schools in that area.

A lot of people's parents didn't live in the area, they weren't even informed about these risks, they weren't informed about these services. So, we are still doing the work of reaching out to them now.

Mr. RASKIN. One final question. This is not a problem that affects only the people in New York. There are people who have left New York for other parts of the country. Also, we weren't just hit in New York. We were hit down here in our area, at the Pentagon. We were hit in Pennsylvania.

Mr. Stewart, let me come to you, since I know you have been such a zealous advocate for the people in the room. How do we get all of America to understand this is a national problem, this doesn't affect just one isolated community geographically?

Mr. STEWART. I am pretty sure all of America does understand that. I think our problem has been with the part of America that represents America. Our problem has been with the Congress and not with the American people. It is not like the support for this community isn't out there. Our problem has been that there are oftentimes just a lot of excuses.

Look, it takes an incredible amount of effort from these men and women to come down here. I have been at this for 10 years with them. John Feal has been at it for, I don't know, 14 years. They are down here hundreds of times, spending thousands of hours. It is not hard to convince the American people that this is a no-brainer and a worthy cause. Our problem has been in these chambers.

I am sorry, it is not meant as an attack on the grand institution of democracy. It is meant as a dumbfounded shrug of: I can't understand why this has been so hard and why every time we take one step forward something gets withheld.

We have been to too many funerals, hospitals, and hospices. It is going to keep going and I think we are just at the end of the rope.

Mr. RASKIN. Thank you for your advocacy.

Mr. Chairman, I yield back.

I excuse myself only to go to the floor of the House to introduce legislation.

Thank you.

Chairman NADLER. I thank the gentleman.

The gentlelady from Pennsylvania, Ms. Scanlon.

Ms. SCANLON. Okay. Before I begin, I want to say thank you to all the witnesses. Thank you for being here. Thank you for sharing your stories.

I also want to say that I am sorry, not just for the loss and the grief that you have endured, and those are obviously profound, but I am sorry that you have to be here again to plead your case to reauthorize the Victim Compensation Fund, a decision that, as Mr. Stewart says, should be a no-brainer.

This cause is close to my heart. I have followed it over the years, for a couple reasons. My father-in-law, Red Stewart, was a volunteer firefighter in New Jersey for over 50 years. My brother-in-law is a medic and a lieutenant in a Rhode Island fire department. I have several other relatives who are sworn police officers.

While I am not a New Yorker, as a resident of southeastern Pennsylvania when the terrorist acts on 9/11 occurred, it felt a little bit like we were in the eye of a hurricane, because things were unfolding to the north of us in New York, to the south of us in DC, and to the west of us in Shanksville. Friends, neighbors, and rel-

atives were impacted, whether because they were at one of those sites or because they lost loved ones.

The shock and horror of those events were really surpassed by the bravery, grace, and humanity of the first responders—many of whom who are here, some of whom we lost—and everyday Americans as they responded to that tragedy.

So it is that humanity that demands that Congress address this issue once and for all. That is why I am a proud cosponsor of the bill. As a new Member of Congress, one who ran because of anger over why things that seemed so obvious aren't getting done, I hear you. I look forward to swift passage of permanent reauthorization of this bill.

Just a couple quick questions.

Lieutenant O'Connell, you have already received your award from the VCF. Why are you here to testify today about this?

Mr. O'Connell. I am here because I did receive my award and I have seen people fall sick and die right in front of me that haven't.

I believe we lost about 20-something people last month, that their families—we have to sit there in front of them, somebody who actually has a wife and three children at home, knowing that they are taken care of. I am looking at somebody else's wife and children, and they don't know where their future lies. That is why I am here.

Ms. SCANLON. That is the common humanity that says we should pass this. Thank you.

I yield back.

Chairman NADLER. I thank the gentlelady.

The other gentlelady from Pennsylvania, Ms. Dean.

Ms. DEAN. Thank you, Mr. Chairman.

I am pleased to be here today, as heartbreaking as the stories are. Please understand that I, too, am a new Member of Congress. I, too, am baffled that we are even having this conversation or that we have forced you to come here and share your heartbreak, some of you not well, struggling for your own health.

So don't misinterpret, if you see people coming in and out of here. Some of us have other hearings. We are just trying to balance and do the work of both. Do not misinterpret that we do not care. We care. We think this is a grievous wrong, that you have to come and ask for reauthorization. It is an absolute insane, grievous wrong, and we get it. This new majority, I believe, will take action.

I wanted to start with Ms. Henry.

