

GAO

Testimony

Before the Subcommittee on National Security,  
Emerging Threats, and International Relations,  
Committee on Government Reform, House of  
Representatives

For Release on Delivery  
Expected at 10:00 a.m. EDT  
Wednesday, September 8, 2004

SEPTEMBER 11

Health Effects in the  
Aftermath of the World  
Trade Center Attack

Statement of Janet Heinrich  
Director, Health Care—Public Health Issues





Highlights of [GAO-04-1068T](#), a testimony before the Subcommittee on National Security, Emerging Threats, and International Relations, Committee on Government Reform, House of Representatives

## Why GAO Did This Study

When the World Trade Center (WTC) buildings collapsed on September 11, 2001, nearly 3,000 people died and an estimated 250,000 to 400,000 people who were visiting, living, working, and attending school nearby, or responding to the attack, were exposed to a mixture of dust, debris, smoke, and various chemicals. In the months to follow, thousands of people who returned to the area to live and work, as well as responders who were involved in the search for remains and site cleanup, were also exposed. In addition, people in New York City and across the country were exposed to the emotional trauma of a terrorist attack on American soil.

Concerns have been raised about the short- and long-term physical and mental health effects of the attack. Various government agencies and private organizations established efforts to monitor and understand these health effects.

GAO was asked to describe the health effects that have been observed in the aftermath of the WTC attack and the efforts that are in place to monitor and understand those health effects. GAO searched bibliographic databases such as Medline to determine the pertinent scientific literature, reviewed that literature, and interviewed and reviewed documents from government officials, health professionals, and officials of labor groups.

[www.gao.gov/cgi-bin/getrpt?GAO-04-1068T](http://www.gao.gov/cgi-bin/getrpt?GAO-04-1068T)

To view the full product, including the scope and methodology, click on the link above. For more information, contact Janet Heinrich at (202) 512-7119.

## SEPTEMBER 11

# Health Effects in the Aftermath of the World Trade Center Attack

## What GAO Found

In the aftermath of the September 11 attack on the World Trade Center, a wide variety of physical and mental health effects have been reported in the scientific literature. The primary health effects include various injuries, respiratory conditions, and mental health effects. In the immediate aftermath of the attack, the primary injuries were inhalation and musculoskeletal injuries. During the 10-month cleanup period, despite the dangerous work site, responders reported few injuries that resulted in lost workdays. A range of respiratory conditions have also been reported, including wheezing, shortness of breath, sinusitis, asthma, and a new syndrome called WTC cough, which consists of persistent cough accompanied by severe respiratory symptoms. Almost all the firefighters who responded to the attack experienced respiratory effects, and hundreds had to end their firefighting careers due to WTC-related respiratory illness. Unlike the physical health effects, the mental health effects were not limited to people in the WTC area but were also experienced nationwide. Because most of the information about mental health effects comes from questionnaire or survey data, what is reported in most cases are symptoms associated with a psychiatric disorder, rather than a clinical diagnosis of disorder. The most commonly reported mental health effects include symptoms associated with depression, stress, anxiety, and posttraumatic stress disorder (PTSD)—a disorder that can develop after experiencing or witnessing a traumatic event and includes such symptoms as intrusive memories and distressing dreams—as well as behavioral effects such as increased use of alcohol and tobacco and difficulty coping with daily responsibilities.

Six programs were established to monitor and understand the health effects of the attack, and these programs vary in terms of which people are eligible to participate, methods for collecting information about the health effects, options for treatment referral, and number of years people will be monitored. Although five of the programs focus on various responder populations, the largest program—the WTC Health Registry—is open not only to responders but also to people living or attending school in the vicinity of the WTC site, or working or present in the vicinity on September 11. The monitoring programs vary in their methods for identifying those who may require treatment, and although none of these programs are funded to provide treatment, they provide varying options for treatment referral. Under current plans, HHS funding for the programs will not extend beyond 2009. Some long-term health effects, such as lung cancer, may not appear until several decades after a person has been exposed to a harmful agent.

GAO provided a draft of this testimony to DHS, EPA, HHS, and the Department of Labor. In its written comments, HHS noted that the testimony does not include significant discussion of ways in which mental health symptoms have changed over time. The evidence GAO examined did not support a full discussion of changes in mental or physical health effects over time.

---

Mr. Chairman and Members of the Subcommittee:

I appreciate the opportunity to be here today as you discuss the health effects of the September 11, 2001, terrorist attack on the World Trade Center (WTC).<sup>1</sup> When the WTC buildings collapsed on that day, nearly 3,000 people died and an estimated 250,000 to 400,000 people were immediately exposed to a mixture of dust, debris, smoke, and various chemicals.<sup>2</sup> These people included those living, working, and attending school in the vicinity as well as the thousands of emergency response workers who rushed to the scene. Also exposed to these substances were the thousands of responders<sup>3</sup> who were involved in some capacity in the rescue operations, search for remains, and site cleanup in the days, weeks, and months to follow and the thousands of residents, commuters, and students who returned to the area to live and work while the cleanup continued.<sup>4</sup> In addition, people in New York City (NYC) and across the country were exposed to the emotional trauma of a terrorist attack intended to instill fear and anxiety in the American population.

Concerns have been raised about the short- and long-term physical and mental health effects of the attack. Experts have stressed the importance of understanding the health effects related to the attacks and ensuring that these effects are investigated and that people needing treatment are identified. Under challenging circumstances due to the unprecedented nature of the events and the need for rapid response, various government

---

<sup>1</sup>A list of abbreviations used in this testimony is given in Appendix I.

<sup>2</sup>New York City Department of Health and Mental Hygiene and U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, *Protocol for the World Trade Center Health Registry* (New York, 2003).

<sup>3</sup>For purposes of this testimony, the term responders refers to anyone involved in rescue, recovery, and cleanup efforts at or in the vicinity of the WTC site and Staten Island Fresh Kills landfill (the off-site location of the WTC recovery operation), including firefighters, law enforcement officers, emergency medical technicians and paramedics, morticians, health care professionals, construction workers, ironworkers, carpenters, heavy equipment operators, mechanics, truck drivers, engineers, laborers, telecommunications workers, and various federal, state, and local agency employees who assisted with rescue, recovery, and cleanup activities.

<sup>4</sup>For more information on exposures to these substances, see, for example, U.S. Environmental Protection Agency, *Exposure and Human Health Evaluation of Airborne Pollution from the World Trade Center Disaster (External Review Draft)* (Washington, D.C., 2002), and J.D. Pleil et al., "Air Levels of Carcinogenic Polycyclic Aromatic Hydrocarbons after the World Trade Center Disaster," *Proceedings of the National Academy of Sciences of the United States of America*, vol. 101, no. 32 (2004).

---

agencies and private-sector organizations established several efforts to monitor and understand the health effects resulting from the attack. You asked us to examine these efforts.

In this testimony, we describe (1) health effects that have been observed in the aftermath of the WTC attack and (2) efforts that are in place to monitor and understand those health effects. My colleague's testimony addresses workers' compensation for people who were injured while working during the attack or its aftermath.<sup>5</sup>

To describe the health effects of the WTC attack and the efforts to monitor and understand them, we reviewed the scientific literature related to efforts to identify, track, or treat the physical and mental health effects of the September 11 attack<sup>6</sup> and interviewed and reviewed documents from federal, state, and local agency officials, as well as medical and public health professionals and officials of labor groups. We searched 19 bibliographic databases such as Medline to determine the pertinent literature. The studies of health effects vary in study design, measures used, survey instruments, time periods, and populations studied, and thus in many cases the reported results cannot be directly compared. The federal, state, and local officials we interviewed were from the U.S. Departments of Defense (DOD), Education, Health and Human Services (HHS), Homeland Security (DHS), Justice (DOJ), Labor (DOL), and Veterans Affairs (VA); the Environmental Protection Agency (EPA); the New York State Department of Health; the New York State Office of Mental Health; and the New York City Department of Health and Mental Hygiene. The medical and public health professionals we interviewed were affiliated with the Association of Occupational and Environmental Clinics, the City University of New York's Queens College, the New York City Fire Department's (FDNY) Bureau of Health Services, the Greater New York Hospital Association, the Johns Hopkins Bloomberg School of Public Health, the Mailman School of Public Health at Columbia University, the Mount Sinai-Irving J. Selikoff Clinical Center for Occupational and Environmental Medicine, the New York Academy of Medicine, the New York University School of Medicine's Child Study Center, and the National Child Traumatic Stress Network. We also interviewed representatives of

---

<sup>5</sup>GAO, *September 11: Federal Assistance for New York Workers' Compensation Costs*, [GAO-04-1013T](#) (Washington, D.C.: Sept. 8, 2004).

