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The Impact Of Hurricane Sandy On Healthcare Workers In Nyc

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The Impact of Hurricane Sandy on Healthcare Workers in NYC

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Yale School of Public Health

Thesis

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Abstract

There is a gap in the literature regarding whether training in emergency preparedness and response makes a difference in the overall health outcomes of healthcare workers who are responding to and working during a natural disaster. The objective of this study was to investigate whether emergency preparedness training lowers the risk of poor health outcomes as reported by healthcare workers in New York City responding to Hurricane Sandy. A survey created by 1199 SEIU United Healthcare Workers East was conducted between July and August 2014 to capture the health and safety experience of workers during and after Hurricane Sandy. The study population consisted of a convenience sample of 124 healthcare workers from 4 hospitals and 3 nursing homes. Receiving emergency preparedness training before or during the hurricane was not found to be significantly associated with better overall health outcomes ($P = 0.795$), but males were found to have better health outcomes compared to females ($P = 0.002$), as did hospital workers compared to nursing home workers ($P < 0.001$). Workers who received training were 3.57 times less likely to miss days of work during and after the hurricane compared to those who did not receive training ($P = 0.014$). In addition, individuals who reported being stressed were 2.86 times more likely to miss days of work than individuals who were not stressed. Several characteristics were also shown to increase the reported degree of Hurricane Sandy's impact upon study participants, including having a job that involved working directly with patients ($P = 0.023$) or having patient contact without direct care ($P = 0.052$), working an evening, overnight, or varied shift ($P = 0.002$), working in a nursing home ($P = 0.027$), having physical damage to one's property ($P = 0.052$), or having problems heating or cooling one's home ($P = 0.001$). We conclude that training, as well as the recognition of factors that influence the overall impact of a disaster event upon workers, is critical to an effective disaster plan.

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Introduction

Hurricane Sandy touched down on the northeast coast of the United States on October 29, 2012. It began as a category 1 hurricane, but weakened to a post-tropical cyclone once it made landfall. However, due to its immense size, it created a storm surge along the coastlines of New York and New Jersey, causing catastrophic destruction in those areas. In New York City, major flooding and power outages afflicted most of the city, costing an estimated \$19 billion in damages. Overall, Hurricane Sandy was the second costliest hurricane in history behind Hurricane Katrina (Blake, Kimberlain, Berg, Cangialosi, & Beven, 2013).

A major concern during any natural disaster is keeping healthcare facilities operating. As a result, individuals who work in these facilities may have to contend with situations such as infrastructure damage due to flooding and high winds, power outages, evacuations, influxes of patients, and shortages in staff and supplies, among others (Brands et al., 2013). Healthcare workers already have the highest rates of nonfatal work-related illness and injuries compared to workers in other industries (Occupational Safety and Health Administration [OSHA], 2013). During a natural disaster, they must learn to cope with additional hazards and stressors, all while worrying about their own health and safety, and that of their families. If the proper precautions and procedures are not put in place, safety of the healthcare workforce can become compromised.

The current thinking is that the health and safety of healthcare workers and their patients could be improved if everyone working within these facilities were properly trained before the disaster event and knew their responsibilities during an emergency. It is in this way that chaos and miscommunication can be reduced, and the emergency can be dealt with in an organized and calm manner (Danna, Bernard, Jones, & Mathews, 2009). Although there is a considerable

amount of literature regarding the need for more emergency preparedness during natural disasters like a hurricane (Bistaraki, Waddington, & Galanis, 2011; Brands et al., 2013; Dosa et al., 2008; Powell, Hanfling, & Gostin, 2012), there is a gap in knowledge concerning whether or not training in emergency preparedness and response makes a difference in the overall health outcomes of those individuals responding to and working during a disaster, such as the healthcare workers themselves.

Background

To date, there are very few studies that have been published examining the health outcomes of healthcare workers responding to a natural disaster. Swygard and Stafford (2009) conducted a study that investigated the short- and long-term health outcomes of healthcare personnel and volunteers deployed to a field hospital during Hurricane Katrina. The authors surveyed these individuals at 1, 3, and 6 months after returning from deployment. They found that the hazards they encountered depended on the time of deployment, and included exposure to contaminated water and foul odors (such as decaying bodies), insect bites, and injury due to physical trauma. One month after deployment, reports of skin lesions and respiratory symptoms (coughing and shortness of breath) were common, while 3 and 6 months after deployment saw an increase in symptoms of post-traumatic stress disorder (PTSD). Many of these individuals took preventative measures to avoid injury or illness before and during deployment. For example, over half of the 154 participants received a vaccination in the 30 days before deployment, primarily for Hepatitis A and tetanus. Other preventative measures included wearing sunscreen, using insect repellent, and staying hydrated. However, a major limitation of this study was that it had a very low participation rate (Swygard & Stafford, 2009).

Other studies that have been conducted on this population of workers focus on their overall experience during natural disasters. One particular study by VanDevanter and colleagues (2014), focused on nurses' experience with the evacuation of NYU Langone Medical Center during Hurricane Sandy, and their subsequent deployment to other hospitals in the area. Qualitative interviews were conducted with 20 nurses, and 528 nurses participated in an online survey. 54% of the nurses who were assigned to work at another hospital after the evacuation responded that the experience was stressful or extremely stressful. This was due to working in an unfamiliar environment, limited orientation, and issues related to assignments, including lack of consistency in patient assignments and high assignment load. Many found the experience of evacuation to be traumatizing and exhausting, which made it harder for them to adapt to a new environment. However, these individuals did report that having peer and supervisory support was helpful in managing the stress (VanDevanter et al., 2014).