I think you are joined by your children behind you. I see the heartbreak in them, in the pictures they carry. I have to tell you, I was so touched by the way you talked about your husband and how proud he was of his work.

Ms. HENRY. Thank you.

Ms. DEAN. Isn't that what it is all about?

Ms. HENRY. That is what it is all about.

Ms. DEAN. Proud American work, cleaning trucks. You said maybe a simple task, but not so simple at all.

Ms. HENRY. No.

Ms. DEAN. He gave of himself, all of himself.

Can you tell us how your family will be impacted if you should receive only a 30 percent award for his loss?

Ms. HENRY. Well, my son just turned 18 after his father passed away. He was not there to see his 18th birthday. College right now to be paid for him. We have other bills, our mortgage has to be paid, and other things. He was the breadwinner for the family. Right now, I have to stand in that position, where whatever he was coming home with, now we do not have it. With the little I am making; I have to be careful how I spend it now and make ends meet for our family.

Ms. DEAN. Yes. I keep thinking of what the Special Master has to go through to try to slice this up and try to be as equitable as possible. It should not be that way at all.

Ms. HENRY. Thank you. Thank you.

Ms. DEAN. Again, thank you for your family.

Ms. HENRY. Thank you.

Ms. DEAN. Ms. Nordstrom, I think your testimony is particularly compelling. Can you describe more about what notices you were given, even as young students, or your parents were given, or your teachers were given about the status of the health in your school?

Ms. NORDSTROM. Once we were already back at the school, we received a number of cryptic warnings. We started to get notes home that said don't drink out of the water fountain, and we were suddenly not allowed to leave the building for lunch, which was a privilege that we had enjoyed before that. For some reason, it was supposed to be okay that we walked to and from the subway in that same air, but apparently eating lunch was not going to be safe.

As soon as we were back, a sort of contentious discussion broke out about whether we should be there or not. But, we didn't hear from any agency in that discussion. That was obviously a discussion that was happening between government officials, parents, and teachers at the school.

So we sort of witnessed a lot of information come out late in the game. After the parents' Administration started to investigate things, that is, the parents Administration is who discovered that the air quality at the barge was as bad as the air at Ground Zero on many days. It was the parents association that discovered that the carpeting and upholstery in our auditorium was contaminated. It was the parents association that pushed the board of education to finally replace the filters in our ventilation system. That that was supposed to be done before we went back and did not get done. All of that took months to unfold.

So, by the end of the year, it was pretty clear that we should have never been there. We never really received that information at a point where we could have acted on it. Certainly, if the government officials charged with our care had been honest about the situation, I think it would been appropriate to remove us from the premises.

No decision like that ever got made. Instead, you would just see small steps, where they were going to hose down the debris, and then, they were going to replace the carpeting in the theater but not the seats. Small steps like that got made, but nothing substantial until at the end of the year, looked back and realized, oh, God, we shouldn't have been here.

Ms. DEAN. It sounds like malpractice to me, that you would have been allowed to be educated there.

Then, Mr. Alvarez—I wish I could talk to all of you. My time is limited.

Mr. Alvarez, I just wanted to offer you my thoughts, prayers. The strength that you show, it is extraordinary. You represent this audience filled with first responders and volunteers.

I was impressed by you saying you didn't want anything for yourselves, you just wanted to do the work and help others.

Mr. ALVAREZ. Yes.

Ms. DEAN. I guess, can you just tell me, other than the obvious, provide full funding, permanent funding, what else would you like us to know?

Mr. ALVAREZ. Well, I have been lucky because I received my VCF payment. With my New York City Police Department disability check, I am doing okay. There are others out there who aren't doing okay, who don't have a disability, who count on that money to pay their bills. It is tough on them. It is really tough on them.

Ms. DEAN. I will just close with saying, may we be guided by your selflessness.

Thank you, Mr. Chairman. I yield back.

Chairman NADLER. Thank you.

The gentlelady from Texas, Ms. Jackson Lee.

Ms. JACKSON LEE. I thank the gentleman who just came into the room.

Mr. Chairman, thank you very much, and to Mr. Cohen. Thank you to the Ranking Member.

I was here on 9/11. I am reminded of the immediate work of Jerry Nadler and Carolyn Maloney and Peter King. My recollection is that I stood with them in the first introduction, along with their Senators.

I was also here on the day of the incident. Frankly, in the United States Capitol, no one knew what was going on. All we heard was screaming and banging on the door, you needed to get out. What a small experience compared to those of you in this room.

