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## **NIOSH HEALTH HAZARD EVALUATION REPORT**

**HETA #2006-0027-3001  
New Orleans Police Department  
New Orleans, Louisiana**

**May 2006**

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**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.

## ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Christine West of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS). Field assistance and technical support were provided by Bruce Bernard, Margaret Kitt, Charles Mueller, Elena Page, Chad Dowell, Lynda Ewers, Sangwoo Tak, Richard Driscoll, Joseph Hurrell, Angela Warren, Thomas Hales, Ken Mead, Lauralynn Taylor-McKernan, and Yvonne Boudreau. Clerical support was provided by Jenise Brassell. Desktop publishing was performed by Robin Smith. Editorial assistance was provided by Ellen Galloway.

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**For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.**

## Highlights of the NIOSH Health Hazard Evaluation

In October 2005, NIOSH investigators conducted a health hazard evaluation of the New Orleans Police Department (NOPD) in New Orleans, Louisiana, to assess the impact of the Hurricane Katrina disaster on employee mental and physical health.

### What NIOSH Did

- We gave a questionnaire to NOPD personnel at all district offices, supporting units, and at a Police Association of New Orleans (PANO) Meeting.
- We analyzed questionnaire data to evaluate relationships between health symptoms and exposures related to Hurricane Katrina.

### What NIOSH Found

- Twenty-eight percent of participants reported daily Katrina-related upper respiratory symptoms and the risk of these symptoms are related to floodwater contact with eyes, nose, or mouth and exposure to floodwater sediment.
- Those who reported skin contact with floodwater sediment and floodwater in their eyes, nose, or mouth were twice as likely to report gastrointestinal symptoms.
- Fifty-four percent of personnel reported skin rash symptoms and the risk of these symptoms was related to skin as well as eyes, nose, or mouth contact with floodwater and floodwater sediment.
- Nineteen percent reported symptoms consistent with posttraumatic stress disorder (PTSD). Factors associated with PTSD were assault, family member injury, involvement in crowd control, and recovery of bodies.
- Twenty-six percent reported symptoms of major depression two months after the

Hurricane. NOPD personnel who had rare family contact, injury to a family member, an uninhabitable home, or who were assaulted or isolated from their regular NOPD assignment were more likely to report symptoms of depression.

### What New Orleans Police Department Managers Can Do

- Provide clinical follow-up for physical and psychological health conditions for all NOPD employees who were directly involved in Hurricane events.
- Continue building on critical components of the disaster preparedness program.
- Form a joint employee-management committee that meets regularly to discuss health and safety concerns.
- Develop a plan for periodic medical evaluation and use a surveillance or incident reporting system to document and respond to patterns of injuries and illnesses.
- Provide opportunities for social support and counseling among NOPD personnel.

### What the New Orleans Police Department Employees Can Do

- Report work-related physical and psychological symptoms to management and seek proper medical attention.
- Continue participating in counseling and medical services offered to first responders involved in Hurricane Katrina.



**What To Do For More Information:**  
We encourage you to read the full report. If you would like a copy, either ask your health and safety representative to make you a copy or call 1-513-841-4252 and ask for HETA Report #2006-0027-3001



# Health Hazard Evaluation Report 2006-0027-3001

## New Orleans Police Department

### New Orleans, Louisiana

#### May 2006

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## SUMMARY

In October 2005, the National Institute for Occupational Safety and Health (NIOSH) received a health hazard evaluation (HHE) request from the New Orleans Police Department (NOPD) management asking for assistance in documenting the extent of injury, illness, and mental health problems among NOPD officers subsequent to Hurricane Katrina, which occurred in August 2005.

In response, NIOSH investigators met with NOPD management and employee representatives to design and prepare for a survey. On October 17–28, 2005, NIOSH investigators gave questionnaires to 912 NOPD personnel. The self-administered questionnaire covered demographics, smoking history, work duties and location, Hurricane Katrina activities, medical care and counseling services sought, and presence of symptoms occurring after the Hurricane.

Among the new-onset symptoms (symptoms that were not present prior to Hurricane Katrina), head/sinus congestion (45%) and nose/throat irritation (43%) were the most common physical symptoms reported. Daily upper respiratory symptoms were associated with contact with floodwater to the eyes, nose, or mouth (prevalence ratio [PR]=1.6, 95% confidence interval [CI]=1.3,2.1) and floodwater sediment (PR=1.9, CI=1.4,2.6). Floodwater contact with eyes, nose, or mouth and contact with floodwater sediment were also associated with reports of daily cough ([PR=1.7, CI=1.3,2.3][PR=1.8, CI=1.3,2.5]) respectively. Floodwater sediment contact was associated with daily lower respiratory symptoms (PR=2.4, CI=1.3,4.3). Those who reported that floodwater came in direct contact with their eyes, nose, or mouth (PR=1.9, CI=1.1,3.2) were more likely to report daily gastrointestinal symptoms as were those who reported contact with floodwater sediment (PR=2.4, CI=1.2,4.7). NOPD personnel who reported floodwater contact with their skin (PR=1.5, CI=1.2,1.9); eyes, nose, or mouth (PR=1.2, CI=1.0,1.3); and skin contact with the floodwater sediment (PR=1.3, CI=1.1,1.5) were more likely to report skin rash.

Nineteen percent of personnel reported symptoms of posttraumatic stress disorder (PTSD), and 26% of NOPD personnel reported depressive symptoms 8 weeks after Hurricane Katrina. Officers who experienced an assault (PR=2.0, CI=1.2,3.5), had an injured family member (PR=2.3, CI=1.5,3.4), were involved in crowd control (PR=1.6, CI=1.1,2.1), or participated in recovery of bodies (PR=1.7, CI=1.2,2.3) were more likely to report symptoms consistent with PTSD. The following factors were associated with depressive symptoms: rare contact with family (PR=1.6, CI=1.2,2.1), injury of a family member (PR=1.7, CI=1.2,2.4), and Hurricane damage to the home rendering it uninhabitable (PR=1.4, CI=1.0,1.8), an assault (PR=1.8, CI=1.0,3.1), or isolation from their regular NOPD assignment (PR=1.5, CI=1.1,2.0).

This information is not a substitute for clinical evaluation but is an estimate of the impact of the Hurricane and its aftermath on the health of NOPD personnel.

Physical and mental health symptoms were associated with work-related exposures in NOPD personnel due to Hurricane Katrina. Clinical follow-up for physical and mental health symptoms should be provided for NOPD personnel affected by the Hurricane. Recommendations pertaining to the findings of this evaluation are included in this report.

Key Words: NAICS 922120 (Police Protection), disaster response, PTSD, depression, respiratory, gastrointestinal, occupational health, hurricane recovery efforts

# Table of Contents

Preface.....	ii
Acknowledgments and Availability of Report.....	ii
Highlights of Health Hazard Evaluation .....	iii
Summary.....	iv
Introduction.....	1
Background .....	1
The New Orleans Police Department .....	1
Methods.....	1
Questionnaire .....	2
Statistical Analysis .....	2
Results .....	3
Physical Symptoms Related to Hurricane Katrina.....	4
Report of Symptoms Consistent with PTSD and Depression .....	4
Discussion .....	5
Respiratory Symptoms .....	5
Gastrointestinal Symptoms .....	6
Skin Problems.....	7
Injuries .....	7
Posttraumatic Stress Disorder (PTSD) .....	8
Depression.....	8
PTSD and Depression .....	8
Services.....	9
Strengths and Limitations .....	9
Conclusions.....	10
Recommendations .....	10
References.....	12

## INTRODUCTION

In October 2005, the National Institute for Occupational Safety and Health (NIOSH) received a Health Hazard Evaluation (HHE) request from the Superintendent of the New Orleans Police Department (NOPD) asking for assistance in documenting the extent of physical and mental health symptoms among the NOPD personnel subsequent to Hurricane Katrina, which swept through New Orleans, Louisiana, in August 2005.

