



NIOSH HEALTH HAZARD EVALUATION REPORT

**HETA #2002-0090; 2002-0096; 2002-0101-3028
Buildings in the Vicinity of the World Trade Center
New York City, New York**

November 2006

**DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health**



PREFACE

The Hazard Evaluation and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (NIOSH) conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health (OSHA) Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employers or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

HETAB also provides, upon request, technical and consultative assistance to federal, state, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease. Mention of company names or products does not constitute endorsement by NIOSH.

ACKNOWLEDGEMENTS AND AVAILABILITY OF REPORT

This report was prepared by Bruce Bernard, Rick Driscoll, Sherry Baron, and Kenneth Wallingford of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS). Field assistance was provided by Jenise Brassell, Robin Smith, and Elaine Moore. Analytical support was provided by Charles Mueller. Desktop publishing was performed by Robin Smith. Editorial assistance was provided by Ellen Galloway.

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**Health Hazard Evaluation Report 2002-0090;
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SUMMARY

On January 1, 2002, the National Institute for Occupational Safety and Health (NIOSH) received three health hazard evaluation (HHE) requests from employee representatives at four different work sites: Stuyvesant High School, the Borough of Manhattan Community College (BMCC), 120 Broadway and 40 Rector Street (housing four city agencies), near the World Trade Center (WTC) site. This report summarizes four separate NIOSH investigations, which document the extent of physical and psychological symptoms among workers at these sites in the months following the September 11, 2001 disaster at the WTC.

Each of these reports compared physical and mental health symptoms among employees at these buildings with the same symptoms among employees at comparable New York City work sites distant from the WTC. NIOSH personnel conducted a questionnaire survey of employees at Stuyvesant High School and a comparison high school, La Guardia High School, in late January 2002. The survey occurred at BMCC and a comparison college, York Community College, in mid-March 2002; at 40 Rector Street in early April 2002, and at 120 Broadway (state attorney general's office) in early June 2002. The LeFrak Building, was surveyed in early April 2002 and was the comparison building for 40 Rector Street and 120 Broadway.

We used a self-administered questionnaire to ask about physical and mental health symptoms that occurred since September 11 and symptoms still present at the time of the survey. In addition, we used the questionnaire to ask participants about experiences on September 11, about medical diagnoses since then, and about social support.

Participation rates were 82%–83% at both high schools and at the 40 Rector Street building, 76% at the comparison office building, about 55%–60% at BMCC, about 45%–50% at the comparison college, and 37% at the 120 Broadway building. In all four studies, the prevalence of physical symptoms, including upper and lower respiratory symptoms, tended to be higher at the work sites near the WTC site than at the comparison work sites. The prevalence of persistent symptoms (upper and lower respiratory symptoms) also tended to be higher.

Depressive symptoms and post traumatic stress disorder (PTSD) symptoms were prevalent at Stuyvesant and BMCC, but not at the two office buildings. Likewise, PTSD diagnosed since September 11 was more prevalent at Stuyvesant and BMCC than at their comparison sites, and a similar, though not statistically significant, prevalence ratio was found at the 40 Rector Street building. Newly diagnosed depression was not statistically more prevalent at any of the individual sites than at the comparison sites.

All the surveys were limited by the lack of quantitative information about employees' exposures to dust and smoke from the collapsing buildings and fires on September 11 and our inability to infer medical diagnoses solely on the basis of a symptom survey. Since our interim letters were issued, published reports from several studies have described short- and medium-term physical health effects among rescue workers, office workers, and residents from the surrounding community. These studies have provided information suggesting that exposure to the dust cloud and the chemical/physical properties of the dust from the collapse of the buildings on September 11 as well as exposures to combustion products from the burning materials have contributed to the respiratory problems. Continued longitudinal follow-up of those exposed will be necessary to determine whether the changes in spirometry documented up to 5 years post-disaster will lead to chronic problems or whether the initial decline in respiratory function will be followed by recovery, as has been seen in other irritant-exposed groups.

Reports of psychological problems have also been well documented since our interim letters were issued. On-going interventions addressing these reactions may help prevent the development of long-lasting psychological sequelae.

NIOSH investigators determined that an occupational health hazard due to exposures surrounding the collapse of the World Trade Center existed among the working groups studies. A substantial burden of symptoms of depression and PTSD, as well as physical symptoms of eye irritation and upper airway irritation were present among those surveyed. Recommendations for medical evaluation of symptomatic persons, facilitating access to medical health services, fostering social support, and training were given.

Keywords: World Trade Center, WTC, September 11, post-traumatic stress syndrome, PTSD, Depression, psychological, social support, upper respiratory, lower respiratory, New York City, public high school, office buildings, community college, teachers, disasters, NAICS codes: 611210, 611110, 922130, 561110

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INTRODUCTION

On January 1, 2002, the National Institute for Occupational Safety and Health (NIOSH) received three health hazard evaluation (HHE) requests from employee representatives at several work sites in the vicinity of the World Trade Center (WTC) site, including a New York City College, a public high school, and two New York City (NYC) office buildings. NIOSH investigators conducted four separate NIOSH investigations documenting the extent of physical and psychological symptoms among workers at these buildings.

Interim reports for the four buildings were issued June 5, 2002 (Stuyvesant High School), August 30, 2002 (Borough of Manhattan Community College, BMCC), and October 23, 2002 (two reports: office buildings at 40 Rector Street and 120 Broadway). Each of these reports compared symptoms among employees at these buildings with those among employees at comparable New York City work sites distant from the WTC.

This report includes a general summary of results across the surveys and separate sections detailing the methods and results for each of the buildings.

FOUR SITE OVERVIEW

NIOSH personnel conducted a questionnaire survey of employees of Stuyvesant and a comparison high school in late January 2002, at BMCC and a comparison college in mid-March, at 40 Rector Street (four city agencies) in early April, and at 120 Broadway (state attorney general's office) in early June. The comparison building (a city office building) for both of the office buildings was surveyed in early April. The questionnaires asked about symptoms that occurred since September 11, 2001, and symptoms still present at the time of the survey. The questionnaire included a 20-question epidemiologic survey instrument to identify symptoms of depression and a series of questions to detect post-traumatic stress disorder (PTSD) symptoms. The questionnaire also asked about experiences on September 11, about medical diagnoses since then, and about social support.

Participation rates were 82%-83% at both high schools and at the 40 Rector Street building, 76% at the comparison office building, about 55%-60% at BMCC, about 45%-50% at the comparison college, and 37% at the 120 Broadway building. In all four studies, prevalences of physical symptoms tended to be higher at the work sites near the WTC site than at the comparison work sites (Table 1). Prevalences of persistent symptoms also tended to be higher (Table 2).

Table 3 presents data on depressive symptoms and post traumatic stress disorder (PTSD) symptoms. Relative to the comparison sites, these conditions (as defined by questionnaire responses) were of greater prevalence at Stuyvesant and BMCC than at the two office buildings. Likewise, PTSD diagnosed since September 11 was more prevalent at Stuyvesant and BMCC than at their comparison sites, and a similar, though not statistically significant, prevalence ratio was found at the 40 Rector Street building. Newly diagnosed depression was not statistically more prevalent at any of the individual sites relative to their comparison sites.

All the surveys were limited by the lack of quantitative information about employees' exposures to dust and smoke from the collapsing buildings and fires on September 11 and our inability to infer medical diagnoses solely on the basis of a symptom survey. The survey findings were similar to those of other studies of the WTC and other disasters, but cannot readily be used to predict the effect of the disaster and its attendant exposures on long-term physical and mental health. NIOSH investigators recommended

medical evaluation of symptomatic persons, facilitating access to mental health services, fostering social support at the workplace, and training of managers and supervisors to respond to employee health and safety concerns.

Although the interim reports all noted plans for further analysis of the combined data, NIOSH investigators subsequently decided that even though many findings were consistent across the study sites, several problems would increase the complexity and compromise the validity of such an analysis. First, the participation rates were low at the colleges and at the 120 Broadway building. Second, the surveys were done at different times after September 11: 4 1/2 months for the high schools, 6 months for the colleges, and 7 and 9 months for the office buildings (with the comparison building at 7 months). Thus, the time frame for both symptom occurrence and symptom persistence differed. Also, the accuracy of recall of September 11 experiences may have differed according to the increasing time since the event. This could affect the results of the risk factors analyses. Finally, the opportunity for exposures (to both air contaminants and psychological stressors) differed at the four study sites. Stuyvesant was evacuated during the morning of September 11 and did not reopen to students and faculty until October 20. In contrast, BMCC reopened for all staff on September 26. (Both facilities were used for rescue and recovery operations, so some security and maintenance staff continued working after September 11.) The 40 Rector Street building was not evacuated on September 11, and workers left at various times throughout the day. The building was then closed until October 25. The 120 Broadway building was officially evacuated in the morning of September 11, although some workers reported staying until 4:00 p.m. The building reopened September 20, 2001 (on a voluntary basis), and all employees were required to return to work by October 4, 2001.

For the above the reasons, NIOSH investigators decided to let the individual interim reports stand by themselves, and include the material from them as separate sections in this report.

The long-term health effects among residents and workers in lower Manhattan related to exposure to environmental contaminants from the WTC attacks is uncertain. Since our interim reports were issued, published reports from several studies^{1,2,3,4,5} have described short- and medium-term physical health effects among rescue workers, office workers, and residents from the surrounding community. These studies have provided information suggesting that exposure to the dust cloud and the chemical/physical properties of the dust from the collapse of the buildings on September 11 as well as exposures to combustion products from the burning materials have contributed to the respiratory problems. Continued longitudinal follow-up⁶ of those exposed will be necessary to determine whether the changes in spirometry documented up to 5 years post-disaster will lead to chronic problems or whether the initial decline in respiratory function will be followed by recovery, as has been seen in other irritant-exposed groups.^{7,8}

We also found a substantial percentage of high school staff with PTSD and depression symptoms four months after September 11. Reports of psychological problems^{9,10,11} have also been well documented since our interim letters were issues. On-going interventions addressing these reactions may help prevent the development of long-lasting psychological sequelae.

This report, constitutes the final report for HETA 2002-0090 (Stuyvesant and LaGuardia High Schools), HETA 2002-0096 (Borough of Manhattan Community College and York College) and for HETA 2002-0101 (New York City offices: Civilian Complaint Review Board, Taxi and Limousine Commission, Office of Administrative Trials and Hearings, and Campaign Finance Board, all at 40 Rector Street; New York State Office of the Attorney General, at 120 Broadway, and New York City Office of Environmental Protection, at the Lefrak Building in Queens).

Table 1
Prevalence Ratios (and 95% Confidence Intervals) for Physical Symptoms
Occurring since September 11, 2001, at Four Buildings near the
World Trade Center Site*, New York City, 2002.
HETA 2002-0090, HETA 2002-0096, and HETA 2002-0101-3028

Symptom	Stuyvesant	BMCC	40 Rector	120 Broadway
Nose/throat irritation	1.6 (1.3-2.1)[†]	1.7 (1.4-2.1)	1.6 (1.2-2.2)	1.8 (1.3-2.4)
Eye irritation	1.1 (1.2-2.0)	1.8 (1.4-2.1)	1.3 (1.0-1.7)	1.6 (1.2-2.1)
Skin irritation	1.3 (0.8-1.9)	1.4 (1.0-1.9)	1.4 (0.8-2.3)	1.1 (0.6-2.1)
Congestion	1.2 (0.9-1.5)	1.1 (0.9-1.4)	1.1 (0.8-1.5)	1.1 (0.8-1.4)
Cough, any type	1.7 (1.3-2.1)	1.7 (1.2-2.0)	2.2 (1.5-3.2)	2.2 (1.5-3.2)
Cough with phlegm	1.6 (1.1-2.3)	1.4 (1.1-1.9)	1.7 (1.1-2.8)	1.6 (0.9-2.6)
Shortness of breath	1.7 (1.2-2.4)	2.3 (1.6-3.8)	2.3 (1.3-4.1)	2.5 (1.3-4.4)
Chest tightness	1.5 (0.9-2.2)	2.5 (1.7-3.8)	3.6 (1.6-8.1)	3.3 (1.5-7.5)
Wheeze	1.4 (0.9-2.3)	2.6 (1.6-4.5)	1.9 (0.8-4.0)	2.2 (1.1-4.8)
Headache	1.2 (0.99-1.5)	1.3 (1.1-1.5)	1.5 (1.1-1.9)	1.1 (0.8-1.4)
Indigestion	1.4 (0.9-2.0)	1.3 (1.0-1.8)	1.4 (0.8-2.4)	1.6 (0.9-2.8)
Nausea	1.7 (0.99-2.9)	2.2 (1.3-3.8)	2.3 (1.1-5.2)	1.3 (0.6-3.3)
Diarrhea	1.6 (0.9-2.7)	1.1 (0.8-1.7)	2.0 (1.1-3.8)	1.8 (0.9-3.5)

*For each study site, a unique comparison building was surveyed as a referent population

[†]Boldface indicates that the 95% confidence interval does not include 1.0; that is, the prevalence ratio is statistically different than 1 at the 95% confidence level.

Table 2
Prevalence Ratios (and 95% Confidence Intervals) for Persistent Physical Symptoms (see text) at Four Buildings near the World Trade Center Site*, New York City, 2002.
HETA 2002-0090, HETA 2002-0096, and HETA 2002-0101-3028

Symptom	Stuversant	BMCC	40 Rector	120 Broadway
Nose/throat irritation	1.8 (1.2-2.7)[†]	1.7 (1.4-2.1)	1.6 (1.2-2.2)	1.8 (1.3-2.4)
Eye irritation	1.95 (1.3-3.0)	1.8 (1.4-2.10)	1.3 (1.0-1.7)	1.6 (1.2-2.1)
Skin irritation	1.3 (0.7-2.6)	1.4 (1.0-1.9)	1.4 (0.8-2.3)	1.1 (0.6-2.1)
Congestion	1.7 (1.1-2.6)	1.1 (0.9-1.4)	1.1 (0.8-1.5)	1.1 (0.8-1.4)
Cough, any type	2.7 (1.6-4.6)	1.7 (1.4-2.0)	2.2 (1.5-3.2)	2.2 (1.5-3.2)
Cough with phlegm	2.4 (1.3-4.5)	1.4 (1.1-1.9)	1.7 (1.1-2.8)	1.6 (0.9-2.6)
Shortness of breath	2.8 (1.4-5.4)	2.3 (1.6-3.8)	2.3 (1.3-4.1)	2.5 (1.3-4.4)
Chest tightness	3.5 (1.5-8.1)	2.5 (1.7-3.8)	3.6 (1.6-8.1)	3.3 (1.5-7.5)
Wheeze	4.2 (1.5-11.9)	2.6 (1.6-4.5)	1.9 (0.8-4.0)	2.2 (1.1-4.8)
Headache	1.5 (0.9-2.2)	1.3 (1.1-1.5)	1.5 (1.1-1.9)	1.1 (0.8-1.4)
Indigestion	1.8 (0.9-3.7)	1.3 (1.0-1.8)	1.4 (0.8-2.4)	1.6 (0.9-2.8)
Nausea	1.9 (0.7-4.8)	2.2 (1.3-3.8)	2.3 (1.1-5.2)	1.3 (0.6-3.3)
Diarrhea	0.6 (0.2-1.4)	1.1 (0.8-1.7)	2.0 (1.1-3.8)	1.8 (0.9-3.5)

*For each study site, a unique comparison building was surveyed as a referent population

[†]Boldface indicates that the 95% confidence interval does not include 1.0; that is, the prevalence ratio is statistically different than 1 at the 95% confidence level.

Table 3
Prevalence Ratios (and 95% Confidence Intervals) for Mental Health
Outcomes (see text) at Four Buildings near the World Trade Center Site*,
New York City, 2002.
HETA 2002-0090, HETA 2002-0096, and HETA 2002-0101-3028

Outcome	Stuyvesant	BMCC	40 Rector	120 Broadway
Symptoms				
Depression [†]	1.9 (1.3-2.8)[‡]	1.4 (1.0-2.0)	1.1 (0.7-1.9)	0.8 (0.5-1.5)
PTSD [§]	3.8 (2.9-7.5)	1.7 (1.04-2.9)	1.4 (0.7-2.8)	0.9 (0.4-2.0)
Diagnoses[¶]				
Depression	2.8 (0.75-12)	2.5 (0.7-8.9)	2.3 (0.8-11.0)	0.9 (0.8-11.0)
PTSD	4.8 (1.1-31)	5.1 (1.2-22.1)	4.6 (0.3-23.2)	2.9 (0.3-23.2)

*For each study site, a unique comparison building was surveyed as a referent population

[†]Defined as a score of 22 or greater using the National Institute of Mental Health Center for Epidemiologic Studies Depression Scale (CES-D).