<sup>6</sup>See the bibliography for a list of the scientific literature that we relied on in producing this testimony.

---

labor groups, including the American Federation of State, County and Municipal Employees District Council 37; the Communications Workers of America; the New York State American Federation of Labor-Congress of Industrial Organizations; and the Uniformed Firefighters Association.

We relied primarily on data from published, peer-reviewed articles and government reports and did not independently verify the data contained in the scientific literature or documents obtained from agency officials and medical professionals. However, we did review the methods used in the studies and discussed any questions we had about the studies with their authors. We determined that the data reported from these studies were sufficiently reliable for our objectives. We conducted our work from March 2004 through September 2004 in accordance with generally accepted government auditing standards.

In summary, in the aftermath of the September 11 attack on the World Trade Center, a wide variety of physical and mental health effects have been reported in the scientific literature. The primary health effects include various injuries, respiratory conditions, and mental health effects. In the immediate aftermath of the attack, the primary injuries were inhalation and musculoskeletal injuries. During the 10-month cleanup period, despite the dangerous nature of the work site, responders reported few injuries that resulted in lost workdays. A range of respiratory conditions have also been reported, including wheezing, shortness of breath, sinusitis, asthma, and a new syndrome called WTC cough, which consists of persistent cough accompanied by severe respiratory symptoms. Almost all the firefighters who responded to the attack experienced respiratory effects, and hundreds had to end their firefighting careers due to WTC-related respiratory illness. Whereas the physical health effects were limited to people in the WTC area, the mental health effects, although more pronounced in the NYC area, were experienced nationwide. Because most of the information about mental health effects comes from questionnaire or survey data, what is reported in most cases are symptoms associated with a psychiatric disorder, rather than a clinical diagnosis of the disorder itself. The most commonly reported mental health effects include symptoms associated with depression, stress, anxiety, and posttraumatic stress disorder (PTSD)—an often debilitating and potentially chronic disorder that can develop after experiencing or witnessing a traumatic event and includes such symptoms as intrusive memories and distressing dreams—as well as behavioral effects such as increased use of alcohol and tobacco and difficulty coping with daily responsibilities.

---

Six programs have been established by federal, state, and local government agencies and private organizations to monitor and understand the health effects of the attack. These programs vary in terms of which people are eligible to participate, methods for collecting information about the health effects, options for treatment referral, and number of years people will be monitored. Although five of the monitoring programs focus on various responder populations, the largest program—the WTC Health Registry—is open not only to responders—that is, those involved in the rescue, recovery, and cleanup efforts—but also to people living or attending school in the vicinity of the WTC site, or working or present in the vicinity on September 11. The monitoring programs vary in their methods for identifying those who may require treatment, and although none of these programs are funded to provide treatment, they provide varying options for treatment referral. Under current plans, HHS funding for the programs will not extend beyond 2009. Some long-term health effects, such as lung cancer, may not appear until several decades after a person has been exposed to a harmful agent.

We provided a draft of this testimony to DHS, DOL, EPA, and HHS. In its written comments, HHS noted that the testimony does not include significant discussion of ways in which mental health symptoms have changed over time. The evidence we examined did not support a full discussion of changes in mental or physical health effects over time. HHS and the other agencies also provided technical comments, which we incorporated as appropriate.

---

## Background

Although people across the country were exposed through the media to the emotional trauma of the WTC attack, the residents, office workers, and others living, working, or attending school in the WTC area and the WTC responders not only experienced the traumatic event in person but also were exposed to a complex mixture of potentially toxic contaminants in the air and on the ground, such as pulverized concrete, fibrous glass, particulate matter, and asbestos. Almost 3,000 people, including some who were trapped above the impact zone and others who entered the buildings to assist in the evacuation, were killed in the attack.<sup>7</sup> The majority of the estimated 16,400 to 18,800 people who were in the WTC complex that

---

<sup>7</sup>National Commission on Terrorist Attacks upon the United States, *The 9/11 Commission Report* (Washington, D.C., 2004).

---

morning were able to evacuate, however, with minor or no injuries.<sup>8</sup> An estimated 40,000 responders were at or in the vicinity of the WTC site or the Staten Island Fresh Kills landfill, participating in rescue, recovery, and cleanup efforts<sup>9</sup>; conducting environmental and occupational health assessments; providing crisis counseling and other treatment; providing security; and assisting with the criminal investigation.

The responders included personnel from many agencies at the federal, state, and local levels, as well as from organizations in the private sector, and various other workers and volunteers. The agencies and organizations include HHS's Agency for Toxic Substances and Disease Registry (ATSDR), HHS's Centers for Disease Control and Prevention (CDC), the Department of Energy, EPA, DOJ's Federal Bureau of Investigation (FBI), DHS's Federal Emergency Management Agency (FEMA), HHS's National Institute for Occupational Safety and Health (NIOSH), HHS's National Institute of Environmental Health Sciences (NIEHS), the Department of the Interior's National Park Service, DOL's Occupational Safety and Health Administration (OSHA), HHS's Public Health Service Commissioned Corps, HHS's Substance Abuse and Mental Health Services Administration (SAMHSA), DOD's U.S. Coast Guard, DOJ's U.S. Marshals Service, the New York State Department of Environmental Conservation, the New York State Emergency Management Office, the New York State National Guard, the New York State Office of Mental Health, the New York State Department of Health, the Metropolitan Transportation Authority's New York City Transit, FDNY and emergency medical services (EMS), the New York City Department of Health and Mental Hygiene, the New York City Police Department (NYPD), the New York City Department of Design and Construction, the New York City Department of Environmental Protection, the New York City Department of Sanitation, the New York City Office of Emergency Management, the American Red Cross, and the Salvation Army.

Recognizing a need to monitor and understand the full health effects of the WTC collapse, officials from various organizations secured federal funding

---

<sup>8</sup>National Commission on Terrorist Attacks upon the United States, 2004.

<sup>9</sup>Department of Health and Human Services, "HHS Awards \$81 Million for Five-Year Health Screening of World Trade Center Rescue, Recovery Workers," Department of Health and Human Services, <http://www.hhs.gov/news/press/2004pres/20040318.html> (accessed Aug. 9, 2004).

---

to establish programs to monitor the health of affected people.<sup>10</sup> FDNY sought federal support in order to provide comprehensive medical evaluations to its firefighters, and established its WTC Medical Monitoring Program (referred to here as the FDNY program). The Mount Sinai Clinical Center for Occupational and Environmental Medicine also sought federal support in the weeks following the attack to develop its WTC Worker and Volunteer Medical Monitoring Program (referred to here as the Mount Sinai program).<sup>11</sup> Through its Federal Occupational Health (FOH) services, HHS initiated a WTC responder screening program for federal workers (referred to here as the FOH program) involved in WTC rescue, recovery, and cleanup activities. Similarly, the New York State Department of Health established the medical monitoring program for New York State responders (referred to here as the NYS program) engaged in emergency activities related to the September 11 attack. In addition, two registries were established to compile lists of exposed persons and collect information through interviews and surveys in order to provide a basis for understanding the health effects of the attack. The New York City Department of Health and Mental Hygiene contacted ATSDR in February 2002 to develop the WTC Health Registry. ATSDR provided technical assistance to the New York City Department of Health and Mental Hygiene and worked with FEMA to obtain funds for the WTC Health Registry for responders and people living or attending school in the vicinity of the WTC site, or working or present in the vicinity on September 11. Separately, Johns Hopkins received a grant from NIEHS to create another registry

---

<sup>10</sup>FEMA provided funds appropriated for disaster relief and emergency response to the September 11, 2001, terrorist attacks to HHS through interagency agreements to support monitoring efforts. See Consolidated Appropriations Resolution, 2003, Pub. L. No. 108-7, 117 Stat. 11, 517; see also 2002 Supplemental Appropriations Act for Further Recovery from and Response to Terrorist Attacks on the United States, Pub. L. No. 107-206, 116 Stat. 820, 894; Department of Defense and Emergency Supplemental Appropriations for Recovery from and Response to Terrorist Attacks on the United States Act, 2002, Pub. L. No. 107-117, 115 Stat. 2230, 2338; and 2001 Emergency Supplemental Appropriations Act for Recovery from and Response to Terrorist Attacks on the United States, Pub. L. No. 107-38, 115 Stat. 220-1.