## BACKGROUND

Hurricane Katrina struck the Gulf Coast on August 29, 2005, causing extensive structural damage from severe flooding, wind, and breached levees in and around New Orleans, Louisiana. This resulted in an unprecedented displacement of the population. Utilities were disrupted throughout the region, rendering much of the area uninhabitable. The relief and response personnel available during and after Hurricane Katrina were faced with overwhelming devastation and unique circumstances.<sup>1</sup>

Immediately after Hurricane Katrina and the resulting flood, NOPD personnel were required to work in the uncertainties inherent in a complex, post-disaster environment. In addition to physical demands, law enforcement personnel were subject to isolation, inoperative communication equipment, and life-threatening conditions. NOPD personnel faced extended working hours, loss of sleep, and austere living conditions. Many of the NOPD district stations and administrative buildings were flooded or damaged during the hurricane, forcing most of the NOPD to operate in temporary facilities.<sup>2</sup>

### **The New Orleans Police Department**

The Office of the Superintendent, the Fiscal and Human Resource Management Office, and the following four bureaus: Policy, Planning, and Training; Operations; Technical and Support;

and Public Integrity compose the NOPD. Within the Operations Bureau, there are eight District Stations located throughout the 326 square-mile area of Orleans Parish. Other units support the district stations and target specific programs. These include the Public Housing Community Oriented Policing Squad (P.H.C.O.P.S.) section, Special Support units, Investigative Support, Traffic Division, Special Operations, Narcotics Division, Juvenile Division, Mounted/K-9, and Reserve Division.<sup>3</sup>

NOPD management reported that the city employed 1650 NOPD officers prior to Hurricane Katrina.<sup>4</sup> By January 2006, approximately 7%–15% of officers resigned or were terminated.<sup>1,4,5</sup> Prior to the hurricane, NOPD personnel were considered essential personnel and ordered to remain in the city to assist the community. Following the hurricane, an accurate account of NOPD officers was impossible due to downed communications, isolation of personnel due to flooding, and the chaotic events that immediately followed the hurricane.

## METHODS

In early October 2005, a NIOSH team met with NOPD management to discuss administering a cross-sectional illness, injury, and mental health symptom survey among the police force. During site visits, NIOSH team members met with administrators, police commanders, and other officers to discuss the HHE program. After receiving the HHE request from the Superintendent, further information was obtained about NOPD work-related activities and health-related concerns. Police affiliate groups, such as the Police Association of New Orleans (PANO), Fraternal Order of Police (FOP), Black Order of Police (BOP), and Police Officer Women of Every Rank (POWER) were contacted and informed about the survey. The NOPD does not have a recognized bargaining unit for police officers.

NIOSH staff distributed questionnaires October 17–28, 2005, to police personnel at the NOPD Command Center, during roll call hours at each

of the eight district stations and supporting units, and at the monthly PANO meeting. All NOPD personnel involved in response and recovery efforts following Hurricane Katrina were asked to complete the anonymous, self-administered questionnaire. At the beginning of each roll call, NIOSH staff explained the purpose, confidentiality, and voluntary nature of the survey. During the administration of the questionnaire, NIOSH personnel were available to answer questions. After completing the questionnaire, each respondent received a resource packet that contained contact information regarding available local and national health services.

## **Questionnaire**

The primary purpose of the questionnaire was to evaluate the physical and mental health symptoms among NOPD personnel who were involved with Hurricane response and recovery. We included questions about work history and locations, family circumstances, level of damage to residence, contact with floodwaters and sediment, and use of personal protective equipment. Personnel were asked about the presence and frequency of physical symptoms that occurred in association with Hurricane Katrina and about past medical history. We also asked about symptoms of posttraumatic stress disorder (PTSD) and depression and whether officers sought mental health care related to Hurricane Katrina events.

Physical symptoms evaluated included respiratory symptoms, gastrointestinal symptoms, skin problems, and injuries. New-onset symptoms were defined by a positive response to the question, "Have you had any of the following symptoms since Hurricane Katrina?" and a negative response to, "Did you have this symptom prior to Hurricane Katrina?" New-onset symptoms reported daily were defined based on a response of "every or almost every day" to the question, "How often have you had this symptom in the last 4 weeks?" Case definitions were created using the above new-onset and daily reported symptom criteria for upper and lower respiratory symptoms, cough, and gastrointestinal symptoms. Daily upper

respiratory symptoms were defined as a positive response to questions concerning head/sinus congestion or nose/throat irritation. Daily cough was defined as positive responses to questions concerning either dry cough or cough with phlegm. Daily lower respiratory symptoms were defined as a positive response to questions concerning shortness of breath with minimal activity, wheezing/whistling in the chest, or chest tightness. Daily gastrointestinal symptoms were defined as a positive response to questions concerning nausea/vomiting, diarrhea, or abdominal pain. Skin problems were defined by a positive response to, "Have you had any type of skin problem or rash as a result of Hurricane Katrina?" Skin rash was defined as the participant experiencing pimples or bumps, blisters, boils, itching, swelling, or redness. Injuries/events were defined as a positive response to the question, "Have you had any of the following since Hurricane Katrina?"

The questions related to posttraumatic stress included 19 items derived from the Veterans Administration PTSD Checklist.<sup>6</sup> Scoring for PTSD corresponded to diagnostic criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV).<sup>7</sup>

For depression, an abbreviated set of 10 questions from the Center for Epidemiologic Studies Depression Scale (CES-D)<sup>8</sup> was used. This scale has been shown to be reliable and valid to detect symptoms of depressed mood for a wide range of study populations.<sup>9,10</sup> We used a cut-off score of 11 (out of a total possible score of 30) to define persons exhibiting major depressive symptoms.

## **Statistical Analysis**

The report describes the prevalence of physical and mental health symptoms reported among NOPD personnel related to working in the aftermath of Hurricane Katrina. We examined relationships between Hurricane-related exposures and reported physical and mental health symptoms using prevalence ratios (PR) along with their corresponding 95% confidence intervals (95% CI). We constructed regression models to adjust for non-occupational



confounding factors such as age, gender, and past medical history for mental health symptoms and smoking status for respiratory symptoms. Additional frequency data describe the characteristics of the survey population and selective activities following the Hurricane. The statistical software used for the analyses was SAS version 9.1, SAS Institute, Cary, NC.

The prevalence ratio (PR) is defined as the prevalence of symptomatic personnel exposed to a certain factor divided by the prevalence of symptomatic personnel not exposed to the same factor. If we find that 50% of NOPD personnel who reported cough were exposed to floodwater sediment compared to 25% of NOPD personnel reporting cough who were not exposed to floodwater sediment, then our PR would be 2 (50/25). We would conclude NOPD personnel exposed to floodwater sediment are twice as likely to report cough as those not exposed to floodwater sediment. A PR of 1.0 indicates no difference in the prevalence of the symptom between the exposed and non-exposed group. If the PR is less than 1.0, the prevalence of the symptom in the exposed group is less than in the non-exposed group. Because all prevalence estimates have some uncertainty, we also calculated the 95% CI. If the lower number in the 95% CI is greater than 1.0 then the evidence for the increase in symptoms in the exposure group compared to the non-exposure group is especially convincing. The term “statistically significant” is used to describe the prevalence ratios that meet these criteria.

While this report contains descriptions of physical and mental health symptom findings in the group of participants, this information is not to be used as a diagnosis of individual mental health or physical problems. Diagnosis must be made by a qualified health care/mental health provider.

## RESULTS

We received questionnaires from 912 NOPD officers. Despite persistent attempts, we were unable to obtain rosters or employment records from NOPD management to verify the number

of NOPD officers at the time of our survey. Unofficial reports of the number of officers present in the city at the time of our survey varied from 1200–1448 officers.<sup>11</sup> Given these numbers, we estimate a participation rate of 63%–76% on the survey. Denominators vary in the results below due to missing data on certain questions.