As we fled as Members out of the Capitol, no one had any information. No BlackBerrys existed. Flip phones did not work. As we escaped, shoes falling off, we could see the billowing smoke from the Pentagon. A plane had hit.

Rumors abounded. It was going to hit the White House, the State Department, and the United States Capitol. Certainly, in that instance, the first responders that we had, the Capitol Police, were trying to shuttle Members and leadership.

Then the stories began to come. Even here in Washington, you wondered where your staff were, whether the buildings were going ready to be hit.

If anyone can self-contain those experiences, just a slight memory, there should be nothing more but clean sailing of this legislation out of the House.

My belief, make it a suspension. What does that mean? It goes to the floor and you pass it immediately. Then it goes to the Senate, and there is no procedural tomfoolery. You pass it. They can pass it on unanimous consent. Then it goes to the President of the

United States, and all he has to do is sign that bill to give life to people who are in need. I don't see why that cannot be our process.

As a Member of the United States Congress during that time, I desired greatly, in the midst, to get to Ground Zero. The time that I went, flights were not active and we took the train.

When we actually got on the ground—I would never make the point that I was there during rescue. I was there during recovery. During that time, I watched with my own eyes men go in and out and in and out, finding remains, finding loved ones, finding their fellow comrades. I think you know I was there. You blew a whistle, and they would come with the gurney. They would stand in silence. They would take those remains. As they did so, you could still see in pockets the smoke and debris.

I only want to say in this instance that I see no reason for us to stop on this dime. We need to move.

Let me ask the Special Master, in the short time that I have, in the claims that you have had and the overwhelming that you have seen, can you tell me whether there is any tomfoolery with those who have come to apply? Should we be concerned about the need? Should we question the lieutenant or the FBI director or the mother and wife that is grieving? Should we question any of those? Should we look to Mr. Alvarez and be concerned about anything that he is going through that is not real? Are you facing the devastation of having to say “no” to people who are in need?

Special Master?

Ms. BHATTACHARYYA. Thank you, Congresswoman.

The VCF, under the Zadroga Act, has not documented any instance of fraud in a paid claim.

We have very robust standards and procedures in place. Obviously, as a component of the Justice Department, we take fraud very seriously. We work very closely with our inspector general's office to investigate any suspicion of fraud. And we have numerous internal procedures in place, including independent data verification with Federal, State, and local entities, to provide independent, third-party verification of the data that we receive.

We have never documented any instance of fraud in a paid claim.

Ms. JACKSON LEE. I am an original cosponsor of this bill. I want to thank the proponents, as I said. I think that is important to put on the record.

Jon Stewart, thank you. I have watched you over the decades.

All I should suggest: Pass the bill. Pass it out of the Senate. Give the money. Never let these people look one moment to see that they are not great Americans and patriots. They deserve to be honored. Let's do it now.

I yield back.

[Applause.]

Chairman NADLER. I thank the gentlelady.

The gentleman from Virginia, Mr. Cline.

Mr. CLINE. Thank you, Mr. Chairman. Thank you for championing this legislation.

I want to thank all our witnesses for being here, for everyone in the audience who is here to advocate for this legislation. It is an important bill.

I see some familiar faces in the audience who came to visit me about a month ago to talk about this bill, to educate me, as they have been educating all Members, about the importance of continuing this important fund and providing for these heroes who are here and home and the families of those who served their country not just on September 11 but in the days, weeks, months, years following that fateful day.

I want to thank the gentlelady for her comments. Because I recall that day well because I, too, was in this building, as a staffer. We weren't rushed to a safe room by the Capitol Police, as some of the Members were. We were given guidance to get your staff out. I was a chief of staff, and we were told, "Get them out."

So, however we needed to—walk, run—we evacuated, not knowing what was going on, but seeing the smoke coming from the Pentagon. There was talk of a bomb at the State Department. There was talk of more planes in the sky.

We don't know where Flight 93 was headed, but we know it was headed in this direction. For the heroes who took action that day and said, "let's roll," we are eternally grateful for their heroism.

For those who, in the 18 years since, the tens of thousands of men and women, first responders, relief workers, local residents, whose testimony was so moving—and I read it last night, but to hear it in person—Ms. Henry, I know that was very hard for you to articulate just how important this bill is to you and your family, but it has definitely had an impact.

It has an impact for my district as well. We have 29 from the Sixth District of Virginia who are on the list of having benefited from this fund.

We have to make sure that not only every year on September 11 that we never forget but every day we owe it to the men and women here, we owe it to the men and women who sacrificed on that day and in the weeks after to renew this fund.

