

# FINAL PROGRESS REPORT

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*Evaluating the Needs, Knowledge and Health Impacts of Three Worker  
Populations During Hurricane Sandy*  
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Margaret E. Lumia, PhD, MPH, Principal Investigator

New Jersey Department of Health  
Consumer, Environmental and Occupational Health Service  
Occupational Health Surveillance Unit  
PO Box 369  
Trenton, New Jersey 08625-0369  
609-826-4984  
[Margaret.Lumia@doh.state.nj.us](mailto:Margaret.Lumia@doh.state.nj.us)

Marija Borjan, PhD, MPH  
Daniel Lefkowitz, PhD

Elizabeth G. Marshall, PhD, Co-Investigator

Rutgers School of Public Health  
Department of Epidemiology  
683 Hoes Lane West  
Piscataway, NJ 08854

Joel Swerdel, MPH  
Heather Jordan, MPH  
Pinar Erdogdu, MPH  
Shou-En Lu, PhD  
Zhengyang Shi, MS

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## LIST OF TERMS AND ABBREVIATIONS

ASPR	Assistant Secretary for Preparedness and Response
CAA	Committee for the Advancement of Arboriculture
CDC	Centers for Disease Control and Prevention
CO	Carbon Monoxide
CPWR	Center for Protection of Workers Rights
CSTE	Council of State and Territorial Epidemiologists
ED	Emergency Department
EMS	Emergency Medical Services
EpiCenter	NJ Syndromic Surveillance System
HD	Hospital Discharge Data
ICD	International Classification of Diseases
NIOSH	National Institute for Occupational Safety & Health
NJDOH	New Jersey Department of Health
NJDLWD	New Jersey Department of Labor & Workforce Development
NJPIES	New Jersey Poison Information and Education System
NJVOAD	New Jersey Voluntary Organizations Active in Disasters
OHS	Occupational Health Surveillance
OEMS	New Jersey Office of Emergency Medical
OFPAG	New Jersey Occupational Fatalities Prevention Advisory Group
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
UB	Uniform Billing
WCD	Workers' Compensation Data

## ABSTRACT

On October 29, 2012, Hurricane Sandy made landfall near Atlantic City, New Jersey (NJ), severely affecting regions along the NJ shoreline and impacting virtually every county in the state. Nearly two-thirds of the state's approximately 2.6 million utility customers were without power. The state's infrastructure, including a major highway along the shore and the mass transit system serving the NJ/New York metro region, was severely damaged.<sup>1</sup> The NJ Department of Labor and Workforce Development (2012) estimated that the 10 hardest hit counties in NJ (those closest to the main coastal and riverfront areas) included almost 6 million residents and 41% of the NJ labor force. Work-related injuries and acute illnesses occurring as a result of natural disasters are serious public health concerns. As a direct result of the effects of Hurricane Sandy, seven work-related fatalities occurred in NJ, many of whom were working in a response capacity, including three tree care workers.

This project aimed to: 1) summarize work-related injuries and acute illnesses in NJ after Hurricane Sandy through retrospective analyses of statewide data sources; identify gaps in existing data sources; and provide recommendations for strategies for future occupational health surveillance. 2) conduct focus groups among three first responder worker populations, Emergency Medical Services (EMS) responders, tree care company employers and employees, and disaster volunteers, to understand, reduce, or eliminate adverse health impacts by providing recommendations for educational and outreach materials.

The week immediately following Hurricane Sandy showed a decline in total work-related injuries: RR=0.85(95%CI: 0.69, 1.05), and no overall increase in the year post-Hurricane Sandy. However, high impact counties showed an elevated risk of work-related injuries in the first and third quarters post-Sandy among men, especially for Blacks and Hispanics. The greatest excesses occurred in the third quarter post-storm, May-July, for falls, RR=1.30(95% CI: 1.08, 1.57); cut/pierce injuries, RR=1.24(1.09, 1.40); struck by injuries, RR=1.17(1.02, 1.34); and overexertion, RR=1.26(1.10, 1.44).

Both the EMS and tree care company focus groups reported few injuries and no deaths among their colleagues but did report hazardous, high risk environments, and discussed the importance of assessing job sites and reviewing safety protocols. Other key findings included sporadic use of PPE and working 16+ hour days. The tree care employees and employers also described how the storm damaged trees presented dangerous working conditions, along with the lack of lighting, fuel, cash, and food. There was some disparity between the larger and more expert tree companies which offered more training and PPE versus smaller companies and Spanish-speaking laborers, who reported little formal training and minimal use of PPE.

In conclusion, the rate of work-related injuries in Hurricane Sandy's high impact area increased after the storm. Based on timing and type of injury, the greatest impact in work-related injury may be associated with rebuilding and recovery rather than initial response. Experience with this project can provide recommendations to improve surveillance of work-related injury in NJ and other states.

## SECTION 1

### Aim 1

Under the NIOSH Cooperative Agreement to Aid Recovery from Hurricane Sandy, the Occupational Health Surveillance (OHS) Unit of the New Jersey Department of Health (NJDOH) in collaboration with Rutgers University, School of Public Health accomplished the following:

**Aim 1:** Through retrospective analyses of several uniquely available statewide data sources on medical care, summarize work-related injuries and acute illnesses (poisoning, asthma) in NJ after Hurricane Sandy, and evaluate strategies for use and improvement of existing data systems for surveillance of work-related health effects.

**Objective 1:** Analyze a linked dataset based on emergency department visits, hospitalization and death certificate data to estimate the extent and characteristics of work-related traumatic injuries and acute illnesses associated with the onset and aftermath of Hurricane Sandy over time.

**Objective 2:** Qualitatively compare the results in Objective 1 with other sources of data on injuries and illnesses from the same timeframe.

**Objective 3:** Identify and disseminate opportunities for prevention of specific adverse health outcomes and opportunities to improve the response and recovery from natural disasters.

#### ***Significant (Key) Findings:***

- Analysis of work-related injuries showed increases in injuries in communities heavily impacted by the storm in the spring and summer months following Hurricane Sandy. There was no overall increase immediately after the hurricane, though the results are insufficient to differentiate possible competing pressures: increased risk of certain injuries because of the storm and decreased risk of more typical injuries because of disruption in electrical power, everyday infrastructure and transportation.
- Data from the syndromic surveillance system (EpiCenter) and the New Jersey Poison Information and Education System (NJPIES) was compared to the hospital and emergency department data (UB). For all occupational injuries occurring soon after Hurricane Sandy, the EpiCenter data showed the same general pattern as the UB data, but captured only a small portion of work-related injuries.

#### ***Translation of Findings:***

- There is some evidence to suggest that risky activities associated with clean-up, demolition and rebuilding may have resulted in an increase in the number of work-related injuries in NJ after Hurricane Sandy. Despite some changes in the incidence of respiratory illnesses, the effects of the storm from other infectious and weather effects could not be distinguished. Further research is needed to describe injury risks in detail, improve the completeness of reporting and develop strategies for preventing future injuries and illnesses related to extreme weather events.
- The use of key words in EpiCenter for tree care related events resulted in more detail on these types of injuries than those in the UB data.
- NJPIES showed a modest increase in poisonings at occupational settings in the three weeks beginning one week after Sandy. It is difficult to compare NJPIES with the ED or other data sources.

#### ***Outcomes/Impact:***

- The results have been presented at preparedness and applied epidemiology conferences and a scientific manuscript was submitted to Disaster Medicine and Public Health Preparedness journal. As part of a special journal focused on Hurricane Sandy, other preparedness researchers and practitioners will have access to those results for future planning.
- The UB results suggest an increased risk of demolition and construction injuries related to rebuilding after Hurricane Sandy, and results will be shared with the NIOSH construction safety center, CPWR as well as worker centers in NY and NJ.
- Finally, experience with this project can provide recommendations to improve surveillance of work-related injury in NJ and other states. These recommendations include addressing missing data (such as location and mechanism) in the UB data system and identifying further ways to distinguish work-related outcomes in addition to workers compensation.

## Aim 2

Under the NIOSH Cooperative Agreement to Aid Recovery from Hurricane Sandy, the Occupational Health Surveillance (OHS) Unit of the New Jersey Department of Health (NJDOH) in collaboration with Rutgers University, School of Public Health accomplished the following:

**Aim 2:** Aim 2a qualitative (focus group) and Aim 2b quantitative (surveys) research will allow a better understanding of the hazards, health outcomes (physical and mental) and other unique work-related challenges faced by three target populations: emergency responders, tree care company employers and employees and Red Cross volunteer workers during and after Hurricane Sandy.

**Objective 1:** Elucidate similarities and differences between “regular” day-to-day job tasks versus “emergency” job tasks related to Hurricane Sandy among the target populations.

**Objective 2:** Understand the possible exposures to contaminants among the target populations.

**Objective 3:** Describe the use of PPEs and other safety equipment among the target populations.

**Objective 4:** Characterize the physical and mental health outcomes among the target populations.

### ***Significant (Key) Findings:***

- The focus group participants described exposure to unusual conditions, such as floodwater, contaminated sand, downed power lines, animals, feces, mold, hostile residents, working 16+ hour days and downed trees, which presented especially dangerous working conditions. The different worker groups were aware they were exposing themselves to work-related hazards and took some precautions to stay safe; however, they looked beyond these risks when completing their job tasks, especially to help the community.
- The EMS focus group participants noted PPE was not always used.
- Among the tree care participants, there appeared to be a disparity between those employed by large companies versus day laborers. Larger and more expert companies had more training and higher use of protective equipment than smaller companies. Spanish-speaking laborers reported little formal training and minimal use of PPE. Both groups discussed the importance of assessing job sites and reviewing safety protocols.

### ***Translation of Findings:***

- Focus group results suggest that emergency responders, EMS workers and tree care workers, take calculated risks to complete their job assignments. Although the employees are aware some of the risks they take may lead to adverse health outcomes, they still complete the job tasks and hope no injuries or other adverse events occur.
- There is some evidence to support the need for tree care companies to provide culturally-appropriate training or PPE to their employees, particularly Spanish-speaking laborers.

### ***Outcomes/Impact:***

- Additional training on effective communication, safety, and the use of PPE, e.g. N95 filtering face piece respirator, in disasters could reduce mortality and morbidity among these worker populations' in future natural disasters. The research team received a two-year Assistant Secretary for Preparedness and Response funded project to develop plans and recommendations for tracking and preventing tree-related injuries among workers, volunteers and residents, and to develop recommendations to improve training and the use of PPE among all tree care employees, particularly Spanish-speakers.
- The focus group results were presented at disaster preparedness and applied epidemiology conferences and were well-received. Currently, staff are drafting an article for The Canopy which will summarize the project objectives, results, and implications for the tree-care industry. Also a manuscript is in preparation to be submitted to the journal Disaster Medicine and Public Health Preparedness. If accepted, other public health practitioners will have access to those results for future planning.