Table 1 lists work locations reported among NOPD participants at the time of the survey. Most of the participants reported working in the Operations Bureau and among the district stations. Among the district stations, district stations 1 and 5 had the largest number (n=95) of participants. The participants were predominately male (724/909, 80%) with a mean age of 38 years (range: 19–78). The most common shift reported was day shift (454/909, 50%), followed by the night shift (331/909, 36%), and other shift (124/909, 14%). Mean duration of NOPD employment was 11 years (range: 0–41). Table 2 gives a distribution of the locations of NOPD personnel the first week after Hurricane Katrina. Table 3 lists activities in which NOPD personnel were involved during and after Hurricane Katrina. Patrol duty (709/912, 78%), and looting control (535/912, 59%) were the most commonly reported activities. Of the participants, 69% reported they never smoked (623/903), 18% (166/903) reported being a current smoker, and 13% (114/903) reported being a former smoker.

Seventy-six percent (687/905) of NOPD participants reported direct skin contact with floodwater; 30% (258/864) reported their eyes, nose, or mouth came in contact with floodwater, and 56% (497/888) reported contact with sediment. Most participants reported two or more of the above exposures. Of those who reported skin contact with the floodwater, only 38% (252/664) reported eyes, nose, or mouth contact with the floodwater. Of participants who reported eyes, nose, or mouth contact with floodwater, 98% (252/257) of them reported floodwater contact with their skin. Of those who reported skin contact with floodwater sediment, 87% (430/496) reported skin contact with floodwater. Lastly, 80% (205/256) of those who

reported eyes, nose, or mouth contact with floodwater also reported contact with floodwater sediment.

Fifty-five percent (501/905) of NOPD personnel reported that their home was uninhabitable; 42% (381/905) reported reparable flood or wind damage to their home, and only 5% (41/905) reported their home was not damaged as a result of the Hurricane.

As shown in Table 4, the most frequently reported personal protective equipment (PPE) used were gloves (287/912, 31%) and rubber boots (286/912, 31%). Less than 5% of participants reported use of respirators, waders, ear protection, or hard hats.

### ***Physical Symptoms Related to Hurricane Katrina***

Table 5 presents the number and percent of NOPD participants reporting upper and lower respiratory and gastrointestinal symptoms experienced after Hurricane Katrina but not before. Of these, head/sinus congestion and nose/throat irritation were the most common, followed by itching, dry cough, and diarrhea. Also included are the number and percent of subjects reporting these symptoms daily. Although 28% of participants reported having diarrhea after Hurricane Katrina, only 5% reported it daily.

Table 6 lists the type of skin problems reported. Itching (323/908, 36%) and cuts, scrapes, or lacerations (278/911, 31%) were the most common types of skin problems reported. Twenty-nine percent (267/912) reported that arms or hands and 30% (278/912) reported that lower legs or feet were the most common locations for skin problems. Table 7 lists common injuries reported following Hurricane Katrina. The most common were laceration/puncture (184/912, 20%), sprain/strain (120/912, 13%), and animal bites and stings (104/911, 11%).

Table 8 presents the relationships between contact with floodwater and sediment and new-onset daily upper respiratory, cough, and

gastrointestinal symptoms. We also determined whether an association existed between floodwater and sediment exposure and skin rash. We controlled for smoking status in all of the relationships involving respiratory symptoms. Daily upper respiratory symptoms were significantly related to floodwater contact with the eyes, nose, or mouth (PR=1.6, CI=1.3,2.1) and contact with floodwater sediment (PR=1.9, CI=1.4,2.6). Eye, nose, or mouth contact with floodwater (PR=1.7, CI=1.3,2.3) and contact with floodwater sediment (PR=1.8, CI=1.3,2.5) were also significantly associated with reports of daily cough. Daily lower respiratory symptoms were significantly related to contact with floodwater sediment (PR=2.4, CI=1.3,4.3). Those who reported contact with their eyes, nose, or mouth to floodwater were more likely to report daily gastrointestinal symptoms of nausea/vomiting, diarrhea or abdominal pain (PR=1.9, CI=1.1,3.2). Likewise, those who reported contact with floodwater sediment also were likely to report the same gastrointestinal symptoms (PR=2.4, CI=1.2,4.7). NOPD personnel who reported floodwater contact with their skin (PR=1.5, CI=1.2,1.9); eyes, nose, or mouth (PR=1.2, CI=1.0,1.3) and direct skin contact with floodwater sediment (PR=1.3, CI=1.1,1.5) were more likely to report skin rash.

Thirty-one percent (279/897) of NOPD personnel reported seeing a health care provider for Hurricane-related symptoms. Eight percent (73/906) reported lost workdays due to health problems related to the Hurricane and 2% (15/906) reported restricted work activities because of health problems related to the Hurricane.

### ***Report of Symptoms Consistent with PTSD and Depression***

Table 9 provides the prevalence of PTSD and depressive symptoms. Nineteen percent of NOPD personnel reported symptoms that met the criteria for PTSD and 26% reported symptoms that met the criteria for major depression.

Tables 10 and 11 describe the associations found between personal and work-related exposures

with self-reported symptoms of PTSD and depression. Predictors of PTSD, after adjusting for age, gender, and a previous history of PTSD were assault (PR=2.0, CI=1.2,3.5), family member injury (PR=2.3, CI=1.5,3.4), involvement in crowd control (PR=1.6, CI=1.1,2.1), and recovery of bodies (PR=1.7, CI=1.2,2.3). After adjusting for age, gender, and a previous history of depression, NOPD personnel who had rare contact with their family (PR=1.6, CI=1.2,2.1), a family member injured (PR=1.7, CI=1.2,2.4), an uninhabitable home (PR=1.4, CI=1.0,1.8), were assaulted (PR=1.8, CI=1.0,3.1), or were isolated from their regular NOPD assignment (PR=1.5, CI=1.1,2.0) were more likely to report symptoms of depression. Depressive or PTSD symptoms were significantly related to reports of new-onset daily upper and lower respiratory symptoms, skin rash, and daily gastrointestinal problems. Table 12 provides the prevalence of mental health services the NOPD participants reported they used. Individual counseling was the most common type of service used (126/897, 14%).

## DISCUSSION

The main objectives of our investigation were to determine the prevalence and characterize the risk factors for physical and mental health symptoms among NOPD personnel following Hurricane Katrina. Of the physical symptoms reported, head/sinus congestion and nose/throat irritation were the most common, followed by dry cough and diarrhea. Contact with floodwater sediment was associated with self-reported daily upper and lower respiratory symptoms, cough, gastrointestinal, and skin rash symptoms. Of the mental health symptoms, more NOPD participants reported depressive symptoms than symptoms consistent with PTSD. Several work and personal factors were associated with both PTSD and depressive symptoms.

### **Respiratory Symptoms**

The most frequently reported respiratory symptoms among NOPD personnel were head/sinus congestion, nose/throat irritation, dry cough, or cough with phlegm. Daily upper and

lower respiratory and cough symptoms were also significantly associated with contact with floodwater sediment. These results are consistent with results of another Centers for Disease Control and Prevention (CDC) survey<sup>12</sup> in which relief workers (fire fighters, police, military, and volunteer responders) reported more acute respiratory symptoms than residents immediately following the Hurricane.

Simple upper respiratory infections are common in the general population, and NOPD participants may have been more susceptible given their state of heightened stress, poor living conditions and little sleep. In addition, evidence suggests that asthma-related symptoms are common after thunderstorms although the mechanism is unknown. High concentrations of respirable allergens in the air, as may have occurred in the timeframe surrounding the Hurricane, could have exposed people to a rapid increase in pollen allergen.<sup>13</sup>

Another possible explanation for these findings is increased exposure to respirable dust released from dried sediment. The Occupational Safety and Health Administration (OSHA) found that some of the workers around New Orleans were exposed to respirable dust levels above the Permissible Exposure Limit (PEL) of 15 milligrams per cubic meter (mg/m<sup>3</sup>). Many of these workers were laborers, flagmen, and others stationed outdoors within the New Orleans city limits.<sup>14</sup> This suggests that of those NOPD personnel working outside, sediment dust exposure may have been a concern. However, due to a limited number of samples taken and considerable variation in occupation and job duties, it is not known if these results are representative of NOPD personnel.