[‡]Boldface indicates that the 95% confidence interval does not include 1.0; that is, the prevalence ratio is statistically different than 1 at the 95% confidence level.

[§]Post-traumatic stress disorder, defined according to the fourth edition of the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)¹⁸ using answers to questions from the Veterans Administration PTSD Checklist¹⁴.

[¶]Physician diagnoses since September 11, 2001.

STYVESANT AND LA GUARDIA HIGH SCHOOLS

Background

On January 1, 2002, the National Institute for Occupational Safety and Health (NIOSH) received a health hazard evaluation (HHE) request from the United Federation of Teachers (UFT) and the American Federation of State, Municipal, and County Employees (AFSMCE) asking for assistance in documenting the extent of physical and mental health problems among the staff at Stuyvesant High School subsequent to the attack on the World Trade Center (WTC) on September 11, 2001. To document these concerns at the sites around the WTC, NIOSH investigators administered a questionnaire survey at Stuyvesant High School, as well as comparison site not proximal to the WTC. La Guardia High School, 6 miles north of the WTC disaster site, was chosen for the comparison site to Stuyvesant High School.

A NIOSH team of medical and social epidemiologists and an industrial hygienist visited Stuyvesant High School on January 17, 2002, and La Guardia High School on January 28, 2002. During the site visits, the NIOSH team held opening conferences with school administrators, New York City School Board representatives, faculty members, facility maintenance personnel, cafeteria managers, security officers, and union representatives from the UFT and AFSMCE to discuss the HHE request and NIOSH policy and procedures. Information was obtained relating to the buildings, relevant events that took place at the time of and after the WTC attack, history of concerns involving indoor environmental quality (IEQ), and other health-related concerns. Following the opening conferences, NIOSH investigators conducted walk-through evaluations of the buildings. On January 29, 2002, NIOSH investigators returned to conduct a questionnaire survey among the high school staff.

Methods

Selection of Sites for the HHE

Stuyvesant High School was included in the original HHE request; it is located one and a half blocks away from the WTC site. La Guardia High School was selected as a referent school because it is located 6 miles from the WTC site, and had similar building characteristics to Stuyvesant, including central air conditioning and a lack of significant IEQ problems which required major changes or consultation within the previous 5 years.

Stuyvesant High School

Stuyvesant High School is a specialized school for mathematics, physical and biological science, and technology and is part of the New York City Public School System. It is a nationally known coeducational college preparatory school. Stuyvesant High School is located approximately one and a half blocks north of the WTC site at West and Chambers Streets. Approximately 300 staff work in the Stuyvesant building in teaching, administration, support services, and building services. Student enrollment is around 3040 students. Stuyvesant High School is a single, multi-level building that was completed and occupied in 1992.

On the morning of September 11, 2001, Stuyvesant High School was beginning a normal teaching day. At 8:46 a.m., a plane hit the WTC Tower 2, the South Tower. During the interval from the first plane crashing into the WTC tower to the time of the initiation of the school's evacuation (about 10:15 a.m.), instructions and information about unfolding events were communicated over the intercom system by Stuyvesant administrators. The staff and students were filing out of the building when the North WTC Tower came

down at 10:28 a.m. Several of the Stuyvesant staff accompanied the students to Chelsea Pier, where teachers organized students into groups for transportation home. Other staff walked students across the Brooklyn Bridge, or accompanied them up the East Side, still others the West Side. Public transportation was not available in the area around the school. Several of the maintenance and cafeteria staff remained in the building after the evacuation of the students and teaching staff. After the events of September 11, 2001, Stuyvesant High School was closed to students and faculty until October 20, 2001. Teaching staff and students were moved to Brooklyn Technical High School. Stuyvesant was used as a respite facility and Command Center for rescue workers for several weeks after September 11, 2001.

Following the initial search and rescue mission at the WTC, a barge loading operation for the transport of debris from the WTC disaster site was located adjacent to the north side of the Stuyvesant building. Trucks carrying debris from the rubble pile were offloaded by a stationary overhead crane system, with the loose debris picked up and deposited into barges. The continuous barge operation was visible at all times from the enormous glass windows at the north end of the Stuyvesant hallways until May 2002, when it was dismantled.

Environmental Characterization for Identification of Comparison School

To help in selecting a comparison high school, a walk-through evaluation of Stuyvesant High School was performed on January 17, 2002. A variety of environmental factors were noted during this walk-through evaluation including the building's architectural style, physical structural characteristics, construction methods and materials, interior room orientation and uses, ventilation systems design and performance, preventive maintenance practices, housekeeping practices, building renovation history, and current building appearance (particularly the interior).

To adequately characterize the schools, a building inspection checklist (Appendix A) was developed using the knowledge of environmental risk factors gained from previous NIOSH indoor environmental quality research.¹² The building inspection checklist included selected environmental risk factors previously associated with occupant reporting of the most common building-related health symptoms.

Based on the walk-through evaluation of Stuyvesant High School, two environmental factors were determined to disqualify a high school building for the purpose of comparison: (1) the lack of central air-conditioning; and (2) the presence of significant indoor environmental quality problems that required major changes or consultation within the previous 5 years. Both buildings (La Guardia and Stuyvesant) have had their share of typical indoor environmental quality problems in the past 5 years, including histories of water damage and leaks from faulty plumbing. Prior to the NIOSH visit, the UFT and NYC Board of Education had never received specific requests for investigations concerning the indoor environments at either school, although there have been recurring incidents and on ongoing concerns about the indoor air quality among both staffs. These incidents have been handled by the on-site administration and buildings maintenance staff.

The other environmental risk factors on the building inspection checklist were used to obtain the best available match for the comparison high school. After discussions with the unions, NYC Board of Education, and knowledgeable maintenance and equipment personnel, as well as a site visit, La Guardia High School was selected as the comparison high school.

La Guardia High School

La Guardia High School is a specialized school for the arts and is part of the New York City Public School System. It is a nationally known coeducational school for music, art, and performing arts. Located approximately 6 miles north of the WTC site, it is proximal to Lincoln Center for the Performing Arts, between 64th and 65th Streets at 100 Amsterdam Avenue. Approximately 225 staff work in the La Guardia building in teaching, administration, support services, and building services. The school has a student enrollment of around 2240 students. It is a single, multi-level building that was completed and occupied in 1984.

On September 11, 2001, La Guardia held a normal teaching day for its students. Because of the distance from the WTC, the La Guardia staff was not initially aware that the terrorist attacks had occurred. However, within the hour of the first plane crash, many of the staff became aware of the events at the WTC because students' parents began arriving at La Guardia to take them away from the school, concerned about their safety. In the late morning, an announcement of the attack was made over the intercom, but school remained in session. Staff and students were asked to continue their routine tasks and schedules. School was not dismissed early. Upon dismissal, several of the teaching staff stayed at the school for several hours assisting students with transportation and other needs.

Questionnaire

On January 28, 2002, NIOSH representatives administered a questionnaire to staff at both high schools during school in-service administrative staff meetings. NIOSH personnel discussed the scope of the study, the voluntary nature of participation and confidentiality issues, and answered specific questions about the survey. Cafeteria and maintenance staffs were surveyed separately from the teaching staff to accommodate their schedules.

The primary purpose of the questionnaire survey was to evaluate the prevalence of symptoms (mental health and physical) among the staff of the two high schools. The questionnaire was self-administered and included questions about work duties and location, physical symptoms occurring after September 11, and whether those physical symptoms had improved or gotten worse since then. We asked for selected information on past medical history, and activities related to events on September 11, and the WTC attack.

Definition of Physical Symptoms

The physical symptoms included on the questionnaire (irritation symptoms, upper and lower respiratory symptoms, mucous membrane symptoms, gastrointestinal symptoms) were chosen based on prior NIOSH surveys and on information gathered during informal meetings with workers employed around the WTC site. An affirmative response to 'did you have any of the following symptoms after the WTC disaster on September 11' was defined as having 'symptoms.' 'Persistent symptoms' were defined as either of the following: 1) those with symptoms that existed before September 11 but had worsened since September 11, or 2) those with new onset symptoms since September 11 that had not improved.

Definition of Mental Health Symptoms

The questionnaire also included questions (referred to in this report as mental health symptoms) to assess symptoms associated with depression and symptoms associated with post-traumatic stress disorder¹⁴ (PTSD). The questions related to depression were from the 20-question Center for Epidemiologic Studies Depression Scale (CES-D).¹³ The Center for Epidemiologic Studies of the National Institute of Mental Health developed this short self-reported scale designed to assess symptoms of depression in the general population. It was not originally designed as a scale to evaluate people after a terrorist event. Because of the nature of the WTC terrorist event, and the likelihood that respondents would experience common acute

symptoms that are similar to those found on the depression scale, we chose to narrow our focus to those having major depressive symptoms, and used a cut-off score of 22.

Participants were also asked to respond to questions about having persistent intrusive thoughts, dreams, and vivid reminders about the WTC disaster and whether they were feeling emotionally numb, distant, or cut off from friends. These symptoms and others were used to determine whether respondents were experiencing symptoms that are characteristic of PTSD. The questions related to PTSD were from the Veterans Administration PTSD Checklist¹⁴. It is important to note that the questions we used to assess the symptoms of depression and PTSD are screening instruments, and are not used to individually diagnose any specific medical disorder.

Administration of the Questionnaire

The Management at Stuyvesant High School allowed use of the ground floor auditorium at Stuyvesant High School for the survey. The Federation of Teachers and the school management were asked to assemble their personnel so that we could seek their participation in the symptom survey. NIOSH staff members explained the purpose of the survey, the time required to complete the questionnaire, and informed each employee about the confidentiality of the individual responses, and that he or she had the right to refrain from answering any or all of the questions. We then distributed questionnaires to each employee present in the auditorium. All of the questionnaires were self-administered with NIOSH personnel available to answer questions. The Cafeteria staff was surveyed in the cafeteria break room separately. A few questionnaires were completed via a translator because of English literacy barriers. Maintenance workers were also separately surveyed in the auditorium.

Data Analysis

Persons who provided an affirmative response to the question “did you have any of the following symptoms after the WTC disaster on September 11” were defined as having “symptoms.” We completed analyses of a subset of symptoms, including comparisons of those with and without symptoms prior to September 11, by high school, those with persistent symptoms, and those whose symptoms had improved. Persistent symptoms were defined as either of the following: 1) symptoms that existed before September 11 but have gotten worse since September 11 or 2) new onset of symptoms since September 11 that have not gotten better.

Criteria used previously in the interpretation of the CES Depression Scale include a score of 22 or more (out of a total possible score of 56) as a measure of depression.¹⁵ Possible responses included “rarely = (0), sometimes = (1); often = (2), and always = (3).” Persons who provided an affirmative response (defined as an answer of “moderately,” “quite a bit,” or “extremely”) to those questions defining PTSD from the VA PTSD scale according to Diagnostic and Statistical Manual (DSM)-IV¹⁸ criteria were defined as exhibiting “PTSD symptoms.”

The prevalences of reported symptoms (including irritation symptoms, upper and lower respiratory symptoms, mucous membrane symptoms, gastrointestinal symptoms, referred to in this report as physical symptoms) were compared between the Stuyvesant staff and the La Guardia staff. The comparison was done by assessing the prevalence ratio (PR). The PR represents the prevalence of the symptom in the Stuyvesant staff relative to the prevalence in the La Guardia staff. A PR of 1.0 means there is no difference in symptom/illness prevalence between the schools. A PR of greater than one indicates prevalence is greater at Stuyvesant High School. For example, a PR of 2.0 would mean that a person in the Stuyvesant group is two times more likely to have reported the symptom than a person in the La Guardia group. A 95% confidence interval (95% CI) that excluded one was considered to indicate a statistically significant finding.

Results

Walk-through Characterization

Walk-through evaluations were conducted at both high schools to complete the building inspection checklists for each at approximately the same time as the health symptom survey of the workers was performed. The walk-through evaluations of La Guardia and Stuyvesant High Schools were conducted on January 28 and 29, 2002, respectively. During these evaluations, a variety of environmental factors were noted as previously described in the Methods section of this report.

Both high school buildings had central air-conditioning with ventilation systems of a similar design, and neither had been involved in significant IEQ health investigations within the previous five years. Both high school buildings were well-maintained and clean. The two major environmental differences were (1) La Guardia High School had evidence of some chronic but minor water leakage around several of the perimeter classroom windows, and (2) the interiors of the central ventilation systems serving La Guardia High School were slightly dirtier than those serving Stuyvesant High School. This latter finding can be attributed to the difference in the age of the two schools (18 years for La Guardia High School and 10 years for Stuyvesant High School).

Questionnaire

Two hundred twenty-four Stuyvesant High School employees completed the questionnaire (83% of the 271 employees present on the day of the survey); 155 La Guardia High School employees completed the questionnaire (82% of the 191 present on the day of the survey). Because the La Guardia cafeteria and security staff were not surveyed until March 19, 2002 (89% of 19 participated), their results have not been included in this report.

Participants by school and job category are noted in Table 1. At both Stuyvesant and La Guardia, teachers and maintenance personnel were the two largest groups of participants. Other characteristics of the two groups of participants are presented in Table 2. Of note, the groups were similar in terms of age, gender, race, education, and current cigarette smoking.

To evaluate the potential role of workplace exposure versus residential proximity, the survey included a question concerning zip code of residence. Among the Stuyvesant staff, 16 persons (7% of the 224) reported living in lower Manhattan (defined by a northern boundary of zip codes 10013 and 10002, approximately corresponding to Charlton St. and Broome St.); 5 (3%) of the La Guardia staff reported living in lower Manhattan. Because of the low numbers of survey participants living in lower Manhattan, further analysis of the data based on location of residence was not performed.

Medical History

Information on past medical history (Table 3) indicated that prevalence of asthma and other respiratory conditions prior to September 11 was similar among the two High School staffs. Twelve (6%) Stuyvesant employees and three (2%) La Guardia employees were diagnosed with depression or mood disorder by a physician and 14 (7%) of the Stuyvesant and two (1%) of the La Guardia employees were diagnosed with PTSD by a physician after September 11, both of which were statistically significantly different. There were three new cases of asthma, six cases of bronchitis, and nine cases of allergies among the Stuyvesant participants; one case of asthma, one case of bronchitis, and one case of allergy at La Guardia. There were no significant differences between Stuyvesant and La Guardia employees in the proportion of persons seeing a physician or being prescribed medications or having lost work days since September 11.

Physical Symptoms after September 11, 2001

Table 4 shows the prevalence rates for those reporting symptoms since September 11 and the prevalence rate ratios for symptoms after September 11, comparing Stuyvesant to La Guardia staff. It also includes prevalence for those reporting new symptoms since September 11. For the Stuyvesant staff, nose/throat irritation, cough, eye irritation, and headache were the symptoms reported most frequently. Headache, congestion, nose/throat irritation, cough, and eye irritation were the symptoms most frequently reported by La Guardia participants (38%, 45%). The majority of the participants had no history of symptoms prior to September 11.

Persistent symptoms (either of the following: 1) those with symptoms that existed before September 11 but have gotten worse since September 11; or 2) those with new onset of symptoms since September 11 that have not gotten better) are listed in Table 5. About a fourth of the Stuyvesant staff and less than a fifth of the La Guardia staff continues to have headache, nose/throat irritation, congestion, cough and eye irritation. Table 6 shows that 30% to 45% of those who experienced symptoms after September 11, had improved at the time of our survey. We have found that the majority of them reported improving within days or a few weeks.

Events Associated with September 11, 2001

The majority of the Stuyvesant staff (69%) reported being in the school building when both Tower 2, the South Tower (Table 7), and Tower 1, the North Tower (Table 8), collapsed. Over 15% of the Stuyvesant staff reported that they were in the streets when the towers collapsed. Eighty-four percent of the La Guardia staff were in the school building during the time of collapse, 8% were at home, and 3% were in the streets. One hundred sixty five (93%) of the Stuyvesant staff reported that they left the High School building between 10:00 and 11:00 a.m. Five people left between 9:00 and 10:00 a.m.. Six of the staff reported that they never left the workplace on September 11.