## SECTION 2

### SCIENTIFIC REPORT

#### Aim 1

#### **A. Background**

Hurricane Sandy was distinct in its size and scope of impact in New Jersey (NJ). The state's infrastructure, including a major highway along the shore and the mass transit system serving the NJ/New York metro region, was severely damaged. The damage and disruption required a mobilization of a diverse array of workers for response, recovery, and rebuilding.

Previous research has outlined the occupational health risks of extreme weather events such as Hurricane Sandy. Shulte and Chun have outlined possible hazardous conditions and efforts such as flood cleanup, lightning, and disruption of infrastructure that are most relevant to Hurricane Sandy. Potential outcomes include injury, communicable disease, and other illnesses.<sup>2</sup> Workers performing tasks such as restoring electrical power and demolishing damaged buildings can be inherently at high risk of injury, while other workers might put themselves at unusual risk when asked to extend hours, take on new roles, and work in physically demanding conditions without power. In addition, while there might be risk to both the general and working population soon after the event, workers could continue to be at higher risk because of the longer time frame for recovery and rebuilding. Despite the occupational health risks associated with hurricanes, there has been little comprehensive accounting of work-related injuries among workers in the wake of a major hurricane. Existing data from the United States comes from experience with Hurricane Katrina, particularly among employees such as firefighters.<sup>2-4</sup> NJDOH identified work-related fatalities directly associated with Hurricane Sandy in NJ, such as tree care workers. CDC also reported on injuries immediately after Hurricane Sandy, but did not separate injuries incurred during work from other injuries.<sup>5</sup>

#### **B. Progress Achieved Under Specific Objectives**

The overall goal of the work conducted by the Occupational Health Surveillance (OHS) Unit and Rutgers University, School of Public Health under the Aid Recovery from Hurricane Sandy funding had the following Aim to enhance existing surveillance of occupational injuries, illness and fatalities during natural and manmade disasters in NJ:

Through retrospective analyses of several uniquely available statewide data sources on medical care, summarize work-related injuries and acute illnesses (poisoning, asthma) in NJ after Hurricane Sandy, and evaluate strategies for use and improvement of existing data systems for surveillance of work-related health effects.

This aim was achieved through the following Specific Objectives:

##### **Objective 1:**

**Analyze a linked dataset based on emergency department visits, hospitalization and death certificate data to estimate the extent and characteristics of work-related traumatic injuries and acute illnesses associated with the onset and aftermath of Hurricane Sandy over time.**

Table 1 shows the distribution and characteristics of the mean number of injuries by quarter during the three years prior to Hurricane Sandy as well as the four quarters post-Hurricane Sandy, beginning with October 29, 2012. There was some indication that all injuries among patients age 18-65 declined minimally over time since the mean total injuries for each quarter was less after Hurricane Sandy than before. Based on our definition, work-related injuries constituted 8-9% of the total injuries among this age group, with small increases in the percent work-related comparing pre- to post-Hurricane Sandy. The vast majority of the hospital visits were admitted to the emergency department (96-97% of work-related injuries) and then released to home (data not shown). There were few deaths recorded: for each quarter, there were about 1-4 work-related deaths with no discernible change over time (data not shown). The first week after the storm hit, when many NJ residents were not at work because of power loss and disruption of transportation, shows a decline from the previous several weeks and in

comparison to the previous three years. After the hurricane, the number of work-related injuries returned to approximately the same number as in previous years, with a decline at the end of November (Thanksgiving holiday).

In contrast to the statewide results, there were increases in the rate of work-related injury among those considered at highest risk overall: men in the high impact counties. Table 2 and Figure 1 show how work-related injuries changed over time in this portion of the population. There was a significant increase in the first quarter post-Hurricane Sandy as well as the third quarter post-Hurricane Sandy, during the rebuilding period. Compared to the previous three years, rate ratios were significantly greater than one for Non-Hispanic Blacks (RR: 1.18, 95%CI: 1.01, 1.38); for the mechanism Cut/Pierce injuries (RR: 1.19, 95%CI: 1.09, 1.40); and for diagnosis of Open Wounds (RR: 1.42, 95%CI:1.01, 1.33). In the third quarter after Hurricane Sandy (April 29-July 30, 2013), there were significant increases among Non-Hispanic Blacks, Hispanics, and among several specific mechanisms/causes, including falls, cut/pierce, overexertion, and struck by/against. There were corresponding but non-significant increases in diagnoses that might be associated with these mechanisms, including fractures, dislocations, amputations, and open wounds.

The number of work related respiratory illnesses was small compared to the overall number of work related injuries during the time soon after Hurricane Sandy. No significant increase in work related respiratory illnesses was seen one year after Hurricane Sandy. Looking at subgroups, no increase was seen by gender or specific diagnosis such as allergic respiratory response or asthma. However, some increase was seen by impact area and age. The greatest increase in all work-related respiratory illnesses was seen in the middle impact counties in the Oct29, 2012 to Jan 28, 2013 time period (1.78, 95% CI: 1.13, 2.79). This was also seen in the Jan29 to Apr28 quarter, which was 2.22 (95% CI: 1.46, 3.37) times the average seen during the same quarter three years before. An increase in cough was seen during the first quarter, from 23 cases to 33 cases in the quarter after Hurricane Sandy. The number of asthma cases decreased during the first two quarters, but an increase was seen during the third quarter, from an average of 17 cases to 25 cases after Hurricane Sandy.

**Table 1:** Characteristics of Patients with Hospital Visits for Work Related Unintentional Injuries after Hurricane Sandy and the Same Calendar Periods in the Prior Three Years in New Jersey.

	Oct29-Jan28		Jan29-Apr28		Apr29-Jul28		Jul29-Oct28	
	2009-2012	2012-2013	2010-2012	2013	2010-2012	2013	2010-2012	2013
	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)	Total
All Injuries	100293 (1278.1)	97222	99835 (1710.1)	94147	123969 (585.5)	115979	114822 (1686.0)	106878
Work Injuries	8959 (120.8)	8511	8886 (208.1)	8583	10284 (214.5)	10221	10036 (308.7)	9477
Age								
18-30	2599(79.2)	2599	2632(51.0)	2552	3392(59.4)	3366	3152(80.2)	3089
31-50	4323 (147.3)	3872	4170 (142.7)	3956	4709 (135.5)	4574	4649 (220.9)	4262
51-65	2037(130.6)	2040	2084(44.7)	2075	2183(41.4)	2281	2236(80.5)	2126
Gender								
Female	3142(119.0)	2903	3091(159.1)	3017	3334(35.3)	3280	3272(41.5)	3173
Male	5817 (20.3)	5608	5795 (61.0)	5566	6951 (184.6)	6941	6764 (289.0)	6304
Impact Area								
High	3707(67.9)	3953	3627(103.2)	3833	4402(52.0)	4705	4235(98.4)	4279
Middle	3337 (164.9)	2889	3330 (115.3)	3042	3736 (242.2)	3545	3709 (319.8)	3249
Low	1913 (57.0)	1666	1926 (68.4)	1708	2145 (9.5)	1967	2090 (32.1)	1948

Race/Ethnicity									
Non-Hisp White	5467(82.8)	5121	5379(205.6)	4991	6221 (213.8)	5874	5919 (184.9)	5347	
Non-Hisp Black	1301(54.5)	1245	1296(49)	1296	1447(36.6)	1528	1456(47.2)	1446	
Hispanic	1542(35.2)	1358	1528(39.6)	1512	1783 (117.6)	1839	1821(171.2)	1808	
Asian/oth	563 (34.1)	687	588(30.6)	673	716 (102.5)	845	718 (131.9)	778	
Unknown	86(16.1)	100	94(7.6)	111	117(12.5)	135	122(39.2)	98	

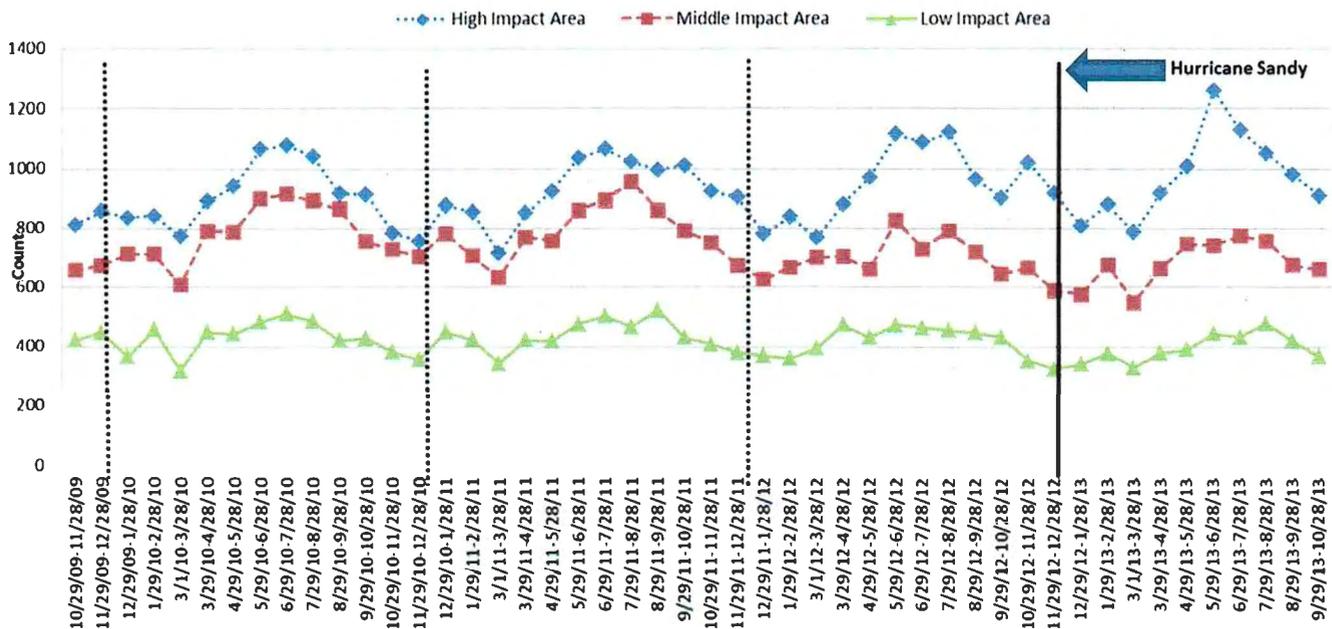
**Table 2.** Relative Risks for Male Patients in the High Impact Area of New Jersey with Hospital Visit for Work Related Unintentional Injuries During the year after Hurricane Sandy and the Same Calendar Periods in Prior Three Years