NIOSH conducted a limited post-Hurricane evaluation of airborne sediment dust exposure samples on October 17, 2005, among New Orleans fire fighters.<sup>15</sup> These data can be used to estimate potential NOPD exposures as fire fighters had been working in similar conditions. Task-based personal breathing zone (PBZ) air samples were collected during movement of a fire truck through the Ninth Ward, an activity

thought to raise airborne dust. Although results from these samples showed exposure to respirable and total particulate below occupational criteria, some people may experience symptoms related to those exposures because of pre-existing respiratory conditions and allergies.

The massive flooding as a result of Hurricanes Katrina and Rita and the warm and humid conditions typical of the New Orleans region resulted in extensive mold contamination of structures. At the time of our survey, many NOPD personnel probably had not yet been extensively involved in mold cleanup activities at work or at home. However, there may have been personnel who experienced respiratory health effects from exposure to mold-contaminated environments. An early CDC-led investigation determined that 46% of inspected buildings in the four parishes of New Orleans (Orleans, Jefferson, Plaquemines, and St. Bernard) had visible mold growth.<sup>16</sup> Dampness in buildings can promote the growth of mold, house dust mites, cockroaches, and microbial agents and can contribute to the breakdown of building materials and furnishings. A variety of substances and particles derived from mold, bacteria, insects, and building materials may be released into the indoor air environment. Recently, the Institute of Medicine of the National Academy of Sciences conducted an extensive review of past scientific studies on the health effects for occupants of damp buildings and concluded that excessive indoor dampness is a public health problem.<sup>17</sup> Based on its review of available research, the Institute of Medicine found *sufficient evidence* that indoor dampness or mold is associated with asthma symptoms (in sensitized asthmatic persons), cough, wheeze, and nasal and throat symptoms. In addition, the Institute of Medicine found *sufficient evidence* that exposure to mold or bacteria in damp indoor environments is associated with hypersensitivity pneumonitis, an allergic pneumonia. It found *limited or suggestive evidence* that exposure to indoor dampness is associated with the development of shortness of breath and asthma. In scientific studies, different types of mold typically have not been associated with specific

health effects in building occupants. There are currently no regulatory standards or guidelines regarding safe or unsafe mold levels. People should strive to reduce their exposure to molds as much as possible, especially people with underlying immunosuppression.<sup>18</sup>

## **Gastrointestinal Symptoms**

Gastrointestinal symptoms defined as diarrhea, nausea or vomiting, or abdominal pain occurring daily among the participants were found to be significantly associated with eye, nose, or mouth exposure to floodwaters and contact with floodwater sediment. Gastrointestinal symptoms such as nausea, abdominal pain and diarrhea are common in the population after a natural disaster although the cause is not always known.<sup>19</sup> However, there is previous evidence that the increase in gastrointestinal symptoms post-hurricane may be due to direct exposure to floodwaters. Following flooding in the Midwest in 2001, persons whose homes or yards were flooded (taken as an indication of exposure to the floodwaters) were found to be at increased risk of gastrointestinal symptoms (OR=2.36, CI=1.37,4.1)<sup>18</sup> compared to residents whose homes or yards were untouched by floodwaters. Only 11% of respondents aged 12 years or more reported at least some contact with floodwaters in this study, much lower than the 76% found among the NOPD.

Diarrhea was also significantly associated with exposure to floodwaters and residing in a flooded home among households affected by Tropical Storm Allison.<sup>17</sup> A door-to-door survey of 420 households found that residents of flooded households were significantly more likely to report diarrhea within one week of the worst flooding than residents whose households were not flooded (OR= 4.7, CI: 1.8,12.0). The effect of gastrointestinal illness was more severe among persons in poor health, in those aged  $\geq 50$  years, and in those with previous gastrointestinal symptoms or illness. It is important to note that the vast majority of persons with diarrhea recover completely, and have no long-term health consequences. Floodwater after Hurricane Katrina was found to contain fecal material from the overflowing sewage systems and from

agricultural and industrial waste. Bacteria from these contaminated waters may have been spread from hand to mouth. The sampling conducted in the floodwaters found no *E. coli* O157, one of the most harmful types of *E. coli* bacteria, nor other pathogenic bacteria.<sup>20</sup>

Another possible explanation could be the stressful work conditions faced by personnel and the unavailability of clean water and hygiene facilities, which may have contributed to the onset of gastrointestinal symptoms among NOPD personnel. Increased incidences of acute diarrhea have been linked to limited access to electricity, clean water, and sanitary facilities.<sup>18,21,22</sup>

### **Skin Problems**

Of the skin problems reported, rash-related symptoms such as itching, pimples/bumps, and redness were commonly reported as well as skin lacerations, cuts, or scrapes as a result of Hurricane Katrina. The rash symptoms reported by the police are similar to those reported by Katrina relief workers and rescue workers involved in early evacuation.<sup>12, 23</sup> We determined that police officers who reported exposure to floodwater and floodwater sediment were more likely to report skin rashes. Many types of skin rash and skin irritation can be attributed to prolonged contact with floodwaters and wet conditions. Long periods of exposure to wet conditions can compromise the function of the skin barrier. Symptoms may include a tingling and/or itching sensation, pain, swelling, cold and blotchy skin, numbness, and a prickly or heavy feeling in the affected area, usually in the hands or feet. When this condition occurs in the feet it is known as trench foot or immersion foot. It can be quite painful, but can be prevented and treated, usually without any long-term effects.

Contamination of wounds with water can also lead to a variety of infections. Open wounds and other skin conditions, such as eczema and psoriasis, may increase the risk of infection. Although infections with waterborne organisms are uncommon, even after floods this still remains a possibility. Waterborne organisms often implicated in these infections include

*Aeromonas* spp., non-cholera *Vibrio* spp. and sometimes *Pseudomonas* or other Gram-negative rods.

### **Injuries**

Injuries most frequently reported among NOPD were laceration/puncture, animal bites and stings, and sprains/strains. These findings are consistent with reports of injuries seen in past hurricane events<sup>24,25</sup> as well as injuries reported through the active CDC surveillance system following Hurricane Katrina.<sup>16</sup> Police, fire fighters, and other rescue workers are typically the first to arrive on scene, often in unfamiliar surroundings and adverse weather conditions. Added to this, they are exposed to numerous hazards inherent in disaster sites, such as flying debris, uneven work surfaces, sharp and jagged materials, piles of heavy debris, and contact with displaced domestic animals, which places them at increased risk for injury.<sup>26</sup> NOPD personnel may have encountered many of these hazards. Many may not have been immediately obvious or identifiable, leaving personnel with limited information to select appropriate protective measures. We recognize that although rescue-related tasks associated with the disaster have decreased, NOPD personnel may be involved in disaster cleanup activities that continue to pose an increased injury risk.<sup>27</sup>

Symptom severity was partially assessed by determining the prevalence of health care sought, use of sick days, and restriction of work activities. Although a relatively small percentage used sick days (8%) or limited their job duties (2%), 31% of NOPD participants sought medical care. Because we only surveyed currently working NOPD personnel, we may have underestimated how many officers used sick leave or sought health care. In addition, we do not know the background or usual rate of these activities so we cannot determine if the amount of health care sought, sick leave, and restricted work activities have changed as a result of the Hurricane.

