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Medical Evaluation of Louisiana Fire Fighters after Hurricanes Katrina and Rita: A Pilot Study

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Table of Contents

Terms and Abbreviations

Abbreviation	Term
CDC	Centers for Disease Control and Prevention
DMAT	Disaster Medical Assistance Team
FDNY	Fire Department of New York
IAFF	International Association of Fire Fighters
KQMI	Krasnoff Quality Management Institute
NIOSH	National Institute for Occupational Safety and Health
NOFD	New Orleans Fire Department
NSLIJ	North Shore-Long Island Jewish Health System
NYS	New York State
PFFALA	Professional Fire Fighters Association of Louisiana
PI	Principal Investigator
PPE	Personal Protective Equipment
WTC	World Trade Center
WTC MMTP	World Trade Center Medical Monitoring and Treatment Program
WTCHP	World Trade Center Health Program

Abstract

Hurricanes Katrina and Rita devastated the Gulf Coast in August and September 2005. Many fire fighters had significant exposure to floodwater, mold, combustion products, metals, sewage, human remains and toxic chemicals. These exposures were likely to be a significant hazard to responders particularly immediately after the disaster. A pilot health surveillance system was established based on the World Trade Center (WTC) Health Program's monitoring examinations for WTC rescue and recovery workers and an earlier surveillance of Katrina/Rita fire fighters. Examinations included an extensive health history (physical and mental health) and symptom review questionnaire, complete physical examination, laboratory testing, pulmonary function testing, and chest x-rays. Recruitment of fire fighters took place from 2011 – 2013 in New Orleans and surrounding parishes. An electronic consent and questionnaire was developed and used to give the fire fighters a secure and HIPAA-compliant means of divulging their personal information with researchers.

One-hundred forty-three fire fighters expressed interested in participating in the study. Seventy-one fire fighters completed the online consent and completed the questionnaire; 53 of those fire fighters also completed all components of their medical exam.

Of those who participated in the program, there were substantial increases in symptoms of upper and lower airway complaints that persisted after work following Hurricane Katrina and Rita. Sixty-five percent of fire fighters reported having upper respiratory symptoms, 31% reported lower respiratory symptoms, 37% reported cough, and 23% reported skin irritation during and/or after the Hurricane Katrina rescue period. Respiratory symptoms increased with length of exposure to flood water. Fire fighters with greater than 72 hours of floodwater exposure were more likely to have lower respiratory symptoms [PR=1.7 (0.9-3.2 95% CI)] and shortness of breath [PR=3.1 (1.0-9.5 CI)]. No association was noted with floodwater duration and upper respiratory symptoms or skin irritations. Mental health symptoms were also persistent, including increased rates of anxiety, irritability, difficulty concentration, hyperarousal, flashbacks, and sleep disturbances.

Recruitment efforts were limited severely by a number of factors. Up to 75% of the active workforce of New Orleans and surrounding parish fire fighters were not part of the Hurricanes Katrina or Rita rescue/recovery efforts and therefore were not eligible to participate. Many fire fighters who participated in the rescue/recovery effort have since retired or left the force, and state legislation prevented retirees from being contacted by their union (our only means of contact with retirees).

In summary, there was an increase in physical and mental health symptoms post-Hurricane Katrina among the fire fighter participants. Ongoing mental health care support programs for disaster responders are recommended, as well as confidential medical evaluations.

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Section 1

Significant (Key) Findings (should address each aim)

Specific Aims

1. Identify Louisiana fire fighters who were involved in the rescue and recovery effort following Hurricane Katrina

Aim 1 proved to be the most challenging aim: Recruitment took place from 2011-2013. By that time most Louisiana fire fighters who were responders to Hurricanes Katrina/Rita had since retired or moved out of state. Neither the Professional Fire Fighters Association of Louisiana (PFFALA) nor the International Association of Fire Fighters (IAFF) had a list of fire fighters, active and/or retired, who were responders during Hurricanes Katrina/Rita. As a result, recruitment efforts were broad-based, and had to be aimed at all active and all retired fire fighters in Louisiana. Inadequate contact information in general, and state regulations regarding communications with former fire fighters, also hampered recruitment efforts.

2. Develop a pilot surveillance program to assess the health consequences of the hurricanes on Louisiana fire fighters

Questionnaires were developed using the monitoring exam questionnaires from the World Trade Center Health Program (WTCHP) as well as questions from a CDC study of the NOFD 3 months after Hurricane Katrina(1). The questionnaires included questions about the fire fighter's mental and physical health history, medications, alcohol and tobacco use, and exposures during the rescue, recovery, and clean-up after Hurricanes Katrina and Rita. Additionally, questionnaires used by the Fire Department of New York (FDNY) for their fire fighters who travelled to New Orleans were incorporated where appropriate.

3. Provide medical surveillance evaluations based on the evaluations conducted as part of the World Trade Center Medical Monitoring and Treatment Program

In addition to the questionnaire, a complete physical examination was performed and included spirometry, standard laboratory tests (blood and urinalysis), a chest x-ray, and an exam by a physician. Examinations were provided by two doctors from a private practice in New Orleans. These physicians are board certified in cardiology and internal medicine. The physicians reviewed the completed self-administered questionnaire (medical history) with the fire fighter, and then performed the complete physical exam, focusing on the upper and lower respiratory tract and musculoskeletal system.

4. Develop a database that ensures confidentiality of data obtained from the medical surveillance evaluations

Partnering with the Krasnoff Quality Management Institute (KQMI), a division of the North Shore-LIJ Health System (NSLIJ), a HIPAA-compliant database was built using Qualtrics as a platform.

Translation of Findings

The findings from the study indicate one of the biggest challenges facing medical surveillance efforts following a disaster: poor data (or inability to gain access to municipality data) on responders,

particularly years after an event. It bespeaks the need for better record keeping for disaster response and responders, and the use of tracking methods for individuals so that a greater understanding of the impact of a disaster can occur, and loss to follow-up can be itemized. This is particularly crucial after natural disasters in which there is a great displacement and home loss.

Findings from this pilot study show that respiratory symptoms are common in previously healthy first responders after a disaster, presumably due to the massive mold infestation after Hurricanes Katrina and Rita. New aerodigestive symptoms were over 10 times more common in these healthy workers as compared to those reported prior to the disaster.

While this was only a pilot study with small numbers of participants, it nonetheless highlights the need to better prepare our emergency responders to keep themselves safe from the negative health effects of response to natural disasters. Further data analysis, currently ongoing, may identify some of the unique features related to this massive hurricane and flooding upon fire fighters responding to Hurricanes Katrina and Rita.