<sup>11</sup>Initial medical screenings of responders conducted by this program were supported by funds appropriated to CDC for disease control, research, and training. See Department of Defense and Emergency Supplemental Appropriations for Recovery from and Response to Terrorist Attacks on the United States Act, 2002, 115 Stat. at 2313.



---

(referred to here as the Johns Hopkins registry) of WTC site workers who were involved in cleanup efforts.<sup>12</sup>

---

## Varied Physical and Mental Health Effects Have Been Observed and Reported across a Wide Range of People

A wide variety of physical and mental health effects have been observed and reported across a wide range of people in the aftermath of the September 11 attacks. The health effects include various injuries, respiratory conditions, reproductive health effects, and mental health effects. Unlike the physical health effects, the mental health effects of the September 11 attacks were not limited to responders and people who were in the WTC area but were also experienced by people across the nation. Because most of the information about mental health effects comes from questionnaire or survey data, what is reported in most cases are symptoms associated or consistent with a disorder, such as PTSD, rather than a clinical diagnosis of a disorder. The most commonly reported mental health effects were symptoms associated with PTSD, depression, stress, and anxiety, as well as behavioral effects such as increases in substance use and difficulties coping with daily responsibilities.

---

## Injuries

Although the total number of people injured during the WTC attack is unknown, data on hospital visits show that thousands of people were treated in its immediate aftermath for injuries, including inhalation injuries, musculoskeletal injuries, burns, and eye injuries. Unpublished data collected by the Greater New York Hospital Association from September 11 through September 28, 2001, showed 6,232 emergency room visits and 477 hospitalizations related to the attack in 103 hospitals in New York State and 1,018 emergency room visits and 84 hospitalizations related to the attack in nearby New Jersey hospitals. These numbers do not include injured people who may have been treated in more distant New York State, New Jersey, and Connecticut hospitals, in triage stations,<sup>13</sup> or by private physicians, and those who did not seek professional treatment. More detailed information on injuries is available from the four hospitals closest to the WTC and a fifth hospital that served as a burn referral

---

<sup>12</sup>The grant was funded by an appropriation to NIEHS to support research, worker training, and education activities. See Department of Defense and Emergency Supplemental Appropriations for Recovery from and Response to Terrorist Attacks on the United States Act, 2002, 115 Stat. at 2337.

<sup>13</sup>Triage stations are temporary facilities set up in the aftermath of a disaster where medical assessments of patients are performed to determine their relative priority for treatment, based on the severity of illness or injury.

---

center. According to the New York City Department of Health and Mental Hygiene, between September 11 and September 13, 2001, these hospitals treated 790 people, 2 of whom later died, for injuries related to the attack (CDC, 2002c). The most common of these injuries were musculoskeletal injuries—such as fractures, sprains, and crush injuries—and inhalation injuries. The majority of people with injuries were treated and released, although about 18 percent required hospitalization.<sup>14</sup>

In addition, thousands of responders were treated for injuries, a small proportion of which were classified as serious, during the 10-month cleanup period. The disaster site was considered to be extremely dangerous, yet no additional life was lost after September 11. Using data from five Disaster Medical Assistance Teams (DMAT) temporary medical facilities<sup>15</sup> and the four hospitals closest to the WTC site, researchers documented 5,222 visits by rescue workers to DMAT facilities and emergency rooms in the first month of the cleanup period (Berrios-Torres et al., 2003). During this month, musculoskeletal injuries were the leading cause of rescue worker visits and hospitalizations. Other injuries included burns and eye injuries. According to OSHA, despite logging more than 3.7 million work hours over the 10-month cleanup period, WTC site workers reported only 57 injuries that OSHA classified as serious because they resulted in lost workdays, yielding a lost workday injury rate of 3.1 injuries per 100 workers per year. This rate is lower than that seen in the type of construction deemed by OSHA to be the most similar to the WTC cleanup, specialty construction, which has a lost workday injury rate of 4.3.

---

## Respiratory Health Effects

A range of respiratory health effects, including a new syndrome called WTC cough and chronic diseases such as asthma, were observed among people exposed to the WTC collapse and its aftermath. Many of the programs examining respiratory health effects are ongoing and have published only preliminary results. Nevertheless, the studies present a

---

<sup>14</sup>In an assessment of the cardiovascular effects of the WTC attack in eight hospitals in NYC, no significant increases in hospitalization for cardiac events immediately following the attack were found (Chi et al., 2003).

<sup>15</sup>The DMAT facilities were set up around the disaster site by FEMA's National Disaster Medical System, which was activated on September 11. The DMATs maintained a 24-hour presence at the WTC site for 2 months after the disaster. In addition to the DMATs, the National Disaster Medical System also includes teams of morticians, veterinarians, nurses, pharmacists, and management personnel.

---

consistent collection of conditions among those people who were involved in rescue, recovery, and cleanup as well as those who lived and worked in the WTC vicinity. The most commonly reported conditions include cough, wheezing, shortness of breath, sinusitis, and asthma. Many of the findings on respiratory effects published to date have focused on firefighters, and FDNY medical staff first described WTC cough, which consists of persistent cough accompanied by severe respiratory symptoms,<sup>16</sup> often in conjunction with sinusitis, asthma, and gastroesophageal reflux disease (GERD).<sup>17</sup> Several studies report on other WTC responders, such as the police, ironworkers, and cleanup workers, and a few studies report on the respiratory effects among people living and working in lower Manhattan.

## FDNY Firefighters

Almost all of the FDNY firefighters who had responded to the attack experienced respiratory effects, and hundreds had to end their firefighting careers due to WTC-related respiratory illness. Within 48 hours of the attack, FDNY found that about 90 percent of its 10,116 firefighters and EMS workers who were evaluated at the WTC site reported an acute cough. The FDNY Bureau of Health Services also noted wheezing, sinusitis, sore throats, asthma, and GERD among firefighters who had been on the scene. During the first 6 months after the attack, FDNY observed that of the 9,914 firefighters who were present at the WTC site within 7 days of the collapse, 332 firefighters had WTC cough (Prezant et al., 2002). Eighty-seven percent of the firefighters with WTC cough reported symptoms of GERD. According to the FDNY Bureau of Health Services, symptoms of GERD are typically reported by less than 25 percent of patients with chronic cough. Some FDNY firefighters exhibited WTC cough that was severe enough for them to require at least 4 weeks of medical leave. Despite treatment of all symptoms, 173 of the 332 firefighters and one EMS technician with WTC cough showed only partial improvement. FDNY also found that the risk of reactive airway dysfunction syndrome, or irritant-induced asthma, and WTC cough was associated with intensity of the exposure, defined as the time of arrival at the site (Banauch et al., 2003). In addition, FDNY reports that one firefighter who worked 16-hour days for 13 days and did not use

---

<sup>16</sup>Severe respiratory symptoms are defined by the FDNY Bureau of Health Services as symptoms that are severe enough to require at least 4 consecutive weeks of medical leave.

<sup>17</sup>GERD occurs when the lower esophageal sphincter does not close properly and stomach contents leak back, or reflux, into the esophagus. When refluxed stomach acid touches the lining of the esophagus, it causes a burning sensation in the chest or throat called heartburn.

---

respiratory protection during the first 7 to 10 days was diagnosed with a rare form of pneumonia that results from acute high dust exposure (Rom et al., 2002). According to an official from the FDNY Bureau of Health Services, because one of the criteria for being a firefighter is having no respiratory illness, about 380 firefighters were no longer able to serve as firefighters as of March 2004 as a consequence of respiratory illnesses they developed after WTC exposure.

### Other WTC Responders

Studies and screenings conducted among other responders—carpenters, cleanup workers, federal civilian employees, heavy equipment operators, ironworkers, mechanics, National Guard members, police officers, telecommunications technicians, truck drivers, and U.S. Army military personnel—have found respiratory health effects similar to those seen in FDNY firefighters. Some of the responders with existing respiratory conditions reported that symptoms worsened, and others reported that they developed new respiratory symptoms on or after September 11. The most commonly reported symptom was cough. For example, about 63 percent of officers from NYPD’s Emergency Services Unit who were evaluated about 1 to 4 months after September 11 reported having a cough (Salzman et al., 2004). Other symptoms observed among responders included chest tightness, nasal congestion, shortness of breath, sore throat, and wheezing. Unpublished results from respiratory health assessments of WTC site workers—including truck drivers, heavy equipment operators, mechanics, laborers, and carpenters—conducted by Johns Hopkins in December 2001 show that among those who reported no previous history of lower respiratory symptoms, 34 percent reported developing a cough and 19 percent reported wheezing. While some responders reported that symptoms improved or resolved a few months after the attack, others reported that they continued to experience symptoms. For example, initial results from screenings of 250 participants in Mount Sinai’s monitoring program show that 46 percent of these responders were still experiencing at least one pulmonary symptom and 52 percent were still experiencing an ear, nose, or throat symptom 9 months after the attack (Herbert and Levin, 2003).