## **Posttraumatic Stress Disorder (PTSD)**

Nineteen percent of NOPD personnel had symptoms consistent with PTSD. Rates of PTSD symptoms in the NOPD are similar to those in rescue workers responding to other natural disasters in a similar time.<sup>28, 29, 30</sup> However, rates found in our study are much higher than in police officers who experienced a single traumatizing experience, where only 7% had PTSD.<sup>31</sup>

PTSD occurs following a traumatic event that causes intense fear and/or helplessness in an individual.<sup>8</sup> PTSD symptoms usually begin within 3 months after the trauma, although there may be a delay of months, or even years, before symptoms appear. Duration of the symptoms varies, with complete recovery occurring within 3 months in approximately half of cases, and with many others having persistent symptoms for longer than 12 months after the trauma. The severity, duration, and proximity of an individual's exposure to the traumatic event are the most important factors affecting the likelihood of developing this disorder. This disorder can develop in individuals without any predisposing conditions, particularly if the stressor is especially extreme, but stress related to the disaster may revive memories of prior trauma and may intensify preexisting psychological or medical problems.<sup>32</sup> Rescue workers at greatest risk for traumatic stress response are those exposed to life-threatening danger or physical harm (or whose family members are exposed to life-threatening danger or physical harm), extreme environmental destruction, loss of home and community, intense emotional demands, loss of family contact or support, and extreme fatigue, weather exposure, hunger or sleep deprivation.<sup>33,34,35</sup> NOPD personnel experienced many of these factors, and our analysis demonstrated a significant association between symptoms of PTSD if they experienced an assault or if their family members were injured. Additionally, we found significant associations between symptoms consistent with PTSD and being involved in crowd control activities and recovery of bodies during or after Hurricane

Katrina after controlling for age, gender, and a history of PTSD.

Hurricane Katrina presented extreme challenges and placed tremendous additional burdens on police, taking priority over normal police operations. Long working hours, hunger, little sleep, and concerns over family and community may have left police officers vulnerable to traumatic stress effects. As personnel controlled crowds or recovered bodies, they may have been faced with or witnessed several life-threatening events, placing their safety as well as the community's health and safety at risk. Exposure to dead or maimed bodies and witnessing bodily injury and gruesome death are risk factors for development of traumatic stress.<sup>32,36</sup> These factors and the possibility that personnel were involved in extremely dangerous situations for extended periods could account for the association between response activities and PTSD symptoms.

## **Depression**

Twenty-six percent of the NOPD personnel reported symptoms consistent with major depression. This percentage is higher than has been seen in rescue workers in other disaster situations.<sup>37,38</sup> We found associations among those with depression and those who had minimal contact with family, those whose family member(s) were injured, those experiencing assault, those whose home was damaged resulting in it being uninhabitable, and those isolated from their regular NOPD assignment. Studies of populations exposed to natural disasters have suggested that the amount of personal loss is a main risk factor for depression.<sup>36,39,40</sup> Regehr et al. found that low social support is an important determinant of depressive symptoms among first responders.<sup>41</sup> This may explain our finding that isolation from their NOPD assignment and rare contact with family members were related to depressive symptoms.

## **PTSD and Depression**

Fourteen percent of NOPD personnel reported both depression and PTSD symptoms. Symptoms related to depression and PTSD

frequently coexist; depression that occurs after a traumatic exposure has been identified as a risk factor for developing PTSD symptoms.<sup>38,42,43</sup> A history of depression may also be predictive of PTSD, but we did not determine if this was a factor in NOPD posttraumatic symptom reporting.<sup>37</sup> Social factors were found to be associated with PTSD and depressive symptoms. Social support from family, friends, supervisors, and coworkers has been shown in repeated studies to attenuate or reduce the effects of psychological stress and depression.<sup>44</sup>

Our analysis also demonstrated a relationship between the following physical symptoms and reports of depression and PTSD: skin rash/problems, upper and lower respiratory symptoms, nausea, diarrhea, and abdominal pain. According to previous studies, there is an association between psychological and physical symptoms, especially gastrointestinal symptoms.<sup>36,45,46</sup> However, due to the nature of our study in which risk factors and health problems were measured at the same time, it is not possible to determine which symptoms are the cause and which are the effect.

It is difficult to predict the long-term effect from this disaster on mental health. Responses to extraordinary traumatic events may provoke a range of reactions, and symptoms alone are not adequate to fully diagnose medical conditions. Considering that this survey was conducted only 8 weeks after the Hurricane, many of the symptoms reported by the NOPD may be part of a normal and reversible acute stress reaction. Similar symptoms reported by other responder populations have been shown to decline over time.<sup>47</sup>

## **Services**

Although few participants reported use of individual or family counseling services or any type of debriefing or defusing services, counseling services appeared to be available after the Hurricane from organizations such as Substance Abuse and Mental Health Services Administration (SAMHSA), Louisiana State University, and American Red Cross. Representatives from these organizations were

present during roll call hours and during off hours to talk to police personnel who had mental health concerns. We cannot determine the reason few personnel sought these counseling services, but police personnel may have been too occupied to access these services soon after the Hurricane. Additionally, the literature suggests that traumatized individuals are typically resistant to seeking treatment.<sup>34</sup> A study of help-seeking patterns in disaster victims following a natural disaster found that victims were more willing to seek mental health assistance from their primary care provider or from family, relatives, friends, and neighbors than from counselors, psychologists, or mental health professionals. This preference appeared to be related to cultural norms regarding shame and self-disclosure of emotional distress. Past research suggests that police culture discourages reporting of emotional difficulties.<sup>31,48</sup> Every effort should be made to ensure available local counseling services are private and confidential in the affected communities.

## **Strengths and Limitations**

Our evaluation had a number of strengths and limitations. Our survey included a moderately high participation rate of 63%–76%, which increases the likelihood that the results are representative of the entire NOPD workforce. It is a study of a large population, which increases the probability of detecting a difference in outcomes of those who were exposed and not exposed to Hurricane-related factors if they do in fact differ. Our timely response to this hurricane event increases the chance that exposures were accurately recalled, but may not capture the true nature of mental health conditions, such as PTSD and depression, as these conditions typically occur later. Although a strength of our study includes the well-established measurement tools used to define the psychological outcome variables, the depression scale instrument may not be appropriate for this working population as it is a scale typically used to assess symptoms of depression in the general population. This is a cross-sectional study, which measures health outcomes and exposures at a single point in time. Inherent in this type of study is the potential for “survivor bias,” i.e., not

including NOPD personnel who left their job because of the health problems of interest. This may have resulted in underestimation of reported prevalence of health problems and exposures. Underestimation may have also occurred due to inclusion of some non-officer participants such as administrators, trainees, and dispatchers. The potential stigma associated with reporting of psychological symptoms may have led to underestimation of PTSD and depressive symptoms.

Because risk factors and health problems are measured at the same time in cross-sectional studies, it is not possible to determine the direction of the association. For example, an association was found between respiratory symptoms and symptoms of depression, but with this study design we are unable to ascertain whether reported respiratory symptoms was associated with perceived depressive symptoms or vs.-versa. Reporting bias may have been a factor in this survey; suggestive of the “toxic gumbo” widely reported in the media, personnel with symptoms may have been more likely to report exposure to floodwater and sediment compared to those without symptoms. This may have been a factor in the other associations measured leading to over-reporting job-related risk factors. If this occurred, associations between those factors and symptoms could have been exaggerated. Lastly, there may have been other chemical or biological exposures that we did not inquire about in the survey that could have been associated with our health outcomes.

## CONCLUSIONS

The most frequent physical health symptoms reported among the NOPD after Hurricane Katrina were head/sinus congestion and nose/throat irritation, followed by itching, dry cough, and diarrhea. In addition to physical symptoms, a high percentage of NOPD personnel reported symptoms consistent with PTSD and depression. Our analysis identified certain factors, such as contact with floodwater and isolation from family that were associated with physical and mental health outcomes.