Outcomes/Impact

This project relates to occupational safety and health with regard to identifying the unique environmental exposures emergency responders experienced during this disaster, whether they persisted, and how we can better prepare for future catastrophic events.

The findings of this study can guide future investigations and research by:

- Serving as an example of how improved record keeping among occupations and unions whose employees also serve as first responders is crucial for future recruitment/enrollment in studies. It is also difficult to recruit participants in medical surveillance projects over time, particularly if they have no symptoms. Given the large job turnover following a massive disaster like Katrina/Rita, it demonstrates the need to have a regular means of communicating with disaster responders, whether disasters occur or not, so that contact information is maintained and so that they are not lost to follow up over time.

- Serving as an example of how online consenting, along with online data collection, is possible, successful and HIPAA compliant. This saves time and reduces the human errors involved with data entry of paper questionnaires.

Section 2

Scientific Report

Background

Hurricanes Katrina and Rita devastated the Gulf Coast in August and September 2005. These storms caused levees to breech, and up to 80% of New Orleans was flooded with water up to 7 meters. The International Association of Fire Fighters (IAFF) estimates that approximately 1,356 Louisiana fire fighters were called to respond to the disasters. In addition to fire suppression activities, they were also involved in the rescue of stranded residents. Many fire fighters had significant exposure to floodwater (which contained concentrations of volatile and semi-volatile organic pollutants, in addition to lead, arsenic, chromium, household and industrial chemicals, petroleum products, pesticides, and flammable liquids), mold, combustion products, metals, sewage, human remains and toxic chemicals. These exposures were likely to be a significant hazard to responders, particularly if proper personal protective equipment (PPE) was not used. There were increased reports of physical illness and psychological strain among fire fighters involved in the rescue effort(2, 3).

This pilot surveillance project, was modeled on the successful World Trade Center Medical Monitoring and Treatment Program (WTC MMTP)(4), now known as the World Trade Center Health Program (WTCHP). The overall goal of this project was to develop a medical monitoring program that could serve as a model for the federal response to natural disasters and help ensure that fire fighters and other emergency responders receive appropriate medical follow-up care, particularly several years after a disaster might have struck.

Initial surveys conducted by the National Institute for Occupational Safety and Health (NIOSH) in late 2005 show a variety of health problems among these fire fighters both immediately after the event and later. Exposure to floodwater that lasted more than a few hours led to a higher risk of respiratory symptoms and skin rash(1).

In the 2005 NIOSH survey, more than 50% of these New Orleans fire fighters reported floodwater contact at the nose, mouth or eyes. Sixty-three percent of fire fighters rescued citizens from flooded areas. Some studies have reported that ingested or inhaled floodwaters might have posed more risk of respiratory symptoms than skin contact to floodwater. The preliminary study conducted by NIOSH has shown that those fire fighters exposed to floodwater had increased rates of new-onset upper respiratory symptoms and skin rash compared to those not exposed to floodwater. Highly reported physical health symptoms among fire fighters include upper respiratory symptoms, cough, skin rash, lacerations, sprains and strains, falls, animal bites, and bee stings. Mental health symptoms most reported include those consistent with post-traumatic stress disorder and depression(1).

The preliminary NIOSH study recommended that those exposed should be monitored for long-term health effects. There were exposures that were unique related to this particular disaster, although many of the exposures can occur with any natural disaster. Some of the Hurricane Katrina/Rita disaster exposures are listed below:

Exposures in the aftermath of Hurricanes Katrina & Rita: There were a number of exposures in the aftermath of the storms and floods. Concern arose regarding exposure to the floodwaters with concern about contamination from chemicals, metals, sewage and human remains(5, 6).
Mold: Mold growth occurred in many of the houses, as well as fire stations, damaged by Katrina. Mold growth was particularly aggressive in homes where flooding had occurred and people were not allowed to enter for weeks after the storm(7). Studies estimate that 24-hr mold concentrations in New Orleans ranged from 21,000-102,000 spore/m^3 in outdoor air and from 11,000 to 645,000 spores/m^3 in indoor air(8). The airborne endotoxin concentrations ranged from 0.6 to 8.3 EU (endotoxin units)/m^3. The high concentrations of mold measured in the New Orleans area post Katrina was likely to be a significant respiratory hazard particularly if proper PPE was not used. Recommendations were made that those exposed should be monitored for long term health effects. The health effects of mold are principally respiratory, such as allergic rhinitis and asthma, as well as hypersensitivity pneumonitis. Affected individuals have also reported symptoms of memory loss and decreased energy(9). These effects are related to both the environmental circumstances that bring people into contact with mold, as well as individual susceptibility t and are dependent on either an individual's immune response, or a pre-existing health condition that might place them at risk, such as a history of atopy.

Chemical Exposures: In the weeks following the storm, floodwater was still brackish and contained very low concentrations of volatile and semi-volatile organic pollutants(10). Lead, arsenic, and chromium measurements exceeded drinking water standards but were not in excess of what is normally observed in typical storm water. The exception of these was lead, which was seen in elevated concentrations in some areas(10). However, individuals normally do not have direct contact with storm water, and had potential for far greater exposure after the hurricanes due to the flooding.

Floodwater Exposure: Following the levee breaches, Hurricane Katrina flooded up to 80% of the city with water reaching a depth of 7m in some areas(11). Rescue workers were exposed to flood water during the course of their work with exposure durations ranging from a few minutes to a few days(1). Hazards range from floodwater and sewage exposures, to household and industrial chemicals, petroleum products, pesticides, and flammable liquids(1). Longer exposure to floodwater, for example, more than a few hours, lead to more of a risk of respiratory symptoms and skin rash.

Impact of the Exposures/Health Effects among New Orleans Fire Fighters: More than 50% of New Orleans fire fighters reported floodwater contact in the nose, mouth or eyes. In terms of activity, 63% rescued citizens from flooded areas. Tak et al. reported that ingested or inhaled floodwaters might have posed more risk of respiratory symptoms than skin contact to floodwater(1). Researchers from the NIOSH conducted a Health Hazard Evaluation consisting of a questionnaire administered to New Orleans fire fighters in November and December 2005 who were involved in the rescue effort. The results of which demonstrate that those fire fighters exposed to floodwater had increased rates of new-onset upper respiratory symptoms and skin rash compared to those not exposed to floodwater(1). Of the 525 fire fighters surveyed, 31% reported upper respiratory symptoms; 23% reported cough; 49% reported a skin rash; 24% reported lacerations; 25% reported sprains and strains; 10% reported falls; and 8% reported animal bites and bee stings(1). In terms of mental health symptoms, 22% reported symptoms consistent with post-traumatic stress disorder and 27% reported symptoms consistent with major depression(12). Nearly 60% of fire fighters were not living with their families in the months following the disaster, adding additional stress. In addition, because of the residency requirement for New Orleans fire fighters, more than 90% of active fire fighters catastrophically lost their residence due to the floods (personal communication, Professional Fire Fighters Association of Louisiana). No further surveillance activities specifically related to the effects of exposures to the floodwaters among fire

fighters have been undertaken. Tak et al recommended that a full diagnostic assessment of the health conditions affecting the fire fighters be done to determine the breadth and scope of illness in persons with persistent symptoms(1). This project sought to begin to address this need and to develop a surveillance examination model that can be used in Louisiana, for all emergency responders in the area, and throughout the Nation.