Among Stuyvesant staff, 89 (40%) reported personally witnessing the plane(s) crashing into the building. One hundred eleven (50%) reported witnessing the collapse of the WTC; 76 (34%) witnessed individuals falling or jumping from the burning towers, 10 (4%) saw human remains, and 25 (11%) reported seeing pieces of the plane. Several staff (59 [26%]) reported witnessing other activities associated with the WTC disaster, mainly observing the clouds of dust, people fleeing the area, and the smoke and fire from the burning buildings. Sixty-seven of the 214 (31%) Stuyvesant staff members reported knowing someone who was injured or killed during the attack; 59 of the 143 (41%) La Guardia staff members reported knowing a victim. Thirty-two (14%) persons reported participating in rescue/recovery efforts after the WTC attack from Stuyvesant; five persons (3%) from La Guardia participated.

Dust Cloud from the Collapse of the Towers

Ten (5%) of the Stuyvesant staff and none of the La Guardia staff members reported that they were in the dust cloud (generated from the collapse of the towers) so thick that they could not see in front of them. Twenty-nine (14%) Stuyvesant employees and 3 (2%) La Guardia staff members reported that they were in the dust cloud but it did not prevent them from seeing where they were going. Eighty-eight (41%) of the Stuyvesant staff members and 19 (13%) of the La Guardia staff members could see the dust cloud but they were not directly in it.

Odors

Among Stuyvesant staff members, 182 (81%) reported smelling odors from the burning rubble pile. Stuyvesant staff members were more likely than La Guardia staff members to report smelling this burning odor while at work (PR=4.8, 95% CI [3.4 -6.9]). La Guardia staff members, on the other hand, were more

likely to report other odors at the workplace, such as chemicals, Freon, and anti-freeze (PR= 5.0, 95% [CI 2.38, 5.88]).

Mental Health Symptoms

Seventy (33%) of the Stuyvesant staff and 26 (18%) of the La Guardia staff had major depressive symptoms; forty-nine (23%) of the Stuyvesant staff and 9 (6%) of the La Guardia staff had symptoms consistent with PTSD. Forty-five (46%) of those participants who fulfilled the criteria for major depressive symptoms also fulfilled our criteria for PTSD symptoms. Table 10 presents the number and percentage of participants from Stuyvesant and La Guardia meeting our definitions of major depression or PTSD symptoms within the week prior to the survey. Stuyvesant staff were more likely than La Guardia staff to experience major depression symptoms (PR 1.9, 95% CI [1.3, 2.8]) and PTSD symptoms (PR 3.8, 95% CI [2.9, 7.5]). Neither gender, race/ethnicity (white versus non-white or Hispanic versus non-Hispanic), nor education level (high school education or less versus at least some college) was significantly associated with depression and PTSD symptoms (Table 11).

In the questionnaire, participants were asked to describe perceived levels of social support from their fellow workers, relatives, and coworkers. The responses from these three categories were combined into one overall measure of social support, which considers whether a person has someone to talk with about problems, someone who does things to help, or someone to go to when things get tough. Stuyvesant staff members who reported high social support were less likely to report symptoms consistent with major depression. Conversely, Stuyvesant staff members who reported lower social support were nearly twice as likely to report symptoms consistent with major depression (PR=2.3, 95% CI [1.6, 3.4]) and PTSD symptoms (2.19 [1.2, 3.6]) (Table 11).

Discussion

We found that physical symptoms (including eye, nose, and throat irritation, cough, and shortness of breath) and mental health symptoms (depression and PTSD) were more prevalent among Stuyvesant High School staff than the La Guardia High School Staff.

Physical Symptoms

Stuyvesant staff had a significantly higher prevalence of symptoms related to irritation of the eye and upper and lower respiratory tracts occurring in the 4 weeks prior to and after September 11, compared to the staff at La Guardia. These symptoms were reported by more than 40% of participants at Stuyvesant. Additionally, 10%-30% of the Stuyvesant staff reported that those symptoms persisted after September 11. Five to eighteen percent of the La Guardia staff reported the persistence of similar symptoms during this time period.

Our questionnaire also assessed physician visits and prescribed medications as measures of symptom severity. Neither of these measures differed between Stuyvesant and La Guardia staff. However after September 11, a large percentage of staff from both schools sought medical care with a physician, 41% from Stuyvesant and 33% from La Guardia.

Other investigations carried out around the WTC site may be useful in examining the breadth of symptoms that study groups experienced. In the study carried out in October 2001 by the New York City Department of Health (NYCDOH) HealthWorks Department¹⁶ approximately 50% of those surveyed at the end of October 2001 continued to experience physical symptoms, especially eye and upper airway irritation. The NYCDOH study was a door-to-door survey of 414 individuals and focus groups of residents from apartments in lower Manhattan who had occupied their homes following the WTC disaster.

Mental Health Symptoms

Seventy (33%) of the Stuyvesant staff and 26 (18%) of the La Guardia staff had symptoms of major depression. Forty-eight (22%) of the Stuyvesant staff and 8 (5%) of the La Guardia staff had symptoms of PTSD. Forty-five of these had both major depression and PTSD symptoms.

The NIOSH survey was conducted 10 weeks after the September 11 attacks. Results showed the prevalence of depression among the Stuyvesant staff (33%) to be twice as high as that found in the survey conducted 5 to 8 weeks after the WTC disaster of adults living below Canal Street (16.8%).¹⁷ The authors of that study used a structured clinical interview from DSM-IV¹⁸ to diagnose depressive episodes, whereas we used the CES-D¹³ scale for a symptom case definition of depression prevalence. Although our analysis has not controlled for potential confounding factors (e.g., age, previous mental health history), our results show that predictors of depression are lower social support, knowing someone who was seriously injured or loss of friends or a loved one, and witnessing the terrorist events (Table 11). These factors have been found in other studies.^{19,20}

The rates for PTSD symptoms among the Stuyvesant staff (22%) were similar to those found by Galea et al.¹⁷ in adults living below Canal Street (20%) who were present right after September 11, using similar case definitions. In the NYCDOH Health Works study¹⁶ of residents of lower Manhattan in October 2001, nearly 50% had symptoms at that time suggestive of PTSD. With univariate analysis, we found that the prevalence of PTSD was higher among persons who were directly exposed to the attacks or their consequences (those who were closest to the attacks, having a friend or relative killed, and having low social support). This is consistent with other studies, which have found predictors of PTSD to include being closer to an attack site, being injured, or knowing someone who was killed or injured.⁴

No statistical difference was found between men or women in the frequency of symptoms of depression or PTSD at either Stuyvesant or La Guardia, a finding that is not consistent with the results of most studies looking at gender and depression and PTSD.^{19,20,21}

Counseling

Of those who scored high on the depression and PTSD scales, about 40% reported they would not benefit from additional supportive counseling, suggesting that some individuals at the two high schools who have experienced significant mental health symptoms do not recognize their need for counseling. As time passes, it is likely that these individuals will be even less likely to consider counseling at a time when it may be beneficial. Individuals may have the impression that they should be able to cope alone because time has put some distance between themselves and the tragic events.

Our interviews with the psychologist at Stuyvesant High School and the UFT representatives revealed that beginning 2 weeks after September 11, counseling services were offered to Stuyvesant staff. Staff members were offered individual sessions or group sessions both upon request and on a drop-in basis. A psychologist was available at Stuyvesant for students and staff several times a week. A partnership with the Jewish Board of Children and Family Services and Stuyvesant High School was developed through a grant from the NYC Board of Education. This partnership offered training sessions for the staff to identify trauma and at-risk behavior in students and staff at work, so that they could be directed to counseling services. It is essential for the high school staff dealing with mental health issues to recognize problems, to respond sensitively, to know what resources exist, and to make proper referrals and/or to address problems effectively themselves. Alternative therapy sessions were also offered at Stuyvesant, consisting of relaxation techniques, yoga, massage, poetry, and music therapy. Initially, counseling services were sought out by the staff, however, there has been much less use of counseling services as time has passed according to the school psychologist.

General Indoor Environmental Quality

Our evaluation of the two high school buildings indicated that both high schools were environmentally quite similar and would not be expected to have a significant difference in occupant reporting of the most common building-related health symptoms. However, during our visit to La Guardia, there were concerns voiced to us regarding the general IEQ in the La Guardia high school building that were unrelated to events of September 11. Table 12 compares the La Guardia and Stuyvesant Staff's symptom prevalence in the four weeks prior to the survey to results obtained during a 1996 NIOSH IEQ Symptom Survey in School Buildings.²² All of the symptom prevalences from La Guardia are within the ranges found in the general IEQ Symptom Survey in School Buildings. These were schools that had requested that NIOSH evaluate conditions because of health concerns similar to those voiced during our visit to La Guardia.

Published studies from NIOSH investigators and others have reported on issues related to occupational exposures and symptoms of employees in office buildings.^{23,24,25,26,27} Scientists investigating indoor environmental problems believe that multiple factors may contribute to building-related occupant complaints.^{28,29} Among these factors are imprecisely defined characteristics of heating, ventilation and air conditioning (HVAC) systems, cumulative effects of exposure to low concentrations of multiple chemical pollutants, odors, elevated concentrations of particulate matter, microbiological contamination, and physical factors such as thermal comfort, lighting, and noise.^{30,31,32,33} Design, maintenance, and operation of HVAC systems are critical to their proper functioning and provision of healthy and thermally comfortable indoor environments.

Occupant perceptions of the indoor environment often are more closely related to the occurrence of symptoms than the measurement of any indoor contaminant or condition.³¹ Some studies have shown that besides the issues mentioned above, relationships between the psychological, social, and organizational factors in the workplace may also affect the occurrence of symptoms and comfort complaints.^{32,33}

Conclusions

At four and a half months after the September 11, 2001 terrorist attacks, we found a substantial burden of symptoms of depression and PTSD, as well as physical symptoms of eye irritation, upper airway irritation, and indigestion among the staff at Stuyvesant High School. We observed that both physical and mental health symptoms were more prevalent among the Stuyvesant staff than among the La Guardia staff.

The persistence of symptoms in certain individuals over the 4-month period may be due to several factors including differences in the initial exposure, individual susceptibility, existing medical conditions, and factors related to social support and stress. It is also known that certain environmental contaminants (including visible dust and noticeable odors present in lower Manhattan after the WTC attacks) were present in the areas around Stuyvesant High School after the September 11 attacks, which can exacerbate symptoms as well. The odors from the WTC fires were also noticeable over much of Manhattan until after December 19, 2001, when the fires at the WTC were extinguished.

The long-term health effects among residents and workers in lower Manhattan related to exposure to environmental contaminants from the WTC attacks is uncertain. Published reports from several studies have subsequently described physical^{1,2,3,4,5} and psychological^{9,10,11} health effects among rescue workers, office workers, and residents from the surrounding community. Continued longitudinal follow-up of those exposed will be necessary to determine whether the changes will lead to chronic problems or recovery. Ongoing interventions may help prevent the development of long-lasting sequelae.

Recommendations

The information in this report is not a substitute for direct medical or psychological care. While this report contains descriptions of physical and mental health symptom findings, this information is not to be used as a diagnosis of individual mental health or physical problems. Diagnosis must be done with consulting a qualified health care/mental health provider. Participants are advised to consult their health care/mental health providers about their personal questions or concerns for on-going treatment.

- The NYC Board of Education, the Unions (UFT and AFSCME), and the school management of both high schools should continue efforts to address employee concerns resulting from events of the September 11, disaster at the WTC. Specific actions recommended are as follows:
 - Employees with work-related health concerns should be encouraged to see the appropriate health care providers. The health care provider should maintain a log of symptoms, but insure the privacy of those reported. This log should be used for surveillance of injuries and illnesses and reviewed to identify group trends over time.
 - The adequacy of current counseling services should be assessed, and the availability of an adequate level of counseling for employees should be maintained.
 - Counseling services should continue to seek out those who are vulnerable to depression and PTSD, i.e., those who lost a loved one or friend, those who do not have a social network that they can confide in, and those who witnessed the attacks.
 - Training should continue for managers and supervisory personnel at all levels to insure that each group (within the Board of Education, unions, and school management) is responding appropriately to health and safety concerns of employees. As part of this training, issues at the organizational level should be evaluated to determine whether improvements can be made to address widespread concern among employees concerning health, safety, and security issues.
 - Public and private agencies have an obligation to facilitate the use of counseling services. The UFT, AFSCME, the School Board, and the high schools involved should meet to discuss counseling services available to the complete staff at the schools.
- Communication between the NYC School Board, the unions, and employees should be improved to facilitate the exchange of concerns about environmental conditions and security issues in the buildings. A health and safety committee with employee staff and managers should facilitate these communication efforts. We would like to recognize the efforts at Stuyvesant and the on-site staff and management in keeping the staff informed and aware of activities related to the WTC disaster response.
- It would be valuable to evaluate and provide more opportunities at work for social support of the school staff.
- The information provided on general IEQ with this report should be used to address work environment issues as they arise. This information should be provided to the maintenance staff responsible for maintaining the building and any person responsible for the health and safety at the high school buildings. References regarding a written program to deal with IEQ issues include the “Tools for Schools”³⁴ and the “Building Air Quality Action Plan.”³⁵ These documents contain some of the best practical advice available regarding the prevention, evaluation, and correction of IEQ problems.

Table 1
Job Titles of Survey Participants
HETA 2002-0096-3028
Stuyvesant and La Guardia High Schools

Job Title	Stuyvesant High School	La Guardia High School
Teacher	142	101
Maintenance and Equipment	21	18
Civil service (health aide, nurse, dietician, cafeteria staff)	17	1*
Administrator (Principal, Asst. Principal)	12	8
School Secretary	9	6
School Aide	9	11
Counselor	6	6
School Safety Officer	4	0
Other	2	1
Missing	2	3
Total	224	155

* La Guardia staff who participated March 19, 2002 are not included.

Table 2
Description of Survey Participants
HETA 2002-0096-3028
Stuyvesant and La Guardia High Schools

Location	Number	Female (Number and Percent)	Mean Age (Years)	Graduate Degrees (Number and Percent)	Race (Number and Percent)				Current Smokers (Number and Percent)
					White	Asian	Black	Hispanic	
Stuyvesant	224	107 (49%)	48	142 (65%)	151 (71%)	11 (5%)	25 (12%)	28 (13%)	27 (13%)
La Guardia	155	88 (58%)	47	109 (73%)	101 (71%)	5 (4%)	15 (11%)	13 (9%)	16 (11%)

Table 3
Pre-Existing and New Medical Diagnoses
HETA 2002-0096-3028
Stuyvesant and La Guardia High Schools

Medical Conditions	Stuyvesant		La Guardia	
	With Medical Conditions Prior to September 11 (Number and Percent)	New Diagnoses After September 11 (Number and Percent)	With Medical Conditions Prior to September 11 (Number and Percent)	New Diagnoses After September 11 (Number and Percent)
Allergies	83 (39%)	9 (4%)	59 (39%)	1 (1%)
Asthma	18 (8%)	3 (1%)	15 (10%)	1 (1%)
Chronic Obstructive Pulmonary Disease	3 (1%)	0 (0%)	1 (7%)	0 (0%)
Emphysema	2 (1%)	1 (1%)	0 (0%)	0 (0%)
Chronic Bronchitis	5 (2%)	6 (3%)	8 (5%)	1 (1%)
Heart Disease	14 (7%)	0 (0%)	3 (2%)	0 (0%)
Gastroesophageal Reflux Disorder or Hiatal Hernia	23 (1%)	8 (4%)	13 (9%)	1 (1%)
Depression or Mood Disorder	18 (8%)	12 (6%)	13 (9%)	3 (2%)
Anxiety Disorder	16 (8%)	8 (4%)	10 (7%)	1 (1%)
Post Traumatic Stress Disorder	3 (1%)	14 (7%)	4 (3%)	2 (1%)
Multiple Chemical Sensitivity Disorder	2 (1%)	6 (3%)	3 (2%)	1 (1%)

Table 4
Physical Symptoms After September 11
HETA 2002-0096-3028
Stuyvesant and La Guardia High Schools