	Oct29-Jan28	Jan29-Apr28	Apr29-Jul28	Jul29-Oct28
	RR (95% CI)	RR (95% CI)	RR(95% CI)	RR(95% CI)
WR Injuries	1.10(1.00,1.22)	1.05(0.95,1.17)	1.09(1.00,1.19)	0.98(0.89,1.08)
<b>Age</b>				
18-30	1.14(1.00,1.29)	1.06(0.93,1.20)	1.11(0.99,1.24)	1.04(0.93,1.17)
31-50	1.08(0.97,1.21)	1.04(0.93,1.16)	1.06(0.96,1.17)	0.94(0.85,1.05)
51-65	1.11(0.98,1.26)	1.08(0.95,1.23)	1.15(1.02,1.29)**	0.96(0.85,1.09)
<b>Race/Ethnicity</b>				
Non-Hispanic White	1.07(0.96,1.19)	1.00(0.90,1.12)	1.04(0.95,1.15)	0.95(0.85,1.05)
Non-Hispanic Black	1.21(1.01,1.43)**	1.21(1.03,1.42)**	1.18(1.01,1.38)**	0.96(0.82,1.13)
Hispanic	1.01(0.88,1.16)	1.04(0.91,1.20)	1.19(1.05,1.34)*	1.06(0.94,1.20)
Asian/Other Race	1.74(1.45,2.10)*	1.45(1.20,1.76)*	1.25(1.06,1.48)*	1.12(0.94,1.33)
Unknown	0.80(0.37,1.75)	1.13(0.58,2.19)	1.46(0.69,3.08)	0.71(0.33,1.53)
<b>Mechanism/Cause</b>				
Motor Vehicle	1.08(0.87,1.34)	1.21(0.96,1.52)	1.02(0.83,1.26)	1.01(0.81,1.25)
Falls	1.02(0.84,1.23)	1.22(1.02,1.47)	1.30(1.08,1.57)*	1.11(0.92,1.35)
Fire/Burn	1.07(0.79,1.46)	0.83(0.60,1.13)	1.16(0.91,1.48)	0.79(0.59,1.06)
Cut/Pierce	1.19(1.02,1.39)**	1.10(0.94,1.28)	1.24(1.09,1.40)*	1.11(0.97,1.26)
Struck by/Against	1.12(0.97,1.30)	1.04(0.89,1.21)	1.17(1.02,1.34)**	1.02(0.88,1.17)
Overexertion	1.03(0.88,1.21)	1.12(0.96,1.31)	1.26(1.10,1.44)*	1.10(0.95,1.28)
Poisoning	0.98(0.50,1.94)	0.48(0.18,1.23)	0.58(0.27,1.24)	1.07(0.58,1.97)
Machinery	0.92(0.70,1.21)	1.19(0.92,1.53)	1.05(0.82,1.34)	1.30(1.03,1.65)**
Natural/Environ	1.20(0.70,2.05)	0.66(0.38,1.17)	1.02(0.76,1.37)	1.23(0.90,1.68)
Others	1.43(1.17,1.73)*	1.00(0.80,1.24)	1.10(0.91,1.33)	1.10(0.91,1.33)
Missing Cause	1.25(1.06,1.48)*	0.88(0.75,1.03)	0.66(0.56,0.77)*	0.55(0.46,0.65)*

#: P-value<0.01;

##: P-value<0.05

**Figure 1.** Hospital Visits for Work-Related Unintentional Injuries, Total Employment, and Rate of Injury from October 2009-October 2013 Before and After Hurricane Sandy in High Impact area NJ, Men Only

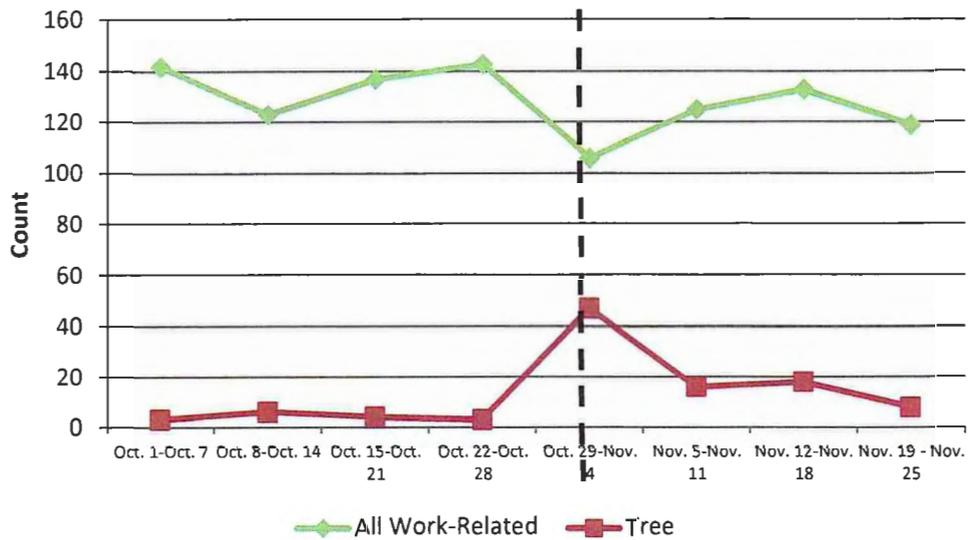


**Objective 2:**

**Qualitatively compare the results in Objective 1 with other sources of data on injuries and illnesses from the same timeframe.**

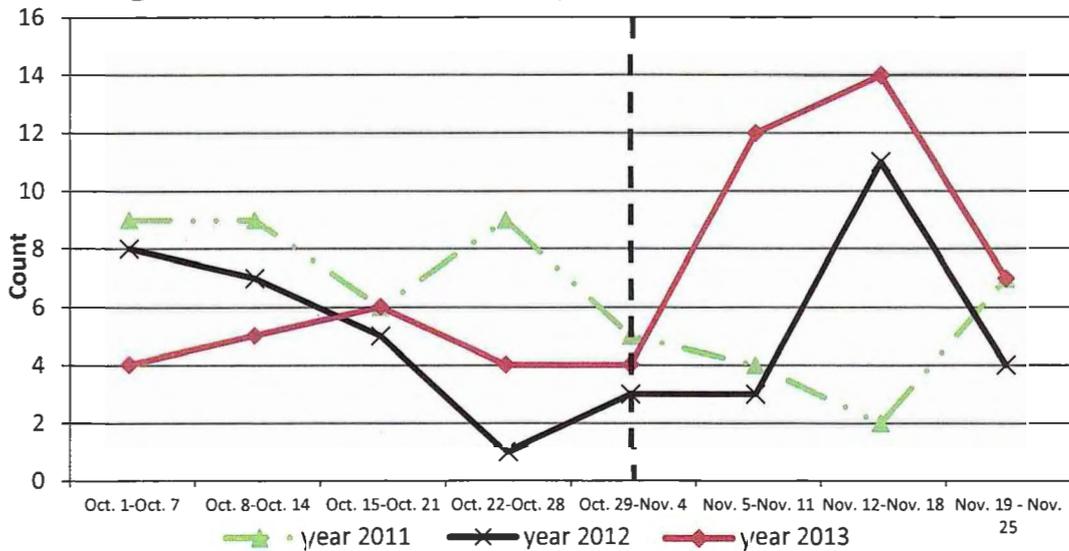
EpiCenter is a statewide syndromic surveillance system used by state and local public health agencies to detect, track and characterize health events in real-time. The system gathers de-identified information on patient symptoms. Key words in the chief complaint field are assessed in comparison to pre-determined syndrome definitions. The system automatically alerts public health agencies when an unusual pattern or trend is occurring by symptom, patient residential location or hospital. A collection of keywords and phrases were developed by assessing the free text chief complaint field and ICD-9 codes found in the electronic ED record for each visit to capture the full range of non-fatal work-related injuries and tree related injuries. Figure 2 shows the change in both general work-related injuries and in tree-related injuries. Compared to the hospital discharge and emergency discharge data, a substantial undercount was seen for the group of visits defined as probably work-related injuries. However, more specific injury descriptions, such as tree-related injuries, seemed to be more useful (Figure 2). Although the tree-related keywords cannot distinguish tree injuries to workers versus those among homeowners and others, the data did identify a substantial spike during the week of Hurricane Sandy. Further analysis of the tree-related EpiCenter data is being conducted as part of the follow-up ASPR study on tree care hazards.

**Figure 2. Occupational vs. tree related injuries, EpiCenter**



Occupational exposures are reportable under NJ state law. One of the areas NJPIES codes for is occupational exposure. A retrospective analysis of calls to the call center was conducted to characterize work-related poisonings captured by NJPIES during Hurricane Sandy. Although only a small percentage of all poisonings reported to NJPIES are work-related (0.75% in 2012), an increase in poisonings was seen after the hurricane from November 5–18, 2012 (Figure 3), with a total of 37 poisonings reported during the four weeks after Hurricane Sandy. However, it is difficult to determine whether this increase was unusual in quantity of type of poisoning. Occupational chemical exposures during this time included industrial cleaners, paint stripper, and unknown fumes. In comparison, the emergency department data reported 41 poisonings during the entire quarter after Hurricane Sandy with little information on source of poisoning.

**Figure 3. Work Related Poisonings (NJPIES)**



### **Objective 3:**

#### **Identify and disseminate opportunities for prevention of specific adverse health outcomes and opportunities to improve the response and recovery from natural disasters.**

The results of the UB data analysis was presented based on the results of Objective 1, project staff have submitted a scientific manuscript to Disaster Medicine and Public Health Preparedness journal. As part of a special journal focused on Hurricane Sandy, other preparedness researchers and practitioners will have access to those results. In addition, these results were submitted and presented successfully at the CDC Public Health Preparedness meeting among Hurricane Sandy grant recipients in March 2015. At that time, the Board of Scientific Counselors discussed issues around day laborers and other workers as first responders in storm response. The data summary was also presented to other researchers and community partners at both the ASPR August 2015 Disaster Research meeting in NYC as well as the Northeast Epidemiology (Regional CSTE meeting) in New Brunswick in October 2015.

The UB results suggest an increased risk of demolition and construction injuries related to rebuilding after Hurricane Sandy, and results will be shared with the NIOSH construction safety center, CPWR. There is insufficient data to identify detailed hazard circumstances from the data. However, the mechanism and diagnostic results, along with experiences reported by the collaborating worker partner organizations, suggest that the hazards of rebuilding after Hurricane Sandy are similar to the well-known hazards and weak safety culture of residential related construction efforts. After the publication has been approved, efforts will be made to further reach out to CPWR and OSHA's programs in construction injury and fall prevention, with an emphasis on preparing for future response and rebuilding.

