

# 2015 Hurricane Sandy Conference: Translating Research into Practice



August 10-11, 2015

NYU Kimmel Center for University Life

[www.PHE.gov/Research2Practice](http://www.PHE.gov/Research2Practice)






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### THE HURRICANE SANDY RECOVERY SCIENCE GRANTS

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When Hurricane Sandy struck in October 2012, the massive storm caused damage across thirteen states. At least 159 people were killed, 8.5 million people were left without power, and 650,000 homes were destroyed or damaged. Several hospitals in New York and New Jersey were forced to close due to flooding, and hospitals reported at least \$68 million in damages. Following the storm, communities up and down the East Coast were faced with the difficult tasks of recovering physically and mentally, rebuilding and repairing homes that had been damaged by the storm or by mold, protecting the health and safety of workers during the recovery phase, and ensuring that their communities and health systems were rebuilt stronger than before the storm.

Science Preparedness ([www.phe.gov/sciencepreparedness](http://www.phe.gov/sciencepreparedness)) provides a framework for conducting scientific research before, during, or in the aftermath of a disaster. Such research offers a strong evidence base to support the difficult decision-making communities face about recovery and future preparedness following Hurricane Sandy. Research conducted under the Science Preparedness framework also can be used to better prepare communities and responders for the next disaster.

Accordingly, just a few weeks after Hurricane Sandy, the New York Academy of Medicine hosted a meeting to identify public health research priorities that had arisen in response to the hurricane. The Office of the Assistant Secretary for Preparedness and Response (ASPR), the Centers for Disease Control and Prevention (CDC), and the National Institute of Environmental

Health Sciences (NIEHS) built on the priorities developed at that meeting to fund, collectively, 31 grants for Hurricane Sandy recovery research. These research efforts, funded under the Disaster Relief Appropriations Act (DRAA) of 2013, demonstrate the role the scientific community can play in emergency preparedness, response, recovery and the importance of being ready to do so when disasters strike.

In January 2013 ASPR, CDC and NIEHS grantees and awardees gathered together for a meeting to kick-off their research efforts and to foster collaboration and data-sharing. As an outgrowth of that meeting, additional funds were made available under the DRAA for ASPR to support collaborative projects between existing ASPR, CDC, and NIEHS awardees. The 13 new and collaborative projects build upon, augment, or enhance the 31 original ASPR, CDC, and NIEHS Sandy recovery science awards.

As the original 31 awards near completion, this conference brings together the researchers, members of impacted communities, and public health and emergency preparedness practitioners. Our main goals are to share the research results and products among these groups, and to find ways to translate the research efforts into practice. We want to use this conference to build connections between people and organizations who can work collaboratively to realize meaningful benefits for Sandy impacted communities as they continue to recover and to prepare for future storms.

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## CONFERENCE GOALS

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- To share research and training outcomes and products from the ASPR, CDC, and NIEHS awardees broadly with the impacted communities, other researchers, and public health policy and disaster preparedness thought leaders, policy makers and practitioners.
- To continue to build a community of practice for “science preparedness” and resilience.
- To identify a strategic path forward for translating research and training outcomes into practices that will transform ongoing recovery from Hurricane Sandy and future response and recovery efforts, including:
  - Enabling individuals and communities to effectively prepare for, withstand, and recover from a hurricane-related public health emergency
  - Identifying and implementing best practices in the public health system response to minimize morbidity and mortality among patients, including vulnerable populations
  - Developing and applying effective risk assessment and risk management tools to evaluate and mitigate health hazards and outcomes among response and recovery workers, volunteers, and homeowners following a disaster, including those related to mold exposure
  - Evaluating the effectiveness of participatory education and training materials and delivery methods on recovery worker performance and resilience, and developing best practices in worker safety training to improve training outcomes
- To highlight the ASPR, CDC, and NIEHS Hurricane Sandy recovery science grants as a model for disaster research science preparedness to inform a National disaster research agenda.
- To provide a platform through which the benefit of Hurricane Sandy recovery research can be demonstrated, and provide transparency and data sharing in support of U.S. Department of Health and Human Services public access initiatives.

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## CONFERENCE AGENDA

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### CONFERENCE DAY 1, MONDAY AUGUST 10

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#### 8 am–9 am: Registration

Elevator Lobby

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#### 9 am–9:30 am: Opening Remarks

(Eisner and Lubin Auditorium, 4<sup>th</sup> floor)

Nicole Lurie, Assistant Secretary for Preparedness and Response, U.S. Department of Health and Human Services

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#### 9:30 am–9:45 am: Break

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#### 9:45 am–11 am: Research and Training Outcomes Session I (*Sessions run concurrently.*)

##### Session I-A: Modeling Community Resilience (Grand Hall, 5<sup>th</sup> floor)

Sarah Lowe, Columbia University Mailman School of Public Health. Presenting for PI Sandro Galea  
James Kendra, University of Delaware

Allison Heid, Rowan University, School of Osteopathic Medicine. Presenting for PI Rachel Pruchno

##### Session I-B: Recovery Worker Safety (KC 914, 9<sup>th</sup> floor)

Arturo Archila, The Labor Institute. Presenting for PI James Frederick

Sherry Baron, Queens College, CUNY. Presenting for PI Steven Markowitz

Mitchel Rosen, Rutgers University School of Public Health

Matthew Kozak, Civil Service Employees Association (CSEA). Presenting for PI Craig Slatin

##### Session I-C: Working with City and Local Health Departments (Eisner and Lubin Auditorium, 4<sup>th</sup> floor)

Joie Acosta, RAND Corporation

Daniel Barnett, Johns Hopkins University

Asante Shipp-Hilts, New York State Department of Health. Presenting for PI Guthrie Birkhead

Thomas Chandler, National Center for Disaster Preparedness, Columbia University

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#### 11:00 am–11:15 am : Break

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#### 11:15 am–12:15 pm: ASPR Sandy Dataset

(Eisner and Lubin Auditorium, 4<sup>th</sup> floor)

Brendan Carr, U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response

Kristin Finne, U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response

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## CONFERENCE AGENDA

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David Lee, New York University. Presenting for PI Lewis Goldfrank  
Shao Lin and Ursula Lauper, New York State Department of Health  
Laura Sands, Virginia Tech. Presenting for PI Rachel Pruchno  
Hyun Kim, University of Minnesota. Presenting for PI Emanuela Taioli

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### 12:15 pm–1:45 pm: Lunch

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### 1:45 pm–3:00 pm: Research and Training Outcomes Sessions II (Sessions run concurrently.)