Symptom	Stuyvesant		La Guardia		Prevalence Ratio and [95% Confidence Interval] of Symptoms after September 11 (Stuyvesant/La Guardia)
	Symptoms after September 11 (Number and Percent)	Symptoms after September 11 and no History of Symptoms Prior to September 11 (Number and Percent)	Symptoms after September 11 (Number and Percent)	Symptoms after September 11 and no History of Symptoms Prior to September 11 (Number and Percent)	
Nose/throat irritation	136 (65%)	106 (50%)	57 (39%)	33 (23%)	1.6 [1.3, 2.1]
Congestion	98 (47%)	57 (27%)	60 (41%)	21 (14%)	1.2 [0.9, 1.5]
Cough, any kind	138 (63%)	101 (46%)	57 (38%)	32 (21%)	1.7 [1.3, 2.1]
Eye irritation	128 (59%)	96 (44%)	57 (38%)	27 (18%)	1.6 [1.2, 2.0]
Headache	119 (56%)	72 (34%)	67 (45%)	35 (24%)	1.2 [0.99, 1.5]
Shortness of breath	75 (35%)	54 (25%)	31 (21%)	18 (12%)	1.7 [1.2, 2.4]
Chest tightness	59 (28%)	48 (23%)	28 (19%)	16 (11%)	1.5 [0.9, 2.2]
Indigestion	65 (30%)	29 (13%)	32 (22%)	7 (5%)	1.4 [0.9, 2.0]
Wheeze	42 (20%)	32 (15%)	21 (14%)	10 (7%)	1.4 [0.9, 2.3]
Skin irritation	50 (23%)	35 (16%)	27 (18%)	13 (9%)	1.3 [0.8, 1.9]
Cough with Phlegm	77 (36%)	57 (27%)	33 (22%)	20 (13%)	1.6 [1.1, 2.3]
Nausea	40 (19%)	31 (14%)	16 (11%)	13 (9%)	1.7 [0.99, 2.9]
Diarrhea	45 (21%)	27 (13%)	19 (13%)	7 (5%)	1.6 [0.9, 2.7]

Table 5
Stuyvesant and La Guardia High School Staff
Persistent Physical Symptoms After September 11
HETA 2002-00963028

Symptom	Stuyvesant	La Guardia	Prevalence Ratio Stuyvesant/ La Guardia
	Persistent Symptoms since September 11*	Persistent Symptoms since September 11*	
Nose/throat irritation	65 (31%)	25 (17%)	1.8 [1.2, 2.7]
Congestion	55 (26%)	23 (16%)	1.7 [1.1, 2.6]
Cough, any kind	59 (27%)	15 (10%)	2.7 [1.6, 4.6]
Eye irritation	62 (22%)	22 (15%)	1.95 [1.3, 3.0]
Headache	57 (27%)	27 (18%)	1.5 [0.9, 2.2]
Shortness of breath	40 (19%)	10 (7%)	2.8 [1.4, 5.4]
Chest tightness	30 (14%)	6 (4%)	3.5 [1.5, 8.1]
Indigestion	27 (13%)	10 (7%)	1.8 [0.9, 3.7]
Wheeze	24 (11%)	4 (3%)	4.2 [1.5, 11.9]
Skin irritation	21 (10%)	11 (7%)	1.3 [0.7, 2.6]
Cough with phlegm	38 (18%)	11 (7%)	2.4 [1.3, 4.5]
Nausea	17 (8%)	6 (4%)	1.9 [0.7, 4.8]
Diarrhea	10 (5%)	11 (7%)	0.6 [0.2, 1.4]

*Those reporting “yes” to symptoms after September 11 and “yes” to either symptom before September 11 with worsening, or new onset of symptoms with no change or worsening. Excludes those with pre-existing symptoms who reported “no change” since September 11.

Table 6
Stuyvesant High School Staff
Improvement of Physical Symptoms after September 11
HETA 2002-0096-3028

Stuyvesant	
Physical Symptom	Symptoms Improved since September 11 (Number and Percent)
Nose/throat irritation	55 (45%)
Congestion	23 (26%)
Cough	57 (44%)
Eye irritation	42 (38%)
Headache	30 (29%)
Shortness of breath	23 (33%)
Chest tightness	19 (35%)
Indigestion	13 (23%)
Wheeze	14 (36%)
Skin irritation	16 (34%)
Cough with phlegm	31 (41%)
Nausea	16 (44%)
Diarrhea	22 (54%)

Table 7
Location when the WTC Tower 2 (South Tower) Collapsed on September 11
HETA 2002-0096-3028
Stuyvesant and La Guardia High Schools

Location when Tower 2 Collapsed	Stuyvesant	La Guardia
My Building	152 (69%)	126 (85%)
Other Building	2 (1%)	1 (1%)
Streets	42 (19%)	3 (2%)
Car, Bus, Train, Ferry	2 (1%)	2 (1%)
Home	13 (6%)	12 (8%)
Other	8 (4%)	5 (3%)

Table 8
Location when the WTC Tower 1 (North Tower) Collapsed on September 11
HETA 2002-0096-3028
Stuyvesant and La Guardia High Schools

Location when Tower 1 Collapsed	Stuyvesant	La Guardia
My Building	159 (72%)	127 (84%)
Other Building	1 (0.5%)	1 (1%)
Streets	32 (15%)	4 (3%)
Car, Bus, Train, Ferry	4 (2%)	2 (1%)
Home	15 (7%)	12 (8%)
Other	9 (4%)	5 (3%)

Table 9
Depression Symptoms by High School
HETA 2002-0096-3028
Stuyvesant and La Guardia High Schools

Stuyvesant	La Guardia	
Depression Symptoms *	Depression Symptoms*	Prevalence Ratio [95% CI]
72 (34)	26 (18)	1.9 [1.3, 2.8]

*Depression symptoms were defined as a score of 22 or more in the questionnaire taken from the modified CES-D scale.

Table 10
Post Traumatic Stress Disorder Symptoms by High School
HETA 2002-0096
Stuyvesant and La Guardia High Schools

Stuyvesant	La Guardia	
Stuyvesant Staff with Post Traumatic Stress Disorder Symptoms *	La Guardia Staff with Post Traumatic Stress Disorder Symptoms *	Prevalence Ratio [95% CI]
49 (23)	9 (6)	3.8 [2.9, 7.5]

* A participant with “post traumatic stress syndrome” was defined as a person who provided an affirmative response (defined as an answer of “moderately,” “quite a bit,” or “extremely”) to those questions defining PTSD according to DSM-IV¹⁸ criteria.

Table 11
Prevalence of Mental Health Symptoms Among Stuyvesant
Participants by Selected Characteristics
HETA 2002-0096-3028
Stuyvesant and La Guardia High Schools

Stuyvesant					
Variable		Depression Symptoms* (Number and Percent)	Prevalence Ratio (95% CI)	Post Traumatic Stress Disorder Symptoms† (Number and Percent)	Prevalence Ratio (95% CI)
Gender	Female	35 (33%)	1.0 (0.7, 1.4)	25 (23%)	1.1 (0.6, 1.7)
	Male	37 (35%)		24 (22%)	
Race: White	Yes	46 (32%)	1.2 (0.8, 1.8)	29 (20%)	1.5 (0.9, 2.5)
	No	22 (37%)		18 (30%)	
Race: Hispanic	Yes	10 (37%)	1.1 (0.7, 1.9)	7 (26%)	1.1 (0.6, 2.3)
	No	58 (33%)		41 (23%)	
Know Victim‡	Yes	30 (46%)	1.7 (1.2, 2.4)	23 (34%)	2.0 (1.2, 3.3)
	No	40 (27%)		25 (17%)	
Social Support§	Low	31 (23%)	2.3 (1.6, 3.4)	25 (36%)	2.19 (1.3, 3.6)
	High	36 (53%)		22 (16%)	

*Depression symptoms were defined as a score of 22 or more (out of a total possible score of 56) for the 19 questions in the questionnaire taken from the modified CES-D scale.

†A participant with “post traumatic stress symptoms” was defined as a person who provided an affirmative response (defined as an answer of “moderately,” “quite a bit,” or “extremely”) to those questions defining PTSD according to DSM-IV¹⁸ criteria.

‡A response to the question “Did you know anyone who was seriously injured or killed during the attack?”

§An overall measure of social support combining three categories of support from friends, relatives, and coworkers

Table 12
Physical Symptoms Experienced in Prior 4 Weeks
Compared to Physical Symptom Prevalence in School Buildings
from NIOSH Indoor Air Quality Symptom Survey, 1996
HETA 2002-0096-3028, Stuyvesant and La Guardia High Schools

Symptom	Stuyvesant	La Guardia	NIOSH IEQ Symptom Survey in School Buildings, 1996
	Symptoms 1-3 days per week in last 4 weeks, or every or almost every workday (Number and Percent)	Symptoms 1-3 days per week in last 4 weeks, or every or almost every workday (Number and Percent)	Symptoms 1-3 days per week in last 4 weeks, or every or almost every workday (Prevalence and range)
Nose/throat irritation	109 (51%)	41 (28%)	24% (6-43 %)
Congestion	100 (47%)	49 (33%)	41% (28-56 %)
Cough	76 (36%)	25 (17%)	20% (10-38 %)
Eye irritation	87 (41%)	37 (25%)	36% (15-54 %)
Headache	60 (28%)	37 (25%)	32% (12-54 %)
Shortness of breath	46 (22%)	18 (12%)	7% (0-26 %)
Chest tightness	38 (19%)	18 (12%)	9% (0-30 %)
Indigestion	35 (17%)	13 (9%)	--
Wheeze	33 (16%)	17 (11%)	7% (0-16 %)
Skin irritation	29 (14%)	15 (10%)	25% (6-41%)
Phlegm	13 (7%)	10 (7%)	--
Nausea	20 (10%)	8(5%)	10% (0-23 %)

OFFICE OF THE ATTORNEY GENERAL AND THE LEFRAK BUILDING

Background

On January 1, 2002, NIOSH received a health hazard evaluation (HHE) request from District Council 37 of the American Federation of State, County and Municipal Employees (AFSCME), Public Employees Federation (PEF), and the Communications Workers of America (CWA) asking for assistance in documenting the extent of physical and mental health problems subsequent to the attack on the World Trade Center (WTC) on September 11, 2001, among their staff of office workers at 120 Broadway. To document these concerns at the sites around the WTC, NIOSH investigators administered a questionnaire survey at 120 Broadway, as well as a comparison site not proximal to the WTC. New York City Department of Environmental Protection workers at the Lefrak building in Queens were selected as the comparison population.

Methods

Selection of Sites for the HHE

The office building at 120 Broadway is located approximately two blocks east of the WTC site. This 40-story building houses a variety of businesses, governmental offices, and programs. The Manhattan offices of the New York State Office of the Attorney General (OAG) occupied eight floors of this building on September 11, 2001. The OAG occupied nine floors of the 120 Broadway Building when the questionnaire was administered in June 2002.

The comparison site, the Lefrak Building in Queens, is located approximately 20 miles from the WTC site and is one of the main office buildings for the New York City Department of Environmental Protection. This comparison site was selected because 1) it is a similar office structure, 2) the range of jobs and tasks are comparable to those at 40 Rector Street, and 3) the building and its occupants were not involved in the direct attack at the WTC.

On September 11, 2001, State workers at the Office of the Attorney General became aware of the attack on the WTC by various means; many of the workers on upper floors of the building had direct views of the Trade Center towers from their offices and conference rooms. Debris from the WTC was scattered about the streets surrounding 120 Broadway. Employees were asked to evacuate the building at 9:15 a.m., some reported that they did not leave the building until after 4:00 p.m. that day. Escape routes were limited; public transportation was disrupted and streets were blocked by emergency personnel. Options available for evacuation were south and east where workers could board the Staten Island Ferry or walk across the Brooklyn Bridge or walk north and east away from the WTC site.

The building remained closed from September 11, 2001 until September 20, 2001, when employees were asked to return to work on a voluntary basis. All employees were required to report back to work on October 4, 2001.

Workers at the comparison office building were not evacuated from their worksite, and workers left for home at various times throughout the day. Work resumed at DEP the following day.

Questionnaire

The purpose of the questionnaire was to obtain information for evaluating the prevalence of symptoms (mental health and physical) among office workers at both work sites. The questionnaire was self-administered and included questions about work duties and location, symptoms occurring after September 11, and whether those physical symptoms had improved or gotten worse since then. We asked selected information on past medical history and activities related to events on September 11. We also asked about mental health symptoms associated with depression and PTSD. It is important to note that the questions we used to assess the symptoms of physical and mental health problems are screening instruments designed for epidemiologic purposes, and are not used to individually diagnose any specific medical disorder. Only a competent health care professional who has completed a thorough clinical evaluation can make a reliable clinical diagnosis.

Definition of Physical Symptoms

The physical symptoms included on the questionnaire (irritation symptoms, upper and lower respiratory symptoms, mucous membrane symptoms, gastrointestinal symptoms) were chosen based on prior NIOSH surveys and on information gathered during informal meetings with workers employed around the WTC site. An affirmative response to 'did you have any of the following symptoms after the WTC disaster on September 11' was defined as having 'symptoms.' 'Persistent symptoms' were defined as either of the following: 1) those with symptoms that existed before September 11 but had worsened since September 11, or 2) those with new onset symptoms since September 11 that had not improved.

Definition of Mental Health Symptoms

The questionnaire also included questions to assess symptoms of depression and post-traumatic stress disorder (PTSD). The questions related to depression were from the 20-question Center for Epidemiologic Studies Depression Scale (CES-D)¹³. The Center for Epidemiologic Studies of the National Institute of Mental Health developed this short self-reported scale to assess symptoms of depression in the general population. Because of the nature of the WTC disaster, and the likelihood that respondents would be experiencing common acute symptoms that are found on the depression scale, we chose to narrow our focus to those having major depressive symptoms, which are defined as those scoring 22 or higher out of a possible 60 points.

Participants were also asked to respond to questions about having persistent intrusive thoughts, dreams, and vivid reminders about the WTC disaster and whether they were feeling emotionally numb, distant or cut off from friends. These symptoms and others were used to determine whether respondents were experiencing symptoms that are characteristic of PTSD. The questions related to PTSD were from the Veterans Administration PTSD Checklist¹⁴. We used the officially accepted criteria for a diagnosis of PTSD as developed by the American Psychiatric Association in the Diagnostic and Statistical Manual of Mental Disorders¹⁸ (DSM-IV) to define those individuals with symptoms consistent with PTSD.

Administration of the Questionnaire

The Attorney General's office employs approximately 1000 workers on nine floors at 120 Broadway, in Manhattan. Because of the number of employees at this site, the Assistant Attorney General in charge of Operations asked that we sample the workforce rather than survey the entire group. We developed a simplified sampling plan that required each floor to be divided into quadrants. We then randomly selected (without replacement) one quadrant for each floor. This sampling plan ensured that each quadrant was equally represented when the questionnaire was completed.

Once quadrants were selected, managers were asked to assemble their personnel so that we could seek their participation in the symptom survey. NIOSH staff members explained the purpose of the survey, the time required to complete the questionnaire, and informed each employee that he or she had the right to refrain from answering any or all of the questions. We then distributed questionnaires to each employee present at the meetings. We asked those who did not wish to participate to write 'do not wish to participate' across the top sheet of the questionnaire and return it in a sealed envelope to the central collection where we collected all questionnaires.

Participants had the option to complete the questionnaire in the meeting room or return to their desks.

Data Analysis

A comparison of symptom rates between office workers at 120 Broadway and at the DEP's Lefrak building in Queens appears below. This report describes reported symptoms, medical conditions diagnosed by a physician since September 11, 2001, and reported time off work. The prevalences of reported symptoms (including irritation symptoms, upper and lower respiratory symptoms, mucous membrane symptoms, gastrointestinal symptoms) referred to in this report as physical symptoms) were compared between the office workers at 120 Broadway and at the DEP's Lefrak building in Queens. The comparison was done by assessing the prevalence ratio (PR).

Results

One hundred and sixty-six (166) employees at 120 Broadway completed the questionnaire for a participation rate of approximately 37%. Seventy-nine (79) DEP employees at three locations in the Lefrak building completed the questionnaire for a participation of 76%.

We examined a number of characteristics such as sex, age, years employed at the job, etc. to determine the similarity between the study population and the comparison population. Ideally, the distribution of these descriptive characteristics should be similar in each, thereby leaving the exposure potential as the only distinguishing characteristic of the study population. Our comparison of key characteristics of age, job tenure, and sex shows that OAG and DEP participants were similar with regard to age and sex distribution. OAG participants had worked for the State an average of 10 years compared to 15 years for DEP workers. In addition, 71% of the OAG participants reported their race as white compared to 44% of DEP workers.