Another study, conducted by French, Sole, and Byers (2002), investigated what the needs and concerns were of nurses in response to Hurricane Floyd. They conducted focus groups at 4 different hospitals, and had a total of 30 emergency department nurses participate. The authors found that the primary concern of these nurses was for personal and family safety, which included their pets. The staff was particularly concerned about whether the buildings could withstand hurricane-force winds due to their inadequate safety ratings. Other concerns included basic needs such as food, water, and sleep, which none of the hospital disaster plans had included. Workers were also unsure of what specific roles they needed to play during the hurricane. They reported that communication was poor, leading to confusion and chaos, and managers did not provide the necessary leadership (French et al., 2002).

Although Hurricane Floyd occurred back in 1999 (French et al., 2002), healthcare workers continue to have the same concerns when deciding whether to report to work during a

natural disaster (Davidson et al., 2009; Qureshi et al., 2005; Smith, 2007). In a study by Davidson et al. (2009), 8 hospital workers in San Diego, CA were interviewed in a focus group about their decision to come to work during a wildfire, since 10.6% of employees at this hospital did not show up to work on the first day of the fire. The individuals who were interviewed reported a conflict between personal and professional commitment. As was found in the study by French et al. (2002), their primary concern was for their own personal safety and that of their family, pets, and property. However, this depended on how close they lived to the wildfire, and the vulnerability of their family members. These individuals were also more likely to report to work if they felt supported by their coworkers, and worked in what they thought was a caring environment. Other factors included the perceived importance of their role (whether their job was considered essential), as well as their past experience during a disaster. The authors emphasize the importance of education in ensuring that these workers know their specific role during a disaster (Davidson et al., 2009).

Similar findings to those of Davidson et al. (2009) have been observed in other literature. Qureshi et al. (2005) examined the ability and willingness of 6,428 healthcare workers in New York City to report to work during various types of disasters. They found that workers were not able to report to work because of issues with transportation, concerns for personal safety, and responsibilities such as childcare, eldercare, and pet care. As for willingness to respond, this largely depended on concern for the safety of their family and for themselves (Qureshi et al., 2005).

Most of the barriers reported by workers can be addressed through intervention in their healthcare facilities. For example, concern for personal safety can be amended through education and training in emergency preparedness (Qureshi et al., 2005; Smith, 2007). However, emergency preparedness training varies considerably depending on the facility, and is oftentimes

inadequate, since it lacks standardization (Slepski, 2007). Many healthcare workers are ill-prepared to respond to a natural disaster (Baack & Alfred, 2013). In a survey of 620 nurses working in two rural hospitals in Texas, Baack and Alfred (2013) found that nurses had a low overall competence in their familiarity with disasters, and did not feel prepared to respond effectively, underscoring the need for a comprehensive emergency preparedness training program. However, perceived competence was improved with previous experience in a major disaster and prior work in a post-disaster shelter (Baack & Alfred, 2013). In another study conducted by Slepski (2007), 200 healthcare professionals who responded to Hurricane Katrina or Rita were surveyed about the professional competencies needed during a natural disaster. First-time responders felt the least prepared to respond during these storms, and 25% of participants addressed the need for more hands-on training, including drills and group exercises (Slepski, 2007).

Although there is a clear need for emergency preparedness training of healthcare workers, there is disagreement among the small number of studies that have been published concerning the effectiveness of these programs, since there is no standard metric available to evaluate them (Baack & Alfred, 2013; Slepski, 2007; Williams, Nocera, & Casteel, 2008). In a study examining whether a 5-hour education course consisting of a lecture, a tabletop exercise, and skills session could improve knowledge about disaster preparedness in healthcare workers in Greece, researchers found significant increases in knowledge immediately following the course. This was determined by comparing the results of a pre-test, immediate post-test, and follow-up test, and the use of a control group that did not receive the training. However, knowledge was found to decrease after one month (Bistaraki et al., 2011).

In contrast to the study by Bistaraki et al. (2011), Williams et al. (2008) conducted a meta-analysis to determine the effectiveness of disaster training for healthcare workers, but

concluded that there was insufficient evidence that these interventions improved skills and knowledge related to disaster response, since it is difficult to compare studies when there is no standard method of training used in healthcare facilities. In addition, increased knowledge does not necessarily predict improved performance in response to a real disaster (Williams et al., 2008). However, another meta-analysis addressed how different methods of training helped improve health and safety in the workplace. It suggested that as training engagement increased, the acquisition of knowledge also increased, and the amount of negative health outcomes decreased (Burke et al., 2006).

Objectives

The objective of this thesis project is to investigate whether emergency preparedness training lowers the risk of poor health outcomes as reported by the healthcare workers responding to a hurricane. The central hypothesis is that healthcare workers who received emergency preparedness training prior to Hurricane Sandy had better overall health outcomes than those workers who did not.

The primary aim is to determine whether the advantage of emergency preparedness training is evident from the reports of overall health “after” as compared to “before” Hurricane Sandy, when compared to those workers who were untrained in emergency preparedness. Importantly, the ability of preparedness training to lower the risk of poor health outcomes will be examined in light of potential modifiers. The secondary aim is to determine what factors influenced to what degree workers reported being impacted by Hurricane Sandy. It would be expected that people with a higher degree of impact rating would report having to cope with a number of issues during the hurricane. The final aim is to determine what factors led workers to

miss days of work during and after the hurricane, since healthcare workers are a critical component of a disaster response.