#### Session II-A: Health System Response and Health Care Access (Eisner and Lubin Auditorium, 4<sup>th</sup> floor)

Silas Smith, New York University. Presenting for PI Lewis Goldfrank  
Roy Alson, American College of Emergency Physicians Presenting for PI Rick Murray  
Margaret Potter, University of Pittsburgh

#### Session II-B: Mental Health Outcomes (KC 914, 9<sup>th</sup> floor)

Pam Factor-Litvak, Columbia University  
Adam Gonzalez, Stony Brook University  
Emanuela Taioli, Icahn School of Medicine at Mount Sinai

#### Session II-C: Recovery Work and Resilience in Volunteers and Citizens (Grand Hall, 5<sup>th</sup> floor)

Mark Catlin, Service Employees International Union (SEIU)  
Elizabeth Marshall, New Jersey Department of Health. Presenting for PI Margaret Lumia  
Michael Reilly, New York Medical College  
Christine Chaisson, The LifeLine Group. Presenting for PI Regina Shih

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### 3:00 pm–3:15 pm: Break

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### 3:15 pm–4:30 pm: Research and Training Outcomes Session III (Sessions run concurrently.)

#### Session III-A: Reducing Morbidity and Mortality (KC 914, 9<sup>th</sup> floor)

Charon Gwynn, New York City Department of Health and Mental Hygiene  
Shao Lin, New York State Department of Health  
Pauline Thomas, New Jersey Department of Health. Presenting for PI Christina Tan

#### Session III-B: Training, Mold Mitigation, and the Health Impacts of Flooding (Grand Hall, 5<sup>th</sup> floor)

John Morawetz, International Chemical Workers Union Council (ICWUC). Presenting for PI Frank Cyphers  
Matthew Perzanowski, Columbia University  
Paula Schenck, University of Connecticut Health Center

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## CONFERENCE AGENDA

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### Session III-A: Vulnerable Population Impacted by Hurricane Sandy (Eisner and Lubin Auditorium, 4<sup>th</sup> floor)

David Evans, Columbia University

Brian Mayer, University of Arizona. Presenting for PI Lynn Grattan

Andrew Rosenblum, National Development and Research Institutes, Inc. (NDRI)

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### 4:30 pm–4:45 pm: Break

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### 4:45 pm–5:15 pm: Wrap Up Session

Ed Gabriel, Principal Deputy Assistant Secretary for Preparedness and Response, U.S. Department of Health and Human Services

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## CONFERENCE DAY 2, TUESDAY AUGUST 11

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### 8:00 am–9:00 am: Registration

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### 9:00 am–9:30 am: Opening Remarks

(Eisner and Lubin Auditorium, 4<sup>th</sup> floor)

Stephen Redd, Director, Office of Public Health Preparedness and Response, Centers for Disease Control and Prevention

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### 9:30 am–9:45 am: Break

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### 9:45 am–11:15 am: Building a Community of Practice

(Eisner and Lubin Auditorium, 4<sup>th</sup> floor)

Linda Birnbaum (by video), Director, National Institute of Environmental Health Sciences, National Institutes of Health

Diane DiEuliis, U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response

David Abramson, Columbia University

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### 11:15 am–12:30 pm: Poster Session

(KC 505/406, 4<sup>th</sup> floor)

*Note: Posters will be available for viewing in KC 405/406 throughout both days of the conference.*

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### 12:30–2:00 pm: Lunch

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### 2:00 pm–5:00 pm: Closed Grantee Meeting

ASPR, CDC, and NIEHS PIs, their key personnel, and selected community partners will convene for a closed grantee meeting. These sessions are by invitation only.

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## LOGISTICS AND HOSPITALITY INFORMATION

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### ***Conference Date and Location***

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The conference will be held August 10th-11th at New York University's Kimmel Center for University Life (60 Washington Sq. South, New York NY 10010). On both days registration will begin at 8:00 am and the conference will convene at 9:00 am.

All of Day 1 (August 10th) and the morning of Day 2 (August 11th) are public meetings and are open to any member of the public who has registered in advance. We welcome participation from a broad range of stakeholders, including disaster science researchers and students, public health practitioners, members of impacted communities, and recovery workers and volunteers.

The afternoon sessions of Day 2 (August 11th) will be held by invitation only, to allow grantees to engage in small-scale workshop style discussions about the dissemination of research results. If you have any questions, please contact [sciencepreparedness@hhs.gov](mailto:sciencepreparedness@hhs.gov).

### ***Accommodations***

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The Kimmel Center webpage provides links to several hotels in the area: <http://www.nyu.edu/community/conference-event-services/amenities-and-services/accommodations-and-local-hotels.html>.

During both days of the conference, room 907 in the Kimmel Center will be available for participants to leave their luggage (at their own risk).

### ***Meal Options***

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ASPR will not provide any food to conference participants.

Pete's Coffee & Tea (located on the Kimmel Center 2<sup>nd</sup> floor) will be open from 8 am to 3 pm on both August 10<sup>th</sup> and August 11<sup>th</sup>.

The Kimmel Center cafeteria (The Market Place at Kimmel) will be open for meeting participants to purchase lunch on both August 10th and August 11<sup>th</sup>, from 11 am to 7 pm. The Market Place at Kimmel offers a variety of international and traditional dining choices including: The Italian Market, Faye's Deli, Habanero Mexican, Halal, and Chloe's Soft Serve. Indoor and outdoor seating is available, and both cash and credit are accepted. The Market Place is located on the Kimmel Center's 3<sup>rd</sup> floor.

There are also multiple restaurants in the Washington Square area.

### ***Wireless Access***

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Wireless access will be available to conference participants.

### ***Directions, Transportation, and Parking***

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#### **Plane**

From La Guardia, Kennedy, or Newark Airport, take the airport shuttle bus to Port Authority Bus Terminal or Grand Central Station. From Port Authority, take the A or E subway downtown to West Fourth Street-Washington Square Station, or from Grand Central, take the Lexington Avenue subway (No. 6 train) downtown to Astor Place Station.

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## LOGISTICS AND HOSPITALITY INFORMATION

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### Train

Metro North into Grand Central Station: Take the Lexington Avenue subway (No. 6 train) downtown to Astor Place Station. Go west on Astor Place to Broadway. Walk south on Broadway to Waverly Place. Walk westward on Waverly Place until you reach Washington Square.

Long Island Rail Road (LIRR) and Amtrak into Pennsylvania Station: Take the 8th avenue subway (A and E trains) downtown to West Fourth Street-Washington Square Station. Walk east on West Fourth Street until you reach Washington Square.

PATH Trains from New Jersey: To Ninth Street Station (Sixth Avenue and Ninth Street), then walk south to West Fourth Street and east to Washington Square.

### Subway

Take the Lexington Avenue subway (No. 6 train) to Astor Place Station. Go west on Astor Place to Broadway. Walk south on Broadway to Waverly Place. Walk westward on Waverly Place until you reach Washington Square.

Take the Broadway subway (N or W train) to Eighth Street Station. At Broadway walk south to Waverly Place. Walk westward on Waverly Place until you reach Washington Square. \* The N runs late at night and on weekends. The R also runs on weekdays and weekends, with limited late night shuttle service.

Take the Sixth Avenue subway (B, D, F, or M train) or 8th Avenue subway (A, C, or E train) to West Fourth Street-Washington Square Station. Walk east on West Fourth Street until you reach Washington Square. \* The A, E, and F trains run late at night. The C does not. The M runs on weekdays with limited late night shuttle service and weekends with shuttle service only. The B train runs weekdays only, from before 6 am until 11 pm, and the D runs at night.