Results indicate 54% of the OAG participants and 38% of the DEP participants knew someone who was injured or killed at the WTC collapse. 120 Broadway workers were three times more likely to have witnessed one or more of the planes crashing into the WTC, and seven times more likely to have seen persons falling or jumping from the WTC than were DEP participants.

Reports of physical symptoms since September 11

Table 1 shows the list of symptoms included in the questionnaire. Most of the symptoms can be broadly grouped as follows: 1) symptoms of irritation of the nose, throat, eyes, and skin, 2) respiratory problems such as cough, wheezing, shortness of breath, and chest tightness, and 3) gastrointestinal problems such as indigestion, nausea, and diarrhea. Table 1 shows the frequency of respondents who reported experiencing each symptom after September 11 and then the prevalence ratio and 95% confidence interval. This table shows that OAG workers had higher rates of symptoms than DEP workers, and rates of nose, throat and eye irritation; all of the respiratory symptoms (except cough with phlegm); eye irritation, and nose/throat irritation were statistically higher in OAG workers compared to DEP workers.

Reports of persistent symptoms since September 11

In addition to reports of any symptoms after September 11, we were interested in determining the rates of persistent symptoms that had not improved by March when the clean up was almost complete. Table 2 shows the rates of these persistent symptoms. A comparison of Table 1 and Table 2 shows that 50% or more of those reporting any symptoms since September 11 reported that the symptom had improved by June 2002. However, OAG employees were still reporting higher prevalence rates of shortness of breath (PR 5.2, 95% CI 1.2, 21.5), cough with phlegm (PR 4.5, 95% CI 1.1, 19.0), nose/throat irritation (PR 2.1, 95% CI 1.1, 4.1) and eye irritation (PR 2.1, 95% CI 1.1, 4.1).

Reports of lost workdays

The questionnaire asked whether the workers had lost time from work because of any of the symptoms listed in Tables 1 and 2. Workers at the OAG reported a slightly higher percentage of employees losing time from work (33%) compared to workers at DEP (28%); however, this difference was not statistically significant.

Reports of symptoms consistent with depression and PTSD

Table 3 provides the rates for symptoms consistent with major depression and PTSD. This table shows that 15% of OAG workers and 19% of DEP workers had symptoms meeting criteria for major depression. The rates of symptoms consistent with PTSD were 9% at OAG and 10% at DEP. There was no statistical difference in the rates of major depression symptoms or symptoms consistent with PTSD at either building.

Reports of conditions newly diagnosed by a physician

We asked workers whether a physician had told them they had specific medical conditions and whether those conditions had been diagnosed before or after September 11. Table 4 shows the rates of respondents who were told by a physician *since* September 11 that they had asthma, allergies, depression or PTSD. These rates were calculated based on those workers who had no previous diagnosis of the condition before September 11. This table shows that rates for physician newly diagnosed allergies, asthma, and PTSD were higher among OAG participants than among DEP participants. Rates for physician diagnosed depression or mood disorder were the same in each building (1.3%).

Discussion and Conclusions

Conclusions and recommendations based upon a survey where only 37% of available employees participated must be viewed with considerable caution. Ideally, we would like to see greater than 80% of the workforce participating in a symptom survey. With a high participation rate we can be reasonably certain that those who participated accurately reflected the experiences and condition of the entire study population. When response rates are low, we must be concerned that participants may be different in important ways from non-participants. If the small percentage of participants in this study also had some of the most severe symptoms, then the results from this study might overestimate health problems. Conversely, if those with the most severe symptoms were not at work or were too sick to participate, we would have an uncharacteristically healthy participating group and we might underestimate the magnitude of the problem. Nonetheless, the results reported are consistent with the results and recommendations that have been found and presented in the companion studies of workers in and around ground zero, where participation rates ranged from 70% to 90%. The recommendations made are in part based upon the data collected as well as current general recommendations that are applicable to workers who continue to experience health problems that may be related to the WTC disaster.

The survey carried out on June 6, 2002, at the Office of the Attorney General, 120 Broadway, Manhattan, has shown that the rates of upper respiratory irritation, indicated by nose/throat irritation, cough, and shortness of breath were significantly higher among OAG participants than among DEP participants. These symptoms persisted in some individuals for at least 9 months after the attack on the WTC and may have been due to exposure to complex environmental contaminants (e.g., smoke, respirable airborne particles, fine dust, and fire combustion products) from the collapse of the towers and ensuing fires. An understandable limitation at the time of the collapse of the WTC was the lack of initial environmental exposure assessment, thus, we do not know the scope or extent of exposure at that time. Sampling by NIOSH, between September 18 and October 4, 2002, to evaluate exposures for those working in the rescue and recovery operation found few of the measured substances that exceeded occupational standards.³⁶

Conversely, rates of symptoms consistent with major depression or PTSD at 120 Broadway were indistinguishable from those at the comparison building and lower than those found among City office workers surveyed in April 2002 at 40 Rector Street.

Symptom surveys and interpretations based on frequency data have limitations. Responses to extraordinary traumatic events may provoke a range of reactions, and symptoms alone are not adequate to fully diagnose medical conditions. Following a traumatic event, symptoms that would once be overlooked, may be perceived as more serious and reported as such. Those who continue to experience persistent or recurrent symptoms should be evaluated by a health care professional so that a complete assessment can be made. Further systematic investigations using full clinical diagnostic assessment, though labor and resource intensive, would be useful in sorting out the breadth and scope of illness in those with persistent symptoms.

We found that 15% of the OAG participants and 19% of the DEP participants had symptoms consistent with major depression. In addition, 9% of OAG participants and 10% of DEP staff had symptoms consistent with PTSD. Although the rates of symptoms of depression in both office buildings are higher than national studies that have used the same set of questions (CES-D),³⁷ those populations had not recently experienced a major disaster and may be of limited utility as a comparison. Other studies of the WTC and previous disasters have shown results similar to our findings. A study that evaluated survivors 6 months after the bombing of the Federal Building in Oklahoma City found that 34% met the diagnostic criteria for PTSD.³⁸ Various studies of New York City residents conducted since September 11 have identified elevated rates of symptoms of depression and PTSD and, although they have used a variety of assessment methods, the rates are consistent but slightly higher than we found in these office buildings.^{17,39,40} One large national study found that all New York City respondents had higher rates of symptoms of PTSD compared to other respondents, and those in the WTC or a surrounding building on September 11 had higher rates compared to other New Yorkers.⁶

It is difficult to predict the long-term effect from this disaster on mental health. Many of the symptoms that the office staff is experiencing may be a normal and reversible reaction to a traumatic event. Researchers evaluating the Oklahoma City bombing found that most individuals directly involved did not develop diagnosable psychiatric illness, but the majority reported experiences such as sleep disturbance, feeling emotionally upset afterwards and loss of concentration.⁴¹ However, it is important to encourage workers who continue to experience symptoms to seek professional help.

Published reports from several studies have subsequently described physical^{1,2,3,4,5} and psychological^{9,10,11} health effects among rescue workers, office workers, and residents from the surrounding community. Continued longitudinal follow-up of those exposed will be necessary to determine whether the changes will lead to chronic problems or recovery. On-going interventions may help prevent the development of long-lasting sequelae.

Recommendations

The workplace plays an important role in the health of its workers. One of the ways the workplace can help reduce the burden of illness is by providing a community and a mechanism for social support. Social support from supervisors and coworkers has been shown in repeated studies to buffer the effects of stress.⁴² Therefore, it is essential that management and labor unions continue to develop a supportive community atmosphere that encourages and assists those who continue to experience symptoms to seek care from a competent health care professional. This is equally important at the DEP where employees were likely to know a victim and, like many other New Yorkers, also expressed symptoms associated with depression. Some of the specific ways that this can be accomplished are listed below:

- Those staff members who experience persistent symptoms should be encouraged to seek competent professional medical assistance. Management and union officials should seek mechanisms such as hot line numbers, counseling services, and posters to inform members of available services.
- Free mental health services have been made available by governmental and nongovernmental agencies. Managers should find methods to advertise these services and seek ways to encourage participation when indicated. Many individuals may avoid accessing mental health services because of the stigma associated with mental illness; therefore, every effort should be made to minimize this stigma and to encourage participation.
- Training should continue for managers and supervisory personnel at all levels to insure that each group is responding appropriately to health and safety concerns of employees. As part of this training, issues at the organizational level should be evaluated to determine whether improvements can be made to address widespread concern among employees concerning health, safety, and security issues.
- Develop programs to foster social support on campus to buffer workplace stress. This may be especially important in the period surrounding the anniversary of September 11.

Table 1
Physical Health Symptoms Occurring After September 11, 2001
120 Broadway, Manhattan, and DEP Lefrak Building, Queens
HETA 2002-0101-3028

Have you had any of the following symptoms since the WTC disaster on September 11?	120 Broadway	DEP Lefrak Bldg	Prevalence Ratio 120 Broadway/ Lefrak (95% CI)
	Number and Percent	Number and Percent	
Nose/throat irritation	110 (67%)	28 (37%)	1.8 (1.3, 2.4)
Eye irritation	114 (69%)	34 (44%)	1.6 (1.2, 2.1)
Skin irritation	32 (18%)	13 (17%)	1.1 (0.6, 2.1)
Congestion	72 (45%)	34 (44%)	1.1 (0.8, 1.4)
Cough, any kind	110 (66%)	23 (30%)	2.2 (1.5, 3.2)
Cough with phlegm	54 (34%)	16 (21%)	1.6 (0.9, 2.6)
Chest tightness	42 (26%)	6 (8%)	3.3 (1.5, 7.5)
Short of Breath	58 (35%)	11 (14%)	2.5 (1.3, 4.4)
Wheeze	34 (21%)	7 (9%)	2.2 (1.1, 4.8)
Indigestion	43 (27%)	13 (17%)	1.6 (0.9, 2.8)
Nausea	17 (11%)	6 (8%)	1.3 (0.6, 3.3)
Diarrhea	34 (21%)	9 (12%)	1.8 (0.9, 3.5)
Headache	79 (48%)	35 (45%)	1.1 (0.8, 1.4)

Table 2
Persistent Physical Health Symptoms Occurring After September 11, 2001
120 Broadway, Manhattan, and DEP Lefrak Building, Queens
HETA 2002-0101-3028

Persistent Symptoms after September 11*	120 Broadway	DEP Lefrak Bldg	Prevalence Ratio 120 Broadway/ Lefrak (95% CI)
	Number and Percent	Number and Percent	
Nose/throat irritation	40 (24%)	9 (12%)	2.1 (1.1, 4.1)
Eye irritation	40 (24%)	9 (12%)	2.1 (1.1, 4.1)
Skin irritation	13 (8%)	4 (5%)	1.5 (0.5, 4.5)
Congestion	29 (18%)	8 (10%)	1.7 (0.8, 3.6)
Cough, any kind	37 (22%)	7 (9%)	2.5 (1.2, 5.3)
Cough with phlegm	19 (12%)	2 (3%)	4.5 (1.1, 19.0)
Chest tightness	15 (9%)	1 (1%)	7.1 (0.9, 53.0)
Shortness of Breath	22 (13%)	2 (3%)	5.2 (1.2, 21.5)
Wheeze	9 (5%)	1 (1.3%)	4.1 (0.5, 32.1)
Indigestion	15 (9%)	0 (0%)	---
Nausea	6 (4%)	1 (1%)	2.8 (0.3, 23.3)
Diarrhea	7 (4%)	1 (1%)	3.3 (0.4, 26.1)
Headache	30 (18%)	7 (9%)	2.0 (0.9, 4.4)

* Symptoms that existed before September 11 but had worsened since September 11 or new onset symptoms that had not improved

Table 3
Mental Health Symptoms
120 Broadway, Manhattan, and DEP Lefrak Building, Queens
HETA 2002-0101-3028

Symptoms consistent with:	120 Broadway Number (%)	Lefrak Bldg Number (%)	Prevalence Ratio (95% CI)
Depression *	25 (15%)	14 (19%)	0.8 (0.5, 1.5)
Post traumatic stress syndrome [†]	15 (9%)	8 (10%)	0.9 (0.4, 2.0)

* Depressive symptoms were defined as a score of 22 or more using the CES-D scale.

[†] Post traumatic stress syndrome was defined using the Veteran's Administration Checklist and applying the DSM-IV¹⁸ criteria.

Table 4
Reported New Physician-Diagnosed Medical Conditions
120 Broadway, Manhattan, and DEP Lefrak Building, Queens
HETA 2002-0101

Has a physician told you that you have:	Physician told me after September 11*		Prevalence Ratio (95% CI)
	120 Broadway	Lefrak	
Allergies	8 (9%)	0 (0%)	-----
Asthma	4 (3%)	0 (0%)	-----
Depression or Mood Disorder	2 (1.3%)	1 (1.3%)	0.9 (0.8, 11.0)
Post Traumatic Stress Disorder	6 (3.7%)	1 (1.3%)	2.9 (0.3, 23.2)

* Rate is based only on those who did not have a diagnosis of the condition before September 11

DEPARTMENT OF ENVIRONMENTAL PROTECTION AND THE LEFRAK BUILDING

Background

On January 1, 2002, NIOSH received a health hazard evaluation (HHE) request from District Council 37 of the American Federation of State, County and Municipal Employees (AFSCME), Public Employees Federation (PEF), and the Communications Workers of America (CWA) asking for assistance in documenting the extent of physical and mental health problems subsequent to the attack on the World Trade Center (WTC) on September 11, 2001, among their staff of office workers at 40 Rector Street. To document these concerns at the sites around the WTC, NIOSH investigators administered a questionnaire survey at 40 Rector Street, as well as a comparison site not proximal to the WTC. New York City Department of Environmental Protection workers at the Lefrak building in Queens were selected as the comparison population.

Methods

Selection of Sites for the HHE

The office building at 40 Rector Street is located approximately three blocks south of the WTC site. This 19-story building houses a variety of private businesses and offices for the City of New York. Employees at four New York City programs participated in this study and include the Civilian Complaint Review Board (CCRB), Taxi and Limousine Commission (TLC), Office of Administrative Trials and Hearings (OATH), and the Campaign Finance Board (CFB). These programs were selected to represent office workers in the WTC area and include a variety of clerical, administrative, and managerial workers.

The comparison site, the Lefrak Building in Queens, is located approximately 20 miles from the WTC site and is one of the main office buildings for the New York City Department of Environmental Protection. This comparison site was selected because 1) it is a similar office structure, 2) the range of jobs and tasks are comparable to those at 40 Rector Street, and 3) the building and its occupants were not involved in the direct attack at the WTC. On September 11, word of the attack spread through the offices at 40 Rector Street. Most employees could not see the WTC from their offices but they could hear and feel the explosions as they occurred. Several offices had indirect views of the WTC but workers had direct views of the debris from the buildings, of an airplane wheel and body parts from victims that were scattered about the streets surrounding the building. Employees began to evacuate the building at approximately 9:05 a.m.. Escape routes were limited; travel to the north was blocked by the fires and falling debris from the WTC. The only options available for evacuation were south and east where workers could board the Staten Island Ferry or walk across the Brooklyn Bridge. Many workers were able to walk east and then finally north, out of Lower Manhattan.

The building remained closed from September 11, 2001 until October 25, 2001, when employees were asked to return to work. Not all offices resumed operation at the same time, but most were back at work by the beginning of November 2001.

Workers at the comparison office building were not evacuated from their worksite on September 11, and workers left for home at various times throughout the day. Work resumed at DEP the following day.

The Questionnaire

The purpose of the questionnaire was to obtain information for evaluating the prevalence of symptoms (mental health and physical) among office workers at both work sites. The questionnaire was self-administered and included questions about work duties and location, symptoms occurring after September 11, and whether those physical symptoms had improved or gotten worse since then. We asked selected information on past medical history and activities related to events on September 11. We also asked about mental health symptoms associated with depression and PTSD. It is important to note that the questions we used to assess the symptoms of physical and mental health problems are screening instruments designed for epidemiologic purposes, and are not used to individually diagnose any specific medical disorder. Only a competent health care professional who has completed a thorough clinical evaluation can make a reliable clinical diagnosis.