If there is a difference in health between those who received training in emergency preparedness and those who did not, or if there are certain factors related to the workplace that were associated with a greater degree of impact or missed days of work during or after the hurricane, then it is critical that employers of healthcare facilities conduct trainings for their employees before the next hurricane strikes. This action will protect worker safety and health, and strengthen our ability to prepare and respond to natural disasters in the future.

Methods

The study population consisted of a convenience sample of 124 healthcare workers who worked at 4 hospitals and 3 nursing homes in New York City. These included NYU Langone Medical Center, Mount Sinai Beth Israel, Interfaith Medical Center, St. John's Episcopal Hospital, Rockaway Care Center, Horizon Care Center, and Sea Crest Rehabilitation and Health Care Center. One study subject also worked at Promenade Rehabilitation and Health Care Center. In this study, a healthcare worker was defined as any individual who worked in one of these 7 healthcare facilities. The study population was not restricted to workers who held a specific job title, and included nurses, housekeepers, maintenance workers, dietary workers, and office workers, among others.

The survey, located in the Appendix, was created by employees at 1199 SEIU United Healthcare Workers East to capture the health and safety experience of workers during and after Hurricane Sandy. It was distributed to workers between July and August 2014 with the help of delegates from the union who work in these facilities. A delegate is elected to be a union representative for a particular healthcare facility, and helps ensure that the rights of workers there

are being protected. No personal identifiers were collected, and the study was determined to be exempt from IRB approval by the Yale University Human Investigation Committee.

Statistical Analysis

To determine whether receiving emergency preparedness training could lead to better overall health outcomes for workers, a multiple linear regression model was created. The dependent variable was change in overall health, defined as self-reported health after the hurricane minus health before the hurricane. Participants were asked to rate their overall health the year before and the year after Hurricane Sandy on a scale from 1 to 5, where 1 signified a “poor” health rating and 5 signified an “excellent” health rating. The primary independent variable was training. Workers responded to a yes or no question about whether their employer had provided any health and safety training related to emergency preparedness and response before or during Hurricane Sandy.

Participants were also asked to check off factors related to how Hurricane Sandy personally affected them and their families. All of the following factors were treated as dichotomous independent variables coded as either yes or no: physical damage to property (flooding, wind damage, fire, etc.), power outages, trouble finding child care, having a lack of food or water, obtaining a physical injury, difficulty with transportation, issues with sanitation, problems with communication (unable to contact family and friends), problems with heating or cooling, missed days of work, loss of a family member or friend, stress, and other.

In addition to training, all of the following variables were included in the multiple linear regression model predicting the difference in overall health: health before (continuous), age (18-29, 30-39, 40-49, 50-59, 60 +), sex (male/female), race/ethnicity (African American, Caucasian, Asian/Pacific Islander, Hispanic, or other), job title (no patient contact, patient

contact without direct care, or direct care), facility (hospital/nursing home), shift (day/other), hours worked during the hurricane (did not work, less hours than normal, same hours, or more hours than normal), missed days of work (yes/no), power outages (yes/no), and problems with communication (yes/no). For the analysis, the variable race/ethnicity was condensed into 5 categories instead of 7, and 3 groups were created for job title according to amount of patient contact. Facility and shift were also made into binary variables.

To address the secondary aim of determining which factors influenced to what degree workers reported being impacted by Sandy, a different multiple linear regression model was created. The dependent variable was degree of impact, which was rated on a scale from 1 to 5, where 1 represented that the hurricane had no impact, and 5 indicated that it had a very large impact. The following variables were included in this model: training, health before (continuous), health after (continuous), age, sex, race/ethnicity, job title, facility, shift, hours worked during the hurricane, missed days of work, power outages, problems with communication, physical damage to property, trouble finding child care, having no food or water, physical injury, difficulty with transportation, issues with sanitation, problems with heating or cooling, stress, and other.

Finally, to determine what factors led workers to miss days of work during and after the hurricane, a multiple logistic regression model was used. The dependent variable was missed days of work, a dichotomous variable coded as yes or no. The variables included in this model were training, health after (continuous), degree of impact (continuous), age (continuous), sex, race/ethnicity, job title, facility, shift, hours worked during the hurricane, power outages, problems with communication, physical damage to property, having no food or water, difficulty with transportation, issues with sanitation, problems with heating or cooling, and stress.

Each of the final models were selected using backwards elimination, and all of the statistical analyses for this study were done using SAS 9.3.

Results

Of the 124 individuals who participated in the survey, 114 were included in the analysis due to missing values. The study population was 70.2% female, and 33.3% were between the ages of 40 and 49, while 34.2% were between 50 and 59 [Table 1]. In addition, 60.9% were African American (non-Hispanic), followed by 11.8% who were Hispanic, and 10.9% who were Caucasian. Hospital workers accounted for 63.2% of the population, while the other 36.8% worked in a nursing home. A majority of the sample (91.2%) also worked during the day as opposed to an evening, overnight, or varied shift. Furthermore, 45.1% of participants had jobs that involved the direct handling of patients, while 26.4% had jobs that involved patient contact without direct care, and 28.6% had jobs that involved no patient contact. During Hurricane Sandy, 19.4% of individuals reported not working, while 39.8% reported working more hours than usual.