## RECOMMENDATIONS

1. NOPD management should encourage NOPD personnel with ongoing physical or mental health symptoms to seek follow-up with a health care provider. Disseminate written information to employees advising them to seek out health care and mental health providers about ongoing health concerns from the Hurricane and its aftermath. Supervisors should be trained to help recognize and support employees who may have health problems.
2. NOPD management should encourage NOPD personnel and their families to use available counseling services by instituting flexible leave policies. NOPD department chaplains, internal advocacy groups (FOP, PANO, BOP, and POWER), and contracted local mental health providers such as LSU mental health providers should disseminate updated information in all the District Offices about available counseling, and encourage police participation. Mechanisms such as hotline numbers, on-site representatives, and posters can be useful for this effort.
  - Offer several different types of services, including a range of venues, providers, and mechanisms for counseling and treatment. It is important to note that not every individual benefits from the same type or source of treatment. Additionally, NOPD management and city officials should consider providing employee assistance program services for their police personnel. This would include ongoing voluntary, short-term counseling and referral to local mental health providers for various issues affecting employee mental and emotional well-being, stress, grief, family problems, and psychological disorders. Peer support services, which would allow personnel experiencing personal or professional problems such as trauma, stress, depression, or family problems to seek support from coworkers trained in basic counseling skills in a private setting, is another alternative.
  - Adequacy and accessibility of available counseling services should be periodically



evaluated. Offer targeted counseling services over time to employees with an awareness that conditions such as PTSD and depression may occur later in the recovery process. Other sources of funding for counseling should be sought if internal resources are limited. For more information on mental health services available in the area, see <http://www.mentalhealth.samhsa.gov>

3. NOPD management should continue developing the critical components of the existing disaster preparedness program in NOPD. Top management commitment and employee participation must be integral parts of this program. An occupational health safety management plan within the larger disaster preparedness program should address the health and safety of NOPD personnel. As a guide, the NIOSH document Protecting Emergency Responders, Volume 3: Safety Management in Disaster and Terrorism Response may be helpful. It is available electronically at <http://www.cdc.gov/niosh/docs/2004-144/>.

- A joint employee-management committee to address ongoing health and safety issues, with representation from all units, sections, districts, and divisions should be formed and convened regularly, and be appropriately supported with resources. The responsibility of the committee should include involvement in decisions on workplace interventions affecting employees at risk such as choosing protective options for disaster response activities, scope and breadth of safety training, and hazard assessment during disaster response conditions.
- The joint employee-management committee should discuss, as part of the disaster preparedness plans, ways to identify additional resources during a large-scale disaster in advance of the crisis. This could include contingency plans to inform other municipalities to provide backup so that NOPD personnel can rest and attend to family safety needs. Other ways to give employees flexibility in attending to personal needs and allow for rest could be

rotation of personnel and/or flexible work hours such as staggered or concentrated work shifts during major disaster periods to the extent feasible. Further discussion should focus on policies that allow for employee compensation and sick-leave absences unique to the disaster (e.g. non-punitive, liberal leave).

4. NOPD management should continue with the improvement of the incident reporting system, ensuring that it provides information for employers and employees, raising their awareness of the number and type of injuries and illnesses occurring in the workplace and identification of their related hazards. Analyze health information periodically to determine high-risk areas, tasks, and job classifications. Specifically, baseline information collected prior to a disaster event would be helpful to determine if the number of injuries and illness increased subsequent to the disaster. The goal of gathering such information is to address safety problems in a timely manner, intervene to improve responder protection, and to know where to direct prevention efforts in future disasters. External audits of accuracy of injury and illness data, including review of all available data sources should be conducted periodically.

5. NOPD management should develop a plan for routine periodic medical evaluation of NOPD employees. The Public Safety Medicine Section of the American College of Occupational and Environmental Medicine is developing medical evaluation guidelines for police officers. When available, these guidelines will assist NOPD management for possible implementation. California and Massachusetts have developed medical evaluation programs for police candidates that may be applicable. These guidelines are available electronically at [http://www.mass.gov/Ehrd/docs/cs/medicalstandardspat/cs\\_pat\\_regs\\_initial\\_fitness\\_standards.pdf](http://www.mass.gov/Ehrd/docs/cs/medicalstandardspat/cs_pat_regs_initial_fitness_standards.pdf) and -3001 <http://www.post.ca.gov/selection/pdf/MedicalScreenGuide Full.pdf>

7. NOPD management should provide opportunities for social support of NOPD

personnel from family, friends, and coworkers. This could include opportunities for discussion and education about emotional responses to the disaster during and after work. Providing a private meeting area in the workplace can allow personnel a forum to talk with family members and coworkers at their discretion. Lastly, forming a disaster support group with coworkers and family members that can meet periodically outside of work may promote support, education, and psychological recovery.

8. For employees working inside areas contaminated with mold for extended periods and where remediation is taking place, a quick guide of population-specific recommendations for protection from mold in buildings flooded after Hurricanes Katrina and Rita is included in Appendix A. These guidelines are part of a comprehensive CDC report titled, "Mold: Prevention strategies and health effects associated with the aftermath of Hurricanes Katrina and Rita." For the full report, see <http://www.bt.cdc.gov/disasters/mold/report/>. Other information about mold health effects and remediation is available at the United States Environmental Protection Agency website at <http://www.epa.gov/mold/index.html>.

9. For comprehensive information related to responder health and safety and general illness prevention after disasters, refer to the following websites for important health information in workers: <http://www.cdc.gov/niosh/topics/flood> and the community: <http://www.bt.cdc.gov/disasters/illness.asp>.

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**Table 1**  
**Number of Participants by Bureau**  
**Survey of NOPD after Hurricane Katrina**  
**October 2005**

<b>Bureau</b>	<b>Number (%)</b>	<b>District Station<sup>1</sup></b>	<b>Number (%)<sup>2</sup></b>
<b>Operations</b>	763 (85)	<b>District 1</b>	95 (12)
		<b>District 2</b>	52 (7)
		<b>District 3</b>	52 (7)
		<b>District 4</b>	48 (6)
		<b>District 5</b>	95 (12)
		<b>District 6</b>	64 (8)
		<b>District 7</b>	72 (9)
		<b>District 8</b>	51 (7)
		<b>District 9 (PHCOPS)</b>	41 (5)
		<b>Not in district station</b>	193 (3)
<b>Office of the superintendent</b>	7 (1)		
<b>Policy, planning, and training</b>	46 (5)		
<b>Technical and support</b>	55 (6)		
<b>Public integrity</b>	28 (3)		
<b>Other/Unknown</b>	13 (1)		
<b>Total number of participants</b>	<b>912</b>		

<sup>1</sup> District Stations are within the Operations Bureau.

<sup>2</sup> Percentages are calculated from total in Operations Bureau.

**Table 2**  
**Location(s)<sup>1</sup> of Participants the First Week after Hurricane Katrina**  
**Survey of NOPD after Hurricane Katrina**  
**October 2005**

<b>Location</b>	<b>Number (%)</b>
<b>Districts 1–9</b>	423 (46)
<b>Hotel</b>	189 (21)
<b>Convention Center</b>	110 (12)
<b>Hospital</b>	82 (9)
<b>Headquarters</b>	76 (8)
<b>Superdome</b>	69 (8)
<b>A location outside of New Orleans</b>	58 (6)
<b>Home, apartment, condo</b>	46 (5)
<b>Evacuation center</b>	25 (3)
<b>Other</b>	146 (16)

<sup>1</sup> Twenty-two percent of respondents indicated more than one location.

**Table 3**  
**Activities<sup>1</sup> Reported During and After Hurricane Katrina**  
**Survey of NOPD after Hurricane Katrina**  
**October 2005**

<b>Activity</b>	<b>Number (%)</b>
<b>Patrol duty</b>	709 (78)
<b>Looting control</b>	535 (59)
<b>Crowd control</b>	525 (58)
<b>Rescue of citizens in flooded areas</b>	473 (52)
<b>Evacuation</b>	444 (49)
<b>Gunfire incidents</b>	364 (40)
<b>Traffic control</b>	257 (28)
<b>Administrative duties</b>	205 (22)
<b>Investigation</b>	125 (14)
<b>Recovery of bodies</b>	121 (13)
<b>SWAT</b>	70 (8)
<b>Narcotic control</b>	61 (7)
<b>Training</b>	33 (4)
<b>Intake</b>	26 (3)
<b>Other</b>	73 (8)

<sup>1</sup> Eighty-seven percent of respondents reported more than one activity.