Take the Seventh Avenue subway to Christopher Street-Sheridan Square Station (1 or 2). Walk east on Christopher Street to West Fourth Street. Continue east to Washington Square. \* The 1 and 2 trains runs late at night.

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### Helpful links

Meeting registration website: [www.PHE.gov/Research-2Practice](http://www.PHE.gov/Research-2Practice)

NYU Kimmel Center website: [www.nyu.edu/kimmel.center/](http://www.nyu.edu/kimmel.center/)

NYU Kimmel Center Hotel Page: <http://www.nyu.edu/community/conference-event-services/amenities-and-services/accommodations-and-local-hotels.html>

New York City Subway: <http://web.mta.info/maps/sub-map.html>

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## COMPLETE LISTING OF PROJECTS

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### ORIGINAL ASPR, CDC, AND NIEHS AWARDS

#### *ASPR Principal Investigators*

**Joie Acosta**, RAND Corporation. “Examining the Relationship Between Public Health Departments and the Nongovernmental Sector to Support Stronger Partnerships for Effective Recovery of Vulnerable Populations”

**David Evans**, Columbia University Mailman School of Public Health. “Assessing and Strengthening Post-Storm Resilience in NYC High Rise Public Housing”

**Sandro Galea**, Boston University. “Community Factors that Promoted Resilience in the Aftermath of Hurricane Sandy”

**Lewis Goldfrank**, New York University School of Medicine. “The Impact of Hurricane Sandy on Health Systems Care and Development of Disaster Response and Resilience Based Metrics”

**Lynn Grattan**, University of Maryland School of Medicine and **Brian Mayer**, University of Arizona. “Modeling the Interplay of Individual and Community Resilience for Recovery from Hurricane Sandy”

**James Kendra**, University of Delaware School of Public Policy and Administration. “Promoting Community Resilience in New York City After Hurricane Sandy: A Model-Based Approach”

**Rick Murray**, American College of Emergency Physicians. “Lessons Learned from Hurricane Sandy and Recommendations for Improved Healthcare and Public Health Response and Recovery for Future Catastrophic Events”

**Margaret Potter**, University of Pittsburgh Graduate School of Public Health. “Hurricane Sandy in the Rockaways, Queens: Response and Recovery for Access to Primary Care”

**Rachel Pruchno**, Rowan University School of Osteopathic Medicine. “Social Capital and Resilience of Older People Exposed to Hurricane Sandy”

**Andrew Rosenblum**, National Development and Research Institutes, Inc. “Challenges to Opioid Treatment Programs After Hurricane Sandy”

#### *CDC Principal Investigators*

**Daniel Barnett**, Johns Hopkins Bloomberg School of Public Health. “Examining and Enhancing Public Health Workers’ Sense of Efficacy Toward Hurricane Sandy Recovery”

**Guthrie Birkhead**, New York State Department of Health. “NYSDOH H. Sandy Recovery: Priority Area C– Evaluation of the Public Health Emergency Response System”

**Thomas Chandler**, National Center for Disaster Preparedness, Columbia University. “Understanding the Health System Impact of the Spillover Effect After Hurricane Sandy”

**Charon Gwynn**, NYC Department of Health and Mental Hygiene. “Impact of Hurricane Sandy on Morbidity and Mortality in NYC”

**Shao Lin**, New York State Department of Health. “Assessing Health Effects and Risk Factors After Hurricane Sandy in NYS”

**Margaret Lumia**, New Jersey Department of Health. “Evaluating the Needs, Knowledge, and Health Impacts of Three Worker Populations During and After Super-Storm Sandy”

**Steven Markowitz**, Queens College CUNY. “Reducing Occupational Hazards of Sandy Related Work of Immigrant Day Laborers”

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## COMPLETE LISTING OF PROJECTS

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**Matthew Perzanowski**, Columbia University Mailman School of Public Health. “Fungal Exposure in NYC Homes Damaged by Hurricane Sandy and Respiratory Outcomes in Asthmatic Children”

**Michael Reilly**, New York Medical College. “Impact of Health Department Worker Safety Training on Health Impacts After Sandy”

**Paula Schenck**, University of Connecticut Health Center. “Recovery from Catastrophic Weather: Mold Exposure and Health Related Training”

**Regina Shih**, RAND Corporation. “Assessing and Managing Health Risks from Fugitive Chemicals After Hurricane Sandy”

**Emanuela Taioli** and **Rebecca Schwartz**, Icahn School of Medicine at Mount Sinai. “Development of a Vulnerability Profile of the Psychological Sequelae of Hurricane Sandy”

**Christina Tan** New Jersey Department of Health and **Amy Davidow**, Rutgers University School of Public Health. “Impacts on Health and Mental Health Post-Superstorm Sandy, New Jersey”

### *NIEHS Principal Investigators*

**Mark Catlin**, Service Employees International Union. “SEIU Education and Support Fund’s Hazardous Waste Worker Training Program”

**Frank Cyphers** and **John Morawetz**, International Chemical Workers Union Council. “International Chemical Workers Union Center for Worker Health and Safety Education, Hurricane Sandy Response and Recovery Training”

**Pam Factor-Litvak**, Columbia University Mailman School of Public Health. “Effects of a Major Climactic Event– Superstorm Sandy– On Pregnancy Outcomes and Telomere Length”

**James Frederick**, United Steelworkers of America. “Steelworker/Tony Mazzocchi Activities for the Hazardous Materials Worker Health and Safety Training”

**Adam Gonzalez**, Stony Brook University School of Medicine. “Effects of Hurricane Sandy on the Respiratory and Mental Health of WTC Responders”

**Mitchel Rosen**, Rutgers, University School of Public Health. “New Jersey/New York Hazardous Materials Worker Training Center”

**Barbara McCabe**, International Union of Operating Engineers. “IUOE National Training Fund Safety Training for Hurricane Sandy Response and Recovery”

**Craig Slatin**, University of Massachusetts at Lowell. “The New England Consortium and the Civil Service Employees Association Hazardous Waste Worker Training Program”

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## CONFERENCE SPEAKERS

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**Nicole Lurie, M.D.,  
M.S.P.H.**

***Assistant Secretary for  
Preparedness and Response  
(ASPR)  
RADM, U.S. Public Health  
Service***

Dr. Nicole Lurie is the Assistant Secretary for Prepared-

ness and Response (ASPR) at the US Department of Health and Human Services (HHS). The mission of her office is to lead the nation in preventing, responding to and recovering from the adverse health effects of public health emergencies and disasters, ranging from hurricanes to bioterrorism.

Dr. Lurie was previously Senior Natural Scientist and the Paul O' Neill Alcoa Professor of Health Policy at the RAND Corporation. There she directed RAND's public health and preparedness work as well as RAND's Center for Population Health and Health Disparities. She also served as Principal Deputy Assistant Secretary of Health in the US Department of Health and Human Services; in state government, as Medical Advisor to the Commissioner at the Minnesota Department of Health; and in academia, as Professor in the University of Minnesota Schools of Medicine and Public Health. Dr. Lurie has a long history in the health services research field, primarily in the areas of access to and quality of care, mental health, prevention, public health infrastructure and preparedness and health disparities.