Most of the study population (73.7%) did not receive any emergency preparedness training before or during the hurricane. Among those who did not receive training, there were more females than males (75% versus 25%), and 61.9% worked in a hospital [Table 1]. Interestingly, 50.8% of individuals who did not receive training were responsible for the direct care of patients, while 41.7% of individuals who did receive training had jobs that did not involve patient contact. In addition, of the participants who were African American, only 20.9% reported receiving training, whereas 50.0% of Caucasians, 30.0% of Asian/Pacific Islanders, and 30.8% of Hispanics reported receiving training. The association between hours worked during Hurricane Sandy and whether or not workers received training is also borderline significant

($P = 0.055$). Among the individuals who worked more hours than normal during the hurricane, 61.0% did not receive training.

Figure 1 displays the change in self-reported overall health ratings for the year before Hurricane Sandy versus the year after. There is a clear shift towards worse outcomes in the distribution of reported health ratings before versus after the hurricane. Before the hurricane, 30.2% of workers rated their overall health as being “excellent”, but only 9.5% chose to rate their health in this manner after the hurricane. In addition, only 0.86% of workers rated their health as being “below average” the year before the hurricane, but 13.8% chose to rate their health this way after the hurricane. When a *t* test of the mean difference between overall health before and after the hurricane was performed, it was found that there was a statistically significant change in overall health before versus after the hurricane ($P < 0.0001$). The mean change in overall health was -0.57, which indicates that the health of these workers did get worse after the hurricane.

As shown in Figure 2, when asked to identify to what degree Hurricane Sandy had an effect on their lives, 30.3% of individuals reported that the hurricane had a very large impact, while only 4.1% stated that it had no impact. These workers also reported experiencing a number of health issues during and after the storm, many of which were psychological [Figure 3]. Commonly reported health problems included headaches (21%), depression (14.5%), anxiety (12.9%), and insomnia (5.6%). Others included back, neck, and joint pain (8.9%), and flu-like symptoms (8.1%).

Receiving emergency preparedness training was not found to be significantly associated with better overall health outcomes ($P = 0.795$) [Table 2]. Nevertheless, it was found that females had worse health outcomes compared to males ($P = 0.002$), and individuals who worked in a hospital had better health outcomes compared to those who worked in a nursing home

($P < 0.0001$). In addition, healthcare workers who were in poor health before the hurricane had even worse health after the hurricane ($P < 0.0001$).

A number of factors were found to be significantly associated with the degree workers reported being impacted by Sandy [Table 3]. An individual whose job involved patient contact without direct care ($P = 0.052$) or the direct care of patients ($P = 0.023$), reported a higher degree of impact compared to individuals whose job involved no patient contact. Hospital workers reported being less impacted by Sandy than nursing home workers ($P = 0.027$), and those who worked during the day were less impacted compared to those who worked during an evening, overnight, or varied shift ($P = 0.002$). In addition, those who missed days of work during or after Sandy had a higher degree of impact compared to those who did not miss days of work ($P = 0.0257$). Factors such as having physical damage to one's property ($P = 0.052$) and problems with heating or cooling ($P = 0.001$) were also found to be significantly associated with a higher degree of impact. Training was not kept in the final model, since it was not found to be a significant predictor of degree of impact.

There were also several factors found to be significantly associated with whether workers missed days of work during or after the hurricane [Table 4]. Workers who did not receive training were 3.57 times more likely to miss days of work compared to those who did receive training ($P = 0.014$). In addition, individuals who reported being stressed were 2.86 times more likely to miss days of work compared to those who reported not being stressed ($P = 0.016$). Degree of impact was also found to be borderline significant ($P = 0.069$). The odds of missing days of work increased by 42% for each 1-unit increase in degree of impact.

Discussion

In this study, receiving emergency preparedness training before or during Hurricane Sandy was found to be a significant predictor of whether healthcare workers missed days of work during or after the hurricane. Individuals may be more inclined to report to work during a hurricane if they feel adequately prepared to respond, or feel they have an important role to play (Davidson et al., 2009). Since the demand for healthcare services increases during a natural disaster, there is a vital need for healthcare personnel (Smith, 2007). Therefore, it is crucial that leaders of healthcare facilities institute training in emergency preparedness in order to increase workers' willingness to report to work during a natural disaster, and for this response to be effective.

Participants who reported being stressed were also more likely to miss days of work, although this could have been due to a number of different factors outside of the workplace. Preplanning by leaders, including offering transportation for workers who cannot access the facility, or offering care for family members and pets, could help reduce the stress felt by these workers during a disaster. It would also help foster a greater sense of community in the workplace, which is an important element for many workers responding to a disaster event (Davidson et al., 2009; Qureshi et al., 2005; Smith, 2007).

Workers who received emergency preparedness training prior to or during Hurricane Sandy were not found to have better health outcomes compared to workers who did not receive training. However, this finding does not suggest that emergency preparedness training is not an important component of an effective disaster plan, as it has been shown by previous studies to increase the knowledge and skills of healthcare workers in regards to disaster response (Bistaraki et al., 2011). It may suggest that the current methods of training being used in these facilities - if any - are not adequately effective. However, more research would need to be conducted before

drawing this conclusion. Only one study has suggested training could result in improved health outcomes for workers, but this was not specific to healthcare workers (Burke et al., 2006).