Rutgers is carrying out a follow-up ASPR project focusing on the identification and prevention of tree care related injuries, based on syndromic surveillance and other data showing an increase in the risk of tree-related injuries after Hurricane Sandy. Finally, experience with this project can provide recommendations to improve surveillance of work-related injury in NJ and other states. These recommendations include addressing missing data (such as location and mechanism) in the UB data system and identifying further ways to distinguish work-related outcomes in addition to workers compensation.

### **C. Conclusions**

In sum, analysis of work-related injuries after Hurricane Sandy showed that there were increases in injuries occurring in the spring and summer months in communities heavily impacted by the storm. There was no overall increase immediately after the hurricane, though the results are insufficient to differentiate possible competing pressures: increased risk of certain injuries because of the storm and decreased risk of more typical injuries because of disruption in electrical power, everyday infrastructure, and transportation. There is some evidence to suggest that risky activities associated with clean-up, demolition and rebuilding are associated with an increase in the number of work-related injuries in NJ in the longer term after Hurricane Sandy.

With respect to other work-related outcomes, the evidence is much weaker. Despite some changes in the incidence of respiratory illnesses, the effects of the storm from other infectious and weather effects could not be distinguished. The evaluation of syndromic surveillance data suggested an increase in tree-related injuries, but attempts to use that data as another general surveillance source for work-related injuries were not productive. The NJPIES data also showed some increase in work-related poisoning calls in the month following Sandy but the exposures involved were diverse and could not be directly compared to the UB or other data.

Overall, the results suggest a focus on preventing both rebuilding and tree-related injuries. Further research is needed to describe injury risks in detail, improve the completeness of reporting and develop strategies for preventing future injuries and illnesses related to extreme weather events.

## Aim 2

### A. Background

The NJ Department of Labor and Workforce Development estimated that during Hurricane Sandy, the 10 hardest hit counties in NJ (those closest to the main coastal and riverfront areas) included 41% of the NJ labor force.<sup>6</sup> Fatal and non-fatal injuries and illnesses were reported among those workers responding in some capacity to the effects of the storm. As a direct result of the effects of Hurricane Sandy, seven work-related fatalities occurred in NJ; of these three were tree care workers. Two died as a result of cutting/removing downed trees and were killed after being struck by cut sections of trees. The other worker died while exiting a pickup truck to begin storm clean-up, and was struck by another truck.

The research team set out to characterize the specific types of conditions, exposures, PPE, injuries and illness experienced by these three worker population through focus groups and surveys. The results of these focus groups and surveys will guide the research team in setting priorities and identifying targets for interventions and injury prevention efforts.

### B. Progress Achieved Under Specific Objectives

The overall goal of the work conducted by the OHS Unit and Rutgers University, School of Public Health under the Aid Recovery from Hurricane Sandy funding had the following Aims to better understand occupational hazards encountered during natural and manmade disasters in NJ:

Aim 2a qualitative (focus group) and Aim 2b quantitative (surveys) research will allow a better understanding of the hazards, health outcomes (physical and mental) and other unique work-related challenges faced by three target populations during and after Hurricane Sandy:

#### *Aim 2a qualitative (Focus Groups)*

Seven focus groups (n=60) were conducted: three EMS focus groups (n=27), three tree-care focus groups (n=30), and one organized disaster response volunteer group (n=3). Table 3 provides a summary of the demographic characteristics of the surveyed populations. However, due to the low participation in the organized disaster response volunteer groups, these data are not presented. During the focus groups, participants were asked to describe similarities and differences between “regular” job/volunteer duties and compare them to Hurricane Sandy-related job/volunteer duties, to describe exposures to contaminants, the use of PPEs and other safety equipment, to characterize their physical and mental health outcomes, and to pilot test questions to be included in a longer electronic survey which was deployed at a later date.

**Table 3. Demographics of EMS and Tree care workers**

Demographics	EMS (n=27)	Tree care workers (n=30)	Demographics	EMS (n=27)	Tree care workers (n=30)
<b>Age (yrs)</b>			<b>Highest level of Education</b>		
18-34	8 (30%)	11 (37%)	Completed primary school	0	1 (3%)
35-49	4 (15%)	6 (20%)	Completed some high school	1 (4%)	2 (7%)
50-64	11 (41%)	4 (13%)	High school diploma or GED	2 (7%)	6 (20%)
65+	4 (15%)	2 (7%)	Some college or technical school	9 (33%)	8 (27%)
Unknown/Missing	0	7 (23%)	Completed technical school	3 (11%)	0
<b>Gender</b>			College Degree (AB, BS)	6 (22%)	5 (17%)
Male	15 (56%)	24 (80%)	Graduate Degree (MS, MPH)	5 (19%)	0
Female	12 (44%)	0	Unknown/Missing	1 (4%)	8 (27%)
Missing/Unknown	0	6 (20%)	<b>Annual household income</b>		
<b>Primary Language at home</b>			39,000 or less	2 (7%)	5 (17%)
English	26 (96%)	21 (70%)	\$40,000 to 49,000	1 (4%)	2 (7%)
Spanish	1 (4%)	3 (10%)	\$50,000 to 59,000	1 (4%)	4 (13%)
Unknown/Missing	0	6 (20%)	\$60,000 to 69,000	2 (7%)	3 (10%)
<b>Ethnicity</b>			\$70,000 to 79,000	2 (7%)	1 (3%)
Not Hispanic	24 (89%)	19 (63%)	\$80,000 or more	17 (63%)	6 (20%)
Hispanic	3 (11%)	4 (13%)	Unknown/Missing	2 (7%)	9 (30%)
Unknown/Missing	0	7 (23%)	<b>Race*</b>		
<b>Race*</b>					
White/Caucasian	26 (96%)	21 (71%)			
Other	1 (4%)	2 (7%)			
Unknown/Missing	0	7 (23%)			

***Aim 2b quantitative (Long Survey)***

In order to develop and deploy the long survey, staff utilized the NJ Hippocrates System. Hippocrates is an integrated application for capturing, managing, displaying and disseminating health information to support users in the preparation for, response to, and recovery from natural and man-made health threats and emergencies. The surveys were built in Hippocrates and the system created a link which was sent via email to potential respondents. Data for the electronic surveys are not presented due to low participation. Despite several attempts at sending the survey link to various listservs, there were few responses to the survey request: 77 EMS completed surveys; 28 Tree-care worker surveys; and 32 organized disaster volunteers/American Red Cross surveys were returned.

The above aims were achieved through the following Specific Objectives:

**Objective 1:**

**Elucidate similarities and differences between “regular” day-to-day job tasks versus “emergency” job tasks related to Hurricane Sandy among the target populations.**

For the EMS focus group participants, 78% of respondents surveyed indicated that their job tasks were different during Hurricane Sandy. For example, working with high or fast-moving water, operating rescue shelters and inspecting for downed wires were identified as specific tasks that were different from day-to-day job tasks. EMS participants noted, “people did not evacuate as they were supposed to” and “...we had to check [for residents who did not evacuate] so now we are putting all of us at risk to... get washed away.” One respondent stated that while checking homes for stranded people “...water was actually at my chest.” An overall impression from the EMS focus groups was “nothing compares” to the types of calls and the need to be “jacks of all trades” they experienced during Hurricane Sandy.

The EMS respondents all noted the importance of bringing in additional resources and people to help relieve the workers. One respondent noted, “I do not like to give up the reins. I was at a point...ok, I surrender” another stated, “you run out of supplies. You run out of squad equipment, so you got to figure out the way to get all that stuff. You do not keep enough oxygen to supply three towns worth of home oxygen and then next thing you know, all of our portable bottles are all gone.”

For the tree-care population, 63% indicated that their job tasks were also different during storm-related work. Examples reported included working on down trees on houses and cars, dealing with uprooted trees under tension, and working around low or downed wires. Tree workers noted most storm clean-up tasks involve downed trees subject to complex/unpredictable forces as compared to a routine pruning, maintenance or removal job.

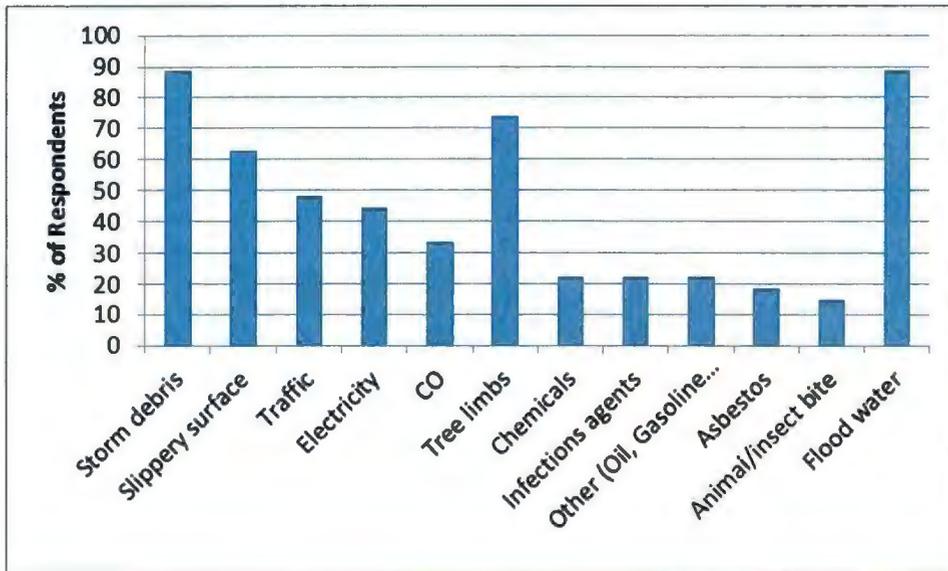
**Objective 2:**

**Understand the possible exposures to contaminants among the target populations.**

The EMS focus group participants described exposure to regular conditions, such as “bodily fluids, animals, weapons,” and more unusual conditions, such as floodwater, sewage, high winds, contaminated sand, downed power lines, animals, feces, mold and hostile residents (Figure 4). An EMS respondent reported, “almost every home was affected somehow by mold...you can smell it as soon as you walk in the door...we [wore] N95 masks pretty much everywhere.”