**Edward Gabriel, M.P.A.,  
E.M.T-P, C.E.M., C.B.C.P.**

***Principal Deputy Assistant  
Secretary for Preparedness  
and Response***

Prior to joining ASPR, Mr. Gabriel served as Director, Global Crisis Management and Business Continuity, for

The Walt Disney Company. Mr. Gabriel was responsible for the development and implementation of global policy, planning, training and exercises to manage crisis, provided leadership and direction to east and west coast medical and emergency medical operations, the Walt Disney Studio's fire department and provided crisis support with global business units. During Crisis incidents his department managed response operations, communications methodology and disaster and business recovery.

Preceding this private sector position, Mr. Gabriel held positions in New York City. He was a twenty-six year Paramedic veteran of New York City Fire Department's (FDNY) Emergency Medical Service (EMS) retiring as an Assistant Chief/Division Commander. He was assigned to New York City Office of Emergency Management (NYC\*OEM) as Deputy Commissioner for Planning and Preparedness and was responsible for all preparedness and planning-related strategy, projects and initiatives until he retired from NYC Government.

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## CONFERENCE SPEAKERS

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***Stephen Redd, M.D.***

***Director, Office of Public Health Preparedness and Response, Centers for Disease Control and Prevention (CDC) RADM, U.S. Public Health Service***

Dr. Stephen Redd is the Director of the Office of Public

Health Preparedness and Response (OPHPR) at the Centers for Disease Control and Prevention (CDC). This office is responsible for all of CDC's public health preparedness and response activities.

Before joining OPHPR, Dr. Redd served as director of CDC's Influenza Coordination Unit. During the H1N1 pandemic, he served as Incident Commander for the nearly year-long response.

A Rear Admiral and Assistant Surgeon General in the United States Public Health Service, Dr. Redd has served 29 years as a Commissioned Officer. He has investigated outbreaks such as Legionnaires' Disease, developed strategies to control malaria, and worked to eliminate measles in the US. A graduate of Princeton and Emory universities, he received his medical degree with honors and trained in medicine at Johns Hopkins. Rear Admiral Redd has authored more than 120 scientific publications and received numerous awards, including the Public Health Service Distinguished Service Medal and the Meritorious Service Medal.



***Linda Birnbaum, Ph.D.***

***Director, National Institute of Environmental Health Sciences (NIEHS) and the National Toxicology Program (NTP), National Institutes of Health***

Linda S. Birnbaum, Ph.D., became the Director of the Na-

tional Institute of Environmental Health Sciences (NIEHS), one of the National Institutes of Health (NIH), and the National Toxicology Program (NTP) on January 18, 2009. In these roles Birnbaum oversees federal funding for biomedical research to discover how the environment influences human health and disease. Several advisory boards and councils provide Birnbaum and NIEHS/ NTP staff with input to accomplish this large task.

Birnbaum is the first toxicologist and the first woman to lead the NIEHS/NTP. She has spent most of her career as a federal scientist. Birnbaum has received numerous awards and recognitions, including being elected to the Institute of Medicine of the National Academies, in October 2010, one of the highest honors in the fields of medicine and health. Birnbaum also finds time to mentor the next generation of environmental health scientists. For example, she serves as an adjunct professor in the Gillings School of Global Public Health, the Curriculum in Toxicology, and the Department of Environmental Sciences and Engineering at the University of North Carolina at Chapel Hill, as well as in the Integrated Toxicology Program at Duke University.

## SESSION I-A: MODELING COMMUNITY RESILIENCE

While much is known about individual resilience in the face of disaster, less is understood about what community resilience is, how to measure it, and how it affects individual recovery. These three projects focus on strategies for defining and modeling community resilience. The projects examine a variety of community characteristics, including interactions with neighbors, social capital, economic development, and presence of faith-based communities.

The projects examined community resilience in New York City and counties in New Jersey most severely affected by Hurricane Sandy using telephone surveys, mail questionnaires, in-depth interviews, and focus groups. Close to 8,000 people participated in the studies.

Findings emerging from these studies include: (1) people living in communities with higher economic development experienced greater resilience while people

living in communities with higher social capital had lower resilience, (2) although neighbors helped mitigate feelings of physical danger experienced by older people during the hurricane, they played a less central role when homes were damaged, and (3) having low income and greater functional and access needs are negatively correlated with being prepared for disasters, with ability to communicate effectively during an event, and with anticipation of evacuating during emergencies.

Together these projects provide new information about which community characteristics matter when disaster strikes and how communities can become more resilient to disaster. Findings will be particularly important for guiding the efforts of policymakers charged with developing interventions designed to bolster communities in the face of disaster.



*Left: Hurricane Sandy survivors gather at a town hall in Staten Island (Photo Credit: FEMA/Eliud Echevarria). Top Right: Debris from the Atlantic City boardwalk destroyed by Hurricane Sandy (Photo Credit: FEMA/Liz Roll). Bottom Right: A New Jersey resident at a recovery information event (Photo Credit: FEMA/Sharon Karr).*



## Community Factors that Promoted Resilience in the Aftermath of Hurricane Sandy

*Sandro Galea, Boston University*

Natural disasters are associated with increased rates of mental health problems such as post traumatic stress disorder (PTSD) and depression. However, many disaster survivors are psychologically resilient and do not experience such problems. Prior research indicates that resilience is shaped by characteristics of individuals, such as age, gender, and previous life experiences. Less is known about how characteristics of communities, such as social capital and economic development, influence resilience.

This project investigates the role of community characteristics in shaping resilience in NYC neighborhoods that were most severely affected by Hurricane Sandy. One thousand residents from these communities have been surveyed – 500 between December 2013 and

March 2014 (Wave 1), and 500 between January and March 2015 (Wave 2).

Analysis of the Wave 1 data has yielded some unexpected findings. For example, participants living in communities with higher social capital, marked by fewer persons living alone, had lower resilience. In addition, living in a community with higher economic development promoted resilience, but *only for participants who did not experience stressors* related to the hurricane, including displacement and property damage.

Secondary analyses have provided insight into geographic location of communities with higher and lower levels of resilience, and variation across communities in which individual characteristics were predictive of resilience.

This study stands to further our understanding of the role of communities in promoting resilience after disasters, and how this changes over time. It will also help identify Sandy-affected communities – and individuals within communities – that continue to have mental health needs.



Map showing neighborhoods that were surveyed and approximate location of Wave 1 participants



## ***Promoting Community Resilience in New York City After Hurricane Sandy: A Model-Based Approach***

***James Kendra, University of Delaware***

***Jonathan Links, Johns Hopkins University***

***Sarah Sisco, New York City Department of Mental Health and Hygiene***

The objective of this project was the development of a conceptual and corresponding computational model to help NYC policymakers decide how to allocate resources to make the city more resilient in the face of a disaster. The model is based on a theory of community functioning, and what characteristics of a community—social, physical, economic, political, etc.—might predict a community's experience with a disaster, including how much loss of function the community experiences, and over what timeframe it takes the community to recover.