### People Living or Working in Lower Manhattan

Surveys conducted among people living or working in lower Manhattan show that these people experienced respiratory health effects similar to those experienced by responders, such as nose or throat irritation and cough. For example, a door-to-door survey conducted by the New York City Department of Health and Mental Hygiene in three residential areas in lower Manhattan between October 25 and November 2, 2001, showed that the most frequently reported symptoms were nose or throat irritation (about 66 percent) and cough (about 47 percent) (CDC, 2002a). A NIOSH

---

survey of federal employees working near the WTC site found that 56 percent of respondents reported having a cough (Trout et al., 2002). Other symptoms observed among those living or working in lower Manhattan include chest tightness, head or sinus congestion, shortness of breath, and wheezing. Some people reported that the WTC collapse and its aftermath exacerbated existing respiratory conditions, such as asthma, and others reported symptoms that developed after September 11, 2001. For example, a review of medical charts of children with existing asthma from a lower Manhattan clinic found that after September 11 there was a significant increase in asthma-related clinic visits among children who lived within 5 miles of the WTC site (Szema et al., 2004). Unpublished preliminary findings from a New York State Department of Health survey of NYC residents found that almost three-fourths of respondents living near the WTC site experienced new upper respiratory symptoms after September 11.

---

## Reproductive Health Effects

For all measures of reproductive health studied except birth weight for gestational age,<sup>18</sup> no differences were found between infants born to women who were in or near the WTC on September 11 and infants of those who were not. The Mount Sinai School of Medicine conducted a study of the 187 pregnant women<sup>19</sup> who were either in or near the WTC on September 11. This study found no significant differences in average gestational duration at birth or average birth weight between infants of the women who were in or near the WTC on September 11 during their pregnancy and infants of the 2,367 women in the study's comparison group, who were not (Berkowitz et al., 2003). Additionally, no significant differences in frequency of preterm births (less than 37 weeks of gestation) or in incidence of low birth weight (less than 2,500 grams) were observed. Nor was an association observed between symptoms of posttraumatic stress in the mother and frequency of preterm birth, low birth weight, or small-for-gestational-age<sup>20</sup> infants. However, 8.2 percent of

---

<sup>18</sup>Gestation is the period between conception and birth of a baby, and gestational age is duration of gestation.

<sup>19</sup>Of the 187 women, 3 miscarried and 2 were unavailable for follow-up, leaving 182 women with live births. The last delivery occurred in June 2002.

<sup>20</sup>The term "small for gestational age" (SGA) means a fetus or infant is smaller in size than is expected for the baby's sex, genetic heritage, and duration of gestation. Birth weight below the population tenth percentile, taking into account gestational age, is the most widely used definition of SGA.

---

infants born to women who were in or near the WTC on September 11 were born with a birth weight below the tenth percentile for gestational age, compared to 3.8 percent of infants born to women in the study's control group. This difference was still statistically significant after variables such as maternal age, race/ethnicity, sex of the infant, and maternal smoking history were taken into account.<sup>21</sup> Because small-for-gestational-age infants are at risk for developmental problems, the Mount Sinai program includes a follow-up study in which researchers plan to obtain physical measurements of growth and perform assessments of early cognitive development.

---

## Symptoms Associated with PTSD

In the weeks and months after the WTC attack, people living, working, or attending school in NYC and responders involved in the rescue, recovery, and cleanup reported symptoms associated with PTSD, as did people across the nation. PTSD is an often debilitating and potentially chronic disorder that can develop after experiencing or witnessing a traumatic event. It includes such symptoms as difficulty sleeping, irritability or anger, detachment or estrangement, poor concentration, distressing dreams, intrusive memories and images, and avoidance of reminders of the trauma.

People living or working near the WTC site reported a higher rate of symptoms associated with PTSD than did those living or working farther from the site. For example, researchers found that about 7.5 percent of Manhattan residents reported symptoms consistent with PTSD 5 to 8 weeks after the attack, with 20 percent of those living in close proximity to the WTC reporting symptoms (Galea et al., 2002a). Similarly, NIOSH surveys found that reports of symptoms consistent with PTSD were significantly higher among school staff in the WTC vicinity than among school staff working at least 6 miles from the WTC site (CDC, 2002a).

---

<sup>21</sup> Additionally, an unpublished study conducted by the Mailman School of Public Health at Columbia University found no differences in birth weight, length, head circumference, or Apgar scores (the Apgar is a test performed at 1 and 5 minutes after birth to determine the physical condition of the newborn). However, in this study, the gestational duration observed among pregnant women who lived or worked near the WTC during the 2 weeks after September 11 was shorter than that of those who did not (274.3 versus 275.9 days). Though this difference was statistically significant, its clinical significance is unclear. Researchers planned to assess cognitive and motor functions of the infants at a 1-year follow-up visit.

---

Some groups of people, such as children and responders, were found to have experienced traumatic reactions to the attack. For example, a citywide survey of a representative sample of NYC fourth to twelfth graders 6 months after the attack found that over 10 percent reported having symptoms consistent with PTSD. The researchers who conducted this survey noted that these symptoms were five times more prevalent than pre-September 11 rates reported for other communities (Hoven et al., 2002). Responders, many of whom lost colleagues, were also affected. Initial findings from the Mount Sinai program show that about 22 percent of a sample of 250 WTC responders reported symptoms consistent with PTSD (Herbert and Levin, 2003).

People across the nation also reported symptoms associated with PTSD. A nationwide survey comparing reactions in NYC to those across the country using a nationally representative sample of U.S. adults found that the prevalence of symptoms associated with PTSD 1 to 2 months after the attack was significantly higher in the NYC metropolitan area (11.2 percent) than in other major metropolitan areas (3.6 percent) and the rest of the country (4 percent) (Schlenger et al., 2002). Another nationally representative sample in a nationwide survey of U.S. adults shows that 17 percent of the U.S. population outside of NYC reported symptoms associated with PTSD 2 months after the attack (Silver et al., 2002). Although no baseline data are available on the prevalence of symptoms related to PTSD, typically about 3.6 percent of U.S. adults have a psychiatric diagnosis of PTSD during the course of a year.<sup>22</sup>

---

### Symptoms Associated with Depression, Stress, and Anxiety

People living, working, and attending school in NYC and WTC responders, as well as people across the nation, reported symptoms associated with depression, stress, and anxiety. For example, in NYC, researchers found that about 9.7 percent of Manhattan residents surveyed 5 to 8 weeks after the attack reported symptoms consistent with depression (Galea et al., 2002a). Nine hospitals in NYC reported that from September 11 to September 24, 2001, the predominant symptoms related to the WTC attack were those associated with anxiety, stress, and depression (Greater New York Hospital Association, 2001). Data from these hospitals show that anxiety declined over the month following the attack but increased again

---

<sup>22</sup>Department of Veterans Affairs, "What Is Posttraumatic Stress Disorder? A National Center for PTSD Fact Sheet," [www.ncptsd.org/facts/general/fs\\_what\\_is\\_ptsd.html](http://www.ncptsd.org/facts/general/fs_what_is_ptsd.html), updated May 14, 2003 (accessed Aug. 16, 2004).

---

around the time that the first case of anthrax in NYC was announced in mid-October 2001. A NIOSH survey of people working in schools near the WTC site also reported symptoms of depression (CDC, 2002a). Among the responders, initial screenings from the Mount Sinai program show that nearly 37 percent of 250 program participants reported symptoms associated with anxiety, insomnia, and depression (Herbert and Levin, 2003). In addition, a nationwide survey conducted 3 to 5 days after the attack in a nationally representative sample of U.S. adults found that 44 percent of those surveyed reported one or more substantial symptoms of stress, including having difficulty concentrating, feeling irritable, feeling upset when something reminds the person of the attack, having disturbing thoughts or dreams, and having trouble sleeping (Schuster et al., 2001).

---

## Behavioral Effects

The behavioral effects in the aftermath of the WTC attack included increased use of substances such as alcohol, tobacco, and marijuana. Increased use of alcohol and tobacco was identified through surveys of the general population conducted by the states of Connecticut, New Jersey, and New York in the 3 months following the attack (CDC, 2002b). In Manhattan, researchers found that almost 29 percent of people who responded to a survey administered 5 to 8 weeks after September 11 reported increased use of cigarettes, alcohol, or marijuana after the attack (Vlahov et al., 2002). According to these researchers, this increase in substance use was still evident 6 months after September 11 (Vlahov et al., 2004a,b).