**Table 4**  
**Reported Use of Personal Protective Equipment in the Disaster<sup>1</sup>**  
**Survey of NOPD after Hurricane Katrina**  
**October 2005**

<b>PPE</b>	<b>Number (%)</b>
<b>Gloves</b>	287 (31)
<b>Rubber boots</b>	286 (31)
<b>Safety shoes</b>	73 (8)
<b>Safety glasses</b>	36 (4)
<b>Waders</b>	35 (4)
<b>N-95 respirator</b>	12 (1)
<b>Ear protection</b>	2 (0.2)
<b>Hard hat</b>	1 (0.1)

<sup>1</sup> Reported “ever” use of personal protective equipment in this disaster.

**Table 5**  
**Physical Symptom Prevalence after Hurricane Katrina**  
**Survey of NOPD after Hurricane Katrina**  
**October 2005**

<b>Symptoms Reported Post-Hurricane</b>	<b>New-Onset Symptom<sup>1</sup> Number (%)</b>	<b>New-Onset Symptoms Reported Daily<sup>2</sup> Number (%)</b>
<b>Head/sinus congestion</b>	388 (45)	186 (21)
<b>Nose/throat irritation</b>	372 (43)	153 (18)
<b>Dry cough</b>	269 (31)	115 (13)
<b>Cough with phlegm (mucous)</b>	229 (26)	111 (13)
<b>Shortness of breath with minimal activity</b>	116 (13)	50 (6)
<b>Wheezing/whistling in your chest</b>	96 (11)	38 (4)
<b>Chest tightness</b>	115 (13)	33 (4)
<b>Fever</b>	98 (11)	14 (2)
<b>Nausea or vomiting</b>	141 (16)	19 (2)
<b>Abdominal pain</b>	123 (14)	25 (3)
<b>Diarrhea</b>	243 (28)	40 (5)

<sup>1</sup> Based on a yes response to symptom and not having the symptom prior to Hurricane Katrina.

<sup>2</sup> Based on a yes response to symptom occurring every or almost everyday in the last 4 weeks and not having symptom prior to Hurricane Katrina.

**Table 6**  
**Reported Skin Problems as a result of Hurricane Katrina**  
**Survey of NOPD after Hurricane Katrina**  
**October 2005**

<b>Symptoms</b>	<b>Number (%)</b>
<b>Itching</b>	323 (36)
<b>Pimples or bumps</b>	239 (26)
<b>Redness</b>	232 (25)
<b>Blisters</b>	129 (14)
<b>Swelling</b>	112 (12)
<b>Boils</b>	48 (5)
<b>Cut, scrape, or laceration</b>	278 (31)
<b>Pain</b>	148 (16)
<b>Bruise</b>	118 (13)

**Table 7**

**Injuries and Events Reported after Hurricane Katrina**

**Survey of NOPD after Hurricane Katrina**

**October 2005**

<b>Injury/Event</b>	<b>Number (%)</b>
<b>Laceration/puncture</b>	184 (20)
<b>Sprain/strain</b>	120 (13)
<b>Animal bite/sting</b>	104 (11)
<b>Fall</b>	84 (9)
<b>Burn</b>	23 (3)
<b>Eye injury</b>	24 (3)
<b>Assault</b>	24 (3)
<b>Motor vehicle accident</b>	22 (2)
<b>Concussion</b>	6 (1)
<b>Other</b>	20 (2)

**Table 8**  
**Multivariable Model of Respiratory<sup>1</sup>, Gastrointestinal, and Skin Rash Symptoms by**  
**Exposure to Floodwater and Sediment**  
**Survey of NOPD after Hurricane Katrina**  
**October 2005**

<b>Exposure</b>	<b>New-Onset Daily Upper Respiratory Symptoms<sup>2</sup></b> PR <sup>3</sup> (95% CI <sup>4</sup> ) n=776	<b>New-Onset Daily Cough<sup>5</sup></b> PR (95% CI) n=778	<b>New-Onset Daily Lower Respiratory Symptoms<sup>6</sup></b> PR (95% CI) n=800	<b>New-Onset Daily Gastro-intestinal complaints<sup>7</sup></b> PR (95% CI) n=784	<b>Skin Rash<sup>8</sup></b> PR (95% CI) n=838
<b>Skin contact with floodwater</b>	0.9 (0.6,1.2)	1.2 (0.7,1.8)	1.3 (0.7,2.5)	1.3 (0.5,3.2)	<b>1.5 (1.2,1.9)</b>
<b>Floodwater contact with eyes, nose, or mouth</b>	<b>1.6 (1.3,2.1)</b>	<b>1.7 (1.3,2.3)</b>	1.3 (0.8,2.0)	<b>1.9 (1.1,3.2)</b>	<b>1.2 (1.0,1.3)</b>
<b>Contact with floodwater sediment</b>	<b>1.9 (1.4,2.6)</b>	<b>1.8 (1.3,2.5)</b>	<b>2.4 (1.3,4.3)</b>	<b>2.4 (1.2,4.7)</b>	<b>1.3 (1.1,1.5)</b>

<sup>1</sup> Adjusted for smoking status (current, former, never).

<sup>2</sup> Based on a yes response to head or sinus congestion or nose/throat irritation occurring every or almost everyday and not having symptom prior to Hurricane Katrina.

<sup>3</sup> PR=prevalence ratio

<sup>4</sup> CI=confidence interval

<sup>5</sup> Based on a yes response to dry cough or cough with phlegm occurring every or almost everyday and not having symptom prior to Hurricane Katrina.

<sup>6</sup> Based on a yes response to shortness of breath with minimal activity, wheezing/whistling in your chest, or chest tightness occurring every or almost everyday and not having symptoms prior to Hurricane Katrina.

<sup>7</sup> Based on a yes response to nausea, diarrhea, or abdominal pain occurring every or almost everyday and not having symptoms prior to Hurricane Katrina.

<sup>8</sup> Based on a yes response to any one of the following skin problems or rash as a result of Katrina: pimples/bumps, blisters, boils, itching, swelling, or redness.

**Table 9**

**Prevalence of Symptoms Consistent with Posttraumatic Stress Disorder and Major Depression**

**Survey of NOPD after Hurricane Katrina**

**October 2005**

<b>Symptoms</b>	<b>Number (%)</b>
<b>Posttraumatic stress disorder symptoms<sup>1</sup></b>	170 (19)
<b>Depressive symptoms<sup>2</sup></b>	227 (26)
<b>Posttraumatic stress disorder and depressive symptoms</b>	119 (14)
<b>Posttraumatic stress disorder or depressive symptoms</b>	278 (31)

<sup>1</sup> A participant with posttraumatic stress disorder symptoms 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-IV criteria.

<sup>2</sup> Depressive symptoms defined in this modified 10-item CES-D used a cutoff score of 11 out of a total possible score of 30.

**Table 10**  
**Multivariable Model for PTSD Symptoms<sup>1</sup>**  
**Survey of NOPD after Hurricane Katrina**  
**October 2005**

<b>Exposure since Hurricane Katrina</b>	<b>PTSD symptoms PR<sup>2</sup> (95% CI<sup>3</sup>) n=836</b>
<b>Assault</b>	2.0 (1.2,3.5)
<b>Family member injured</b>	2.3 (1.5,3.4)
<b>Crowd control<sup>4</sup></b>	1.6 (1.1,2.1)
<b>Recovery of bodies<sup>4</sup></b>	1.7 (1.2,2.3)

<sup>1</sup> Adjusted for age, gender and previous history of PTSD.