Nursing home workers were found to have worse health outcomes compared to hospital workers. Consistent with this result was the finding that nursing home workers also reported experiencing a higher degree of impact due to the hurricane than hospital workers. Although the reasons for this remain unclear, one possible explanation is that the nursing homes in this study fared worse overall (particularly due to flood damage) compared to the hospitals. Therefore, it is imperative that these facilities adequately prepare their workers to respond to the next natural disaster, and make improvements to their disaster plans and infrastructure that will help reduce future injury and illness.

Although emergency preparedness training was not found to be a significant predictor of degree of impact, there were a number of other factors that were determined to be related. Individuals who had jobs that involved at least some contact with patients experienced a higher degree of impact than individuals whose jobs included no patient contact. Since these individuals work with patients, they may have been more likely to be working during the hurricane. In addition, although 91.2% of the study population consisted of people who worked during the day, those who worked an evening, overnight, or varied shift were found to have a higher degree of impact due to Sandy. Working in a stressful environment, particularly if the healthcare facility needed to be evacuated, may have led individuals to report a higher degree of impact. However, workers are also coping with a number of stressors outside of the workplace during a natural disaster, including physical damage to their property, and the inability to heat or cool their homes.

This study had several limitations. First, it had a relatively small sample size, which may have limited the power to detect an association. Second, it was a convenience sample, and therefore was not a true random sample of healthcare workers at the 7 facilities. The study may also have been subject to recall bias, since individuals were being asked to remember their experiences from 2 years ago. Individuals who were more impacted by Hurricane Sandy may have recalled information differently than those who were less affected. In addition, the survey was not designed to address the primary hypothesis, so no other information was known about the training methods used at these facilities other than the fact that a worker did or did not receive training. For example, there was no data on the type of training method used, or when these workers actually received the training. Finally, since the precise time when people missed work is not known, it may be that those who were absent from work were not present to receive the training in emergency preparedness.

Future recommendations include conducting disaster drills that provide a more realistic approach to dealing with the situations encountered during a natural disaster than a lecture-based or computer-based training method (Burke et al., 2006). In addition, leaders need to create a more supportive environment for their workers in order to help alleviate some of the stress and anxiety during a natural disaster, particularly since many of the health problems workers experienced during and after Hurricane Sandy were psychological. Furthermore, workers should have a voice in developing the policies and procedures to be used during a natural disaster, since they can offer insight into what went wrong during a disaster, and what still needs to be improved.

Conclusion

This is one of the first studies to examine whether emergency preparedness training for healthcare workers led to better overall health outcomes after a natural disaster, and one of the few to include all individuals working within a healthcare facility, not only nurses and physicians. Although no association was found between healthcare workers who received training and better overall health outcomes, the results from this study do suggest that individuals who received training are less likely to miss days of work during and after the hurricane. Several predictors of the degree of impact reported by workers were identified as well. Training in emergency preparedness should be implemented in all healthcare facilities in order to increase the willingness of workers to report to work during a natural disaster, and to help protect their health and safety. Although concern for the patient is paramount during a disaster, healthcare workers are risking their own safety to help others, and need to be protected from harm in order to perform their jobs effectively.

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Table 1. Distribution of study variables and their association with training

Variables	N (%)	Received Training, n (%)		p-value
		No Training	Training	
Sex				0.06
Male	34 (29.8)	21 (25.0)	13 (43.3)	
Female	80 (70.2)	63 (75.0)	17 (56.7)	
Age				0.757
18-29	8 (7.2)	5 (6.2)	3 (10.0)	
30-39	17 (15.3)	12 (14.8)	5 (16.7)	
40-49	37 (33.3)	29 (35.8)	8 (26.7)	
50-59	38 (34.2)	26 (32.1)	12 (40.0)	
60 +	11 (9.9)	9 (11.1)	2 (6.7)	
Race/Ethnicity				0.295
African American	67 (60.9)	53 (65.4)	14 (48.3)	
Caucasian	12 (10.9)	6 (7.4)	6 (20.7)	
Asian/Pacific Islander	10 (9.1)	7 (8.6)	3 (10.3)	
Hispanic	13 (11.8)	9 (11.1)	4 (13.8)	
Other	8 (7.3)	6 (7.4)	2 (6.9)	
Job Title				0.144
No patient contact	26 (28.6)	16 (23.9)	10 (41.7)	
Patient contact without direct care	24 (26.4)	17 (25.4)	7 (29.2)	
Direct care	41 (45.1)	34 (50.8)	7 (29.2)	
Facility				0.643
Nursing Home	42 (36.8)	32 (38.1)	10 (33.3)	
Hospital	72 (63.2)	52 (61.9)	20 (66.7)	
Shift				0.125
Day	104 (91.2)	79 (94.1)	25 (83.3)	
Other	10 (8.8)	5 (6.0)	5 (16.7)	
Hours worked during the hurricane				0.055
Did not work	20 (19.4)	17 (22.7)	3 (10.7)	
Less hours	20 (19.4)	18 (24.0)	2 (7.1)	
Same hours	22 (21.4)	15 (20.0)	7 (25.0)	
More hours	41 (39.8)	25 (33.3)	16 (57.1)	
Health before the hurricane				0.318
Poor	1 (0.93)	1 (1.3)	0 (0)	
Below Average	1 (0.93)	0 (0)	1 (3.5)	
Average	34 (31.5)	23 (29.1)	11 (37.9)	
Above Average	39 (36.1)	28 (35.4)	11 (37.9)	
Excellent	33 (30.6)	27 (34.2)	6 (20.7)	
Health after the hurricane				0.612
Poor	2 (1.9)	2 (2.5)	0 (0)	
Below Average	14 (13.0)	8 (10.1)	6 (20.7)	
Average	40 (37.0)	31 (39.2)	9 (31.0)	
Above Average	41 (38.0)	30 (38.0)	11 (37.9)	
Excellent	11 (10.2)	8 (10.1)	3 (10.3)	
Degree of impact				0.019
1 – No difference	5 (4.4)	5 (6.0)	0 (0)	
2	16 (14.0)	9 (10.7)	7 (23.3)	
3	31 (27.2)	18 (21.4)	13 (43.3)	
4	30 (26.3)	24 (28.6)	6 (20.0)	
5 – Very large impact	32 (28.1)	28 (33.3)	4 (13.3)	