The behavioral effects also included difficulty coping with daily responsibilities. Some NYC children and adolescents, family members, and other adults, including members of the response community, are still having difficulty coping 3 years after September 11. For example, an ongoing SAMHSA-supported youth mental health program in NYC is treating 220 children and adolescents who are having problems coping, such as having difficulties functioning in school. In addition, researchers affiliated with the New York University School of Medicine's Child Study Center's bereavement program for families of uniformed personnel killed in responding to the WTC attacks noted that the psychological and emotional reactions of children and adolescents directly affected by the attacks have diminished somewhat over time but that some children continue to be affected by the emotional state and coping difficulties of their parents. Of particular concern to these researchers are the widowed mothers, who are experiencing sustained distress at twice the level typically found in the general population and are having difficulty coping with their daily responsibilities, such as single parenthood, almost 3 years



---

later. Some responders, such as members of FDNY, also report having difficulty coping in the aftermath of September 11.

---

**Programs Established to Monitor and Understand Health Effects Vary in Eligibility Requirements, Methods, Treatment Referrals, and Duration**

The programs established to monitor and understand the health effects of the attack vary in terms of which people are eligible to participate, methods for collecting information about the health effects, options for treatment referral, and number of years people will be monitored. (See table 1.) FEMA provided funding for most of these programs through interagency agreements with HHS. These programs are not centrally coordinated, but some of them are collaborating with each other.

**Table 1: Programs to Monitor Health Effects in the Aftermath of the World Trade Center (WTC) Attack**

	<b>Administrator</b>	<b>Eligible Populations</b>	<b>Participation</b>	<b>Monitoring Methods</b>	<b>Treatment Referral</b>	<b>Intended Duration and Federal Funding<sup>a</sup></b>
<b>WTC Health Registry</b>	NYC Department of Health and Mental Hygiene	Between 250,000 and 400,000 responders and people living or attending school in the area of the WTC or working or being present in the vicinity on September 11	As of 9/2004, 60,483 people were enrolled <sup>b</sup>	Telephone-based health interview; plan to re-interview subset of population in 2005	Provides information on where treatment can be sought; refers participants to LIFENET <sup>c</sup> for mental health services	Agency for Toxic Substances and Disease Registry intends to fund through fiscal year 2008 — \$20 million total Environmental Protection Agency allocated in fiscal year 2004 — \$1.5 million total
<b>FDNY WTC Medical Monitoring Program</b> (FDNY program)	FDNY Bureau of Health Services (FDNY-BHS)	About 11,000 firefighters and 3,500 emergency medical service (EMS) technicians	As of 4/2004, 11,770 firefighters and EMS technicians were enrolled	Medical examination and questionnaire; three follow-up examinations planned	Refers to FDNY-BHS	National Institute for Occupational Safety and Health (NIOSH) intends to fund through 6/2009 — \$25 million total National Center for Environmental Health funded initial monitoring — \$4.8 million total
<b>WTC Worker and Volunteer Medical Monitoring Program</b> (Mount Sinai program)	Mount Sinai's Irving J. Selikoff Clinical Center for Occupational and Environmental Medicine <sup>d</sup>	About 12,000 responders <sup>e</sup>	As of 8/2004, about 11,793 people were enrolled	Medical examination and questionnaire; three follow-up examinations planned	Refers to privately funded program available for responders	NIOSH intends to fund through 7/2009 — \$56 million total NIOSH funded initial monitoring <sup>f</sup> — \$15.8 million total
<b>The medical monitoring program for New York State workers</b> (NYS program)	New York State Department of Health	About 9,800 New York State employees and National Guard personnel	As of 10/2003, 1,677 employees received medical evaluations	Medical examination and questionnaire; follow-up on subset of 300 employees planned	Instructs participants to see their primary care physician or the state's occupational health unit	National Center for Environmental Health funded through fiscal year 2003 — \$2.4 million total
<b>WTC cleanup and recovery worker registry</b> (Johns Hopkins registry)	Johns Hopkins Bloomberg School of Public Health	About 12,000 members from three unions <sup>g</sup> and the NYC Department of Sanitation	As of 6/2003, 1,337 workers responded to the mailed questionnaire	Mail-in health survey	Provides participants with brochures about health services; refers uninsured to Columbia University for mental health services	National Institute of Environmental Health Sciences (NIEHS) funded through fiscal year 2003 <sup>h</sup> — \$1.2 million <sup>i</sup> total

	Administrator	Eligible Populations	Participation	Monitoring Methods	Treatment Referral	Intended Duration and Federal Funding <sup>a</sup>
<b>WTC responder screening program for federal workers<sup>d</sup></b> (FOH program)	Department of Health and Human Services <sup>e</sup> (HHS) Federal Occupational Health services	About 10,000 federal workers responding to WTC	As of 3/2004, 412 exams were completed and reviewed	Medical examination and questionnaire	Instructs participants to see their primary care physician	HHS intends to fund through 12/2005 — \$3.7 million total

Sources: FDNY, HHS, Mount Sinai, New York City Department of Health and Mental Hygiene, and New York State Department of Health.

Note: Programs are ordered according to participation level.

<sup>a</sup>Except as noted, FEMA provided funds to the agencies listed below through interagency agreements with HHS to support efforts to monitor the health effects of the WTC attack.

<sup>b</sup>The WTC Health Registry officials told us that they have generated a list of 185,000 potential participants gathered from various sources, including employers and registration via the Web or telephone. Registry officials told us that the registry will continue to interview and enroll people who are on this list after the registration period ends.

<sup>c</sup>LIFENET is a 24-hour mental health information and referral service provided by the New York State Office of Mental Health.

<sup>d</sup>Mount Sinai is the coordinating center for the five clinics in this program.

<sup>e</sup>People eligible to participate in the Mount Sinai program are those who worked primarily at or immediately adjacent to the WTC site, either during or after the disaster, including firefighters from outside NYC, police officers from NYC and surrounding communities, emergency rescue workers from a variety of organizations (including emergency medical technicians and paramedics), building and construction trade workers from the NYC metropolitan area and throughout the nation, members of the press and news media, health care workers, food service workers, structural and other engineers, and a variety of other public- and private-sector workers, and people who worked in the immediate vicinity of the WTC site restoring essential services, such as telephone services, electricity, and transportation, or performing services necessary to reopen buildings in the area, including cleaning and assessing the structural integrity of nearby buildings. The program excluded federal employees, FDNY firefighters, and, initially, New York State employees, who were all eligible for other programs. New York State responders were initially screened in the NYS program. The NYS program plans to follow 300 of these responders. All New York State responders are now eligible to participate in the Mount Sinai program.

<sup>f</sup>Initial medical monitoring conducted through this program was supported by funds appropriated to CDC.

<sup>g</sup>The International Brotherhood of Teamsters, the International Union of Operating Engineers, and the Laborers International Union of North America.

<sup>h</sup>Funds appropriated to NIEHS to support research, worker training, and education activities supported this grant.

<sup>i</sup>Includes funding for other activities, including Johns Hopkins' WTC Cleanup and Recovery Worker Health Assessment and community outreach.

<sup>j</sup>HHS officials told us that HHS is making modifications to the program and no screenings are taking place.