Specific Aims

1. Identify Louisiana fire fighters who were involved in the rescue and recovery effort following Hurricane Katrina

   The PI, accompanied by a program coordinator, traveled 3 times to New Orleans and parishes in the greater-New Orleans area, in an effort to recruit participants for this project; March 2010, October 2011, and March 2012. The delay between the first meeting and subsequent meetings was related to delays in transferring the grant to a new organization and obtaining IRB approval to begin study recruitment. The initial meeting was with members of the union leadership and provided us with an opportunity to have the union officials (current and former fire fighters) assist us with questionnaire refinement, to ensure that proper terminology was used, as well as map out a strategy for subject recruitment. These visits included board meetings, private meetings with union leadership, and visits to 15 individual fire houses in New Orleans and surrounding parishes. Working with union leadership, specific locations to recruit were discussed. A union representative contacted the local fire houses to arrange our visits. The PI gave flyers with information on the study to union leadership for them to explain and distribute at their meetings with fire fighters and to ask that these flyers be posted within the firehouse so that all interested fire fighters would have an opportunity to contact the investigators if they were interested. The PI also requested that active fire fighters make other fire fighters who were no longer active and with whom they still had contact aware of the project. No lists of active duty or retired fire fighters were given directly to the PI during these trips: fire fighters had to express interest in the study and sign up themselves.

   The investigators learned that many of the fire fighters who responded to the disasters have left fire fighting or retired, or are no longer active fire fighters in Louisiana. They may be retirees living throughout the state, and in many cases, out of state. At our in-person recruitment events, we have found from 50-75% of active firefighters were new to the force since post-Katrina 2005. Most visits to individual fire houses resulted in contact with a small number of fire fighters at a time: from the lowest number of 3, to the highest number of 16. Many fire fighters present expressed interest in participating, but were actually not on active duty at the time of the hurricanes, and were not eligible to participate. The level of interest did indicate that regular surveillance examinations for all fire fighters would be well received.

2. Develop a pilot surveillance program to assess the health consequences of the hurricanes on Louisiana fire fighters

   Working with our consulting epidemiologist, Susan Teitelbaum, PhD, Dr. Moline developed a medical evaluation to address the exposures fire fighters encountered as a result of Hurricanes Katrina and Rita. This consisted of a questionnaire, visit with a physician who conducted a complete medical exam, blood work, urinalysis, pulmonary function testing, and chest x-rays. The questionnaire was reviewed with PFFALA leadership, including Nick Felton and Chad Major, to clarify

"rescue period" dates, "recovery period" dates, and other terms most appropriate for this population.

3. Provide medical surveillance evaluations based on the evaluations conducted as part of the World Trade Center Medical Monitoring and Treatment Program

   As a result of our recruiting efforts, and using questionnaires administered to fire fighters post-Katrina: 143 fire fighters signed up to participate in the study; 53 of the 143 fire fighters received the information to complete the online questionnaire, but did not start it. They were sent 2 email reminders after the initial email with a unique link to the questionnaire; 21 of the 143 fire fighters received the information to complete the online questionnaire, started the online questionnaire, but did not complete it. They were sent 2 email reminders, after the initial email of their unique link to the questionnaire; 12 of the 143 fire fighters completed the online questionnaire, but did not go in for their medical exam. They received 2 follow-up phone calls to schedule their exam appointment; 71 of the 143 fire fighters completed the online questionnaire, 57 of which completed the medical exam; and 57 of the 143 fire fighters completed both the online questionnaire and their medical exam.

4. Develop a database that ensures confidentiality of data obtained from the medical surveillance evaluations

   Working with the Krasnoff Quality Management Institute (KQMI), part of the North Shore-LIJ Health System, we developed an online, HIPAA-compliant questionnaire and database for the fire fighter participants. After hearing about this study and signing up to be a part of it, the fire fighters shared their email address with the research team. A unique ID number was assigned to this individual fire fighter, and the link for the consent form and questionnaire was emailed to them. This link was only available to that individual fire fighter through the email address they provided. The only people with access to the questionnaire were study personnel on the research team, and that individual fire fighter. The database also contained results from the fire fighter's visit to the physician in New Orleans for his/her health screening, routine labs, pulmonary function test (PFT), and chest x-ray. This made it possible to create a final letter, with all of the fire fighter's results, within a short time of the data being entered.

Methodology

This project sought to develop a pilot surveillance program to assess the health consequences of the hurricanes on Louisiana fire fighters. Working with our consulting epidemiologist, Susan Teitelbaum, PhD, Dr. Moline developed a medical evaluation to address the exposures fire fighters encountered as a result of Hurricanes Katrina and Rita. Medical surveillance evaluations were performed based on the evaluations conducted as part of the World Trade Center Medical Monitoring and Treatment Program, with question modeled on the prior study by Tak et al. The evaluation consisted of a questionnaire, visit with a physician who conducted a complete medical exam, blood work, urinalysis, pulmonary function testing, and chest x-rays. The questionnaire was pilot tested and reviewed with PFFALA leadership, to clarify "rescue period" dates and "recovery period" dates, and to ensure that we were using terminology most appropriate for this population.

Qualtrics software was used as the platform for the HIPAA-compliant database developed by KQMI that ensured confidentiality of data obtained from the medical surveillance evaluations and questionnaire data. Based on conversations with members of the advisory board and union members, we were made aware that fire fighters were extremely concerned that personal health information could be adversely used against them. As a result, one of the goals of the study was to enable the participants to complete the questionnaires at home, and allow for greater confidentiality.

After hearing about this study and requesting to be a part of it, the fire fighters shared their email address with the research team. A unique ID number was assigned to this individual fire fighter, and the link for the consent form and questionnaire was emailed to them. This link was only available to that individual fire fighter through the email address they provided. The only people with access to the questionnaire were study personnel on the research team, and that one individual fire fighter.