<sup>2</sup> PR=prevalence ratio

<sup>3</sup> CI=confidence interval

<sup>4</sup> Involvement in “this activity” during and after Hurricane Katrina.

**Table 11**  
**Multivariable Model for Depressive Symptoms<sup>1</sup>**  
**Survey of NOPD after Hurricane Katrina**  
**October 2005**

<b>Exposure since Hurricane Katrina</b>	<b>Depressive symptoms PR<sup>2</sup>(95% CI<sup>3</sup>) n=699</b>
<b>Rare family contact<sup>4</sup></b>	1.6 (1.2,2.1)
<b>Family member injured</b>	1.7 (1.2,2.4)
<b>Uninhabitable home<sup>5</sup></b>	1.4 (1.0,1.8)
<b>Assault</b>	1.8 (1.0,3.1)
<b>Isolation from NOPD<sup>6</sup></b>	1.5 (1.1,2.0)

<sup>1</sup> Adjusted for age, gender, and previous history of depression.

<sup>2</sup> PR=prevalence ratio

<sup>3</sup> CI=confidence interval

<sup>4</sup> If participants answered “rarely” in response to the question “To what extent were you able to stay in contact with your immediate family during the crisis?”

<sup>5</sup> If participants answered “uninhabitable” in response to the question, “What damage did your home sustain as a result of Katrina?”

<sup>6</sup> If participants were isolated at least one day from regular NOPD assignment.









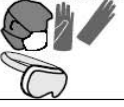


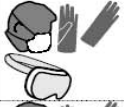
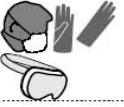














**Table 12**  
**Use of Selected Services after Hurricane Katrina**  
**Survey of NOPD after Hurricane Katrina**  
**October 2005**

<b>Service</b>	<b>Number (%)</b>
<b>Individual counseling</b>	126 (14)
<b>Group meeting (held at shift change or when left site)</b>	105 (12)
<b>Debriefing/critical incident stress debriefing (held post-crisis, usually within 1–4 weeks of incident conclusion)</b>	98 (11)
<b>Defusing (held post-crisis, usually within 12–72 hours of incident conclusion)</b>	36 (4)
<b>Family counseling</b>	21 (2)
<b>Counseling follow-up referral for individual and/or family</b>	14 (2)

## Appendix A

### Population-Specific Recommendations for Protection From Exposure to Mold in Buildings Flooded After Hurricanes Katrina and Rita,<sup>1</sup> by Specific Activity<sup>2</sup> and Risk Factor

Exposure Activity					
Risk Factor	Observing from outside the demolition area (disturbs no dust)	Inspecting or Assessing Damage (disturbs little dust or mold)	Recovering moldy personal belongings (Disturbs some dust or mold)	Sweeping, light cleaning, removing mold (disturbs much dust or mold)	Using power tools, cleaning, demolishing (disturbs all dust and mold)
None	No special precautions Needed	No special precautions needed	 3	 4	
People at High Risk for Infection or Colonization					
Profound immuno-suppression <sup>5</sup>	Avoid exposure	Avoid exposure	Avoid exposure	Avoid exposure	Avoid exposure
Immunosuppression <sup>6</sup>			Avoid exposure	Avoid exposure	Avoid exposure
Obstructive or cavitory lung disease <sup>7</sup>					Avoid exposure
People Who Have Diseases With Immune Sensitization <sup>8</sup>					
Allergic rhinoconjunctivitis (exacerbated by moldy materials)					Avoid exposure
Asthma (exacerbated by moldy materials)				Avoid exposure	Avoid exposure
Hypersensitivity pneumonitis caused by moldy materials				Avoid exposure	Avoid exposure
People With Unknown Risk <sup>9</sup>					
Younger than 12 years <sup>10</sup>	Avoid exposure	Avoid exposure	Avoid exposure	Avoid exposure	Avoid exposure
Pregnant				Avoid exposure	Avoid exposure
Older than 65 years				Avoid exposure	Avoid exposure

Note: Everyone should avoid unnecessary exposure to mold, especially anyone at high risk for infection and anyone with a disease caused by immune sensitization to mold and mold constituents.

*Important: See footnotes on next page.*

## Footnotes

1. Significant mold contamination is assumed if the building's interior was saturated with water for more than 48 hours, extensive water damage is present, extensive mold growth is visible, or "mildew" odors are clearly stronger than before Hurricanes Katrina and Rita.
2. A visible dust cloud suggests high potential for exposure. However, activities can be associated with high fungal exposure even without visible dust. Consider more protective interventions for activities of longer duration or greater frequency.



3. Recommended respiratory protection for residents is a respirator at least as protective as an N-95 filtering face piece. Respirator protection for workers in isolated areas of mold contamination (100 square feet or less) or small isolated areas of heating, ventilation, and air conditioning (HVAC) systems (10 square feet or less) where mold is disturbed is a respirator at least as protective as an N-95 filtering face piece. For working in areas of extensive contamination (greater than 100 contiguous square feet) or HVAC systems with large areas of contamination (greater than 10 square feet) and significant mold-containing dust, full face-piece respirators with N100, R100, P100 particulate filters (or for powered air-purifying respirators – HEPA filters) are recommended.



Gloves and dermal protection.

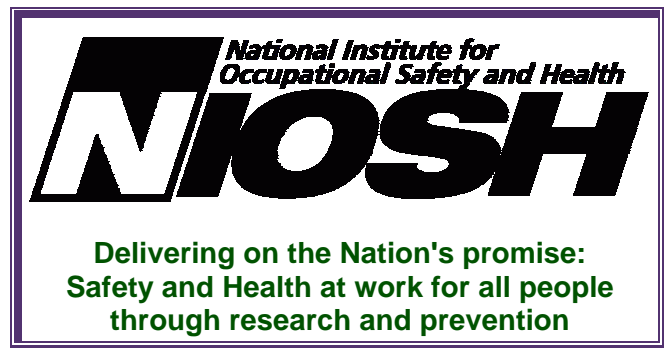


4. Occlusive eye protection (safety goggles, not regular eyeglasses); see discussion of personal protective equipment (PPE) in Chapter 4 of CDC's report, *Mold: Prevention Strategies and Possible Health Effects in the Aftermath of Hurricanes Katrina and Rita*. Available at: <http://www.bt.cdc.gov/disasters/mold/report/>.
5. Transplant recipients, including organ or hematopoietic stem cell recipients within 6 months of transplant or during periods of substantial immunosuppression; neutropenia (neutrophil count < 500/ $\mu$ L) due to any cause (including neoplasm, cancer chemotherapy); CD4+ lymphopenia (lymphocyte count < 200/ $\mu$ L) due to any cause, including HIV infection. Affected individuals should consult with their physicians before entering the affected area.
6. Includes immunosuppressant drug therapy, such as cancer chemotherapy, corticosteroid, or other immunosuppressive drug therapy; and diseases impairing host defense such as leukemia or lymphoma. Affected individuals should consult with their physicians before entering the affected area. Duration and frequency of exposures should be minimal.
7. Such diseases include COPD, asthma not exacerbated by mold, cystic fibrosis, and cavitary tuberculosis. Risk of airway colonization and subsequent diseases following mold exposure is unknown. Recommendations are based on best professional judgment.
8. The optimal treatment for allergic rhinitis, allergic asthma, or hypersensitivity pneumonitis is avoidance of the sensitizing agent. If symptoms occur despite the recommended preventive measures, avoidance of exposure is indicated. In many cases, allergic etiology of rhinitis or asthma needs to be inferred from clinical information, since the available diagnostic reagents for documenting IgE-sensitization to fungi are mostly unstandardized. Similarly, the precise antigenic agent causing hypersensitivity pneumonitis is often unclear.
9. The level of risk associated with exposure activities and the potential benefit of recommended PPE are unknown for these vulnerable populations. Due caution is recommended.
10. Exposure-reducing behavior and respiratory protection are problems for this group.

*Important: See Table on first page.*

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