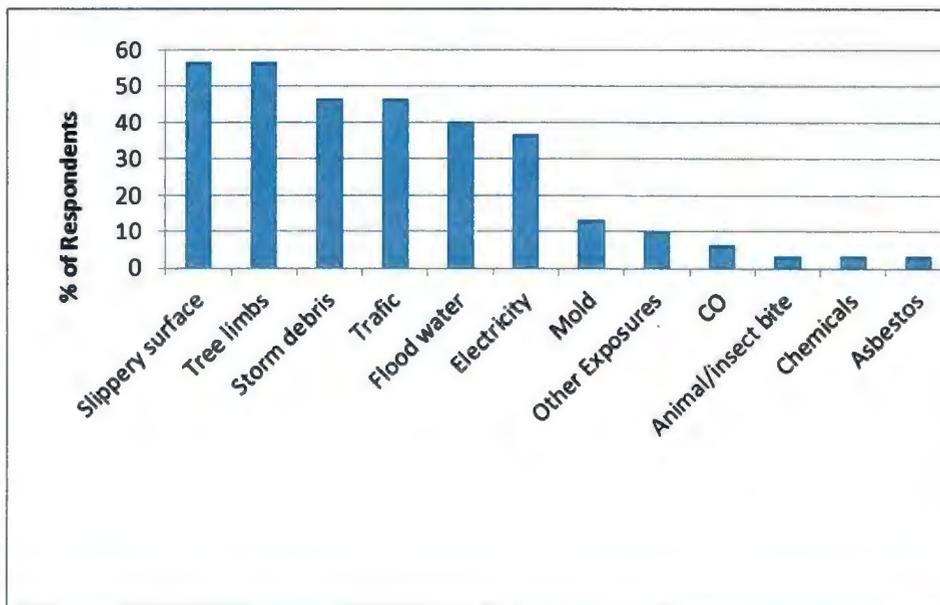
The respondents all noted the loss of power requiring the use of generators. This introduced potential exposure to gasoline and the risk of fire and explosions during refueling. Risk of fire and explosions were also present due to gas leaks from damaged homes and gas lines. EMS workers were quickly instructed on how to turn off the gas, which is not part of their normal training “...We had to turn off the gas line and mark it. This was before we did a search and rescue of the house to see if there were any lives in there.”

**Figure 4. EMS Work-related Exposures During Hurricane Sandy**



The tree care employees and employers described working 16+ hour days following the storm. Downed trees and downed power lines due to this storm presented especially dangerous working conditions (Figure5). One tree company employee noted that while working on tree clean-up, he was asked to remove household debris too, “Everything was destroyed...there were iron parts, glass, and trash. We didn’t have gloves to remove all of that.” Another concern for the tree care workers was contact with energized power lines and the risk of electrocution. One worker said, “One time we were removing roots and we cut a power line. But the only good thing was that it did not have electricity.” He later stated that he thought this happened, “because of the rush.”

**Figure 5. Tree Care Workers Work-related Exposures During Hurricane Sandy**



### Objective 3:

#### Describe the use of PPEs and other safety equipment among the target populations.

During the focus group, participants were asked if they were provided PPE (Table 5) and received training. Overall both focus groups, 88% of the EMS and 76% of the tree care workers, did report they had received basic day-to-day job training. However, both groups reported receiving minimal additional training prior to working on a Hurricane Sandy damaged work-site. Only 25% of EMS reported having additional basic disaster, flood water rescue and high wind hazard training. While 40% of the tree care workers reported having additional training such as, electrical hazard, hazard recognition, CPR and first aid.

The EMS focus group participants noted the use of different types of PPEs, depending on the type of call. If dispatch advised of a code red, one EMS participant explained that required “whole face guard and gloves.” However, PPE was not always used, one participant stated, “We knew there was mold, but it was hot. We didn’t wear our masks.” Another EMS respondent recalled, “one of the guys had to go under the water to hook up the hydrant when a house caught on fire.” When asked if that individual was wearing any PPE, including eye protection, the respondent said, “No. He just dove into the water.” Another respondent noted, “When we first started the recovery, we didn’t wear suits. We didn’t have masks on. We didn’t know that the mold was setting in. We didn’t know if the water was contaminated with sewage. We found out afterwards. I know we were on our hands and knees going through all of it...We didn’t have anything to protect us.”

Among the tree care participants, there appeared to be a disparity between those employed by large companies versus smaller companies and day laborers. Larger and more expert companies had more training and greater use of protective equipment than smaller companies. Spanish-speaking laborers reported little formal training and minimal use of PPE. Both groups discussed the importance of assessing job sites and reviewing safety protocols. One Spanish-speaker said he brought his own gloves because, “Most companies don’t give you anything.”

**Table 5. Does your employer provide PPE?**

<b>Yes Responses (may have picked more than 1)</b>	<b>EMS (n=27)</b>	<b>Tree care workers (n=30)</b>
Coveralls, disposable gown, jacket, reflective safety vest	23 (85%)	19 (63%)
Earplugs or earmuffs	2 (7%)	23 (77%)
Goggles and or safety glasses	22 (81%)	24 (80%)
Hand sanitizer	25 (93%)	24 (80%)
Mask	23 (85%)	0
Protective Gloves	23 (85%)	17 (57%)
Boots	8 (30%)	6 (20%)
Other	8 (30%)	10 (33%)
Unknown/Missing	1 (4%)	1 (3%)

#### Objective 4:

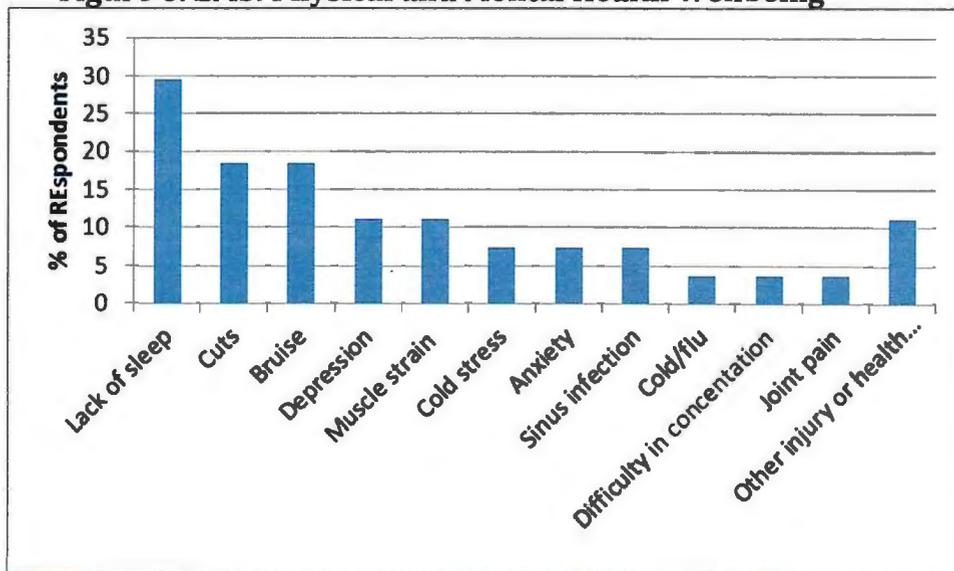
#### Characterize the physical and mental health outcomes among the target populations.

Both the EMS workers and Tree care worker populations reported few injuries and no fatalities among their colleagues, but did report hazardous, high-risk conditions that affected their overall wellbeing and mental health (Figures 6 and 7). One EMS respondent stated, “We were lucky. We had a couple of scrapes and bruises.” A tree care employee noted that he thought, “The danger is for new people.” He witnessed an accident where a branch fell on a new coworker who was not paying attention. Another employee recalled a co-worker injured his back lifting a piece of tree that was too heavy, but the employer was not informed. The tree care workers felt they could not tell management about injuries because of the fear they will be replaced by someone new.

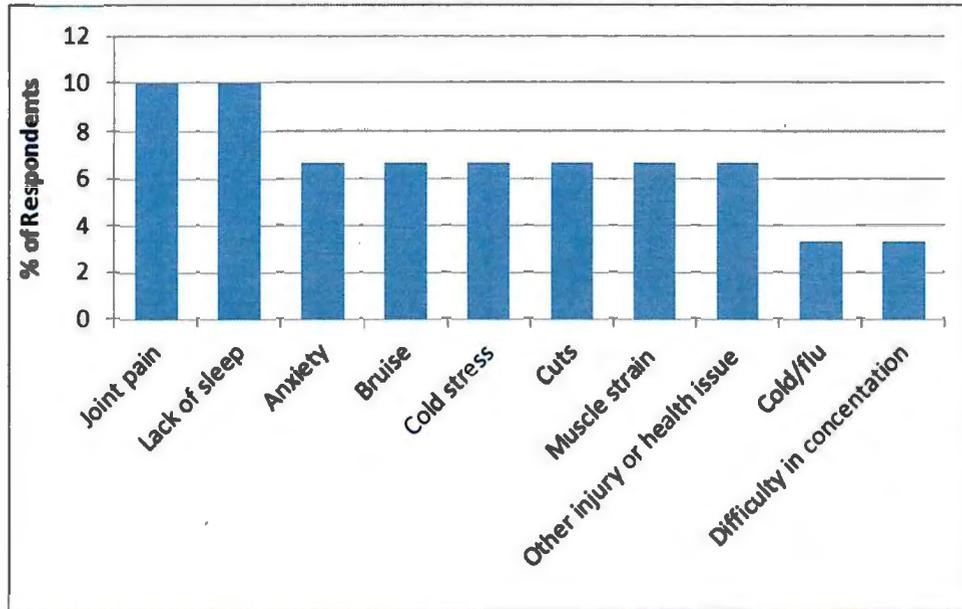
Many participants reported being “sleep deprived,” one EMS respondent said, “...work until you drop to get the job done. There are rules. We are not allowed to work over a certain amount of hours. It all goes out the window when there is a disaster.” A tree company employee stated, “We work long hours in storms. It’s what we do.” Another tree care employee reported, “Employers don’t care if you are working 8 or 24 hours or three days. He doesn’t care about that. He wants his money. He doesn’t care about his employees. He only cares that you work, that you produce more, that’s the reality.”

For calls that could not be taken due to high winds and flood water, a EMS respondent said, “If there is nine feet of water you cannot take the rig in that and you cannot get to them, and that is so emotionally devastating...we couldn’t [do our work]. That is really hard.” Another respondent noted, “We had members who lost their homes. We are a family. We take care of each other.”

**Figure 6. EMS: Physical and Mental Health Wellbeing**



**Figure 7. Tree care Workers: Physical and Mental Health Wellbeing**



### C. Conclusions

EMS responders and tree care company workers and employers were aware they were exposing themselves to work-related hazards and took some precautions to stay safe; however, they looked beyond these risks when completing their job tasks, especially to help the community. Conducting disaster- and worker group-specific focus groups is an effective strategy to uncover health and work-related challenges and risks that may be missed when analyzing major datasets. Information from the focus groups helped identify the presence of hazardous conditions that might lead to injuries and illnesses identified in the datasets, which can be used to create prevention strategies for future disasters.

Due to the low response rate, disseminating electronic surveys to these three worker populations does not appear to be the best way to capture data on Hurricane Sandy work experiences. It is possible too much time had passed from between the events of Hurricane Sandy and when the survey was distributed. Another issue was the inability to validate email addresses or listservs, making it impossible to determine how many workers received the emailed survey link. Alternate strategies to obtain completed surveys may increase response rates. These may include paper and pencil dissemination at EMS station houses, or the use of iPads or other electronic devices during or shortly after the event.