Table 2. Multiple linear regression model predicting the difference^a in overall health (N = 107)

Variables	Adjusted ^b β (SE)	p-value
Training		
No	Reference	---
Yes	0.038 (0.147)	0.795
Health Before	-0.357 (0.082)	< 0.001
Sex		
Male	Reference	---
Female	-0.484 (0.152)	0.002
Facility		
Nursing Home	Reference	---
Hospital	0.669 (0.147)	< 0.001

^a difference = health after – health before

^b Adjusted for age, race/ethnicity, job title, shift, hours worked during the hurricane, missed days of work, power outages, and communication problems.

Table 3. Multiple linear regression model predicting degree of impact (N = 96)

Variables	Adjusted* β (SE)	p-value
Job title		
No patient contact	Reference	---
Patient contact without direct care	0.527 (0.268)	0.052
Direct care	0.624 (0.270)	0.023
Shift		
Other	Reference	---
Day	-1.032 (0.328)	0.002
Missed days of work		
No	Reference	---
Yes	0.481 (0.212)	0.026
Facility		
Nursing Home	Reference	---
Hospital	-0.582 (0.258)	0.027
Physical damage to property		
No	Reference	---
Yes	0.442 (0.224)	0.052
Problems with heating/cooling		
No	Reference	---
Yes	0.769 (0.231)	0.001

*Adjusted for age, race/ethnicity, sex, training, hours worked during the hurricane, health before, health after, power outages, communication problems, trouble finding child care, not having food/water, physical injury, difficulties with transportation, sanitation issues, stress, and other.

Table 4. Multiple logistic regression model predicting missed days of work (N = 112)

Variables	Adjusted* OR (95% CI)	p-value
Training		
No	1.00	---
Yes	0.28 (0.10, 0.77)	0.014
Degree of impact	1.42 (0.97, 2.06)	0.069
Stress		
No	1.00	---
Yes	2.86 (1.22, 6.71)	0.016

*Adjusted for age, race/ethnicity, sex, job title, type of facility, hours worked during the hurricane, shift, health after, power outages, communication problems, not having food/water, physical damage to property, difficulties with transportation, sanitation issues, and problems with heating/cooling.

Figure 1. Self-reported overall health before versus after Hurricane Sandy (N = 116)

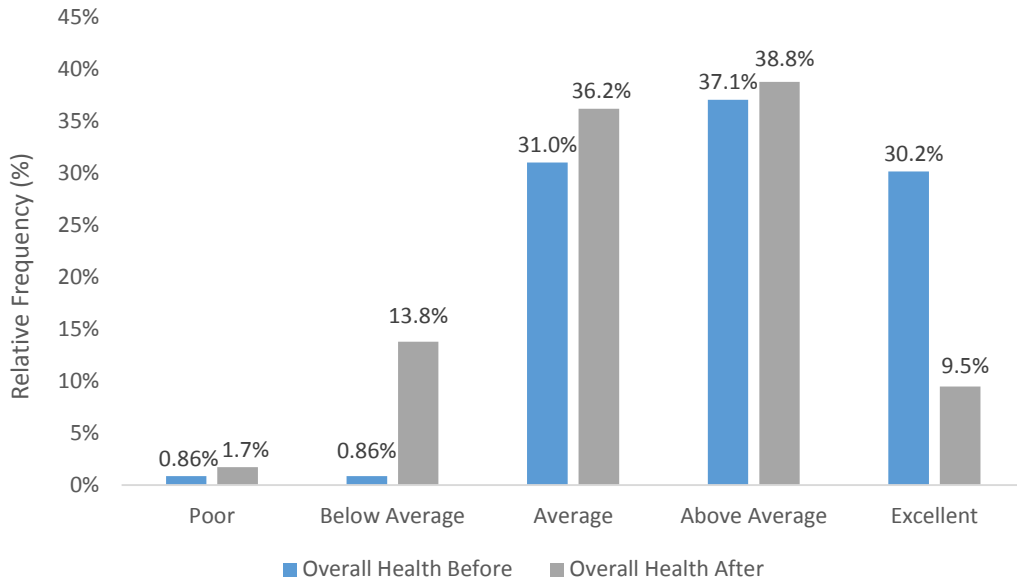


Figure 2. Degree to which Hurricane Sandy affected an individual and their family (N = 122)