The project consisted of two main phases. Phase 1 was the continued development and refinement of the model—the Composite of Post-Event Well-Being (CoPE-WELL)—and the creation of an NYC-specific version. This version was based on the specific functional divisions of the city, and measures unique to it. Phase 2 of the project (2014-2015) was data-gathering. We conducted a telephone survey of 1300 New York City residents, with questions designed to assess their disaster preparedness and their Hurricane Sandy experiences. Furthermore, we analyzed data from a pre-Sandy survey performed by the New York City Department of Health and Mental Hygiene (DOHMH) earlier in 2012. We also gathered data from a variety of sources on Federal and State assistance, building damages, utility out-

ages, and other aspects of Hurricane Sandy impacts. In addition, we conducted focus groups with representatives of community based organizations, which brought in a rich narrative detail of the recovery experiences of people in affected areas.

The NYC-specific model and the data are being used together to both validate the model and to provide a decision-support tool to allow NYC policymakers, starting with the DOHMH, to test the relative impact of various interventions on predicted community resilience. Candidate interventions include helping to enhance social capital in affected areas, actively engaging the faith community in disaster planning and response, and coordinating the delivery of social services with city agencies, NGOs, and neighbors.



*Locations of focus groups with community-based organizations conducted in August, 2014*

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## *Social Capital and Resilience of Older People Exposed to Hurricane Sandy*

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*Rachel Pruchno, Rowan University*

Social relationships are important to the well-being of older people. When disaster strikes and older people are cut off from family and friends who live at a distance, neighbors become even more important. This project sought to identify how neighbors promoted recovery among older people exposed to Hurricane Sandy.

Building on a panel (ORANJ BOWL – Ongoing Research on Aging in New Jersey Bettering Opportunities for Wellness in Life) of 5,688 people aged 50-74 when they were recruited in 2006, this study had three parts. First, a questionnaire asking about exposure to Hurricane Sandy, interactions with neighbors, and mental health was sent to all panelists. Second, qualitative interviews with 30 panelists experiencing major home damage were completed. Third, healthcare spending before and after the hurricane was contrasted using Medicare data.

Results indicated that older adults who reported stronger neighborhood connections also reported fewer depressive symptoms. Although neighbors helped mitigate feelings of physical danger during the hurricane, they played a less central role when homes were damaged. People who developed PTSD after Hurricane Sandy had fewer social connections before the hurricane.

These findings provide important new information about how the neighborhoods in which older people live can be bolstered to provide support in the face of natural disasters. Such interventions will enhance the quality of life of older people, reduce health care costs, and minimize the damage caused by natural disasters.



“A neighbor that I did not know who lives like 2 blocks up invited us inside his home until we could get back to our own home. . .We were all out in the street together.”

– ORANJ BOWL Interviewee

“We checked with each other before the storm ‘you got this,’ ‘you need this,’ what do you need?’ that kind of thing and call me if you need me kind of stuff”

– ORANJ BOWL Interviewee

## SESSION I-B: RECOVERY WORKER SAFETY

Safe workplaces are, even under the usual predictable circumstances, difficult to achieve and disasters greatly magnify these difficulties. Prior experience from a wide-range of disasters has shown that a variety of workers, either as first responders or during post disaster clean up and reconstruction, face hazards for which they may not be adequately trained or protected. The group of projects in this chapter implemented and/or evaluated training programs that strengthened the workers' health and safety skills and provided information, assistance and protection. Projects targeted municipal workers who provided vital assistance to restore the public infrastructure; Latino immigrant day laborers who were hired by contractors to provide cleanup, demolition and reconstruction services; and workers and volunteers who worked through community-based agencies to assist homeowners and others with post disaster cleanup.

All of these projects were able to respond quickly because of the excellent training materials that had been developed during prior disasters, including materials that were available through NIOSH, OSHA and NIEHS. Lacking was mechanisms to make these materials accessible to workers and communities, including in Spanish, the language spoken by many of the day laborers. Working with trusted community organizations such as social service agencies, faith-based organizations, municipal labor unions and workers' centers serving immigrant laborers, the projects found tremendous success in reaching workers and tailoring the available materials to better serve the workers' specific needs. In the process they also help build the capacity of these organization to provide ongoing disaster-related support to the communities they served.

These projects demonstrated impressive results both in creating greater capacity at the organizational level as well as training many thousands of workers. For example, 40 Spanish speaking workers became OSHA-approved trainers who then trained more than 3600 immigrant laborers in the OSHA 10 construction worker course. A cadre of over 2400 workers, volunteers, and community members associated with community organization were provided hands-on skills for cleaning storm-impacted areas combined with resiliency training to assist with disaster-related stress. Mold remediation and working in confined spaces training programs were developed and delivered to state and local municipal workers and an easy-to-use reference guide was developed and deployed for disaster debris and sanitation clean-up. While most projects were funded to do training, one research project found that for immigrant day laborers who received Spanish language training combined with provision of personal protective equipment, these workers felt knowledgeable and confident despite dangerous and unpredictable working conditions and communicated their knowledge to coworkers and employers and refused dangerous work.



*Workers participating in a training session (Photo Credit: The Labor Institute/Rodrigo Toscano)*

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## *The United Steelworkers/Tony Mazzocchi Center Sandy Supplement Project*

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**James Frederick, United Steelworkers of America**

Through the NIEHS-WTP Sandy Supplement, the Tony Mazzocchi Center became acutely aware that tens of thousands of immigrant laborers (mostly from Latin America) engage in clean-up and reconstruction work without prior access to health and safety training. The thousands of small contractors who hire these laborers, often from street corners, have neither the resources, nor the interest, to provide this training to at-risk workers.

Another major contributing factor for the failure to receive training was the lack of OSHA-approved trainers in the NY area who can conduct health and safety programs for immigrant construction workers in Spanish. To meet this pressing need, the USW's Tony Mazzocchi Center partnered with NY-area worker centers, Make the Road New (MRNY) and ten workers centers affiliated with the National Day Laborer Organizing Network (NDLON) to develop 40 Spanish language worker-train-

ers. To qualify, these workers needed five years of construction work and health and safety experience. They also had to successfully complete the two-week OSHA 500, 510 sequence of courses conducted in Spanish by an OSHA Master Trainer, and then pass the written examination and final presentation. Having done so, these 40 immigrant workers became OSHA-approved trainers who then were qualified to conduct OSHA 10 construction worker courses in Spanish.

Working collaboratively with MRNY and NDLON, the Tony Mazzocchi Center jointly developed the infrastructure and support systems that to date has trained 3,668 Spanish-speaking workers with 57,992 contact hours of OSHA-10 construction training since March 2014. We believe this has grown to become the largest immigrant health and safety training program in the U.S.