Definition of Physical Symptoms

The physical symptoms included on the questionnaire (irritation symptoms, upper and lower respiratory symptoms, mucous membrane symptoms, gastrointestinal symptoms) were chosen based on information gathered during informal meetings with workers employed around the WTC site. An affirmative response to 'did you have any of the following symptoms after the WTC disaster on September 11' was defined as having 'symptoms.' 'Persistent symptoms' were defined as either of the following: 1) those with symptoms that existed before September 11 but had worsened since September 11, or 2) those with new onset symptoms since September 11 that had not improved.

Definition of Mental Health Symptoms

The questionnaire also included questions to assess symptoms of depression and post-traumatic stress disorder (PTSD). The questions related to depression were from the 20-question Center for Epidemiologic Studies Depression Scale (CES-D)¹³. The Center for Epidemiologic Studies of the National Institute of Mental Health developed this short self-reported scale to assess symptoms of depression in the general population. Because of the nature of the WTC disaster, and the likelihood that respondents would be experiencing common acute symptoms that are found on the depression scale, we chose to narrow our focus to those having major depressive symptoms, which are defined as those scoring 22 or higher out of a possible 60 points.

Participants were also asked to respond to questions about having persistent intrusive thoughts, dreams, and vivid reminders about the WTC disaster and whether they were feeling emotionally numb, distant, or cut off from friends. These symptoms and others were used to determine whether respondents were experiencing symptoms that are characteristic of PTSD. The questions related to PTSD were from the Veterans Administration PTSD Checklist.¹⁴ We used the officially accepted criteria for a diagnosis of PTSD as developed by the American Psychiatric Association in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV¹⁸) to define those individuals with symptoms consistent with PTSD.

Administration of the Questionnaire

On April 8, 2002, program managers were asked to assemble personnel so that we could seek their voluntary participation in the symptom survey. NIOSH staff members explained the purpose of the survey, the time required to complete the questionnaire, and informed each employee that he or she had the right to refrain from answering any or all of the questions. We then distributed questionnaires to each employee present at the meetings. We asked those who did not wish to participate to write 'do not wish to participate' across the top sheet of the questionnaire and return it in a sealed envelope to the central collection site where we collected all questionnaires.

Participants had the option to complete the questionnaire in the meeting room or return to their desks.

Data Analysis

This report we are compares prevalence symptoms between office workers at 40 Rector Street and DEP office workers at the Lefrak building in Queens. The prevalence ratio (PR) is defined as the prevalence of symptoms in the study population divided by the prevalence of symptoms in the comparison population. If 50% of the employees at 40 Rector Street have a symptom such as congestion, and 25% of the employees at DEP have congestion then the PR is 2.0 ($50/25=2$); the study group has twice the symptom prevalence as the comparison population. Conversely, if the PR is less than 1 then the prevalence of symptoms or disease is less in the study population than that found in the comparison population. Lastly, a prevalence ratio of 1 indicates that there is no difference in the symptom or disease prevalence between the study and comparison groups. Because all prevalence estimates have some uncertainty, we also calculate the 95% confidence interval. If the lower number in the 95% CI is greater than 1.0 then the evidence for the increase in symptoms in 40 Rector Street employees compared to DEP employees is especially convincing. The term “statistically significant” is used in designating the prevalence ratios that meet these criteria.

Results

Two hundred and fifty-one employees at 40 Rector Street completed the questionnaire. These 251 participants were from the Civilian Complaint Review Board [CCRB] (121), Taxi and Limousine Commission [TLC] (56), Campaign Finance Board [CFB] (54), and the Office of Administrative Trials and Hearings [OATH] (20) resulting in an overall participation rate of 82%. Seventy-nine DEP employees at three locations in the Lefrak building completed the questionnaire for a participation rate of 76%.

We examined a number of characteristics such as sex, age, years employed at the job, etc. to determine the similarity between the study population and the comparison population. Ideally, the distribution of these descriptive characteristics should be similar in each, thereby leaving the exposure potential as the only distinguishing characteristic of the study population. Our comparison of key characteristics of age, job tenure, and sex shows that DEP participants tended to be older than 40 Rector Street participants, have worked longer, and were more likely to be male than participants at 40 Rector Street. The mean age of DEP participants was 46 years, while the age of 40 Rector Street participants was 37 years. DEP participants have worked at their job longer than 40 Rector Street participants (11 years vs. 5 years) and DEP participants were predominately male (62%) while the majority of 40 Rector Street participants were female (60%).

Results indicate 49% of the 40 Rector Street participants and 38% of the DEP participants knew someone who was injured or killed at the WTC collapse. 40 Rector Street workers were three times more likely to have witnessed one or more of the planes crashing into the WTC and seven times more likely to have seen persons falling or jumping from the WTC than were DEP participants.

Reports of physical symptoms since September 11

Table 1 shows the list of symptoms included in the questionnaire. Most of the symptoms can be broadly grouped as follows: 1) symptoms of irritation of the nose, throat, eyes and skin, 2) respiratory problems such as cough, wheezing, shortness of breath, and chest tightness, and 3) gastrointestinal problems such as indigestion, nausea, and diarrhea. Table 1 shows the frequency of respondents who reported experiencing each symptom after September 11 and then the prevalence ratio and 95% confidence interval. This table shows that 40 Rector Street workers had higher rates of symptoms than DEP workers,

and rates of nose, throat, and eye irritation, all of the respiratory symptoms (except wheezing), and nausea, diarrhea, and headaches were statistically higher among 40 Rector Street workers than DEP workers.

Table 2 lists symptoms by individual department or program at 40 Rector Street. Symptom prevalences were generally elevated compared to the rates found at the DEP; however, not all of the increased prevalences were statistically significant. The highest prevalence rates were found for respiratory symptoms including cough, chest tightness, shortness of breath, and wheezing (PR range 2.1 to 4.5). Additionally, the prevalence of nausea and diarrhea was higher among CCRB and TLC participants than among DEP personnel (PR range 1.5 to 3.1). Results are not shown in instances where there are fewer than five respondents.

Reports of persistent symptoms since September 11

In addition to reports of any symptoms after September 11, we were interested in determining the rates of persistent symptoms that had not improved by March 2002 when the clean up was almost complete. Table 3 shows the rates of these persistent symptoms. Comparing Table 1 and Table 3, shows 50% or more of those reporting any symptoms since September 11 reported that the symptom had improved by March 2002. However, 8%-26% of 40 Rector Street employees were still reporting eye, nose, throat, and skin irritation, and respiratory complaints such as cough, shortness of breath, wheezing or chest tightness. In addition, 40 Rector Street employees were nine times more likely than DEP workers to report chest tightness (PR=9.0, 95% CI 1.2, 64), five times more likely to report being short of breath (PR=5.0, 95% CI, 1.3, 20.5), and three times more likely to report a persistent headache (PR=3.2, 95% CI, 1.5, 6.6).

Analysis of persistent symptoms by department was not done because the numbers were too small to produce meaningful results.

Reports of lost work days

We asked workers whether they had lost time from work because of any of the symptoms listed in Tables 1 and 3. Thirty six percent of 40 Rector Street employees and 27% of DEP participants reported losing time from work. The percentages of employees reporting lost time from work at 40 Rector Street and DEP were not statistically significant ($p=0.18$).

Reports of symptoms consistent with depression and PTSD

Table 4 provides the rates for those reporting symptoms consistent with major depression and PTSD. This table shows that 21% of 40 Rector Street workers and 19% of DEP workers had symptoms meeting criteria for symptoms of major depression. The rates of symptoms consistent with PTSD were 14% at 40 Rector Street and 10% at DEP. The differences in reported symptoms for major depression and PTSD were not statistically significant.

Table 5 lists the individual department rates for those reporting symptoms consistent with major depression. Rate of symptoms consistent with major depression were elevated for CCRB and TLC compared to DEP and lower for OATH and CFB, however, these results were not statistically significant.

Table 6 shows the individual departmental rates for symptoms consistent with PTSD. Employee participants at CCRB and TLC had elevated rates of symptoms consistent with PTSD; however, these were not statistically significant. Employees at OATH and CFB were less likely than DEP participants to report symptoms consistent with PTSD, but again, these estimates were not statistically significant.

Reports of conditions newly diagnosed by a physician

We asked workers whether a physician had told them that they had specific medical conditions and whether those conditions had been diagnosed before or after September 11. Table 7 shows the rates of respondents who were told by a physician *since* September 11 that they had asthma, allergies, depression, or PTSD. These rates were calculated based on those workers who had no previous diagnosis of the condition before September 11. This table shows that rates of all four diagnoses were higher among 40 Rector Street participants than DEP participants; however, only the differences for allergies and asthma were statistically significant.

Conclusions

The survey carried out in April 2002 at 40 Rector Street and the DEP program offices at the Lefrak Building has shown that the rates of symptoms related to nose, throat and eye irritation as well as respiratory symptoms and some gastrointestinal symptoms were higher at 40 Rector Street compared to the DEP. Although half of those reporting any symptom since September 11 also reported some improvement, between 8% and 26% reported persistent symptoms still present in April 2002. These symptoms may have been due to exposure to complex environmental contaminants (e.g., smoke, respirable airborne particles, fine dust, and fire combustion products) from the collapse of the towers and ensuing fires. An understandable limitation at the time of the collapse of the WTC was the lack of initial environmental exposure assessment, thus we do not know the scope or extent of exposure at that time. Sampling by NIOSH between September 18 and October 4, 2002, to evaluate exposures for those working in the rescue and recovery operation found few of the measured substances that exceeded occupational standards.³⁶

Symptom surveys and interpretations based on frequency data have limitations. Responses to extraordinary traumatic events may provoke a range of reactions, and symptoms alone are not adequate to fully diagnose medical conditions. Following a traumatic event, symptoms that would once be overlooked may be perceived as more serious and reported as such. Those who continue to experience persistent or recurrent symptoms should be evaluated by a health care professional so that a complete assessment can be made. Further systematic investigations using full clinical diagnostic assessment, though labor and resource intensive, would be useful in sorting out the breadth and scope of illness in those with persistent symptoms.

We found that 21% of 40 Rector Street staff and 19% of DEP staff had symptoms consistent with major depression and 14% of 40 Rector Street staff and 8% of DEP staff had symptoms consistent with PTSD. Although the rates of symptoms of depression at both office locations are higher than national studies that have used the same set of questions (CES-D),³⁷ those populations had not recently experienced a major disaster and may be of limited utility as a comparison. Other studies of the WTC and previous disasters have shown results that are similar to our findings. A study that evaluated survivors 6 months after the bombing of the Federal Building in Oklahoma City found that 34% met the diagnostic criteria for PTSD³⁸. Various studies of New York City residents conducted since September 11 have identified elevated rates of symptoms of depression and PTSD and, although they have used a variety of assessment methods, the rates are consistent with what we found in the office populations.^{17,39,40} One large national study found that all New York City respondents had higher rates of symptoms of PTSD compared to other respondents, and those in the WTC or a surrounding building on September 11 had higher rates compared to other New Yorkers.⁶

It is difficult to predict the long-term effect on mental health from this disaster. Many of the symptoms that the workers in these buildings are experiencing may be normal and reversible reactions to traumatic events. Researchers evaluating the Oklahoma City bombing found that most individuals directly involved

did not develop diagnosable psychiatric illness, but the majority reported experiences such as sleep disturbance, feeling emotionally upset afterwards and loss of concentration.⁴¹ However, it is important to encourage workers who continue to experience symptoms to seek professional help.

Published reports from several studies have subsequently described physical^{1,2,3,4,5} and psychological^{9,10,11} health effects among rescue workers, office workers, and residents from the surrounding community. Continued longitudinal follow-up of those exposed will be necessary to determine whether the changes will lead to chronic problems or recovery. On-going interventions may help prevent the development of long-lasting sequelae.

Recommendations

The workplace plays an important role in the health of its workers. One of the ways the workplace can help reduce the burden of illness is by providing a community and a mechanism for social support. Social support from supervisors and coworkers has been shown in repeated studies to buffer the effects of stress⁴². Therefore, it is essential that City Administrators and labor unions continue to develop a supportive community atmosphere that encourages and assists those who continue to experience symptoms to seek care from a competent health care professional. This is equally important at DEP where employees were likely to know a victim and, like many other New Yorkers, also expressed symptoms associated with depression. Some of the specific ways that this can be accomplished are listed below:

- Those staff members who experience persistent symptoms should be encouraged to seek competent professional medical assistance. Administration and union officials should seek mechanisms such as hot line numbers, counseling services and posters to inform members of available services.
- Free mental health services have been made available by governmental and nongovernmental agencies. Managers should find methods to advertise these services and seek ways to encourage participation when indicated. Managers should be aware that many individuals may avoid accessing mental health services because of the stigma associated with mental illness. It is important to find ways to help minimize this stigma and to encourage participation.
- Training should continue for managers and supervisory personnel at all levels to insure that each group is responding appropriately to health and safety concerns of employees. As part of this training, issues at the organizational level should be evaluated to determine whether improvements could be made to address widespread concern among employees concerning health, safety, and security issues. Each program has an existing union/management health and safety committee and these committees are excellent mechanisms to address safety and health concerns as they arise.
- Develop programs to foster social support on campus to buffer workplace stress. This may be especially important in the period surrounding the anniversary of September 11.

Table 1
Physical Health Symptoms Occurring After September 11, 2001
40 Rector Street, Manhattan, and DEP Lefrak Building, Queens
HETA 2002-0101-3028

Have you had any of the following symptoms since September 11?	40 Rector Street	Lefrak Bldg	Prevalence Ratio 40 Rector Street/ Lefrak (95% CI)
	Number and Percent	Number and Percent	
Nose/throat irritation	148 (60%)	28 (37%)	1.6 (1.2, 2.2)
Eye irritation	139 (57%)	34 (44%)	1.3 (1.0, 1.7)
Skin irritation	55 (23%)	13 (17%)	1.4 (0.8, 2.3)
Congestion	117 (49%)	34 (44%)	1.1 (0.8, 1.5)
Cough, any kind	163 (66%)	23 (30%)	2.2 (1.5, 3.2)
Cough with phlegm	86 (36%)	16 (21%)	1.7 (1.1, 2.8)
Chest tightness	69 (29%)	6 (8%)	3.6 (1.6, 8.1)
Short of Breath	78 (33%)	11 (14%)	2.3 (1.3, 4.1)
Wheeze	42 (18%)	7 (9%)	1.9 (0.8, 4.0)
Indigestion	55 (23%)	13 (17%)	1.4 (0.8, 2.4)
Nausea	43 (18%)	6 (8%)	2.3 (1.1, 5.2)
Diarrhea	56 (24%)	9 (12%)	2.0 (1.1, 3.8)
Headache	164 (67%)	35 (45%)	1.5 (1.1, 1.9)

Table 2
40 Rector Street Prevalence Rates by Department
Number (Percent) and Prevalence Rates (PR) of Symptoms by Department at
40 Rector Street compared to DEP Lefrak Building
HETA 2002-0101-3028

Symptoms	40 Rector Street Departments				LeFrak
	CCRB n=121* Number (%) Prevalence Ratio (PR) 95% Confidence Interval (CI)	CFB† n=54 Number (%) PR 95% CI	OATH‡ n=20 Number (%) PR 95% CI	TLC§ n= 56 Number (%) PR 95% CI	DEP¶ n=79 Number (%) PR 95% CI
Nose/Throat Irritation	72 (61%) PR=1.7 95% CI= (1.2, 2.3)	32 (60%) PR=1.6 CI= (1.8, 2.4)	10 (50%) PR=1.4 95% CI= (1.8, 2.3)	34 (63%) PR=1.7 95% CI= (1.2, 2.3)	28 (37%) PR=1.0 Referent
Eye Irritation	65 (56%) PR=1.2 95% CI= (0.9, 1.7)	32 (63%) PR=1.4 95% CI= (1.2, 2.0)	14 (70%) PR=1.6 95% CI= (1.1, 2.4)	28 (28%) PR=1.2 95% CI= (0.8, 1.7)	34 (44%) PR=1.0 Referent
Skin Irritation	26 (22%) PR=1.3 95% CI= (0.7, 2.4)	11 (22%) PR=1.3 95% CI= (0.6, 2.1)	<5	15 (28%) PR=1.7 95% CI= (0.8, 3.2)	13 (17%) PR=1.0 Referent
Congestion	57 (28%) PR=1.1 95% CI= (0.8, 1.5)	27 (52%) PR=1.2 95% CI= (0.8, 1.7)	9 (45%) PR=1.1 95% CI= (0.6, 1.8)	24 (46%) PR=1.1 95% CI= (0.7, 1.5)	34 (44%) PR=1.0 Referent
Cough Any Kind	78 (65%) PR=2.2 95% CI= (1.5, 3.2)	33 (64%) PR=2.1 95% CI= (1.4, 3.2)	12 (60%) PR=2.0 95% CI= (1.2, 3.3)	40 (71%) PR=2.4 95% CI= (1.6, 3.5)	23 (30%) PR=1.0 Referent
Cough With Phlegm	42 (36%) PR=1.7 95% CI= (1.1, 2.8)	21 (42%) PR=1.2 95% CI= (1.2, 3.5)	< 5	20 (37%) PR=1.8 95% CI= (1.1, 3.2)	16 (63%) PR=1.0 Referent