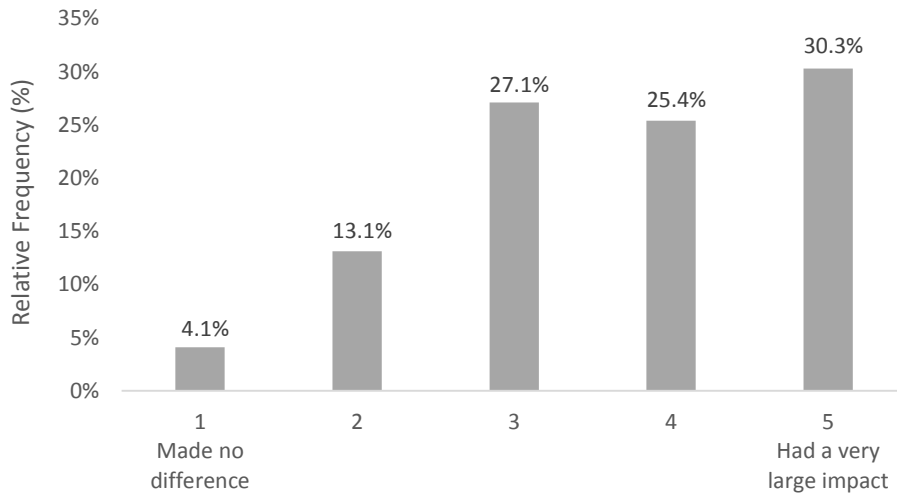
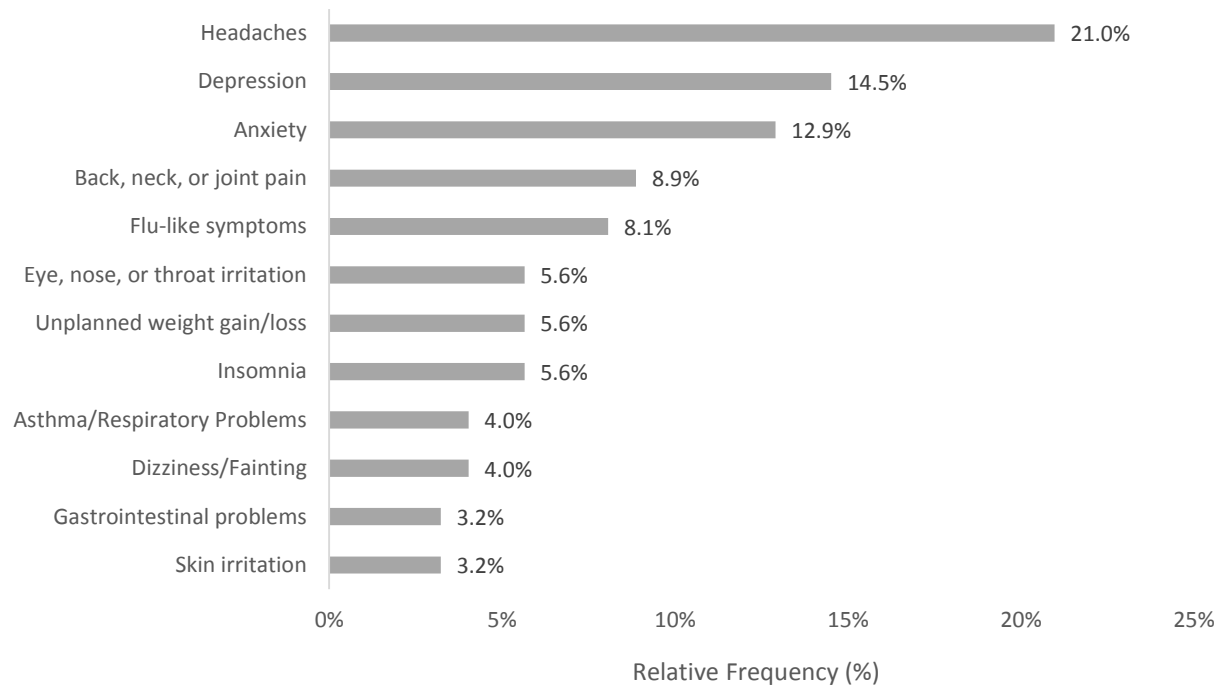


Figure 3. Most common health problems individuals experienced during or after Hurricane Sandy (N=124)



Appendix

Health and Safety Survey

Section 1

1-1. Name of healthcare facility in which you are currently employed:

1-2. Were you working at your current healthcare facility before Hurricane Sandy hit (Oct 2012)? (Check one)

- Yes
- No

1-3. Current job title:

1-4. What shift do you usually work? (Check one)

- Day shift
- Evening shift
- Overnight Shift
- Varies

1-5. Age (Check one):

- 18 - 29
- 30 - 39
- 40 - 49
- 50 - 59
- 60 +

1-6. Gender (Check one):

- Male
- Female
- Transgender
- Other (please specify):

1-7. Race/Ethnicity (Check one):

- African-American (non-Hispanic)
- White/Caucasian (non-Hispanic)
- Asian
- Pacific Islander
- Latino or Hispanic
- Native American or Alaska Native
- Other (please specify):

Section 2

2-1. How much did you work during Hurricane Sandy (Oct 26, 2012 – Nov 15, 2012)? (Check one)

- Less hours than my normal schedule
- More hours than my normal schedule
- The same hours as my normal schedule
- I did not work during Hurricane Sandy

2-2. Did you have other responsibilities outside of your normal job duties during Hurricane Sandy? (Check one)

- Yes
- No

2-3. If yes, what were they?