*Workers who have completed OSHA training. (Photo Credit: The Labor Institute)*

## ***Reducing Occupational Hazards of Sandy Related Work of Immigrant Day Laborers***

***Steven Markowitz, Queens College***

Following Hurricane Sandy, Make the Road New York, along with The Barry Commoner Center at Queens College, developed a safety and health training program for Latino construction workers doing cleanup and reconstruction. Between March and August 2013, the program delivered a 2-hour Spanish language hazard awareness training to 442 workers and provided them with a comprehensive set of personal protective equipment (PPE). This intervention was meant to address the well-documented unmet needs of immigrant day laborers in post-disaster settings.

Through a follow-up phone survey, we demonstrated the effectiveness of the intervention; workers used the majority of the PPE at least 60% of the time and reported taking action by talking to their bosses and co-workers about health and safety and refusing dangerous work. These findings were corroborated through focus groups where workers discussed how the intervention enabled them to feel knowledgeable and confident despite dangerous and unpredictable working conditions.

Furthermore, we developed a mobile application to facilitate workplace assessments that allowed individual workers to capture hazards and exposures through an electronic checklist and photo documentation; workers completed 175 assessments.

Our research demonstrates how training together with provision of PPE is an effective model for intervention post-disaster. The unpredictability of worksite conditions post-disasters remains a challenge to safety even when workers are trained. We are developing a peer-to-peer outreach campaign and ongoing collaboration between multiple community-based organizations with the larger goal of incorporating them into the disaster response structure and building long-term preparedness capacity.

“This, for me is very important, right, to be bringing a pair of gloves, glasses, your masks, your work boots because you don’t know what type of work you are going to be doing that day or the next. It’s necessary to bring your own [PPE].” - Worker on Preparing for Uncertain Working Conditions after the Training



*Left: Photo taken by a worker using the mobile app, 2014. Right: Photo of workers receiving PPE during the initial training, 2013 (Photo Credit: Barry Commoner Center for Health and the Environment)*

## Training Workers in Sandy Recovery

**Mitchel Rosen, Rutgers University School of Public Health**

The New Jersey/New York Hazardous Materials Worker Training Center provided essential training to workers and volunteers who responded to Superstorm Sandy. The Rutgers School of Public Health, New York Committee for Occupational Safety and Health (NYCOSH), and World Cares Center conducted the training.

The training developed a cadre of prepared workers and volunteers to enhance individual and community resiliency after a disaster strikes. The training addressed issues at various stages of disaster response, including preparing workers for future events, providing hands-on skills for cleaning storm-impacted areas, and providing resiliency training so that workers and volunteers are able to have coping mechanisms for dealing with clean-up related stress. By providing the target populations with the critical skills needed to protect themselves and their communities from exposure to hazards encountered as they cleanup and rebuild their commu-

nity, the health and safety of current and future populations at risk will be strengthened.

Training was provided to over 2400 workers, volunteers, and community members to strengthen health and safety skills, and to understand hazards and hazard control, providing essential information so that they can protect themselves during clean-up and recovery stages of a disaster. The courses are included in Table 1.

Training was provided for workers and volunteers at community-based agencies who were impacted by Hurricane Sandy and responded by rebuilding their communities. Some of these agencies included: Good Old Lower East Side (GOLES), Coney Recovers, Reaching Out Ministries, Friends of Rockaway, the Mexican Consulate, Casa Ecuatoriana, Project Hope, Americorp, CERT and CART teams, and others.

“There are many NYCHA developments in the Lower East Side that have been impacted by Hurricane Sandy. The Lower East Side is experiencing a new wave of Section 3 jobs for NYCHA residents. The only barrier that remains is that many jobs require 10-hour OSHA Construction training. GOLES and Rutgers collaborated to train community members, which led to employment for over 60 men and women from the community.”

– Lilah Mejia, Disaster Preparedness Coordinator, Good Old Lower East Side, Inc. (GOLES), New York, NY

Course Name	# Courses	# Trained	Contact Hours
21-hr Mold Remediation TTT	2	21	441
4-hr Disaster Preparedness	8	116	464
10-hr OSHA 10	23	553	5530
14-hr OSHA 10 +	5	68	952
2-hr S&H Capacity Building	20	357	714
4-hr Disaster Safety Clean-up and Mold Remediation	23	313	1252
1-hr Flood Response and Safety Training	49	937	937
4-hr Disaster Supervisor Resiliency	6	71	284
4-hr Disaster Worker Resiliency	1	17	17
1-hr Disaster Worker Resiliency	4	34	34
	141	2487	10625

**Table 1: Hurricane Sandy training provided by the NJ/NY Center (as of June 1, 2015)**



## ***The New England Consortium and the Civil Service Employees Association Hazardous Waste Worker Training Program***

***Craig Slatin, University of Massachusetts Lowell***

TNEC-CSEA conducted health and safety training to support recovery, remediation, rebuilding and resilience in preparing for future extreme weather disasters within areas impacted by Superstorm Sandy. In New York State, CSEA learned that natural disasters create immense political pressure on state and local governments to quickly restore the public infrastructure. That pressure often led public employers to inadvertently circumvent worker safety in order to return conditions to normal as soon as possible. Many responders did not have the proper training and knowledge to safely complete the assigned tasks.

To address these health and safety deficiencies for municipal workers, TNEC-CSEA developed and delivered training for work involving mold remediation and also for working in permit required confined spaces. Addi-

tionally, disaster debris and sanitation clean-up health and safety information was developed in an easy-to-use reference guide for sanitation workers. The work was done in collaboration with the International Chemical Workers Union Council (ICWUC) and MDB, Inc., (the NIEHS Clearinghouse) to develop and modify mold curriculum within muck and gut training. A training of trainers approach was used to build the capacity of spreading the training across a broad region to optimize preparedness and coordination during a storm.

The project acted on knowledge that most public employers are not prepared to protect the health and safety of employees who will respond to a severe weather event. Resources and preparedness training in advance of a disaster will help ensure a safer response.



*DC-37 worker in the Rockaways, Queens, following Hurricane Sandy (Photo Credit: Workforce Development Institute)*

## SESSION I-C: WORKING WITH CITY AND LOCAL HEALTH DEPARTMENTS

Cities and towns are at increased risk from extreme weather due to climate change. Key *public health response capabilities* are impacted as documented in a Hunter et al. study of 45 local health departments in 20 states<sup>1</sup>. The Hurricane Sandy studies in this chapter collected feedback and developed strategies to address critical impacts and modifiers of public health's role in disaster recovery.

The studies utilized mixed methods approaches, including qualitative and quantitative analyses. Feedback was collected from existing emergency reports, key informant interviews, focus groups, and surveys.

Following Hurricane Sandy, there was an immediate need to reduce physical and legal barriers. For example, local drinking water providers did not have identification that allowed them to pass roadblocks.

Women, Infants, and Children (WIC) clinics experienced service delays due to the time required to establish legal waivers for flexibility in providing public health services.

<sup>1</sup> Hunter MD, et al. Public Health System Response to Extreme Weather Events. *Journal of Public Health Management and Practice*, E-pub 9 January 2015.

“Water system operators need ‘First Responder’ status in the execution of their duties during and after these events especially when dealing with law enforcement in the field.”