CCRB*: Civilian Complaint Review Board

CFB†: Campaign Finance Board

OATH‡: Office of Administrative Trials and Hearings

TLC§: Taxi and Limousine Commission

DEP¶: Department of Environmental Protection

Table 2 (Continued)
40 Rector Street Prevalence Rates by Department
Number (Percent) and Prevalence Rates of Symptoms by Department at
40 Rector Street compared to DEP Lefrak Building
HETA 2002-0101-3028

Symptoms	40 Rector Street				LeFrak
	CCRB n=121* Number (%) PR 95% CI	CFB† n=54 Number (%) PR 95% CI	OATH‡ n=20 Number (%) PR 95% CI	TLC§ n= 56 Number (%) PR 95% CI	DEP¶ n=79 Number (%) PR 95% CI
Chest Tightness	42 (35%) PR=4.5 95% CI= (2.0, 10.0)	6 (12%) PR=1.6 95% CI= (0.5, 4.5)	5 (25%) PR=3.2 95% CI= (1.1, 9.3)	16 (31%) PR=4.0 95% CI= (1.6, 9.3)	6 (8%) PR=1.0 Referent
Short of Breath	39 (33%) PR=2.3 95% CI= (1.3, 4.3)	11 (22%) PR=1.5 95% CI= (0.7, 3.3)	<5	24 (61%) PR=3.2 95% CI= (1.7, 6.0)	11 (14%) PR=1.0 Referent
Wheeze	13 (11%) PR=1.2 95% CI= (0.5, 2.8)	9 (18%) PR=1.9 95% CI= (0.8, 4.8)	<5	16 (30%) PR=3.2 95% CI= (1.4, 7.2)	7 (9%) PR=1.0 Referent
Indigestion	24 (21%) PR=1.2 95% CI= (0.7, 2.3)	11 (22%) PR=1.3 95% CI= (0.6, 2.7)	6 (30%) PR=1.8 95% CI= (0.8, 4.1)	14 (27%) PR=1.6 95% CI= (0.8, 3.2)	13 (17%) PR=1.0 Referent
Nausea	28 (23%) PR=3.1 95% CI= (1.3, 7.1)	8 (16%) PR=2.1 95% CI= (0.8, 5.63)	<5	6 (12%) PR=1.5 95% CI= (0.5, 4.4)	6 (8%) PR=1.0 Referent
Diarrhea	85 (26%) PR=2.2 95% CI= (1.1, 4.4)	10 (19%) PR=1.7 95% CI= (0.7, 3.8)	<5	12 (24%) PR=2.0 95% CI= (0.9, 4.4)	9(12%) PR=1.0 Referent
Headache	85 (71%) PR=1.6 95% CI= (1.2, 2.1)	30 (58%) PR=1.3 95% CI= (0.9, 1.8)	14 (70%) PR=1.5 95% CI= (1.1, 2.3)	35 (63%) PR=1.4 95% CI= (1.0, 1.9)	35 (45%) PR=1.0 Referent

CCRB* : Civilian Complaint Review Board

CFB† : Campaign Finance Board

OATH‡ : Office of Administrative Trials and Hearings

TLC§ : Taxi and Limousine Commission

DEP¶ : Department of Environmental Protection

Table 3
Persistent Physical Health Symptoms Occurring After September 11 2001
40 Rector Street, Manhattan, and DEP Lefrak Building, Queens
HETA 2002-0101-3028

Persistent Symptoms after September 11*	40 Rector Street	Lefrak Bldg	Prevalence Ratio 40 Rector Street/ LeFrak (95% CI)
	Number and Percent	Number and Percent	
Nose/throat irritation	53 (22%)	9 (12%)	1.8 (0.9, 3.5)
Eye irritation	62 (26%)	9 (12%)	2.2 (1.2, 4.2)
Skin irritation	20 (8%)	4 (5%)	1.6 (0.5, 4.5)
Congestion	46 (19%)	8 (10%)	1.8 (0.9, 3.7)
Cough, any kind	45 (18%)	7 (9%)	2.0 (0.9, 4.3)
Cough with phlegm	25 (11%)	2 (3%)	4.0 (1.0, 19.0)
Chest tightness	28 (12%)	1 (1%)	9.0 (1.2, 64.0)
Shortness of Breath	31 (13%)	2 (3%)	5.0 (1.3, 20.5)
Wheeze	15 (6%)	1 (1.3%)	4.6 (0.6, 35.0)
Indigestion	26 (11%)	0 (0%)	----
Nausea	11 (5%)	1 (1%)	3.6 (0.5, 27.1)
Diarrhea	17 (7%)	1 (1%)	5.5 (0.7, 40.3)
Headache	71 (29%)	7 (9%)	3.2 (1.5, 6.6)

* Symptoms that existed before September 11 but had worsened since September 11 or new onset symptoms that had not improved

Table 4
Mental Health Symptoms
40 Rector Street, Manhattan, and DEP Lefrak Building, Queens
HETA 2002-0101-3028

Symptom consistent with:	40 Rector Street Number (%)	DEP Lefrak Bldg Number (%)	Prevalence Ratio (95% CI)
Depression*	50 (21%)	14 (19%)	1.1 (0.7, 1.9)
PTSD†	35 (14%)	8 (10%)	1.4 (0.7, 2.8)

*Depressive symptoms were defined as a score of 22 or more using the CES-D scale.

† Post traumatic stress syndrome defined using the Veteran's Administration Checklist and applying the DSM-IV¹⁸ criteria.

Table 5
40 Rector Street:
Symptoms Consistent with Major
Depression by Department
HETA 2002-0101-3028

40 Rector Street Department	Number and Percent	Prevalence Ratio 40 Rector Street/ DEP- Lefrak (95% CI)
CCRB*	32 (27%)	1.43 (0.8, 3.0)
TLC†	10 (20%)	1.1 (0.5, 2.0)
OATH‡	25 (15%)	0.8 (0.5, 1.5)
CFB§	5 (10%)	0.5 (0.2, 1.4)
DEP Comparison Site¶	14 (19%)	1.0 (Referent)

CCRB* : Civilian Complaint Review Board, CFB†: Campaign Finance Board, OATH‡: Office of Administrative Trials and Hearings, TLC§: Taxi and Limousine Commission, DEP¶: Department of Environmental Protection

Table 6
40 Rector Street: Symptoms Consistent with
Post-Traumatic Stress Disorder Syndrome by Department
HETA 2002-0101-3028

40 Rector Street Department	Number and Percent	Prevalence Ratio 40 Rector Street/ DEP-Lefrak (95% CI)
CCRB*	22 (19%)	1.8 (0.9, 3.9)
TLC†	9 (17%)	1.6 (0.7, 4.0)
OATH‡	0 (0%)	-----
CFB§	<5	---
DEP Comparison Site¶	8 (10%)	1.0 (Referent)

CCRB*: Civilian Complaint Review Board,
 CFB†: Campaign Finance Board,
 OATH‡: Office of Administrative Trials and Hearings,
 TLC§: Taxi and Limousine Commission,
 DEP¶: Department of Environmental Protection

Table 7
Reported New Physician-Diagnosed Medical Conditions
40 Rector Street, Manhattan, and DEP LeFrak Building, Queens
HETA 2002-0101-3028

Has a physician told you that you have:	Physician told me after September 11*		Prevalence Ratio (95% CI)
	40 Rector	LeFrak	
Allergies	7 (2%)	0 (0%)	-----
Asthma	5 (2%)	0 (0%)	-----
Depression or Mood Disorder	8 (4%)	1 (1.3%)	2.3 (0.8, 11.0)
Post Traumatic Stress Disorder	14 (6%)	1 (1.3%)	4.6 (0.3, 23.2)

* Rate is based only on those who did not have a diagnosis of the condition before September 11

BOROUGH OF MANHATTAN COMMUNITY COLLEGE AND YORK COLLEGE

Background

On January 1, 2002, NIOSH received a health hazard evaluation (HHE) request from District Council 37 of the American Federation of State, County and Municipal Employees (AFSCME) and the Professional Staff Congress (PSC), which represent the instructional and non-instructional staff at the Borough of Manhattan Community College (BMCC) asking for assistance in documenting the extent of physical and mental health problems subsequent to the attack on the World Trade Center (WTC) on September 11, 2001, among their staff. To document these concerns at the sites around the WTC, NIOSH investigators administered a questionnaire survey at BMCC and at a comparison site not proximal to the WTC. Employees at York College in Jamaica, Queens, were selected as the comparison population.

Methods

Selection of Sites for the HHE

BMCC is a community college located two blocks north of the WTC site at the intersection of Chambers and West Streets. It has a student body of approximately 24,000, and offers classes between 8 a.m. and 10 p.m. While BMCC employs approximately 1700 instructional and non-instructional staff, only 600-650 of the employees are full-time faculty or staff. While most of the full-time staff worked regular 8-hour shifts, the faculty, which accounts for more than half of the full-time employees, are only required to be at the site during their teaching hours or for administrative meetings. The large part-time instructional and non-instructional staff includes professors teaching one or two classes and students or others who may work in clerical and other support services for a few hours per week up to close to a full 40-hour work week.

York College, the comparison college, like BMCC, is one of the City University of New York (CUNY) colleges. It is located in Jamaica, Queens about 15-20 miles from the WTC site and serves approximately 6000 students. York College has about 1000 staff; however, as with BMCC, only about 400-450 are full-time faculty or staff. The time schedule of classes is similar to that of BMCC.

On September 11, classes at BMCC were cancelled after the crash of the two planes into the WTC, and the staff and students were instructed to leave the facility immediately. Because the site became a command center for the rescue and recovery operation, security and maintenance staff were asked to provide services in order to clean up and protect the building. The building was reopened for all staff on September 26, 2001 and classes resumed on October 1, 2001. Although most of the college is housed in one large building, some classes were held at Fiterman Hall which is located directly across from the WTC. Fiterman Hall suffered major damage during the collapse and could not be reoccupied. To accommodate the students and faculty who had been using the damaged facility, several mobile classrooms were placed along West Street, adjacent to the BMCC complex. York College was closed on September 11 following the collapse of the WTC, following a decision by the CUNY administration to cancel classes in all of their colleges. The college reopened on September 12, 2001 with a normal schedule.

Environmental Characterization for Identification of Comparison School (York College)

Prior to the selection of a comparison college, a walk-through evaluation of BMCC was performed on January 17, 2002. Based on the walk-through evaluation of BMCC, two environmental factors were determined to be disqualifiers for the selection of the comparison college, (1) the lack of central air-conditioning; and (2) the presence of significant indoor environmental quality health complaints within the previous 5 years. After discussions with knowledgeable individuals and a site visit on January 30, 2002, York College was selected as the comparison college.

To characterize the differences between BMCC and York, a building inspection checklist (Appendix 1) was developed using the knowledge from previous NIOSH indoor environmental quality research studies. The building inspection checklist included selected environmental risk factors associated with either a significant increase or decrease in occupant reporting of the most common building-related health symptoms.

Walk-through evaluations were conducted at both colleges to complete the building inspection checklists at approximately the same time as the health symptom survey. The walk-through evaluations of York College and BMCC were conducted on March 11 and 12, 2002, respectively. During these walk-through evaluations, a variety of environmental factors were noted including the buildings' architectural style, physical structure characteristics, construction methods and materials, interior room orientation and uses, ventilation system design and performance, preventive maintenance practices, housekeeping practices, building renovation history, and current building appearance (particularly the interior). The observations made during these walk-through evaluations were then used to complete the building inspection checklists.

Both colleges had central air-conditioning with ventilation systems of a similar design; neither reported significant indoor environmental quality health complaints within the previous 5 years. (The faculty of the Science Building at York College, which was closed for mold remediation at the time of the study, is not part of York College faculty and staff and is not included in the study.) Both colleges were well-maintained and clean. The single major environmental difference between the colleges was that the Academic Core Building at York College had evidence of some chronic but minor water leakage around several of the perimeter classroom windows.

These results indicate that both colleges are environmentally similar and, based solely on observed environmental risk factors, would not be expected to have a significant difference in occupant reporting of the most common building-related health symptoms.

The Questionnaire

The purpose of the questionnaire was to obtain information for evaluating the prevalence of symptoms (mental health and physical) among the staff of the two colleges. The questionnaire was self-administered and included questions about work duties and location, symptoms occurring after September 11, and whether those physical symptoms had improved or gotten worse since then. We asked selected information on past medical history and activities related to events on September 11. We also asked about mental health symptoms associated with depression and post-traumatic stress disorder (PTSD). It is important to note that the questions we used to assess the symptoms of physical and mental health problems are screening instruments designed for epidemiologic purposes, and are not used to individually diagnose any specific medical disorder. Only a competent health care professional who has completed a thorough clinical evaluation can make a reliable clinical diagnosis.

Definition of Physical Symptoms

The physical symptoms included on the questionnaire (irritation symptoms, upper and lower respiratory symptoms, mucous membrane symptoms, gastrointestinal symptoms) were chosen based on prior NIOSH surveys and on information gathered during informal meetings with workers employed around the WTC site. An affirmative response to 'did you have any of the following symptoms after the WTC disaster on September 11' was defined as having 'symptoms.' 'Persistent symptoms' were defined as either of the following: 1) those with symptoms that existed before September 11 but had worsened since September 11, or 2) those with new onset symptoms since September 11 that had not improved.

Definition of Mental Health Symptoms

The questionnaire also included questions to assess symptoms of depression and post-traumatic stress disorder (PTSD). The questions related to depression were from the 20-question Center for Epidemiologic Studies Depression Scale (CES-D).¹³ The Center for Epidemiologic Studies of the National Institute of Mental Health developed this short self-reported scale to assess symptoms of depression in the general population. Because of the nature of the WTC disaster, and the likelihood that respondents would be experiencing common acute symptoms that are found on the depression scale, we chose to narrow our focus to those having major depressive symptoms, which are defined as those scoring 22 or higher out of a possible 60 points.

Participants were also asked to respond to questions about having persistent intrusive thoughts, dreams, and vivid reminders about the WTC disaster and whether they were feeling emotionally numb, distant or cut off from friends. These symptoms and others were used to determine whether respondents were experiencing symptoms that are characteristic of a PTSD. The questions related to PTSD were from the Veterans Administration PTSD Checklist.¹⁴ We used the officially accepted criteria for a diagnosis of PTSD as developed by the American Psychiatric Association in the Diagnostic and Statistical Manual of Mental Disorders¹⁸ (DSM-IV) to define those individuals with symptoms consistent with PTSD.

Administration of the Questionnaire

A room at each college was designated as the location where staff could complete the questionnaire. NIOSH staff was available from 8 a.m. until 7 p.m. on 2 consecutive weekdays in order to accommodate faculty who did not have scheduled classes every day of the week. In both schools, notices were widely disseminated by the unions and the administration encouraging staff to come to the room and complete the questionnaire. The non-instructional staff was permitted to complete the questionnaire during their normal work shift. The instructional staff was encouraged to come during non-teaching hours; at BMCC part of the scheduled time fell during the monthly time slot reserved for departmental meetings when no classes are scheduled. Following the two scheduled days, those instructional staff at both colleges who had not participated had questionnaires placed in their college mail boxes with a postage-paid envelope for returning the form to NIOSH. All of the questionnaires were self-administered with NIOSH personnel available to answer questions. A few questionnaires were completed via a translator because of English literacy barriers. The questionnaire was administered on March 13 and 14, 2002 at BMCC and on March 18 and 19, 2002 at York.