Recruitment efforts:

An advisory board meeting was held in March 2010 with the following attendees to discuss the project and provide a preliminary questionnaire that the board members could pilot test. The attendees included:

- Jacqueline Moline, MD, MSc, PI, Chair and Vice President, Population Health, North Shore-LIJ Health System and Hofstra North Shore-LIJ School of Medicine
- Jim Melius, MD, Administrator, NYS Laborers' Health and Safety Trust Fund, Director of Research for the Laborers' International Union of North America, Medical Advisory Board member for the IAFF and the Teamsters Union
- Chad Major, President, Professional Fire Fighters Association of Louisiana
- Nicholas (Nick) Felton, President, New Orleans IAFF Local 632
- Hank Beckham, New Orleans IAFF Local 632
- Michael (Mike) Langston, Vice-President, New Orleans IAFF Local 632
- Wallace Bailey (Deceased, 2013), Captain, New Orleans IAFF Local 632, charter member of the IAFF
- Larry Carbo, Director, Counseling Services Unit, New Orleans Fire Department
- Gary Carbo, Former Medical and Personnel Director, New Orleans Fire Department
- Terrell (Terry) Hampton, Secretary-Treasurer, New Orleans IAFF Local 632
- Brien Ruiz, President, St. Bernard Parish Fire Fighters Association

Three visits were made to New Orleans and parishes in the greater-New Orleans area, in an effort to recruit participants for this project; March 2010, October 2011, and March 2012. These visits included multiple visits to over 15 fire houses in New Orleans and the surrounding parishes (some on multiple occasions), where the PI promoted and discussed the purpose of the study, and answered any questions that the potential participants might have had. During these visits the PI also distributed flyers with contact information if fire fighters were interested in participating. Fire fighters had the option to write down their contact information at these visits, or take a flyer with contact information for the program coordinator and email or call her at a later date. This gave the fire fighter the option of anonymity when in a group of fellow fire fighters. Union leaders were also given additional flyers to pass out to active and/or retired fire fighters.

The Principal Investigator planned her first recruitment visit around the scheduled quarterly pension meeting (October 2011), but less than 24 hours before travel to New Orleans, she was informed that

Chief McConnell wanted to meet with her to discuss the study prior to her attendance and promotion of the study. He was also not available to meet with her prior to that pension meeting, so she was not able to attend and recruit any retired fire fighters at that pension meeting.

Notice of the project was sent out by the PFFALA via blast email to all active fire fighters in Louisiana who had email addresses on file with the PFFALA (approximately 20% of all active fire fighters). A union official distributed informational flyers to all firehouses as well. One-hundred forty-three fire fighters signed up to participate in the study, but many of them did not enter all of their contact information on the sign-in sheet: they were asked to enter their name, email address, home address, and phone numbers. Many only entered their email address, which was the only required field in order to email them their unique link to the questionnaire. If a fire fighter called the study coordinator to sign up, the email address was written down, along with phone number and mailing address. The lack of complete contact information in some recruitment situations limited our means of contacting those fire fighters. Follow-up to partially complete or incomplete questionnaires was difficult for these reasons.

Once a fire fighter completed his/her questionnaire, the database prompted him with the contact information for the physician's office to call to make his/her health screening appointment. This proved to work very well: the majority of fire fighters contacted the physician's office on their own. Additionally, the practice manager at the physician's office was given the contact information for fire fighters who completed the questionnaire, to ensure everyone was aware of their eligibility for the free health screening.

When fire fighters went in for the health screening, the physician reviewed their questionnaire with them, to discuss any current symptoms and history of exposures, both from the hurricanes and their occupations. He also reviewed the mental health screening component of the questionnaire with the fire fighters, to address any potential PTSD, psychological distress, or alcohol abuse. The physician conducted a physical exam, focusing on the upper and lower respiratory tracts, and any other symptoms that were indicated by the fire fighter in person or from the questionnaire. A PFT was conducted in the physician's office by a certified pulmonary function test technician. Chest x-rays and lab work was performed in the same building as the physician's office, whenever possible on the same day as the exam. Results from the exam, the labs, PFT, and chest x-ray, were entered into the database from the physician's office.

Data entry was completed on Fridays, and final letters were available to be printed and mailed the following Monday. All final letters were mailed to fire fighters within 2 weeks of their completion of all components of the exam (health screening, labs, PFT, and xray). If any urgent results arose from the labs and chest x-ray, the fire fighter was contacted that same day via phone. To reinforce expediency of a fire fighter's receipt of the final letter, the physician's office could not invoice for payment of the exam until the final letter was sent out to the participant. The program coordinator was able to monitor completion of the questionnaire, all exam components, and the final letter via the Qualtrics database we designed.

Results

Based on original estimates of the number of eligible fire fighters, and the estimation by the PFFALA that only 25% of fire fighters who were responders to Hurricane Katrina are still active fire fighters, approximately 339 fire fighters were indeed eligible for this study. The participation rate for this study was 42% (143 fire fighters expressed interest in participating).

Of those 143 fire fighters who requested to be part of the study and wrote down their email address:

- 53 of the 143 received the information to complete the online questionnaire, but did not start it. They were sent 2 email reminders, after the initial email of their unique link to the questionnaire.
- 21 of the 143 received the information to complete the online questionnaire, started the online questionnaire, but did not complete it. They were sent 2 email reminders, after the initial email of their unique link to the questionnaire.
- 3 of the 21 fire fighters who started the online questionnaire but did not complete it filled in their mailing address on the questionnaire. Those 3 fire fighters were mailed letters reminding them of their incomplete questionnaire, and free health screening that was available to them upon completion of the questionnaire.
- 12 of the 143 completed the online questionnaire, but did not go in for their medical exam. They received 2 follow-up phone calls to schedule their exam appointment, but declined.
- 57 of the 143 completed both the online questionnaire and their medical exam.
- 71 of the 143 completed the online questionnaire, 57 of which completed the medical exam.
- 6 of the 57 who completed the medical exam were referred for follow-up care.

Data was summarized from the 71 fire fighters who completed the questionnaire in its entirety. This includes the 53 fire fighters who completed the exam, as well.

The online questionnaire was completed by 71 fire fighters. Of those 71, 49% were 45-54 years old, 94% were male, and 73% were white non-hispanic. Eighty percent of fire fighters were high school graduates, 80% were married, and 86% had children. Of the 71 fire fighters who completed the questionnaire, 87% were active fire fighters, and 80% were fire fighters from New Orleans parish, while the remaining 20% were from surrounding parishes. The mean years participants had spent fire fighting was 21, with the maximum number of years fire fighting to be 38 (Table 1).