Finally, enrolling at-risk workers, such as Spanish-speaking day laborers, is challenging. Therefore, collaborating with worker centers, such as New Labor was helpful to recruit participants, and building upon the existing relationship between NJDOH and the tree industry was also critical.

## TRANSLATION OF RESEARCH

### Aim 1

The analysis of UB data for occupational injuries before and after Hurricane Sandy has been submitted to Disaster Medicine and Public Health as a research manuscript. In addition, these results were submitted and presented successfully at the CDC Public Health Preparedness meeting among Sandy grant recipients in March 2015. At that time, the Board of Scientific Counselors discussed issues around day laborers and other workers as first responders in storm response. The data summary was also presented to other researchers and community partners at both the ASPR August 2015 Disaster Research meeting in NYC as well as the Northeast Epidemiology (Regional CSTE meeting) in New Brunswick in October 2015. Rutgers and NJDOH continue to work directly with New Labor, a NJ workers center, on both construction safety and tree care hazards. New Labor is also collaborating regionally with other worker centers on preparedness under the direction of investigators at CUNY Queens on their ASPR follow-up grant.

Efforts to utilize and validate the occupational injury and tree-related injury classifiers using the syndromic surveillance system resulted in mixed accomplishments. Based only on the chief complaint and keyword evaluation, the occupational injury classifier did not successfully identify an effective portion of all occupational injury to be generally used for surveillance. In contrast, the tree-related injury classifier did successfully identify a substantial number of related injuries, a type of injury that cannot otherwise be identified. This classifier is currently being further analyzed as part of the ASPR follow-up tree hazards grant (Dr. Rosen, PI) and will be summarized over time and by different mechanisms. The results will be presented to the Tree Care Injury Prevention Work Group associated with the ASPR grant and contrasted with other available data (such as fatalities). Project staff and working group members will translate that information into recommendations for prevention and improved training by September 2016 when that grant is completed.

Recommendations on improving surveillance systems' abilities to capture work-related cases will be summarized in a CSTE abstract and submitted to the 2016 CSTE Annual Meeting. These recommendations will include ways to improve the UB data for occupational health surveillance. For example, recommendations include: improving the use of E codes, anticipating changes that might occur under ICD-10, ways to encourage hospitals to include the codes specifying location, and analyses that might estimate work-related admissions that are not paid by workers compensation. A review of the strengths and weaknesses (for occupational health surveillance) of both the UB data and the syndromic surveillance data with NJDOH staff that direct those programs will also be completed. NJPIES continues to report occupational poisoning exposures to the NJDOH Occupational Health Surveillance unit, so those reports will continue to be evaluated on an on-going basis.

## **Aim 2**

One of the key findings of the study was that although EMS responders, tree-care workers, and disaster volunteers were aware they were exposing themselves to work-related hazards, focus group participants acknowledged greater risk tolerance (including lack of both PPE and task-specific training) when completing their job tasks after a hurricane, especially to help the community. NJDOH Staff has therefore recommended the following:

Additional training on effective communication, safety and the use of PPE in disasters could reduce mortality and morbidity among these worker populations in future natural disasters. Training should include the proper assessment of job sites and potential hazards, such as downed limbs, flood waters, and hostile displaced shelter evacuees; review of the proper use of equipment, such as chainsaws, chippers, N95 filtering face piece respirators, and latrines, and communication strategies with ground crew, tree climbers, and equipment (e.g., crane) operators.

Conducting additional outreach, especially to at-risk workers, such as Spanish-speaking day laborers and volunteers providing tree trimming and removal services during natural disasters, although challenging, may uncover additional areas for improvement. The research team received a two-year Assistant Secretary for Preparedness and Response funded project to develop plans and recommendations for tracking and preventing tree-related injuries among workers, volunteers and residents.

During this project period, the research team collaborated with various tree care groups presenting and participating in their regional educational and training meeting. The research team published a short article in *The Canopy*, a quarterly newsletter produced by the New Jersey Arborists Chapter of the International Society of Arboriculture, in July 2015 which included information about how to participate in this research study. Currently, staff are drafting an article for *The Canopy* which will summarize the project objectives, results, and implications for the tree-care industry. Staff also published a short article in the NJVOAD Weekly E-Newsletter in June 2015 which included information about how disaster volunteers could participate in this research study.

## PUBLIC HEALTH RELEVANCE AND IMPACT

Data from NJ hospitals did not show a general increase in work-related injuries in NJ during the time period immediately following Hurricane Sandy or throughout the entire year for the entire state. However, an increase in work-related injuries was observed in the first and third quarter after Hurricane Sandy (late spring/summer) among men in the high impact counties. Because the data did not include employer or industry information, it is not possible to identify the true circumstances or the specific conditions under which the increased injuries occurred, such as where falls occurred, what agents were involved in the cut and pierce injuries, and what objects struck the patients.

The timing of the increase in injuries (spring-summer), as well as the leading mechanism/causes, dominance of men, corresponding diagnoses, and ethnicity (many construction workers are Hispanic) seem to suggest a role for construction, demolition, or related industries. Residential construction is particularly hazardous, with a high rate of fatalities and severe injury.<sup>7</sup> Previous work in NJ has shown poor control of hazards in this sector.<sup>8</sup> Tree removal is also recognized as presenting substantial injury risks, including falls, cut/pierce, and struck by injuries.<sup>9</sup> The analysis of tree-related injuries using the syndromic surveillance (EpiCenter) system confirmed those hazards by showing an increase in tree-related injuries immediately after Hurricane Sandy. Increased efforts to improve regulatory oversight and reduce hazards in both the residential construction and tree care industry could substantially reduce injuries among a large number of workers.

Looking at respiratory outcomes, there was some evidence of transient increases in respiratory outcomes, such as cough and asthma, in the quarters following Hurricane Sandy. However, because no information on the incidence and contribution of infectious diseases (e.g. influenza, other viruses) was available, it is difficult to attribute these changes to the hurricane and the working conditions related to response and recovery.

There are some inherent limitations in using hospital-based data to evaluate work-related injuries and illnesses over time. Defining injuries as work-related based primarily on workers compensation as expected payer underestimates the number of work-related outcomes. Previous work has compared more than one source of injury data (e.g. hospital billing, workers compensation, trauma registry data).<sup>10,11</sup> These studies suggest that a substantial proportion of work-related injuries seen in emergency rooms are not submitted for workers compensation. Emergency department billing records do not have sufficient information in the coded records to describe injuries or illnesses in detail. There is insufficient description to identify preventive strategies, and no way to distinguish injuries likely to be directly related to the hurricane (e.g. flooding, tree removal, or demolition injuries) from other injuries occurring because of more typical working conditions. Most of the billing records do not record the location where the injury occurred, either by type (e.g. building, street, factory, etc) or actual location. Although ICD-9 E codes for type of location do exist, most of those were missing in the data available for 2009-13 for NJ. Improving the inclusion of location in the UB records in the future could assist in preparing for and responding to future disasters. Because the actual geographic location of the injury (e.g. municipality or address) is unknown, hospital county was utilized as a proxy, but the distance from the site of injury to the hospital could vary substantially.

The findings from the focus groups revealed that the EMS responders and tree care company workers were aware they were exposing themselves to work-related hazards and took some precautions to stay safe; however, they appear to be tolerant of the risks when completing their job tasks, especially to help the community. The focus groups confirmed the widespread presence of previously identified hazards and the potential for injury and illness as a consequence. Overall the research team determined that there

was a lack of training among both groups on how to identify the types of hazards they may encounter when working in a natural disaster area, how to evaluate what safety precautions and appropriate PPE are needed in these working conditions and how to better control potential hazards and exposure found at their work site. Additional training on effective communication, safety, and the use of PPE in disasters could reduce mortality and morbidity among these worker populations in future natural disasters.

## **PUBLICATIONS, PRESENTATIONS, AND MEDIA COVERAGE**

### ***Publications***

Marshall, Elizabeth G., PhD; Lu, Shou-En, PhD; Shi, Zhengyang, MS; Swerdel, Joel, MPH; Borjan, Marija, PhD; Lumia, Margaret E., PhD. Work-Related Unintentional Injuries Associated with Hurricane Sandy in New Jersey. *Disaster Medicine and Public Health Preparedness*. (in Review)

Jordan, Heather, MPH; Lefkowitz, Daniel, PhD; Erdogdu, Pinar, MPH; Lumia, Margaret, PhD; Marshall, Elizabeth G., PhD; Clancy, Terry, PhD. A qualitative characterization of Emergency Medical Service and tree care industry worker occupational health issues related to Hurricane Sandy in New Jersey. (In preparation)

### ***Presentations***

Marshall B, Jordan H, Erdogdu P. Hazards of tree care work: A public health collaboration to prevent occupational health fatalities and injuries in New Jersey. Presentation at the annual meeting of Certified Tree Experts. January 2015; Freehold, NJ.

Lumia M, Marshall E, Lu S, Jordan H, Borjan M, Swerdel J, Lefkowitz D, Erdogdu P, Shi Z. Occupational Health Aspects of Hurricane Sandy in NJ. Poster and Presentation: CDC Hurricane Sandy Grantee Meeting, March 25-27, 2015; Atlanta, Ga

Lumia, Margaret E., PhD; Marshall, Elizabeth G., PhD; Lu, Shou-En, PhD; Shi, Zhengyang, MS; Swerdel, Joel, MPH; Borjan, Marija, PhD;. Occupational Health Aspects of Hurricane Sandy in NJ. Poster: Council of State and Territorial Epidemiologist 2015 Annual Conference. June 13-18, 2015; Boston, MA

Lumia M, Marshall E, Lu S, Jordan H, Borjan M, Swerdel J, Lefkowitz D, Erdogdu P, Shi Z. Evaluating the Needs, Knowledge and Health Impacts of Three Worker Populations During and After Hurricane Sandy. Oral presentation at the ASPR/CDC/NIEHS 2015 Hurricane Sandy Conference. August 2015; New York City, NY

Lumia M, Jordan H, Erdogdu P, Marshall E, Lefkowitz D, Borjan M. A Preliminary Summary of Working Conditions, Health Impacts, and Other Work-related Challenges of Three Worker Groups During Hurricane Sandy in New Jersey. Poster presented at the ASPR/CDC/NIEHS 2015 Hurricane Sandy Conference. August 2015; New York City, NY.

Jordan H, Lumia M, Marshall E, Lu S, Borjan M, Swerdel J, Lefkowitz D, Erdogdu P, Shi Z. Occupational Health Effects of Hurricane Sandy. Oral presentation at the Northeast Epidemiology Conference; September 2015; New Brunswick, NJ.