So, I appreciate all the hard work. Your education had an impact on me, not just because of my experiences on 9/11 but also in learning about your stories, learning about the stories of each and every first responder, each and every construction worker—Ms. Henry, your husband. That is why I am glad to be a cosponsor of the bill.

Ms. Henry, you spoke of your husband's pride in his work, the job that he was doing. He knew he was a part of something bigger, of something that was a moment in our Nation's history that will never be forgotten. I know that he brought that home with him at the end of his day. Can you speak to that pride with which he did his job?

Ms. HENRY. When my husband was transferred over there, I don't think—we didn't have anything in our mind that he would—all this debris and all these things was out there, that we would get that. He went to work and he went to work with pride.

I remember my son, Justin, being almost 2—almost 1 year old, and I remember he would sit in the back of the van. Every Saturday morning, we would drop him at work, and at about 2 or 3 o'clock, we would go back and pick him up. On a Saturday, I don't work, so it was my pleasure to take him down there. He was happy to work there.

I am telling you, I have the badge, that badge he had they gave him to enter that building. He never threw it away. He held on to that badge, and he said that is his memory. For anybody talk about 9/11, he has that to tell them, yes, I did work at 9/11. I wish I had that badge to show it to you right now. That is the badge we had, that is not a badge, a pass. He had to scan that and walk in. The pass that we have, that reminded us.

My husband going through all his sickness, we never thought that it was 9/11 until we met Dr. Demopoulos from the North Shore Hospital, when they referred us to him. In talking to him, he said, what your husband had, did he work at 9/11? Then it came to my—my husband said no, because he didn't remember. But going back into his pile of papers and stuff, here comes the badge, his pass. And, like, oh, my God, he did work there.

Then we brought that—and that is how we spoke to Matt. Matt have us right here. I am thankful, he was the first to help us. Because my kids, they miss their dad so much. His only daughter, we don't know if she is going to walk down the aisle one day, what am I going to do? Maybe Justin or Kendall, his oldest son—Kendall is not here with us—will have to step in for their father, step in as a father.

My family, who is stepping in as father—this morning, we woke up. We drive up last night. All we could talk about was if he was there. He is our navigator. We don't need a navigator. Anywhere we go, he knows. "Make a left, make a right," and we would be right there. We went to Canada, we went to Georgia for the first time, and we were like, "We don't know where we are." And he said, "Don't worry. Make a left. Make a right." There is a circle in Georgia, we keep going, and he tell me, "When you go in a circle, take the first right, take the first left." And that is what it is.

Sightseeing on a Saturday morning, he would say, "Wake up, wake up. Let's go out." "Where are we going to?" "Anywhere. Just jump in the car." We would just leave. That is how we discovered Pennsylvania. That is how we went to different places. We miss that. Right now, we want to go out, but he is so much in our memory.

Driving up last night was not an easy task. It was not easy. I am so happy that we have Justin—Justin just got his driver's license. He was the one who showed him some of the shortcuts. Although, one day he did it, he tell Justin, "Follow the police car." And as Justin was, "Oh," Justin realized, I am following the police car and I am going to somewhere. Justin checking [inaudible], all laughing. You don't have a memory anymore. You making Justin follow the car going to the wrong direction, and we had a good laugh at it.

So, coming up last night, Justin is driving, and we were just thinking, if Daddy was there, he would tell you, make a left, overtake this car, take this next—and the police won't catch you. He would say, no, Dad, he would tell me to the stop, the police are down there.

We really miss him. I thought my husband did enjoy working at Ground Zero. That was his pride. He told everybody, I did work at Ground Zero, I know what it is like.

So, we really, really, really, really, miss him.

Mr. CLINE. Thank you very much.

Ms. HENRY. Thank you.

Mr. CLINE. I hope that we can pass this bill.

I appreciate everyone for their testimony today. I am sorry I wasn't here for each and every one of your testimony. I have another hearing in Education and Labor, and so we are back and forth. To each and every one of you who was here, I appreciate your testimony and all of the work you have done.

Let's pass this bill.

Thank you.

Chairman NADLER. I recognize the gentlelady from Texas for a unanimous consent request.

Ms. JACKSON LEE. Yes, Mr. Chairman. Thank you.

First, these are all good people, and I think they are all going to be committed to you.

I wanted to ask unanimous consent to put in the record an article that said, "Officials Demand Permanent Funding for 9/11 Victims Compensation to Stem 'Escalating Crisis.'"

I think we hear your cry and we are going to listen.

I ask unanimous consent to place it in the record.