Table 2 lists activities the fire fighters were involved in during the Hurricane rescue period [8/29/05 – 10/15/05]. The most common activities were fire suppression, rescue/recovery, and using power tools (89%, 82%, and 70%, respectively). We found that large percentages of fire fighters never wore eye protection or respiratory protection (64% and 27%) during the Hurricane rescue period from 8/29/05 – 10/15/05 [data not shown]. However, regarding other forms of personal protective equipment, 51% wore gloves and 61% wore rubber boots. During the Hurricane rescue period [8/29/05 – 10/15/05], only 21% of participating fire fighters suffered from extreme dehydration, heat exhaustion or heat related illness, and out of that 21%, only 4% received medical treatment.

Fire fighters reported the occurrence of musculoskeletal injuries during the Hurricane rescue period [8/29/05 – 10/15/05]. Twenty-one percent reported neck pain, 23% reported knee pain, and 41% reported back pain as new or worsening orthopedic injuries that occurred during the hurricane rescue

period. Additionally, as a result of injuries experienced during the hurricane rescue period, 44% of fire fighters needed first aid using fire department supplies, 25% used services from the Disaster Medical Assistance Team (DMAT) at the disaster site or the medical office at camp, and 16% needed to call an EMT/paramedic.

Skin problems were expected in this population as a result of work during the hurricane rescue and recovery periods. This included cuts, scrapes, lacerations, pimples or bumps, blisters, boils, bruises, itching, swelling, pain, or redness. The fire fighters who completed this survey reported 69 cases of skin problems on their hands and arms, 85 cases on their legs and feet, 26 cases on their trunk or buttocks, and 19 cases on their head, face, or neck, based on answers obtained using a figure to delineate where the skin problem occurred.

Table 3 presents information pertaining to the fire fighters' contact with their families after Hurricane Katrina. Ninety-three percent of respondents were isolated from their family for a period of time after Hurricane Katrina made landfall, and 40% were only occasionally to rarely able to stay in contact with their immediate family during the immediate rescue period [8/29/05 – 10/15/05]. The fire fighters reported that their activity levels before and after Hurricane Katrina remained overall constant, with the exception of sleeping and drinking alcohol. Fifty percent reported that they sleep less compared to before Hurricane Katrina, and 53% that they drink more alcohol since Hurricane Katrina (Table 4).

Fire fighter participants were asked if they experienced a list of mental health problems before, during, or after the Hurricane Katrina rescue and recovery period. While very few reported feeling this list of mental health problems before Hurricane Katrina, the numbers who reported feeling these items during and after increased dramatically. No fire fighters reported to "feel numb" before the hurricane, but 14% reported feeling numb during and 23% after Hurricane Katrina. Only 3% reported feeling "distant from friends or family" before Hurricane Katrina, but 27% reported to feel that way during, and 45% reported feeling distant after the hurricane. Fifty-one percent reported experiencing "flashback memories of the disaster" after Hurricane Katrina, but 46% reported "difficulty remembering details of the disaster." "Difficulty concentrating," "difficulties falling asleep," and "difficulty getting a good night's sleep," were reported by 45%, 41%, and 51% of fire fighters, respectively. After Hurricane Katrina, 38% reported "feeling anxious or unusually restless," 46% reported "unusual irritability," and 40% reported feeling "unusual anger" (Table 5).

Of all fire fighter respondents, only 28% reported being "seen by a health care provider" for health issues or injuries related to Hurricane Katrina; only 11% reported missing work. We included a question to determine what type of counseling or support services they would prefer in the future. Fifty-eight per cent said they would like counseling or support services at a "private non-fire department facility," 38% said they would like an "employee assistance program," and 23% said "peer counselors."

Table 6 describes prevalence of health outcomes by the fire fighter participants' characteristics. The highest prevalence of upper respiratory symptoms were in fire fighters less than 34 years of age (75%) and between 45-54 years of age (74%). It was also highest among fire fighters whose job duration as a fire fighter was 11-20 years (71%). Lower respiratory symptoms were most prevalent among fire fighters who were less than 34 years of age (50%) and whose duration of a job as a fire fighter was less than 10 years (44%). Cough was most prevalent in fire fighters who were between ages 35-44 (42%) and whose job duration as a fire fighter was 21-30 years (43%). Skin irritation was most prevalent in fire fighters between the ages of 45-54 (35%) and whose job duration as a fire fighter was 21-30 years (43%).

Table 7 describes the prevalence of physical symptoms by types of exposure to floodwater. The highest prevalence was found between skin contact with flood water and upper respiratory symptoms, ranging from 53% prevalence of upper respiratory symptoms when skin contact with floodwater was longer than a few hours, to 68% prevalence when skin contact with floodwater was extensive ("enough to be worrisome"). No fire fighters reported skin irritation when skin contact with floodwater was only for a few minutes. Only 7 of the 71 fire fighters reported having no contact with the floodwater at all.

Table 8 (13)reports the prevalence ratio for physical symptoms associated with length of floodwater exposure. "Condition absent" is defined as having reported never having the symptoms or a report of having the symptoms only prior to Hurricane Katrina. "Condition present" is defined as any report of the symptoms during or after Hurricane Katrina whether or not they had the symptoms prior to Hurricane Katrina. Only 59 fire fighters completed PFTs. Using the criteria that above the 75th percentile is considered normal, 85% of fire fighters had normal PFTs. Three fire fighters were determined to have a potential restriction on the spirometry and were referred for follow-up care. No abnormal chest x-ray findings were noted.

Discussion

Hurricanes Katrina and Rita devastated the Gulf coast of the Unites States in 2005. Rescue and recovery workers toiled under hazardous conditions in the months following the hurricanes, when there were rudimentary basic services, and they worked in hazardous conditions, while fearing for their safety. The majority of fire fighters had flood water exposure, with potential exposure to chemicals, petroleum products, sewage, pesticides, and flammable liquids. (6) The goal of this project was to determine if there were long lasting sequelae to fire fighters who had responded after the Hurricanes, and highlight practices that might be amenable to future disasters with respect to disaster surveillance.

In November to December 2005, Tak and colleagues went to Louisiana and administered a questionnaire to 525 fire fighters who were listed on the initial rosters (approximately 12 weeks after the Hurricanes). Approximately 49% of participants reported skin rashes, and 38% reported new onset respiratory symptoms, including upper respiratory symptoms, lower respiratory symptoms, and cough (1). We modeled many of the questions in this project, which occurred six to seven years later, on the original questions that Tak et al had used, so that we could make meaningful comparisons.