---

## Program Eligibility

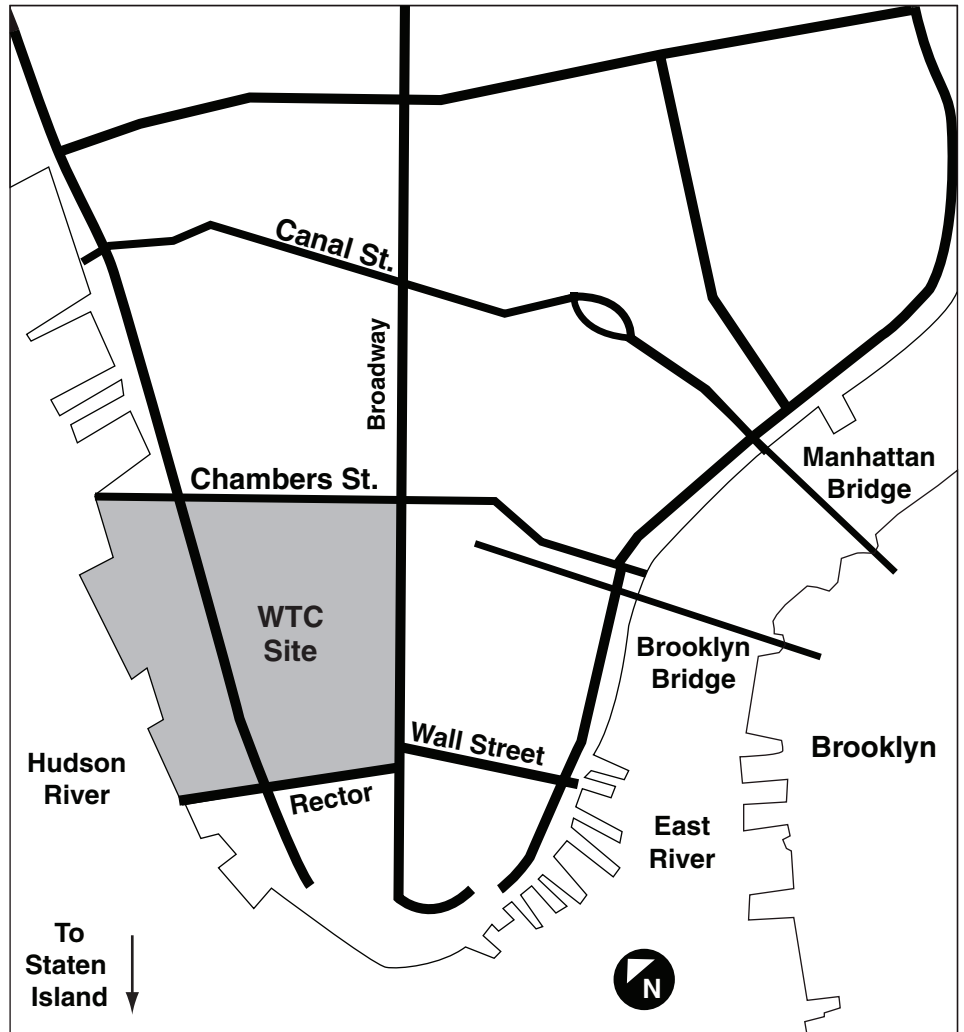
The six programs that have been created to monitor people who were exposed to the WTC attack and its aftermath vary in terms of populations eligible to participate. Although five of the programs focus on various responder populations, the largest program—the WTC Health Registry—is open not only to responders but also to people living or attending school in the vicinity of the WTC site, or working or present in the vicinity on September 11. Specifically, people eligible for participation in the WTC Health Registry include anyone who was in a building, on the street, or on the subway south of Chambers Street on September 11; residents and staff of or students enrolled in schools (prekindergarten through twelfth grade) or day care centers south of Canal Street on September 11; and those involved in rescue, recovery, cleanup, or other activities at the WTC site and/or WTC recovery operations on Staten Island anytime between September 11, 2001, and June 30, 2002. (See figure 1.) An estimated 250,000 to 400,000 people are eligible for the WTC Health Registry<sup>23</sup>; however, the registry was planned with the expectation that 100,000 to 200,000 people would enroll. Together the FDNY program and the Mount Sinai program cover more than half of the estimated 40,000 WTC responders.<sup>24</sup> The FDNY program is open to all 11,000 FDNY firefighters and all 3,500 FDNY EMS technicians, including firefighters and technicians who were not exposed. Some 12,000 other responders are eligible to participate in the Mount Sinai program. Responders who were government employees are eligible for participation in programs such as the FOH program, which is open to the estimated 10,000 federal workers who responded to the WTC attacks, and the NYS program, which was open to about 9,800 New York State employees and New York National Guard personnel who were directed to respond to the WTC disaster. In addition, approximately 12,000 members from three NYC unions and the NYC Department of Sanitation, whether they were responders or not, were eligible to participate in the Johns Hopkins registry.

---

<sup>23</sup>New York City Department of Health and Mental Hygiene and Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, *Protocol for the World Trade Center Health Registry* (New York, 2003).

<sup>24</sup>Officials involved in the monitoring efforts acknowledge the potential for duplication across programs—for example, a responder could be enrolled in the Mount Sinai program, the Johns Hopkins registry, and the WTC Health Registry—but they have not determined the extent of duplication.

**Figure 1: Map of Lower Manhattan Showing Canal Street, Chambers Street, and the WTC Site**



Source: GAO adaptation based on WTC Health Registry Eligibility Map provided by New York City Department of Health and Mental Hygiene.

Concerns have been raised by community and labor representatives regarding the eligibility requirements for some of these programs, and while changes have been made to accommodate some of these concerns, others remain unresolved, particularly with respect to the WTC Health Registry. For example, the eligibility criteria for participation in the Mount Sinai program were initially more restrictive, covering responders who

---

had been at the site at least 24 hours between September 11 and 14, 2001. After discussions with labor representatives and CDC officials, the program expanded its eligibility criteria to include additional responders who may not have been there on those days but were there later in September. In contrast, community and labor representatives have been unsuccessful in their attempts to expand the eligibility criteria of the WTC Health Registry. These representatives have noted that the geographic boundaries used by the registry exclude office workers below Chambers Street who were not at work on September 11 but returned to work in the following weeks; office workers, including several groups of city employees, working between Chambers and Canal Streets; and Brooklyn residents who may have been exposed to the cloud of dust and smoke. Registry officials told us that they understand the desire to be included but they believe coverage is adequate to provide a basis for understanding the health effects of the WTC attack.

---

## Monitoring Methods and Options for Treatment Referral

The monitoring programs vary in their methods for identifying those who may require treatment, and although none of these programs are funded to provide treatment, they provide varying options for treatment referral. Some programs refer participants to affiliated treatment programs, whereas others provide information on where participants can seek care. The FDNY program offers a comprehensive medical evaluation that includes collection of blood and urine for analysis, a pulmonary function test, a chest X-ray, a renal toxicity evaluation, a cardiogram, a hepatitis C test, and hearing and vision tests, as well as self-administered questionnaires on exposures and physical and mental health. Funds for the monitoring program do not cover treatment services. However, FDNY members who require treatment after being screened can obtain treatment and counseling services from the FDNY Bureau of Health Services and the FDNY Counseling Services Unit as a benefit of their employment. Similarly, under the Mount Sinai program, people receive a comprehensive physical examination that includes blood and urine analysis, a chest X-ray, a pulmonary function test, and complete self-administered as well as nurse-administered questionnaires on exposure, clinical history, and mental health.<sup>25</sup> If a person requires follow-up medical care or mental health services but is unable to pay for the services, he or she can be

---

<sup>25</sup>In addition, a standardized evaluation of nasal passages and upper airways is performed on a subgroup of 1,000 participants.

---

referred for care to other Mount Sinai programs such as the Health for Heroes program, which is supported through philanthropic donations.

The FOH and NYS programs also consist of medical evaluations of participants and self-administered health and exposure questionnaires. The FOH program conducted about 400 medical evaluations of federal workers. These evaluations included a physical examination, a pulmonary function test, a chest X-ray, and blood tests. Under the NYS program, the New York State Department of Civil Service Employee Health Service clinics or affiliated clinics conducted medical evaluations that included a physical examination and a pulmonary evaluation of almost 1,700 state workers. The questionnaires for both programs are more limited than the FDNY or Mount Sinai questionnaires; for example, they have fewer mental health questions. Under the FOH and NYS programs, workers who require care have been told to follow up with their primary care physicians under their own insurance.

Unlike most of the other monitoring programs, the WTC Health Registry and the Johns Hopkins registry do not include a medical evaluation, and neither effort is affiliated with a treatment facility or program. Instead, the programs collect information from participants solely through questionnaires and provide information on where participants can seek care. The WTC Health Registry questionnaire is generally administered over the telephone. The program provides all participants with a resource guide of occupational, respiratory, environmental, and mental health facilities in New York State, New Jersey, and Connecticut where people can seek treatment. Some of the services provided by these facilities require health insurance, whereas others are free of charge. If in the course of a telephone questionnaire, a person's responses to the mental health questions suggest that he or she may need to speak with a mental health professional, the person is given the option of being connected directly to a LIFENET counselor. The LIFENET counselor provides the person with information on where to go and whom to call for help with problems related to the WTC disaster. For the Johns Hopkins registry, the participants complete a mail-in questionnaire on physical and mental health. Responders who report mental health symptoms and agree to be recontacted may receive follow-up calls to refer them to mental health services. The referral process is facilitated by Columbia University's Resiliency Program, which provides free, short-term mental health services to affected people. The Johns Hopkins registry also provides participants with brochures about health services and programs they may find useful, including information about the Mount Sinai program.