– *Drinking Water Provider*

Training was an important theme. Public health workers in multiple health departments across several states were required to provide services and work in roles for which they did not feel fully prepared or confident. Many were unaware of preparedness plans – including plans for disaster recovery – or had not participated in training exercises.

Communication and coordination was another important theme. Computers and phones were not readily available, and responsibilities were shifting. This was challenging within the public health system and when working with the healthcare delivery sector and community-based organizations (CBOs).

The studies in this chapter are filling these gaps by providing training modules (including train-the-trainer), tabletop exercises, and tool kits to improve public health preparedness, communication, and coordination among public health organizations, and with CBOs and healthcare providers.



*Disaster Recovery Center set up at a hockey rink in Long Beach, New York (Photo Credit: FEMA/Christopher Ragazzo)*



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## ***Examining the Relationship Between Public Health Departments and the Non-governmental Sector to Support Stronger Partnerships for Effective Recovery of Vulnerable Populations***

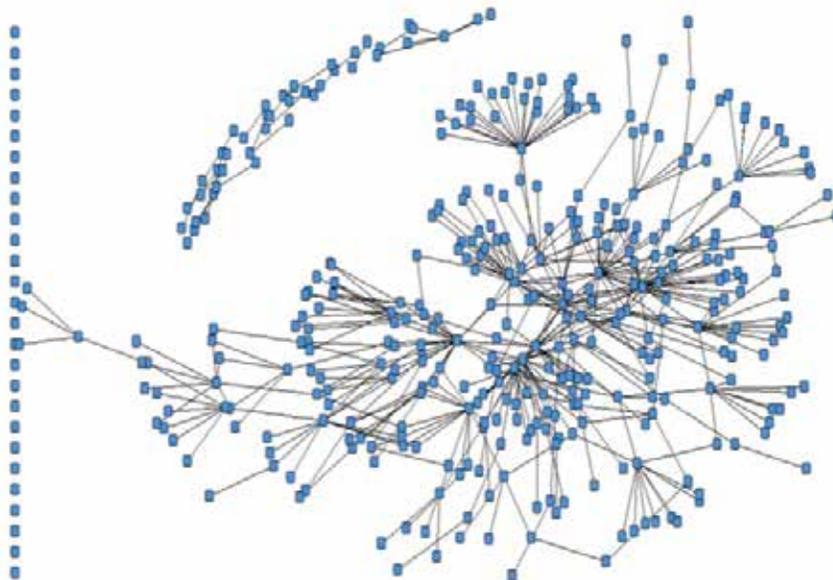
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***Joie Acosta, RAND Corporation***

Community-based organizations are critical in disaster recovery. So, how can public health departments improve their partnerships with CBOs before disaster occurs? RAND, UCLA, and the University of Colorado, Denver partnered with the New York City's Department of Health and Mental Hygiene (DOHMH) to study how partnerships between CBOs and DOHMH changed as a result of Hurricane Sandy and whether communities with stronger partnerships recover faster. Preliminary findings suggest that recovery partnerships serve a variety of functions ranging from informal (e.g., sharing information and clients, serving together on a recovery partnership group) to formal (e.g., providing joint services, sharing staff, funding or other resources via a formal MOU/MOA). New partnerships formed, within a month of Hurricane Sandy, more often in communities

with more severe damage. Overall most partnerships formed after Hurricane Sandy were functioning a year later. Organizations that participated in a Long-Term Recovery Committee reported having a greater impact on community recovery.

We also engaged DOHMH and CBOs in a recovery reflection exercise one-year after Sandy and will be hosting a recovery tabletop exercise with these same groups in summer 2015. We will also meet with DOHMH to help them plan ways to strengthen their CBO partnerships, based on our findings. We will compile all data and tools into a Partnerships for Recovery Across The Sectors (PRACTIS) toolkit that local health departments like DOHMH can use to assess and improve their recovery partnerships with CBOs.



*Visual representation of recovery partnerships in New York City after Hurricane Sandy*

## ***Examining and Enhancing Public Health Workers' Sense of Efficacy Toward Hurricane Sandy Recovery***

***Daniel Barnett, Johns Hopkins Bloomberg School of Public Health  
Stephanie Garrity, Cecil County (Maryland) Health Department***

There has been markedly limited research on perceptions of public health workers toward their vital roles in disaster recovery. To address this gap, this study uses focus groups and quantitative surveying to understand perceptually- and operationally-relevant barriers and facilitators to local health department (LHD) workers' participation in Hurricane Sandy recovery activities; and to inform and assess the impact of a novel, train-the-trainer style curricular intervention -- the Public Health System Training in Disaster Recovery [PH STriDR] -- designed to boost these workers' sense of efficacy (loosely translated as confidence and sense of individual/collective role importance) toward Hurricane Sandy and future disaster recovery efforts.

Major baseline findings from this study that informed PH STriDR's current development were that approximately 30% of surveyed LHD workers indicated a lack of sense of efficacy toward Hurricane Sandy recovery

activities; approximately 20% lacked confidence in having a safe worksite or sufficient training to perform effectively during recovery following future disasters; and approximately 20% indicated they would be unwilling to participate in recovery efforts following future disasters.

Presently, this research-in-progress is analyzing quantitative (re-survey) and qualitative (focus group) data regarding PH STriDR's impacts on these baseline deficits. The randomized controlled trial design will allow for meaningful comparisons between LHDs that received this curriculum versus those that did not. The research team will translate these findings into an updated PH STriDR curriculum that will be made freely available to health departments via enduring online hosting on the National Center for Disaster Medicine and Public Health website.



## Evaluation of Hurricane Sandy Public Health Response in New York State

**Guthrie Birkhead, Millicent Eidson, Trang Nguyen, and Asante Shipp-Hilts**  
New York State Department of Health

To evaluate the NYS public health (PH) system response to Hurricane Sandy, the NYS Department of Health (NYSDOH) developed a community based participatory research project involving local health departments, emergency management, and PH service providers. The PH service providers included public drinking water systems, community HIV/STD service providers, and Women, Infants and Children (WIC) program providers.

Many of the services provided by these public health programs were interrupted. For example, multiple WIC agencies were closed with clients unable to obtain services, redeem vouchers for nutritional supplementation, or receive referrals for other health services.

A better understanding of the PH partner needs during emergencies is vital to disaster planning and has been the driving force behind the NYSDOH research efforts.

NYSDOH collected feedback from emergency reports, focus groups, individual interviews, and anonymous surveys. This information provides the first-hand perspective of providers who responded during Sandy and the recommendations they reported for improving disaster response.

Some of the key recommendations that were shared include:

- Practice existing emergency response plans, including non-management staff
- Improve shared emergency reporting between health departments and emergency management
- Utilize web-based communication tools at remote sites
- Explore options for alternate/mobile WIC sites
- Develop Memorandums of Understanding (MOUs) for shelter operations (nursing, laundry, food service)



*Left: WIC building being repaired. Right: Destroyed WIC supplies, equipment, incentives, breast pumps, and books (Photo Credit: Addabbo Family Health Center)*

“Our staff were getting really tired. Our days were long... We needed more MOUs... They were doing roles that they were not comfortable with.”