Overall, our population of fire fighters was similar with respect to age distribution, gender, and smoking status (Table 1).The overall prevalence of upper and lower respiratory symptoms reported in our study was higher than Tak et al. However, the prevalence of lower respiratory symptoms with exposure to flood water was similar to Tak et al's findings. We found 10% prevalence of lower respiratory symptoms with skin contact with floodwater for a few minutes (Table 7), and Tak et al found 8.1% prevalence. Shortness of breath was the only symptom that was statistically significantly associated with exposure and the test for trend was significant (Table 8). Adjustment for age and race eliminated the significant association observed for the longest water exposure category and lower respiratory symptoms, which includes shortness of breath. Tak et al. did not observe an association between lower respiratory symptoms and water exposure. However, Tak et al. found an association for upper respiratory symptoms, cough and skin rash with the "highest" level of water exposure. Rates of skin irritation were lower years later than in the weeks following the Hurricanes (49% versus 23%). This might be expected if the skin conditions were related to the environmental conditions, and resolved over the ensuing years. We did not observe significant associations for flood water exposure and upper respiratory symptoms, cough and skin rash. Our overall symptom rates for upper and lower respiratory symptoms may reflect a

selection bias, since those individuals who had symptoms may have been more likely to participate than those who did not have symptoms. Pulmonary function testing, however, showed normal results for virtually all of the participants in the study, and these symptoms did not interfere with their ability to work.

Mental health symptoms were common following the Hurricanes. Few participants endorsed any mental health symptoms prior to Hurricane Katrina or Rita. Virtually all fire fighters (93%) were isolated from their family members after the Hurricanes for an average of 22 days. Many participants had symptoms of post-traumatic stress syndrome(14), such as flashback memories, difficulty concentrating, difficulty sleeping, irritability, and avoidance of the disaster. Few sought care for mental health symptoms after the Hurricanes. Our questionnaires specifically asked the participants with whom they would prefer care; the majority (58%) wished to receive care outside of the auspices of the fire department. Given the level of concern about confidentiality endorsed by many fire fighters during our recruitment sessions, this was not surprising. Further analysis of the mental health findings is on-going.

In general, our response rate was much lower than Tak et al achieved in 2005. Several factors may account for the discrepancy. While we anticipated that there would be approximately 1356 fire fighters eligible based on the project eligibility criteria we had significantly lower response rate and participation rate. As outlined earlier, recruitment was the biggest challenge for this project. Despite initial responses from 143 fire fighters, only 71 (49.6%) completed the questionnaires, and only 39.8% completed the questionnaire and the examination. The fire fighters did express concern to the investigators, and union officials also voiced concern that any medical information could be used against them. Despite our best efforts to convince the fire fighters of the confidentiality protections in place, this remained a large hurdle, and one that is difficult to overcome. Additionally, the PFFALA only has a list of email addresses for approximately 20% of their active fire fighters, which had been anticipated as a primary recruitment tool for fire fighters to become aware of the study (source: Terrell Hampton).

We were informed by the President of the PFFALA that a large number of fire fighters who were active during Hurricanes Katrina and Rita have since retired. This too made recruitment challenging, since we have only been able to communicate with the active fire fighters, via the PFFALA, as outlined in the grant application. Despite frequent contact with union officials, our recruitment was hampered by other state regulations, which were not apparent during the grant submission process. Specifically, prior to July 1st, 2013, state legislation was in place that prohibited any emails or mailings from the Professional Fire Fighters Association of Louisiana (PFFALA) or the International Association of Fire Fighters (IAFF), to retirees, other than pension checks. The unions were also prohibited from sharing retiree contact information with us prior to July 2013. As a result, we were unable to work with the PFFALA Retirement Office to send emails or mailings to retirees about participating in this study. This regulation was rescinded in the summer of 2013, but we did not receive a list of retired fire fighters from the PFFALA until August 25th, 2013, with a grant end date of August 31st, 2013. In addition, none of our contacts at the PFFALA or the IAFF was able to provide us with a concise list of fire fighters who were definite responders during Hurricanes Katrina/Rita, so that the list received in August 2013 contained names/contact information of all retired members of the PFFALA. They were unsure who stayed, who evacuated prior to the storm, whose homes were damaged, who needed/was forced to relocate, and who returned.

Conclusion

This pilot study of fire fighters shows persistent respiratory symptoms among fire fighters who responded to Hurricanes Katrina and Rita, and a correlation between flood water exposure and persistent shortness of breath. There were notable increases in mental health symptoms post-Hurricane Katrina. This pilot study provides further evidence of the need for ongoing medical services for first responders after natural and man-made disasters, for symptoms can persist years after a disaster.

Publications

Publications for this study are in progress.

Inclusion of Gender and Minority Study Subjects – Inclusion Enrollment Report

See Inclusion Enrollment Report

Inclusion of Children

No children were included in this study.

Materials Available for Other Investigators

N/A

Citations

1. Tak S, Bernard BP, Driscoll RJ, Dowell CH. Floodwater exposure and the related health symptoms among firefighters in New Orleans, Louisiana 2005. American Journal of Industrial Medicine 2007;50:377-382.
2. Muzaffar S. International Association of Fire Fighters: Louisiana Fire Figthers Medical Surveillance Needs Assessment. In; 2006.
3. CDC. Health Hazard Evaluation of Police Officers and Firefighters after Hurricane Katrina --- New Orleans, Louisiana, October 17-28 and November 30 - December 5, 2005. Morbidity & Mortality Weekly Report 2006;55(16):456-458.
4. Herbert R, Moline J, Skloot GS, Metzger K, Baron S, Luft B, et al. The World Trade Center disaster and the health of workers: Five-year assessment of a unique medical screening program. Environmental Health Perspectives 2006;114(12):1853-8.
5. CDC. Infectious disease and dermatologic conditions in evacuees and rescue workers after Hurricane Katrina - Multiple staes, August-September, 2005. Morbidity & Mortality Weekly Report 2005a;54:961-964.
6. CDC. Surveillance for illness and injury after Hurricane Katrina - New Orleans, Louisiana, September 8-25, 2005b. Morbidity & Mortality Weekly Report 2005b;54:1018-1021.
7. Manuel J. In Katrina's Wake. Environmental Health Perspectives 2006;114(1):A33-A39.
8. Solomon G, Hjelmroos-Koski M, Rotkin-Ellman M, Hammond S. Airborne Mold and Endotoxin concentrations in New Orleans, Louisiana after Flooding, October through November 2005. Environmental Health Perspectives 2006;114(9):1381-1386.
9. Sinks T, Falk H. Environmental Health at the Centers for Disease Control and Prevention and the Agency for Toxic Substances and Disease Registry. In: Rom W, Markowitz S, editors. Environmental and Occupational Medicine. 4th ed. Philadelphia: Lippencott Williams & Wilkins; 2007.
10. Pardue J, Moe W, McInnis D, et al. Chemical and Microbiological Parameters in New Orleans Floodwater Following Hurricane Katrina. Enviro Sci Tech 2005;39(22):8591-8599.
11. Knabb R, Rhome J, Brown D. Tropical cyclone report: Hurricane Katrina. Miami, FL: National Oceanic and Atmospheric Administration; 2005.
12. Tak S, Driscoll R, Bernard B, West C. Depressive Symptoms among Firefighters and Related Factors after the Response to Hurricane Katrina. J Urban Health 2007;84(2):153-161.
13. Speigelman D, Hertzmark E. Easy SAS calculations for risk or prevalence ratios and differences. American Journal of Epidemiology 2005;162(3):199-200.
14. Stellman JM, Smith RP, Katz CL, Sharma V, Charney DS, Herbert R, et al. Enduring Mental Health Morbidity and Social Function Impairment in the World Trade Center Rescue, Recovery, and Cleanup Workers: The Psychological Dimension of an Environmental Health Disaster. Environmental Health Perspectives 2008;116(9):1248-1253.