### ***Media Coverage***

DOH Committed to Enhancing Sandy Recovery Through Research. New Jersey Department of Health, Health Matters July/August 2015. Available at:

[http://nj.gov/health/newsletter/documents/july\\_august\\_2015\\_newsletter.pdf](http://nj.gov/health/newsletter/documents/july_august_2015_newsletter.pdf)

DOH Collaborates with Rutgers School of Public Health on Investigation & Prevention of Injuries Among Tree Service Workers. New Jersey Department of Health, Health Matters September/October 2015. Available at:

[http://nj.gov/health/newsletter/documents/sept octo 2015\\_newsletter.pdf](http://nj.gov/health/newsletter/documents/sept_octo_2015_newsletter.pdf)

## CITATION

1. Manuel J. The long road to recovery: environmental health impacts of Hurricane Sandy. *Environ Health Perspect* 2013;121(5):a152-9.
2. Schulte PA, Chun H. Climate Change and Occupational Safety and Health: Establishing a Preliminary Framework. *Journal of Occupational and Environmental Hygiene* 2009;6(9):542-554.
3. Goldman L, Coussens C. Environmental Public Health Impacts of Disasters: Hurricane Katrina, Workshop Summary: National Academies Press; 2007.
4. Tak S, Bernard BP, Driscoll RJ, Dowell CH. Floodwater exposure and the related health symptoms among firefighters in New Orleans, Louisiana 2005. *Am J Ind Med* 2007;50(5):377-82.
5. Brackbill RM, Caramanica K, Maliniak M, Stellman SD, Fairclough MA, Farfel MR, et al. Nonfatal injuries 1 week after hurricane sandy--New York city metropolitan area, October 2012. *MMWR Morb Mortal Wkly Rep* 2014;63(42):950-4.
6. Economics and Statistics Administration USDoC. Economic Impacts of Hurricane Sandy. 2013.
7. Dong XS, Wang X, Largay JA, Platner JW, Stafford E, Cain CT, et al. Fatal falls in the U.S. residential construction industry. *Am J Ind Med* 2014;57(9):992-1000.
8. Ochsner M, Marshall EG, Martino C, Pabelon MC, Kimmel L, Rostran D. Beyond the classroom: a case study of immigrant safety liaisons in residential construction. *New Solut* 2012;22(3):365-86.
9. Julius AK, Kane B, Bulzacchelli MT, Ryan HD, 3rd. Compliance with the ANSI Z133.1 - 2006 safety standard among arborists in New England. *J Safety Res* 2014;51:65-72.
10. Friedman L, Krupczak C, Brandt-Rauf S, Forst L. Occupational amputations in Illinois 2000-2007: BLS vs. data linkage of trauma registry, hospital discharge, workers compensation databases and OSHA citations. *Injury* 2013;44(5):667-73.
11. Davis LK, Hunt PR, Hackman HH, McKeown LN, Ozonoff VV. Use of statewide electronic emergency department data for occupational injury surveillance: A feasibility study in massachusetts. *American Journal of Industrial Medicine* 2012;55(4):344-352.

## HUMAN SUBJECTS RESEARCH

### **Human Subjects Involvement, Characteristics and Design**

The target populations include workers seeking health care at hospitals and emergency departments for diseases and injuries that occur as a result of work or work activity during Hurricane Sandy; employers and employees who may have witnessed an occupational injury and/or fatality; any case of occupational and environmental disease, injury, or poisoning report by a health care provider; and patients found in the hospital discharge summary with worker's compensation listed as payer.

Women, minorities and children (16 to 20 years of age) will be included based on their proportions of identified working individuals and not specifically targeted. Based on the demographics of New Jersey, the study population will likely be comprised of the following approximate percentages of civilian employment by race: 35% White; 7% Black; 4% Asian; and 0.3% other. The percentages of civilian employment by Hispanic origin are 10% Hispanic and 90% Not Hispanic. The percentages of civilian employment by sex are 54% Male and 47% Female. The percentage of civilian employment for ages 16-20 years is 0.7%.

### **Sources of Materials**

The primary source of research materials is from secondary data of existing health data/records of individuals containing private health information. These data are collected from hospital discharge data or Uniform Bill-Patient Summaries, a set of computerized records that hospitals create at the time of patient discharge, which contain information compiled by hospitals on each patient's stay, codes for the most relevant diagnosis and secondary diagnoses, procedures performed, primary payer and the admission and discharge dates. Other sources of research materials include death certificates from the NJ Electronic Death Registration System which contains a check-off box for a work-related fatality and the ICD-9 or 10 codes for underlying cause of death. Patient records will be obtained from the New Jersey State Cancer Registry, a population-based registry that collects data on all cancer cases diagnosed and/or treated in New Jersey since October 1, 1978. These data profile each patient including demographic and medical information on each cancer diagnosis (such as the anatomic site, histological type, stage of disease and treatment). All patients are followed annually and vital status is recorded. For deceased cases, the underlying cause of death is also included.

Based on specific information found in the previously mentioned research sources, some individuals may have been contacted for interviews and follow-up. Information obtained for the interviews included personal demographics, work history, job task performed, health related symptoms experience during work, training provided by the employer, use of personal protective equipment, etc.

### **Potential Risks**

The primary risk is loss of confidentiality if the subject's health status, records, or interview/survey responses are revealed by accident, theft, or legal proceedings.

### **Adequacy of Protection Against Risks**

#### **Recruitment and Informed Consent**

The research team obtained potential cases of occupational illnesses, injuries and fatalities from the secondary data sources mentioned previously. For the secondary data sources only, the research team received a waiver to the requirement to obtain informed consent, assent and parental permission pursuant to Federal Regulations for the protection of human subjects at 45 CFR 46.116(d). This portion of the research project involves no more than minimal risk to the subjects, the waiver did not adversely affect the rights and welfare of the subjects and this research could not have been practicably carried out without this waiver. Also, NJDOH is not required to receive consent from the patient in order to obtain medical records, X-rays, and other information needed, as interpreted in N.J.A.C. 8:58-1.5. However, if an individual specifically denies access to their medical records, no attempt was made to obtain the records.

For the portion of the research project that conducted surveys, interviews and site visits, informed consent was obtained. Each potential participant received a consent document describing the proposed project, time commitment, an explanation of the study purpose, study measures, confidentiality, the voluntary nature of the study and the benefits and risks of participating. Verbal informed consent was obtained from all interviewees prior

to collecting information. Participants may decline to answer questions or may terminate the survey or interview at any time.

**Protections Against Risk**

The risk of loss of confidentiality is minimized by maintaining the confidentiality of the names of individuals from existing health data/records. The main dataset was kept on the password-protected PCs and any paper records was kept in locked filing cabinets within the offices of the NJDOH Occupational Health Surveillance Unit. The door to this floor locks automatically and access to the building as a whole requires NJDOH identification and is patrolled by security.

For any children (age 16-20) that may have been interviewed, the additional safeguards listed in 45 CFR 46 Subpart D was implemented.

**Potential Benefits of the Proposed Research to Human Subjects and Others and Importance of the Knowledge to be Gained**

The risks associated with the reported data are minimal. There were considerable potential benefits to society from the proposed research. A better understanding of the causes of occupational illnesses, injuries and fatalities is important in providing employers, employees and policy makers information about a population's health status with respect to workplace injuries and illnesses and about factors that can influence health. Such knowledge may eventually lead to better interventions and prevention methods to decrease the number of occupational cases in the future.

## Inclusion of Women and Minorities

Women and minorities were included based on their proportions of identified individuals. Inclusion criteria did not target or intentionally exclude any vulnerable populations, minorities or sub-groups. Inclusion is based purely on existence of records in the research sources. The study population was comprised of the following approximate percentages:

Based on 2015 population and labor force projections from the Dept. of Labor and Workforce Development ([http://lwd.state.nj.us/labor/lpa/dmograph/lfproj/lfproj\\_index.html](http://lwd.state.nj.us/labor/lpa/dmograph/lfproj/lfproj_index.html))

Percentage of civilian employment by Hispanic origin

Hispanic: 10%

Not Hispanic: 90%

Percentage of civilian employment by race:

White: 35%

Black: 7%

Asian: 4%

Other: 0.3%

Percentage of civilian employment by gender:

Male: 54%

Female: 47%

**Note:**

The 2000 and 2010 figures are based on the Census Modified Age-Race-Sex (MARS) data.

"Other Races" include American Indian, Alaska Native, Native Hawaiian and other

Pacific Islander. Hispanic origin is not a race. Persons of Hispanic origin may be of any race.

## **Inclusion of Children**

Children ages 16-17, who are employed, were included based on their proportions of identified individuals (0.7%). Inclusion criteria did not target or intentionally exclude any vulnerable populations, minorities or sub-groups. Inclusion was based purely on existence of records in the research sources.

## EQUIPMENT INVENTORY LIST AUTHORIZATION/PURCHASE

**Report Date:** 9/30/2015

**Grant Number:** 1U01OH010622-01

**Project Title:** Evaluating the Needs, Knowledge and Health Impacts of Three Worker Populations During Hurricane Sandy

**Project Period:** 9/30/2013 to 9/30/2015

**Grantee Name:** New Jersey Department of Health  
**Grants Management Officer:** Steve Inserra

**Project Officer:** Margaret Lumia  
**Grants Specialist:** Brownie Anderson-Rana

Description of Item (i.e., pH Meter)	Mfr. <sup>1</sup> (i.e., Fischer)	Serial Number	Quantity	Condition	Location	Purchase Cost	Date Received
NA							

<sup>1</sup>Mfr. (Manufacturer)

**Property Administrator & PO Disposition Recommendation and Instructions:**

Description of Item (copy from above)	Disposition	Address <sup>1</sup>
Click here to enter text.	Choose an item. Click here to enter text.	Attn: Click here to enter text. Centers for Disease Control & Prevention
Click here to enter text.	Choose an item. Click here to enter text.	Peachtree Distribution Center 3719 North Peachtree Road, #100 Chamblee, GA 30341
Click here to enter text.	Choose an item. Click here to enter text.	
Click here to enter text.	Choose an item. Click here to enter text.	
Click here to enter text.	Choose an item. Click here to enter text.	

<sup>1</sup>The CDC Warehouse is the central receiving point for the delivery of all non-hazardous and non-perishable supplies and equipment, CDC – AM – 2004-03, update 2010





State of New Jersey  
DEPARTMENT OF HEALTH

PO BOX 360  
TRENTON, N.J. 08625-0360

[www.nj.gov/health](http://www.nj.gov/health)

CHRIS CHRISTIE  
Governor

KIM GUADAGNO  
Lt. Governor

CATHLEEN D. BENNETT  
Acting Commissioner

December 11, 2015

Brownie Anderson-Rana  
Centers for Disease Control and Prevention  
Procurement and Grants Office (PGO)  
2960 Brandywine Road  
Mail Stop E-01  
Atlanta, GA 30341

RE: Grant Number  
1U01OH010622-01

Ms. Anderson-Rana:

Enclosed please find a copy of the Final Federal Financial Report for the above referenced grant: *Evaluating the Needs, Knowledge and Health Impacts of Three Worker Populations During and After Super-Storm Sandy* for the period ending September 29, 2015.