2-4. How did Hurricane Sandy affect you and your family? (Check all that apply)

- Physical damage to your property (flooding, wind damage, fire, etc.)
- Power outages
- Missed days of work
- Trouble finding child care
- Lack of water / food
- Physical injury to yourself or a family member
- Other (please describe):
- Difficulty with transportation
- Sanitation issues
- Problems with communication (Unable to contact family and friends, etc.)
- Problems with heating / cooling
- Loss of a family member or friend
- Stress

2-5. On a scale from 1 - 5, where 1 is “made no difference” and 5 is “had a very large impact,” please indicate to what degree Hurricane Sandy affected you and your family. (Circle one)

1 2 3 4 5

2-6. Did your employer provide any special health and safety training related to emergency preparedness and response before or during Hurricane Sandy? (Check one)

- Yes
- No

Section 3

3-1. Please indicate which of the following workplace hazards you experienced during or after Hurricane Sandy (Oct 26, 2012).

Workplace Hazards	Check all that apply to you	Please specify <i>how</i> you were exposed to the hazard
Stress	<input type="checkbox"/>	
Working more than 12 hours per day	<input type="checkbox"/>	
Violence / Assault	<input type="checkbox"/>	
Unsafe patient handling	<input type="checkbox"/>	
Back and joint injury from lifting or repetitive movement	<input type="checkbox"/>	
Slips and falls	<input type="checkbox"/>	
Needle stick / sharps	<input type="checkbox"/>	
Blood and body fluid exposure	<input type="checkbox"/>	
MRSA, <i>C. difficile</i>, or other contact-spread infectious diseases	<input type="checkbox"/>	
Tuberculosis or other droplet / airborne infectious disease	<input type="checkbox"/>	
Chemical exposure	<input type="checkbox"/>	
Burns / Cuts	<input type="checkbox"/>	
Radioactive material and x-ray hazards	<input type="checkbox"/>	
Hazardous drug exposure	<input type="checkbox"/>	
Waste anesthetic gas exposure	<input type="checkbox"/>	
Other (please specify):		

3-2. Please indicate which of the following health problems you experienced during or after Hurricane Sandy (Oct 26, 2012).

Health Problems	Check all that apply to you	Please specify <i>how</i> you received the injury or illness
Headaches	<input type="checkbox"/>	
Dizziness / Fainting	<input type="checkbox"/>	
Head injury	<input type="checkbox"/>	
Flu like symptoms	<input type="checkbox"/>	
Skin irritation	<input type="checkbox"/>	
Kidney or liver problems	<input type="checkbox"/>	
Depression	<input type="checkbox"/>	
Alcohol or drug dependency	<input type="checkbox"/>	
Insomnia	<input type="checkbox"/>	
Anxiety	<input type="checkbox"/>	
Gastrointestinal problems	<input type="checkbox"/>	
Unplanned weight loss or gain	<input type="checkbox"/>	
Eye, nose, or throat irritation	<input type="checkbox"/>	
Asthma or other respiratory problems	<input type="checkbox"/>	
Increased allergic reaction	<input type="checkbox"/>	
Back, neck, or joint pain	<input type="checkbox"/>	
Sprains / strains	<input type="checkbox"/>	
Broken bone(s)	<input type="checkbox"/>	
Burns	<input type="checkbox"/>	
Electric shock	<input type="checkbox"/>	
Other (please specify):		

3-3. On a scale from 1 to 5, how would you rate your overall health the year *before* Hurricane Sandy (Nov 2011 – Oct 2012). (Circle one)

Poor	Below Average	Average	Above Average	Excellent
1	2	3	4	5

3-4. On a scale from 1 to 5, how would you rate your overall health the year *after* Hurricane Sandy (Nov 2012 – Oct 2013). (Circle one)

Poor	Below Average	Average	Above Average	Excellent
1	2	3	4	5

3-5. What were the major problems you experienced because of Hurricane Sandy?

Section 4

For all the workplace hazards and health problems you checked off in section 3, please complete the following questions.

4-1. Did you report any of the injuries or illnesses you identified in Section 3? (Check one)

- Yes
- No

4-2. If you answered *yes* to the previous question, list **ALL** of the injuries or illnesses that you did report.

4-3. If you *did not* report any injuries or illnesses, what kept you from reporting them?

(Check all that apply)

- | | |
|-----------------------------------------------------------------------------------------|---------------------------------------------------------------|
| <input type="checkbox"/> Too little time | <input type="checkbox"/> I did not think it was important |
| <input type="checkbox"/> Worried about disciplinary action from a supervisor or manager | <input type="checkbox"/> Discouraged by supervisor or manager |
| <input type="checkbox"/> Other (please specify): | |

4-4. If you made a report, who did you report the illness or injury to? (Check all that apply)

- | | |
|------------------------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> Supervisor or manager | <input type="checkbox"/> Other (please specify): |
| <input type="checkbox"/> OSHA or government official | |
| <input type="checkbox"/> Union representative | |

4-5. Did you miss any days of work due to any of the health issues you checked off in Section 3?

(Check one)

- Yes
- No

4-6. If yes, how many days?

4-7. Did you file a workers compensation claim for the injury(s) or illness(es) you reported?

(Check one)

- Yes
- No

4-8. Was your workers compensation claim approved? (Check one)

- Yes
- No

4-9. If yes, for which injury(s) did you receive workers compensation?