Appendix

Table 1. Characteristics of Participating Louisiana FD Personnel	Finished Qx (N=71)	
Characteristics	N	%
Age on 8/29/2005 (years)		
<=34	17	24
35-44	22	31
45-54	30	42
55 and above	2	3
Gender		
Male	67	94
Female	2	3
Not Reported	2	3
Race/Ethnicity		
White, Non-Hispanic	52	73
Black, Non-Hispanic	13	18
Hispanic	2	3
Native American or Alaskan Native	1	1
Not Reported	3	4
Children		
Yes	61	86
No	10	14
Smoking status		
Never smoked	51	72
Current smoker	6	9
Former smoker	14	20
Fire Department		
New Orleans	57	80
Other Parishes*	14	20
Current Firefighter		
Yes	62	87
No, retired	9	13

*Other Parishes include Saint Bernard Parish, Jefferson Parish East Bank, and 3rd District Volunteers

Table 2. Activities fire fighters were involved in during the Hurricane rescue period [8/29/05 – 10/15/05]	n	%
Fire suppression	63	89
Rescue/recovery	58	82
Patient care activities at disaster site	32	45
Urban search & rescue	38	54
Using power tools	50	70
Administrative	19	27
Other	8	11

Table 3. Isolation from Family after Hurricane made Landfall	n or mean	% or sd
Were you isolated from your family after Hurricane Katrina made landfall?	66	93
Number of days isolated	22	35
To what extent able to stay in contact with your immediate family during Hurricane Katrina and the immediate rescue period [8/29/05 – 10/15/05]?		
Rarely	26	39
Occasionally	26	39
Sometimes	10	15
Fairly often	4	6
Very often	0	0

Table 4. Activity levels before/after Hurricane Katrina Comparing your activities prior to Hurricane Katrina to now, do you:	Less		No change		More	
	n	%	n	%	n	%
Exercise	21	30	33	47	17	24
Interact socially	26	37	40	56	5	7
Sleep	35	50	33	47	3	4
Eat	9	13	42	60	19	27
Drink alcohol	12	18	20	30	36	53
Smoke	5	8	51	80	8	13

Table 5. Mental health problems experienced by fire fighters prior/during/after Hurricane Katrina								
	Prior		During		After		Never	
	n	%	n	%	n	%	n	%
Feel numb	0	0	10	14	16	23	37	52
Distant from friends or family	2	3	19	27	32	45	24	34
Dazed or detached from surroundings	2	3	12	17	22	31	33	47
Flashback memories of the disaster	0	0	6	9	36	51	22	31
Difficulty remembering details of the disaster	0	0	11	16	33	47	25	35
Difficulty concentrating	1	1	8	11	32	45	24	34
Difficulty falling asleep	3	4	14	20	29	41	28	39
Difficulty getting a good sleep	4	6	17	24	36	51	25	35
Nightmares	5	7	11	16	22	31	34	48
Difficulty getting out of bed	1	1	6	9	16	23	38	54
Feeling anxious or unusually restless	2	3	11	16	27	38	25	35
Unusual irritability	2	3	11	16	33	47	24	34
Unusual anger	2	3	9	13	28	39	25	35
Avoiding things/people that remind disaster	0	0	3	4	16	23	37	52
Difficulty functioning at work	0	0	1	1	11	16	42	59
Difficulty functioning at home	0	0	4	6	13	18	43	61

Table 6. Prevalence (%) of Health Outcomes by Participants' Characteristics									
		Upper respiratory symptoms[a]		Lower respiratory symptoms[b]		Cough[c]		Skin irritation[d]	
Demographics	N	n	%	n	%	n	%	n	%
Total	71								
Age at Qx completion (years)									
<=34	8	6	75	4	50	3	38	1	13
35-44	12	5	42	3	25	5	42	0	0
45-54	34	25	74	12	35	13	38	12	35
55 and above	17	10	59	3	18	5	29	3	18
Job duration as FF (years)									
<=10	9	5	56	4	44	1	11	0	0
11-20	24	17	71	7	30	10	42	4	16
21-30	21	14	67	8	39	9	43	9	43
31-40	16	10	63	3	19	6	38	3	19

[a]Upper respiratory symptoms were defined by a positive response to the question, "Please check the corresponding box if you have experienced any of the below problems during the corresponding time periods" and having these symptoms "Nasal /Sinus Congestion or Drip" or "Sore Throat, Hoarse Throat, or Loss of Voice" and at least one of the corresponding time periods "During the Hurricane Katrina Rescue Period [8/29/05 – 10/15/05]" or "After the Hurricane Katrina Rescue Period Ended [10/16/05 – Present."

[b]Lower respiratory symptoms were defined by a positive response to the question, "Please check the all the boxes that apply for all time periods below to identify if/when you experienced the following: I have had decreased ability to exercise because of shortness of breath:" and selecting at least one of these categories "On getting up, or first things in the morning," "During the rest of the day," "At night," "As much as twice a day, 4 or more days out of the week," or "Yes, with minimal activity" and at least one of the corresponding time periods "During the Hurricane Katrina Rescue Period [8/29/05 – 10/15/05]" or "After the Hurricane Katrina Rescue Period Ended [10/16/05 – Present."