Data Analysis

The comparison was done by assessing the prevalence ratio (PR). The PR represents the prevalence rate of the symptom in the BMCC staff relative to the prevalence in the York staff. A PR of 1.0 means there is no difference in symptom prevalence between the schools. A PR of greater than 1.0 indicates the prevalence is greater at BMCC. For example, a PR of 2.0 would mean that the respondents at BMCC were two times more likely to have reported the symptom than respondents at York. Because all prevalence estimates have some uncertainty, we also calculate the 95% confidence interval. If the lower

number in the 95% CI is greater than 1.0 then the evidence for the increase in symptoms in BMCC compared to York is especially convincing. The term “statistically significant” is used in designating the prevalence ratios that meet these criteria.

Although both part-time and full-time employees were invited to complete the questionnaire, we found that few part-time employees chose to participate. Although part-time employees constitute the majority of employees at both campuses, slightly less than 20% of respondents were part-timers. Therefore, we decided to restrict our statistical analyses to the full-time employee respondents.

Most of the respondents worked in the main building on each campus. Of the BMCC full-time faculty and staff participants only 13 (4%) reported working in one of the mobile classrooms and 24 (7%) reported being in Fiterman Hall on September 11. At York College only six workers (3%) reported spending most of their time in the Science Building during the previous year while most (87%) reported spending their time in the Academic Core Building. Therefore, although they were included in our main analyses, we did not attempt to assess the additional impact of assignments to these other buildings or classrooms.

Results

At BMCC, 374 of the 600-650 full-time employees (57%-62% participation rate) completed the questionnaire and at York, 204 of the 400-450 full-time employees (45%-51% participation rate) completed the questionnaire. There were no statistical differences between the two colleges with regard to job category, sex, number of years working at CUNY, or smoking status. Approximately 60% of respondents in both colleges were either faculty or other instructional staff (higher education officers and laboratory technicians). Participation rates for instructional and non-instructional staff did not differ substantially between the schools. At both colleges, approximately half the respondents were female and had worked an average of 14 years for CUNY. Thirteen percent of respondents in both colleges were current smokers.

According to the questionnaire, 37% of both the York staff and the BMCC staff personally knew someone injured or killed at the WTC collapse. Although the crash occurred before 9 a.m., when many college staff may not yet have arrived at work, two thirds of the BMCC staff reported being in lower Manhattan at the time. Not surprisingly, at BMCC the staff was five times more likely to report having witnessed the planes crashing into the WTC and 15 times more likely to report seeing individuals falling or jumping from windows compared to the York staff.

Reports of physical symptoms since September 11

Table 1 shows the list of symptoms included in the questionnaire. Most of the symptoms can be broadly grouped as follows: 1) symptoms of irritation of the nose, throat, eyes, and skin, 2) respiratory problems such as cough, wheezing, shortness of breath, and chest tightness, and 3) gastrointestinal problems such as indigestion, nausea, and diarrhea. Table 1 shows the number and percent of respondents who reported experiencing each symptom after September 11 and then the prevalence ratio and 95% confidence interval. This table shows that BMCC workers had higher rates of symptoms than the York workers, and rates of nose, throat and eye irritation, all of the respiratory symptoms, and nausea and headaches were statistically higher in BMCC workers compared to York workers.

Reports of persistent symptoms since September 11

In addition to reports of any symptoms after September 11, we were interested in determining the rates of persistent symptoms that had not improved by March when the clean up was almost complete. Table 2 shows the rates of these persistent symptoms. A comparison of Table 1 and Table 2, shows that 50% or

more of those reporting any symptoms since September 11 reported that the symptom had improved by March 2002. However, 10%-30% of the BMCC employees were still reporting eye, nose, throat, and skin irritation, and respiratory complaints such as cough, shortness of breath, wheezing, or chest tightness. The prevalence ratios show that the rates of persistent symptoms were higher in BMCC than York and most differences were statistically significant.

Reports of lost work days

The questionnaire asked whether the workers had lost time from work because of any of the symptoms listed in Tables 1 and 2. At BMCC 27% of the respondents reported losing time from work, while at York 16% reported losing time from work. The difference between these two percentages was statistically significant.

Reports of symptoms consistent with depression and PTSD

Table 3 provides the rates for those reporting symptoms consistent with major depression and PTSD. This table shows that 24% of BMCC workers and 17% of York workers had symptoms meeting criteria for symptoms of major depression. The rates of symptoms consistent with PTSD were 15% at BMCC and 8% at York. The rate for PTSD was statistically higher at BMCC compared to York.

Reports of conditions newly diagnosed by a physician

We asked workers whether they had been told by a physician that they had specific medical conditions and whether those conditions had been diagnosed before or after September 11. Table 4 shows the rates of respondents who were told by a physician *since* September 11 that they had asthma, allergies, depression or PTSD. These rates were calculated based on those workers who had no previous diagnosis of the condition before September 11. This table shows that rates of all four diagnoses were higher in BMCC than in York but only the difference for PTSD was statistically significant.

Conclusions

The survey carried out in March 2002 at BMCC and York Colleges has shown that the rates of symptoms related to nose, throat and eye irritation as well as respiratory symptoms and some gastrointestinal symptoms were higher at BMCC compared to York. Although half of those reporting any symptom since September 11 also reported some improvement, at BMCC between 6% and 31% reported persistent symptoms still present in March 2002. These symptoms may have been due to exposure to complex environmental contaminants (e.g., smoke, respirable airborne particles, fine dust, and fire combustion products) from the collapse of the towers and ensuing fires. An understandable limitation at the time of the collapse of the WTC was the lack of initial environmental exposure assessment, thus we do not know the scope or extent of exposure at that time. Sampling by NIOSH, between September 18, 2001 and October 4, 2001 to evaluate exposures for those working in the rescue and recovery operation found that few of the measured substances exceeded occupational standards.³⁶

Symptom surveys and interpretations based on frequency data have limitations. Responses to extraordinary traumatic events may provoke a range of reactions, and symptoms alone are not adequate to fully diagnose medical conditions. Following a traumatic event, symptoms that would once be overlooked, may be perceived as more serious and reported as such. Those who continue to experience persistent or recurrent symptoms should be evaluated by a health care professional so that a complete assessment can be made. Further systematic investigations using full clinical diagnostic assessment, though labor and resource intensive, would be useful in sorting out the breadth and scope of illness in those with persistent symptoms.

We found that 24% of BMCC staff and 17% of York staff had symptoms consistent with major depression and 15% of BMCC staff and 8% of York staff had symptoms consistent with PTSD. Although the rates of symptoms of depression in both colleges are higher than national studies that have used the same set of questions (CES-D),³⁷ those populations had not recently experienced a major disaster and may be of limited utility as a comparison. Other studies of the WTC and previous disasters have shown similar results. A study which evaluated survivors 6 months after the bombing of the Federal Building in Oklahoma City found that 34% met the diagnostic criteria for PTSD.³⁸ Various studies of New York City residents conducted since September 11 have identified elevated rates of symptoms of depression and PTSD and, although they have used a variety of assessment methods, the rates are consistent with what we found in the colleges.^{17,39,40} One large national study found that all New York City respondents had higher rates of symptoms of PTSD compared to other respondents, and those in the WTC or a surrounding building on September 11 had higher rates compared to other New Yorkers.⁶

It is difficult to predict the long term effect from this disaster on mental health. Many of the symptoms which the college staff is experiencing may be normal and reversible reactions to a traumatic event. Researchers evaluating the Oklahoma City bombing found that most individuals directly involved did not develop diagnosable psychiatric illness, but the majority reported experiences such as sleep disturbance, feeling emotionally upset afterwards and loss of concentration.⁴¹ However, it is important to encourage the members of the college staff who continue to experience symptoms to seek professional help.

Published reports from several studies have subsequently described physical^{1,2,3,4,5} and psychological^{9, 10,11} health effects among rescue workers, office workers, and residents from the surrounding community. Continued longitudinal follow-up of those exposed will be necessary to determine whether the changes will lead to chronic problems or recovery. On-going interventions may help prevent the development of long-lasting sequelae.

For questionnaire studies such as this, we aim for a participation rate of over 80% of the staff to assure that the results are representative of all employees. The participation rate in this study was 45%-60%. The college environment posed certain challenges in obtaining an adequate participation rate including the irregular schedule of the faculty, the difficulty of recruiting and locating staff among the thousands of students and the general burden of paperwork that faculty and staff are required to complete. However, the results of the same survey completed by staff of Stuyvesant High School and La Guardia High School, where participation rates were over 80%, showed very similar results to the colleges.

Recommendations

The workplace plays an important role in the health of its workers. One of the ways the workplace can help reduce the burden of illness is by providing a community and a mechanism for social support. Social support from supervisors and coworkers has been shown in repeated studies to buffer the effects of stress⁴². Therefore, it is essential that the college administration and labor unions continue to develop a supportive community atmosphere that encourages and assists those who continue to experience symptoms to seek care from a competent health care professional. This is equally important at York where employees were likely to know a victim and, like many other New Yorkers, also expressed symptoms associated with depression. Some of the specific ways that this can be accomplished include:

- Those staff members who continue to experience persistent symptoms should be encouraged to seek competent professional medical assistance. Administration and union officials should seek mechanisms such as hot line numbers, college-based counseling services and posters to inform members of available services.

- Free mental health services have been made available by governmental and nongovernmental agencies. The administration should find methods to advertise these services and seek ways to encourage participation when indicated. Many individuals may avoid accessing mental health services because of the stigma that is associated with mental illness. It is important for the college community to find ways to help minimize this stigma and to encourage participation.
- Training should continue for managers and supervisory personnel at all levels to insure that each group is responding appropriately to health and safety concerns of employees. As part of this training, issues at the organizational level should be evaluated to determine whether improvements can be made to address widespread concern among employees concerning health, safety and security issues. Each college has an existing union/management health and safety committee and these committees are excellent mechanisms to address safety and health concerns as they arise.
- Develop programs to foster social support on campus to buffer workplace stress. This may be especially important in the period surrounding the anniversary of September 11.

Table 1
Physical Health Symptoms Occurring After September 11 2001
Borough of Manhattan Community College and York College
HETA 2002-0096-3028

Have you had any of the following symptoms since September 11?	BMCC	York	Prevalence Ratio BMCC/ York (95% Confidence Interval)
	Number (%)	Number (%)	
Nose/throat irritation	219 (62%)	72 (37%)	1.7 (1.4, 2.1)
Eye irritation	224 (62%)	70 (36%)	1.8 (1.4, 2.1)
Skin irritation	91 (25%)	37 (19%)	1.4 (1.0, 1.9)
Congestion	156 (44%)	78 (39%)	1.1 (0.9, 1.4)
Cough, any kind	216 (60%)	72 (36%)	1.7 [1.4, 2.0]
Cough with phlegm	106 (30%)	42 (21%)	1.4 [1.1, 1.9]
Chest tightness	111 (31%)	24 (12%)	2.5 [1.7, 3.8]
Shortness of Breath	130 (36%)	31 (16%)	2.3 [1.6, 3.3]
Wheeze	72 (20%)	15 (8%)	2.6 [1.6, 4.5]
Indigestion	97 (27%)	42 (21%)	1.3 [1.0, 1.8]
Nausea	60 (17%)	15 (8%)	2.2 [1.3, 3.8]
Diarrhea	61 (17%)	30 (15%)	1.1 [0.8, 1.7]
Headache	197 (55%)	86 (43%)	1.3 [1.1, 1.5]

Table 2
Persistent Physical Health Symptoms Occurring After September 11, 2001
Borough of Manhattan Community College and York College
HETA 2002-0096-3028

Persistent Symptoms after September 11*	BMCC	York	Prevalence Ratio BMCC/ York (95% Confidence Interval)
	Number (%)	Number (%)	
Nose/throat irritation	102 (29%)	19 (10%)	3.0 (1.9, 4.7)
Eye irritation	112 (31%)	20 (10%)	3.1 (2.0, 4.8)
Skin irritation	46 (13%)	9 (5%)	2.8 (1.4, 5.7)
Congestion	74 (21%)	18 (9%)	2.3 (1.4, 3.8)
Cough, any kind	101 (28%)	25 (13%)	2.2 [1.5, 3.3]
Cough with phlegm	45 (13%)	12 (6%)	2.1 [1.1, 3.9]
Chest tightness	49 (14%)	5 (3%)	5.4 [2.2, 13.3]
Shortness of breath	65 (18%)	9 (5%)	4.0 [2.0, 7.8]
Wheeze	37 (10%)	5 (3%)	4.1 [1.6, 10.1]
Indigestion	44 (12%)	6 (3%)	4.2 [1.8, 9.6]
Nausea	19 (5%)	4 (2%)	2.6 [0.9, 7.6]
Diarrhea	20 (6%)	7 (4%)	1.6 [0.7, 3.7]
Headache	100 (28%)	28 (14%)	2.0 [1.4, 2.9]

* Symptoms that existed before September 11 but had worsened since September 11 or new onset symptoms that had not improved

Table 3
Mental Health Symptoms
Borough of Manhattan Community College and York College
HETA 2002-0096-3028

Symptoms consistent with:	BMCC Number (%)	York Number (%)	Prevalence Ratio BMCC/York (95% Confidence Interval)
Depression*	85 (24%)	34 (17%)	1.4 (1.0, 2.0)
PTSD †	53 (15%)	17 (8%)	1.7 (1.04, 2.9)

*Depressive symptoms were defined as a score of 22 or more using the CES-D scale.

†Post traumatic stress syndrome was defined using the Veteran's Administration Checklist and applying the DSM-IV¹⁸ criteria.

Table 4
Reported Newly Diagnosed Medical Conditions
Borough of Manhattan Community College and York College
HETA 2002-0096-3028

Has a physician told you that you have:	Physician told me after September 11*		Prevalence Ratio BMCC/York (95% CI)
	BMCC Number (%)	York Number (%)	
Allergies	16 (7%)	3 (2%)	2.9 (0.8, 10.1)
Asthma	10 (3%)	1 (1%)	5.8 (0.7, 46.0)
Depression or Mood Disorder	14 (4%)	3 (2%)	2.5 (0.7, 8.9)
Post Traumatic Stress Disorder†	18 (5%)	2 (1%)	5.1 (1.2, 22.1)

*Rate is based only on those who did not have a diagnosis of the condition before September 11

**Appendix 1
Building Inspection Checklist**

HETA No.: _____ Date: _____

Name of Inspector(s): _____

Building Name: _____

Building Address: _____

Lower Manhattan Building

Comparison Building

Building Design and Maintenance

Work Areas Appear Overcrowded Y N

Comments: _____

Suspended Ceiling Panels are Present Y N

Comments: _____

Cloth Partitions are Present Y N

Comments: _____

Surface Dusting is Performed Daily Y N

Comments: _____

Evidence of Moisture: Y Estimated Area (ft²) _____ N

Comments: _____

Renovation Was Performed Within the Last 6 Months Y N

Comments: _____

Heating, Ventilating, and Air-Conditioning (HVAC) System(s)

HVAC Design and Maintenance

HVAC System(s) Provide Air Conditioning Y N
HVAC System(s) have Scheduled Inspections Y N
HVAC System(s) have Scheduled Maintenance Y N

HVAC Outdoor Air Intake(s) Y N

Location: Roof Ground Level Below Grade Exterior Wall

Other (specify) _____

Cleanliness: Clean 5 4 3 2 1 Dirty

Describe _____

Within 25 Feet of the Outdoor Air Intake(s) There Are:

Sanitary Vents Exhaust Vents Vehicle Traffic Standing Water

Trash Dumpster

Comments _____

HVAC Air Filters

Filter Cleanliness: Clean 5 4 3 2 1 Dirty

Filters Fit Securely in Frame without Leakage Y N

Scheduled Filter Replacement Y N

Comments _____

HVAC Moisture

Condensate Drain Pan(s) Drains Properly Y N

Sound Liner is moist Y N

Comments _____

HVAC Cleanliness

Comments _____

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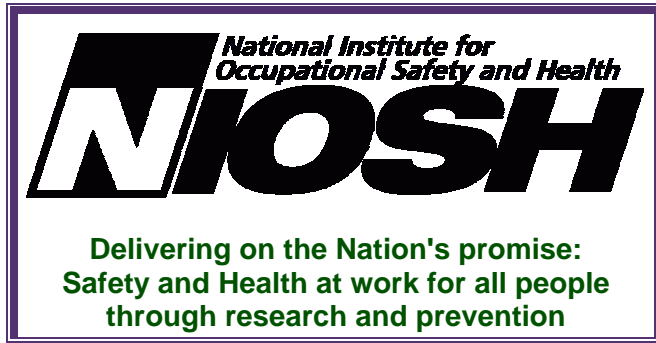
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