Please do not hesitate to contact Greg Alvarez at 609.633.7658 or via email at [Gregory.Alvarez@doh.state.nj.us](mailto:Gregory.Alvarez@doh.state.nj.us) with any questions.

Sincerely,

A handwritten signature in blue ink, appearing to read "Eric S. Carlsson".

Eric S. Carlsson  
Director, Budget Office

Enclosure

c: C. Schillaci  
C. Neuwirth  
file: 340-3

# FEDERAL FINANCIAL REPORT

(Follow form instructions)

1. Federal Agency and Organizational Element to Which Report is Submitted <b>Centers for Disease Control and Prevention: National Institute for Occupational Safety and Health</b>		2. Federal Grant or Other Identifying Number Assigned by Federal Agency <b>1U01OH010622-01</b>			Page <b>1</b>	of <b>1</b>  pages	
3. Recipient Organization (Name and complete address including Zip code) <b>NJ DEPARTMENT OF HEALTH PO BOX 360 TRENTON, NJ, 08625-0360</b>							
4a. DUNS Number <b>80-641-8075</b>	4b. Ein <b>216 000 928</b>	5. Recipient Account Number or Identifying Number <b>14-4230-510-3403 LLO: S029</b>		6. Report Type <input type="checkbox"/> Quarterly <input type="checkbox"/> Semi-Annual <input type="checkbox"/> Annual <input checked="" type="checkbox"/> Final	7. Basis of Accounting  <input type="checkbox"/> Cash <input checked="" type="checkbox"/> Accrual		
8. Project/Grant Period <b>Evaluating the Needs, Knowledge and Health Impacts of Three Worker Populations During and After Super-Storm Sandy/ 09/30/2013--09/29/2015</b>				9. Reporting Period End Date <b>9/29/2015</b>			
10. Transactions <i>(Use lines a-c for single or multiple grant reporting)</i>					Cumulative		
<b>Federal Cash:</b>							
a. Cash Receipts							
b. Cash Disbursements							
c. Cash on Hand (line a minus b)							
<i>(Use lines d-o for single grant reporting)</i>							
<b>Federal Expenditures and Unobligated Balance:</b>							
d. Total Federal funds authorized					\$	<b>496,498.00</b>	
e. Federal share of expenditures					\$	<b>458,522.64</b>	
f. Federal share of unliquidated obligations					\$	<b>-</b>	
g. Total Federal share (sum of lines e and f)					\$	<b>458,522.64</b>	
h. Unobligated balance of Federal funds (line d minus g)					\$	<b>39,975.38</b>	
<b>Recipient Share:</b>							
i. Total recipient share required							
j. Recipient share of expenditures							
k. Remaining recipient share to be provided (line i minus j)							
<b>Program Income:</b>							
l. Total Federal program income earned							
m. Program income expended in accordance with the deduction alternative							
n. Program income expended in accordance with the addition alternative							
o. Unexpended program income (line l minus line m or line n)							
	a. Type	b. Rate	c. Period From	Period To	d. Base	e. Amount Charged	f. Federal Share
11. Indirect Expense	Fixed	15.1%	07/01/13	06/30/14	\$ 18,020.38	\$ 2,721.08	\$ 2,721.08
	Fixed	15.6%	07/01/14	06/30/15	\$ 27,837.36	\$ 4,342.63	\$ 4,342.63
	Fixed	12.3%	07/01/15	06/30/16	\$ 6,921.48	\$ 851.34	\$ 851.34
g. Totals:					\$ 52,779.20	\$ 7,915.05	\$ 7,915.05
12. Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation: <b>This FFR is completed on a quarterly basis as required by the CDC. This FFR represents the Final Federal Financial Report for this award.</b>							
13. Certification: By signing this report, I certify that it is true, complete, and accurate to the best of my knowledge. I am aware that any false, fictitious, or fraudulent information may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)							
a. Typed or Printed Name and Title of Authorized Certifying Official  <b>Eric S. Carlsson: Director, Budget Office</b>				c. Telephone (Area code, number, extension) <b>(609) 292-7646</b>			
				d. Email address <b>Eric.Carlsson@doh.state.nj.us</b>			
b. Signature of Authorized Certifying Official 				e. Date Report Submitted (Month, Day, Year) <b>12.11.2015</b>			
STAMP/CERTIFY DATE	LAST UPDATED BY		LAST UPDATED ON		14. Agency use only:		

Standard Form 425  
OMB Approval Number: 0348-0061

**Paperwork Burden Statement**  
According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number. The valid OMB control number for this information collection is 0348-0061. Public reporting burden for this collection of information is estimated to average 1.5 hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0060), Washington, DC 20503.

**CDC Sandy: Needs and Health Impacts, Three-Worker Population Study Expenditures**

**Appropriation: 510**

Accept Date	LLO	Activity Code	Div Org	BFY	Object	Trans	Transaction ID	Vend No.	Vendor Name	Dollar Amount
12/30/13	S029	J002	4230	2014	3020	TV	42302018066	000689664	MARGARET ELLEN LUMIA	\$ 263.79
2/6/14	S029	J002	4230	2014	3010	TV	42302018105	000689664	MARGARET ELLEN LUMIA	\$ 60.00
2/6/14	S029	J002	4230	2014	3010	TV	42302018106	000701822	MARIJA BORJAN	\$ 44.00
2/19/14	S029	J002	4230	2014	3420	UA	42107007949	NONE		\$ 1,280.00
5/19/14	S029	J002	4230	2014	1210	EM	42300008315	.		\$ 10,971.48
5/19/14	S029	J002	4230	2014	1910	EM	42300008315	.		\$ 5,568.03
5/30/14	S029	J002	4230	2014	5810	UA	42307007247	NONE		\$ 1,656.69
6/3/14	S029	J002	4230	2014	3110	UA	42107008051	NONE		\$ 614.00
6/16/14	S029	J002	4230	2014	1210	EM	42300008359	.		\$ 2,973.06
6/16/14	S029	J002	4230	2014	1910	EM	42300008359	.		\$ 1,508.84
6/16/14	S029	J002	4230	2014	5810	UA	42307007269	NONE		\$ 448.84
7/21/14	S029	J002	4230	2014	1210	EM	42300008433	.		\$ 3,979.80
7/21/14	S029	J002	4230	2014	1910	EM	42300008433	.		\$ 2,019.75
7/21/14	S029	J002	4230	2014	5810	UA	42307007286	NONE		\$ 800.85
8/6/14	S029	J002	4230	2014	1210	EM	42300008555	.		\$ 98.01
8/6/14	S029	J002	4230	2014	1910	EM	42300008555	.		\$ 48.72
8/6/14	S029	J002	4230	2014	5810	UA	42307007359	NONE		\$ 14.50
9/16/14	S029	J002	4230	2014	3610	AV	42306036405	462354111	RUTGERS THE STATE UNIV RBHS	\$ 47,847.76
9/26/14	S029	J002	4230	2014	1210	EM	42300008598	.		\$ 4,897.81
11/5/14	S029	J002	4230	2014	1210	EM	42300008659	.		\$ 1,045.91
11/5/14	S029	J002	4230	2014	1910	EM	42300008659	.		\$ 2,386.40
2/3/15	S029	J002	4230	2014	1210	EM	42300008773	.		\$ 6,991.84
2/3/15	S029	J002	4230	2014	1910	EM	42300008773	.		\$ 2,807.22
2/19/15	S029	J002	4230	2014	3890	PV	42307642866	710415188	WAL MART STORES INC	\$ 4,500.00
2/23/15	S029	J002	4230	2014	7710	PV	42307636185	742485040	DELL MARKETING LP	\$ 1,130.03
3/11/15	S029	J002	4230	2014	3610	AV	42308037099	462354111	RUTGERS THE STATE UNIV RBHS	\$ 84,072.72
3/11/15	S029	J002	4230	2014	3610	AV	42308037100	462354111	RUTGERS THE STATE UNIV RBHS	\$ 46,002.04
4/10/15	S029	J002	4230	2014	3060	TV	42302018728	000689664	MARGARET ELLEN LUMIA	\$ 549.88
4/10/15	S029	J002	4230	2014	3060	TV	42302018731	510331454	BANK OF AMERICA	\$ 237.20
4/21/15	S029	J002	4230	2014	3610	AV	42308037270	462354111	RUTGERS THE STATE UNIV RBHS	\$ 58,300.65
4/24/15	S029	J002	4230	2014	1210	EM	42300008914	.		\$ 7,392.74
4/24/15	S029	J002	4230	2014	1910	EM	42300008914	.		\$ 2,988.19
5/28/15	S029	J002	4230	2014	2120	PV	42107717805	522124631	TLG SIGNS INC	\$ 75.00
5/29/15	S029	J002	4230	2014	3420	AV	42105001773	NONE		\$ 5,958.00
6/28/15	S029	J002	4230	2014	1210	EM	42300008994	.		\$ 5,229.56
6/28/15	S029	J002	4230	2014	1910	EM	42300008994	.		\$ 2,089.87
6/29/15	S029	J002	4230	2014	5810	UA	42307007552	NONE		\$ 3,987.03
7/7/15	S029	J002	4230	2014	3890	PV	42307756434	605384219	MIRIAM HEBE LOPEZ	\$ 480.00
7/14/15	S029	J002	4230	2014	3110	AV	42105001822	NONE		\$ 2,461.00
7/16/15	S029	J002	4230	2014	2120	AV	42105001826	NONE		\$ 200.00
7/29/15	S029	J002	4230	2014	1210	EM	42300009117	.		\$ 2,279.50
7/29/15	S029	J002	4230	2014	1910	EM	42300009117	.		\$ 915.22
7/29/15	S029	J002	4230	2014	5810	EM	42300009117	.		\$ 355.80
7/31/15	S029	J002	4230	2014	3610	AV	42308037800	462354111	RUTGERS THE STATE UNIV RBHS	\$ 53,148.38
10/20/15	S029	J002	4230	2014	5810	UA	42307007674	NONE		\$ 651.34
10/23/15	S029	J002	4230	2014	1210	EM	42300009216	.		\$ 6,921.46
10/23/15	S029	J002	4230	2014	1910	EM	42300009216	.		\$ 3,131.98
10/28/15	S029	J002	4230	2014	2120	AV	42105001846	NONE		\$ 100.00
11/6/15	S029	J002	4230	2014	7710	PV	42307848054	742485040	DELL MARKETING L.P.	\$ 688.99
12/1/15	S029	J002	4230	2014	3610	AV	42308038016	462354111	RUTGERS THE STATE UNIV RBHS	\$ 88,411.17
							Sum:			\$ 456,622.64