[c]Cough was defined by a positive response to the question, "Please check the all the boxes that apply for all time periods below to identify if/when you experienced the following: Have you ever experienced a dry cough (excluding colds):" or "I have a cough with phlegm (mucus) for a period greater than 3 months (excluding colds)" and selecting at least one of these categories "On getting up, or first things in the morning," "During the rest of the day," "At night," "As much as twice a day, 4 or more days out of the week," or "Yes, with minimal activity" and at least one of the corresponding time periods "During the Hurricane Katrina Rescue Period [8/29/05 – 10/15/05]" or "After the Hurricane Katrina Rescue Period Ended [10/16/05 – Present."

[d]Skin irritation was defined by a positive response to the question, "Have you had any of the below skin problems or rash as a result of the Hurricane Katrina" and selecting at least one of these body regions "Hands/arms," "Legs/feet," "Trunks/buttocks," "Head/Face/Neck.", and at least one of the corresponding injuries "Cut, scrape, laceration, pimples or bumps, blisters, boils, bruise, Itching, Swelling, Pain, or Redness."

Table 7. Prevalence (%) of Physical Symptoms by Types of Exposure to Floodwater (N = 71)									
		Upper respiratory symptoms		Lower respiratory symptoms		Cough		Skin irritation	
Exposure	N	n	%	n	%	n	%	n	%
Total	71								
Skin contact with floodwater for a few minutes	10	6	60	1	10	5	50	0	0
Skin contact with floodwater longer than a few hours	19	10	53	6	32	7	37	6	32
Skin contact with floodwater extensively (enough to be worrisome)	25	17	68	10	40	12	48	7	29
No contact with floodwater	7	6	86	2	29	1	14	1	14
Missing	10	7	70	3	30	1	10	2	20

Table 8. Prevalence Ratios (PR) and 95% confidence intervals (CI) of physical symptoms by length of exposure to flood water among Louisiana firefighters.

	Flood water exposure	Condition present (N)	Condition absent (N)	$PR_{(unadj)}$	95% CI		$PR_{(adj)}$*	95% CI	
Lower respiratory symptoms[a]	0-24 hrs	9	22	1.0	reference		1.0	reference	
	25-72 hrs	9	8	1.8	0.9	3.7	1.7	0.9	3.3
	>72 hrs	9	6	**2.1**	**1.0**	**4.1**	1.7	0.9	3.2
Shortness of breath	0-24 hrs	4	26	1.0	reference		1.0	reference	
	25-72 hrs	7	10	**3.1**	**1.1**	**9.0**	**3.0**	**1.0**	**8.9**
	>72 hrs	6	7	**3.5**	**1.2**	**10.2**	**3.1**	**1.0**	**9.5**
Upper respiratory symptoms[b]	0-24 hrs	23	8	1.0	reference		1.0	reference	
	25-72 hrs	13	3	1.1	0.8	1.5	1.2	0.9	1.7
	>72 hrs	13	2	1.2	0.9	1.6	1.1	0.9	1.5
Cough with phlegm	0-24 hrs	6	24	1.0	reference		1.0	reference	
	25-72 hrs	6	10	1.9	0.7	4.9	2.0	0.8	5.1
	>72 hrs	6	8	2.1	0.8	5.5	2.0	0.8	5.0
Dry cough	0-24 hrs	11	21	1.0	reference		1.0	reference	
	25-72 hrs	8	10	1.3	0.6	2.6	1.2	0.6	2.4
	>72 hrs	9	7	1.6	0.9	3.1	1.5	0.8	3.0
Cough (with phlegm and/or dry)	0-24 hrs	14	18	1.0	reference		1.0	reference	
	25-72 hrs	9	9	1.1	0.6	2.1	1.2	0.6	2.1
	>72 hrs	10	6	1.4	0.8	2.5	1.3	0.8	2.3
Skin irritation	0-24 hrs	10	18	1.0	reference		1.0	reference	
	25-72 hrs	7	7	1.4	0.7	2.9	1.4	0.7	2.7
	>72 hrs	7	9	1.2	0.6	2.6	1.2	0.6	2.5
Pre-bronchodilator FVC - Predicted ≤75%	0-24 hrs	3	21	1.0	reference		1.0	reference	
	25+ hrs	5	27	1.3	0.3	4.7	1.2	0.3	4.5
Pre-bronchodilator FEV1 - Predicted ≤75%	0-24 hrs	3	21	1.0	reference		1.0	reference	
	25+ hrs	5	27	1.3	0.3	4.5	1.2	0.3	4.5

*adjusted for age on 8/29/2005 and race (white/non-white)

[a]Lower respiratory symptoms defined as having at least one symptom: (1) shortness of breath, (2) wheezing, or (3) chest tightness

[b]Upper respiratory symptom defined as having either (1) head/sinus congestion or (2) nose/throat irritation

Program Director/Principal Investigator (Last, First, Middle): Moline, Jacqueline Miriam

Inclusion Enrollment Report

This report format should NOT be used for data collection from study participants.

Study Title: Medical Evaluation of Louisiana Fire Fighters after Hurricanes Katrina and Rita: A Pilot Study

Total Enrollment: 71 **Protocol Number:** 10-133A

Grant Number: 7H75OH009824-02

PART A. TOTAL ENROLLMENT REPORT: Number of Subjects Enrolled to Date (Cumulative) by Ethnicity and Race

Ethnic Category	Females	Males	Sex/Gender Unknown or Not Reported	Total
Hispanic or Latino	0	2	0	2 **
Not Hispanic or Latino	2	62	2	66
Unknown (individuals not reporting ethnicity)	0	3	0	3
Ethnic Category: Total of All Subjects*	2	67	2	71 *
Racial Categories				
American Indian/Alaska Native	1	0	0	1
Asian	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0
Black or African American	0	13	0	13
White	1	50	2	53
More Than One Race	0	0	0	0
Unknown or Not Reported	1	3	0	4
Racial Categories: Total of All Subjects*	3	66	2	71 *

PART B. HISPANIC ENROLLMENT REPORT: Number of Hispanics or Latinos Enrolled to Date (Cumulative)

Racial Categories	Females	Males	Sex/Gender Unknown or Not Reported	Total
American Indian or Alaska Native	0	0	0	0
Asian	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0
Black or African American	0	0	0	0
White	0	1	0	1
More Than One Race	0	0	0	0
Unknown or Not Reported	0	1	0	1
Racial Categories: Total of Hispanics or Latinos**	0	2	0	2 **

* These totals must agree.
** These totals must agree.