Chairman NADLER. Without objection, the document will be placed in the record.

[The information follows:]

MS. JACKSON LEE FOR THE RECORD

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Officials demand permanent funding for 9/11 victims compensation to stem 'escalating crisis' | am New York

NEWS/POLITICS

Officials demand permanent funding for 9/11 victims compensation to stem 'escalating crisis'

Without permanent funding, more than 90,000 9/11 first responders and survivors across the country will be left without financial assistance, according to officials.



Rep. Carolyn Maloney, center, City Councilwoman Margaret Chin, left, and Councilman I. Daneek Miller, right, rally in lower Manhattan in support of a federal bill that would permanently authorize the September 11th Victim Compensation Fund Act. Photo Credit: Rush Perez

By Lauren Cook

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Updated May 29, 2019 6:05 PM

Politicians and advocates rallied in lower Manhattan Wednesday in support of a federal bill that would permanently authorize the September 11th Victim Compensation Fund Act.

The rally, organized by City Council members I. Daneek Miller and Margaret Chin, was held across from the National September 11 Memorial and Museum a day before the 17-year anniversary of the end to recovery operations at Ground Zero.

"With more individuals coming forward with related illnesses, we cannot turn our backs on these survivors," said Chin, who represents lower Manhattan. "With the funding for this critical program set to expire next year, it is incumbent upon elected representatives to ensure our country delivers on this promise."

Sponsored by U.S. Rep. Carolyn Maloney and Sen. Kirsten Gillibrand, the Never Forget the Heroes Act would guarantee money for the Victim Compensation Fund through 2090. It also would make several amendments to the fund, including an extension of claim submissions to October 2089 and reimbursements to claimants whose payments were slashed due to insufficient funding.

In February, officials running the fund had warned they were running dangerously low on cash and that payments to those suffering from illnesses would be drastically cut. The fund was last authorized in 2015, but since then almost \$5 billion of the allotted \$7.375 billion has already been doled out to more than 21,000

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Officials demand permanent funding for 9/11 victims compensation to stem 'escalating crisis' | am New York

people suffering from cancers and other illnesses linked to the toxic rubble at Ground Zero, officials had said in February.

City Councilman I. Daneek Miller speaks during Wednesday's rally across from the National September 11 Memorial and Museum in lower Manhattan. Photo Credit: Rush Perez

Without permanent funding, more than 90,000 9/11 first responders and survivors across the country will be left without financial assistance, according to officials. Since 9/11, more than 2,000 FDNY members and nearly 1,000 NYPD personnel have retired due to illnesses linked to the toxic air at Ground Zero. Hundreds more FDNY and NYPD members have died.

"The notion that the 9/11 Victim Compensation Fund could one day cease to exist is unimaginable," said Miller, chair of the

City Council Civil Service and Labor Committee. "The escalating crisis of sick and injured seeking help through the VCF to address their health needs have grown beyond the program's capacity and must be resolved quickly and definitively."

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Maloney, who also attended the rally, said the number of people to die of 9/11-related illnesses could soon eclipse the 2,997 lives lost on the day of the attacks.

"We vowed to never forget the first responders, survivors, and families who risked their lives and made incredible sacrifices for our country," she said. "While we made health care permanent, the

compensation fund is running out of funds. We need to make sure these heroes never have to go without the support they need."

Established in 2001, the Victim Compensation Fund first gave more than \$7 billion to the families of those killed in the 9/11 terror attacks as well as thousands of survivors who were injured. The fund closed in 2004 but was reopened in 2011 with the signing of the James Zadroga 9/11 Health and Compensation Act.

The Never Forget the Heroes Act will likely to be brought up in the House Judiciary Committee next month and is expected to be approved by the House of Representatives. It will then go through a hearing and be put to a vote in the Senate.

<https://www.amny.com/news/politics/911-victims-compensation-funding-1.31720589>

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Chairman NADLER. This concludes today's hearing.

I want to remind people that tomorrow in this room we will have a full Committee meeting for the purpose of marking up and reporting to the House floor this bill tomorrow. We will move the bill to the floor tomorrow. We will get this done as quickly as possible. I do think we will get it done.

I want to thank our witnesses. I want to thank all the first responders and others for attending and for all the work that you have done over the years and for your sacrifices.

Without objection, all Members will have 5 legislative days to submit additional written questions for the witnesses or additional materials for the record.

Chairman NADLER. Without objection, the hearing is adjourned. [Whereupon, at 12:31 p.m., the Subcommittee was adjourned.]