---

## Duration and Funding

The duration of the monitoring programs may not be long enough to fully capture critical information on health effects. Under current plans, HHS funding for the programs will not extend beyond 2009. For example, ATSDR entered into a cooperative agreement with the New York City Department of Health and Mental Hygiene in fiscal year 2003 with the intent to continue support of the WTC Health Registry for 5 years of its planned 20-year duration. Similarly, NIOSH awarded 5-year grants in July 2004 to continue the FDNY and Mount Sinai programs, which had begun in 2001 and 2002, respectively. Health experts involved in the monitoring programs, however, cite the need for long-term monitoring of affected groups because some possible health effects, such as cancer, do not appear until several decades after a person has been exposed to a harmful agent.<sup>26</sup> They also emphasize that monitoring is important for identifying and assessing the occurrence of newly identified conditions, such as WTC cough, and chronic conditions, such as asthma.

---

## Collaboration

Although the monitoring programs began as separate efforts, some of the programs are collaborating with each other. In addition, there are other kinds of collaborative efforts, including those in which programs receive advice from various outside partners.

The WTC Responder Health Consortium is an example of collaboration between monitoring programs. It was established by NIOSH in March 2004 to coordinate the existing health monitoring of WTC responders initiated by the FDNY and Mount Sinai programs and to facilitate data sharing. It awarded \$81 million in 5-year grants to six institutions to become clinical centers for WTC health monitoring. FDNY and Mount Sinai serve as coordinating centers under the consortium, and the other four institutions are coordinated with Mount Sinai.<sup>27</sup> Together, these institutions will

---

<sup>26</sup>For example, symptoms of lung cancer may not appear for decades after exposure.

<sup>27</sup>These four institutions are the Long Island Occupational and Environmental Health Center, the New York University School of Medicine, the City University of New York's Queens College, and the University of Medicine and Dentistry of New Jersey's Robert Wood Johnson Medical School.



---

provide follow-up health evaluations to a total of about 12,000 NYC firefighters and EMS technicians and up to 12,000 other WTC responders.<sup>28</sup>

Collaboration efforts have also been fostered between the monitoring programs and outside partners and researchers. For example, the WTC Registry has a Scientific Advisory Group that includes representatives from the Mount Sinai School of Medicine, FDNY, the Johns Hopkins University, Columbia University, Hunter College, New York Academy of Medicine, New York University, the New York State Department of Health, and the New Jersey Department of Health. The group has assisted the New York City Department of Health and Mental Hygiene and ASTDR in development of the WTC Registry protocol, selection of the eligible population, and analysis methods. It has been meeting with WTC officials quarterly since early 2002 to advise on such issues as data collection, study options, and guidelines for research studies to be done using the registry.

In addition, EPA convened an expert review panel in March 2004 to obtain greater input on ongoing efforts to monitor the health effects of workers and residents affected by the WTC collapse. The panel consists of representatives from federal and NYC agencies involved in air monitoring; from WTC health effects monitoring programs; and from academic institutions and the affected community. The goals of the panel include identification of unmet public health needs, gaps in exposure data, gaps in efforts to understand the health effects of the WTC attack, and ways in which the WTC Health Registry could be enhanced to allow better tracking of workers and residents.

---

## Concluding Observations

A multitude of physical and mental health effects have been reported in the years since the terrorist attack on the World Trade Center on September 11, 2001, but the full health impact of the attack is unknown. Concern about potential long-term effects on people affected by the attack remains. The monitoring programs may not be in operation long enough to adequately capture information about new conditions, chronic conditions, and diseases whose onset may occur decades after exposure to a harmful agent, such as many cancers. Nevertheless, these programs are providing a more complete picture of the health impact of such events, and as they

---

<sup>28</sup>NYPD also applied to be in the consortium to provide monitoring for its officers who were responders to the WTC disaster, but was not able to secure funding to support its monitoring activities. However, NYPD responders are eligible for enrollment in the Mount Sinai program.

---

proceed they are also providing the opportunity to identify people needing treatment.

---

## Agency Comments

We provided a draft of this testimony to DHS, DOL, EPA, and HHS. HHS provided written comments, in which it noted that the testimony does not include significant discussion on the ways in which mental health symptoms have changed over time. We relied primarily on data from published, peer-reviewed articles and government reports, and some of the researchers we spoke with emphasized that their studies are ongoing and they expect to publish further results. In the absence of these results, the evidence we examined did not support a full discussion of changes in mental or physical health effects over time. HHS and the other agencies also provided technical comments, which we incorporated as appropriate.

---

Mr. Chairman, this completes my prepared statement. I would be happy to respond to any questions you or other members of the Subcommittee may have at this time.

---

## Contact and Staff Acknowledgments

For further information about this testimony, please contact Janet Heinrich at (202) 512-7119. Michele Orza, Angela Choy, Alice London, Nkeruka Okonmah, and Roseanne Price made key contributions to this statement.

---

# Appendix I: Abbreviations

---

ATSDR	Agency for Toxic Substances and Disease Registry
CDC	Centers for Disease Control and Prevention
DOD	Department of Defense
DHS	Department of Homeland Security
DOJ	Department of Justice
DOL	Department of Labor
DMAT	Disaster Medical Assistance Teams
EMS	emergency medical services
EPA	Environmental Protection Agency
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
FOH	Federal Occupational Health
FDNY	New York City Fire Department
GERD	gastroesophageal reflux disease
HHS	Department of Health and Human Services
NIEHS	National Institute of Environmental Health Sciences
NIOSH	National Institute for Occupational Safety and Health
NYC	New York City
NYPD	New York City Police Department
OSHA	Occupational Safety and Health Administration
PTSD	posttraumatic stress disorder
SGA	small for gestational age
SAMHSA	Substance Abuse and Mental Health Services Administration
VA	Department of Veterans Affairs
WTC	World Trade Center

---

# Bibliography

---

Banauch, G.I., et al. "Persistent Hyperreactivity and Reactive Airway Dysfunction in Firefighters at the World Trade Center." *American Journal of Respiratory and Critical Care Medicine*, 168, no. 1 (2003): 54-62.

Berkowitz, G.S., et al. "The World Trade Center Disaster and Intrauterine Growth Restriction." (Letter) *Journal of the American Medical Association*, 290, no. 5 (2003): 595-96.

Berrios-Torres, S.I., et al. "World Trade Center Rescue Worker Injury and Illness Surveillance, New York, 2001." *American Journal of Preventive Medicine*, 25, no. 2 (2003): 79-87.

Boscarino, J.A., et al. "Mental Health Service and Medication Use in New York City after the September 11, 2001, Terrorist Attack." *Psychiatric Services*, 55, no. 3 (2004): 274-83.

Boscarino, J.A., et al. "Psychiatric Medication Use among Manhattan Residents Following the World Trade Center Disaster." *Journal of Traumatic Stress*, 16, no. 3 (2003): 301-6.

Centers for Disease Control and Prevention. "Injuries and Illnesses among New York City Fire Department Rescue Workers after Responding to the World Trade Center Attacks." Special Issue, *Morbidity and Mortality Weekly Report*, 51 (2002a): 1-13.

Centers for Disease Control and Prevention. "Psychological and Emotional Effects of the September 11 Attacks on the World Trade Center—Connecticut, New Jersey, and New York, 2001." *Morbidity and Mortality Weekly Report*, 51, no. 35 (2002b): 784-85.

Centers for Disease Control and Prevention. "Rapid Assessment of Injuries among Survivors of the Terrorist Attack on the World Trade Center—New York City, September 2001." *Morbidity and Mortality Weekly Report*, 51, no. 1 (2002c): 1-5.

Chi, J.S., et al. "Hospital Admissions for Cardiac Events in New York City after September 11, 2001." *American Journal of Cardiology*, 92, no. 1 (2003): 61-63.

Cushman, J.G., et al. "Two New York City Hospitals' Surgical Response to the September 11, 2001, Terrorist Attack in New York City." *Journal of Trauma*, 54, no. 1 (2003): 147-55.

---

DeLisi, L.E., et al. "A Survey of New Yorkers after the Sept. 11, 2001, Terrorist Attacks." *American Journal of Psychiatry*, 160, no. 4 (2003): 780-83.

Deren, S., et al. "Impact of the September 11th Attacks in New York City on Drug Users: A Preliminary Assessment." *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 79, no. 3 (2002): 409-12.

Edelman, P., et al. "Biomonitoring of Chemical Exposure among New York City Firefighters Responding to the World Trade Center Fire and Collapse." *Environmental Health Perspectives*, 111, no. 16 (2003): 1906-11.

Fairbrother, G., et al. "Posttraumatic Stress Reactions in New York City Children after the September 11, 2001, Terrorist Attacks." *Ambulatory Pediatrics*, 3, no. 6. (2003): 304-11.

Feldman, D.M., et al. "Symptoms, Respirator Use, and Pulmonary Function Changes among New York City Firefighters Responding to the World Trade Center Disaster." *Chest*, 125, no. 4 (2004): 1256-64.

Galea, S., et al. "Posttraumatic Stress Disorder in Manhattan, New York City, after the September 11th Terrorist Attacks." *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 79, no. 3 (2002a): 340-53.

Galea, S., et al. "Psychological Sequelae of the September 11 Terrorist Attacks in New York City." *New England Journal of Medicine*, 346, no. 13 (2002b): 982-87.

Galea, S., et al. "Trends of Probable Post-Traumatic Stress Disorder in New York City after the September 11 Terrorist Attacks." *American Journal of Epidemiology*, 158, no. 6 (2003): 514-24.

Greater New York Hospital Association. *GNYHA Survey on the Utilization of Hospital-Based Psychiatric Services Following the Attack on the World Trade Center: A Final Report*. New York, 2001.

Herbert, R., and S. Levin. *World Trade Center Worker and Volunteer Medical Screening Program. Report of Initial Findings to the National Institute for Occupational Safety and Health of the Centers for Disease Control and Prevention*. New York, 2003.

---

Hoven, C.W., et al. "Mental Health of New York City Public School Children after 9/11: An Epidemiologic Investigation." In S. Coates et al. (eds.), *September 11: Trauma and Human Bonds*. Hillsdale, NJ: Analytic Press, 2003.

Landrigan, P.J., et al. "Health and Environmental Consequences of the World Trade Center Disaster." *Environmental Health Perspectives*, 112, no. 6 (2004): 731-39.

Levin, S., et al. "Health Effects of World Trade Center Site Workers." *American Journal of Industrial Medicine*, 42, no. 6 (2002): 545-47.

Levy, B.S., and V.W. Sidel (eds.). *Terrorism and Public Health*. New York: Oxford University Press, 2003.

Lippy, B.E. "Safety and Health of Heavy Equipment Operators at Ground Zero." *American Journal of Industrial Medicine*, 42, no. 6 (2002): 539-42.

Malievskaya, E., et al. "Assessing the Health of Immigrant Workers near Ground Zero: Preliminary Results of the World Trade Center Day Laborer Medical Monitoring Project." *American Journal of Industrial Medicine*, 42, no. 6 (2002): 548-49.

Martyny, J., et al. "Respiratory Protection." *New England Journal of Medicine*, 347, no. 11 (2002): 824-30.

Niles, B.L., et al. "Posttraumatic Stress Disorder Symptomatology in Vietnam Veterans before and after September 11." *Journal of Nervous and Mental Disease*, 191, no. 10 (2003): 682-84.

Prezant, D.J., et al. "Cough and Bronchial Responsiveness in Firefighters at the World Trade Center Site." *New England Journal of Medicine*, 347, no. 11 (2002): 806-15.

Rom, W.N., et al. "Acute Eosinophilic Pneumonia in a New York City Firefighter Exposed to World Trade Center Dust." *American Journal of Respiratory and Critical Care Medicine*, 166, no. 6 (2002): 797-800.

Rosenheck, R.A., and A. Fontana. "Post-September 11 Admission Symptoms and Treatment Response among Veterans with Posttraumatic Stress Disorder." *Psychiatric Services*, 54, no. 12 (2003): 1610-17.

---

Salzman, S.H., et al. "Early Respiratory Abnormalities in Emergency Services Police Officers at the World Trade Center Site." *Journal of Occupational and Environmental Medicine*, 46, no. 2 (2004): 113-22.

Schlenger, W.E., et al. "Psychological Reactions to Terrorist Attacks: Findings from the National Study of Americans' Reactions to September 11." *Journal of the American Medical Association*, 288, no. 5 (2002): 581-88.

Schuster, M.A., et al. "A National Survey of Stress Reactions after the September 11, 2001, Terrorist Attacks." *New England Journal of Medicine*, 345, no. 20 (2001): 1507-12.

Silver, R.C., et al. "Nationwide Longitudinal Study of Psychological Responses to September 11." *Journal of the American Medical Association*, 288, no. 10 (2002): 1235-44.

Simeon, D., et al. "Peritraumatic Reactions Associated with the World Trade Center Disaster." *American Journal of Psychiatry*, 160, no. 9 (2003): 1702-5.

Skloot, G., et al. "Respiratory Symptoms and Physiologic Assessment of Ironworkers at the World Trade Center Disaster Site." *Chest*, 125, no. 4 (2004): 1248-55.

Spadafora, R. "Firefighter Safety and Health Issues at the World Trade Center Site." *American Journal of Industrial Medicine*, 42, no. 6 (2002): 532-38.

Szema, A.M., et al. "Clinical Deterioration in Pediatric Asthmatic Patients after September 11, 2001." *Journal of Allergy and Clinical Immunology*, 113, no. 3 (2004): 420-26.

Thiel de Bocanegra, H., and E. Brickman. "Mental Health Impact of the World Trade Center Attacks on Displaced Chinese Workers." *Journal of Traumatic Stress*, 17, no. 1 (2004): 55-62.

Trout, D., et al. "Health Effects and Occupational Exposures among Office Workers near the World Trade Center Disaster Site." *Journal of Occupational and Environmental Medicine*, 44, no. 7 (2002): 601-5.

---

Vlahov, D., et al. "Increased Use of Cigarettes, Alcohol, and Marijuana among Manhattan, New York, Residents after the September 11th Terrorist Attacks." *American Journal of Epidemiology*, 155, no. 11 (2002): 988-96.

Vlahov, D., et al. "Consumption of Cigarettes, Alcohol, and Marijuana among New York City Residents Six Months after the September 11 Terrorist Attacks." *American Journal of Drug and Alcohol Abuse*, 30, no. 2 (2004a): 385-407.

Vlahov, D., et al. "Sustained Increased Consumption of Cigarettes, Alcohol, and Marijuana among Manhattan Residents after September 11, 2001." *American Journal of Public Health*, 94, no. 2 (2004b): 253-4.

Wallingford, K.M., and E.M. Snyder. "Occupational Exposures during the World Trade Center Disaster Response." *Toxicology and Industrial Health*, 17, no. 5-10 (2001): 247-53.

Warren, T., et al. "Factors Influencing Experienced Distress and Attitude toward Trauma by Emergency Medicine Practitioners." *Journal of Clinical Psychology in Medical Settings*, 10, no. 4 (2003): 293-96.



---

---

This is a work of the U.S. government and is not subject to copyright protection in the United States. It may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.

---

## GAO's Mission

The Government Accountability Office, the audit, evaluation and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

---

## Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's Web site ([www.gao.gov](http://www.gao.gov)). Each weekday, GAO posts newly released reports, testimony, and correspondence on its Web site. To have GAO e-mail you a list of newly posted products every afternoon, go to [www.gao.gov](http://www.gao.gov) and select "Subscribe to Updates."

---

## Order by Mail or Phone

The first copy of each printed report is free. Additional copies are \$2 each. A check or money order should be made out to the Superintendent of Documents. GAO also accepts VISA and Mastercard. Orders for 100 or more copies mailed to a single address are discounted 25 percent. Orders should be sent to:

U.S. Government Accountability Office  
441 G Street NW, Room LM  
Washington, D.C. 20548

To order by Phone: Voice: (202) 512-6000  
TDD: (202) 512-2537  
Fax: (202) 512-6061

---

## To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Web site: [www.gao.gov/fraudnet/fraudnet.htm](http://www.gao.gov/fraudnet/fraudnet.htm)

E-mail: [fraudnet@gao.gov](mailto:fraudnet@gao.gov)

Automated answering system: (800) 424-5454 or (202) 512-7470

---

## Congressional Relations

Gloria Jarmon, Managing Director, [JarmonG@gao.gov](mailto:JarmonG@gao.gov) (202) 512-4400  
U.S. Government Accountability Office, 441 G Street NW, Room 7125  
Washington, D.C. 20548

---

## Public Affairs

Jeff Nelligan, Managing Director, [NelliganJ@gao.gov](mailto:NelliganJ@gao.gov) (202) 512-4800  
U.S. Government Accountability Office, 441 G Street NW, Room 7149  
Washington, D.C. 20548