– A local health department staff interviewee

### *Understanding the Health System Impact of the Spillover Effect After Hurricane Sandy*

*Thomas Chandler, National Center for Disaster Preparedness, Columbia University*

*Benita Panigrahi, National Center for Disaster Preparedness, Columbia University*

*David Abramson, College of Global Public Health, New York University*

*Jeff Schlegelmilch, National Center for Disaster Preparedness, Columbia University*

The National Center for Disaster Preparedness (NCDP), of the Earth Institute, Columbia University, has been conducting a CDC funded study (9/13 – 9/15) to examine the challenges that arose for two public health agencies (Nassau and Westchester Counties, New York) before, during, and after Hurricane Sandy struck the New York City region. This project is informed by recent theoretical work that frames capacity, competency, and capability as ways to analyze public health work performance. Applied to a disaster setting, the study's goals are to: (1) elucidate how complex organizations function during times of extreme duress by illustrating how the health departments operated within the New York State, New York City, and county health systems, and (2) determine how regional public health workers can improve upon their disaster response and recovery strategies, particularly when working to affect an inte-

grated response with socially vulnerable populations during coastal storms. Results are being gathered via content analysis of after action reports and key informant interviews and focus groups with more than 50 regional public health staff and first responders. Findings obtained indicate that there were several surge capacity challenges during Hurricane Sandy involving the transfer of patients to and from hospitals, nursing homes and special needs shelters. In many instances, the public health agencies received requests to carry out tasks that were beyond their purview, often resulting in improvised decision making processes that have not been analyzed extensively in previous research studies. During the second year of this project, the investigators have also been carrying out disaster response trainings in relation to identified needs.



*Ambulances responding during Hurricane Sandy (Photo Credit: Associated Press)*

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## SESSION II-A: HEALTH SYSTEM RESPONSE AND HEALTH CARE ACCESS

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This chapter highlights the stresses on health care providers that arose during and after Hurricane Sandy. Three projects are featured.

The first project, led by researchers at the American College of Emergency Physicians, covers a multi-state area and delves into a range of health care services—including emergency ambulance services, hospital emergency care, and hospital evacuation—in an effort to find lessons for improving the response to and recovery from future catastrophic events.

The second project, from researchers at the New York University School of Medicine, focuses on pre-hospital care and in-hospital emergency care in New York City. It has two perspectives: evaluating Hurricane Sandy's impact on prehospital care in partnership with the city fire department and analyzing the use of a novel, free-standing emergency department at Bellevue Hospital Center.

The third project is a collaboration between researchers at the University of Pittsburgh Graduate School of Public Health and practitioners in the Primary Care Access and Planning unit of the New York City Department of Health and Mental Hygiene. It uses computer modeling to focus on a small but heavily impacted geographic area—the Rockaways, Queens—where the storm interrupted power, communications, and transportation and created a long-lasting deficit in access to primary care for many residents.

All three projects provide insights about the effectiveness of response efforts that actually occurred as well as lessons, innovative care models, and analytic tools for use in future disasters affecting access to health care services.



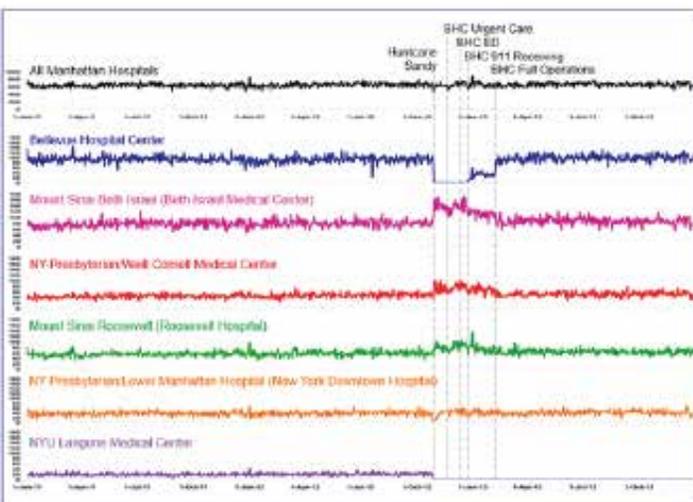
*Ambulances evacuate patients in New York City (Photo Credit: Christopher McStay)*

***The Impact of Hurricane Sandy on Health Systems Care and Development of Disaster Response and Resilience Based Metrics***

***Lewis Goldfrank, New York University School of Medicine***

In partnership with the Fire Department of the City of New York (FDNY), we evaluated Hurricane Sandy’s impact on prehospital care delivery (emergency ambulance services). Separately, we analyzed the contribution of a novel, freestanding emergency department (ED) – absent hospital inpatient services – which was established in the midst of the disaster at Bellevue Hospital Center, in order to decrease stress on the health-care system. We performed a retrospective review of FDNY’s Emergency Medical Services (EMS) activity within NYC’s 911 emergency dispatch system, which classifies calls into medical or trauma emergencies types and subtypes. These are representative of ED visits and complaints. We analyzed post-storm prehospital call volumes, distributions, and subtypes and compared them to historical controls, with specific attention to hospitals in Manhattan and the public safety net NYC Health and Hospital Corporation (HHC) network. The

catastrophic closure of multiple hospitals produced a maldistributed, rapid, and sustained rise in prehospital EMS transfers to alternative Manhattan hospital destinations. We found that prehospital data provided an easily identifiable real-time operational metric for measuring the stressors experienced by specific hospitals and by the healthcare system as a whole during Hurricane Sandy. Increased call volume and subtypes challenged specific Manhattan hospitals either due to their resource-intensive or potentially time-sensitive nature. Re-establishment of emergency care at Bellevue through the freestanding emergency department served both local needs and had an effect beyond adjacent boroughs. Decreases in resource intensive medical care requirements were achieved through Bellevue’s freestanding ED, representing an innovative application of the military’s echelons of care concept to a civilian disaster theater of operations.



**Figure 1.** FDNY EMS transports to Manhattan receiving hospitals January 2011 – December 2013. Beth Israel Medical Center became Mount Sinai Beth Israel (MSBI) following the Continuum Health Partners – Mount Sinai Medical Center merger in 09/2013; Mount Sinai Roosevelt (MSR) assumed its name 01/2014. New York Downtown Hospital became New York-Presbyterian/Lower Manhattan Hospital (NYP-LMH) after its 2013 merger with NYP.



## ***Lessons Learned from Hurricane Sandy and Recommendations for Improved Healthcare and Public Health Response and Recovery for Future Catastrophic Events***

***Rick Murray and Roy Alson, American College of Emergency Physicians***

Our project used mixed methods including in-person, telephone interviews and targeted surveys to identify key indicators for evaluating how storm damage affected patient care. We collected data from several groups including hospitals, EMS services, local and state agencies.. The project evaluated the impact of Hurricane Sandy not only in the hardest hit areas of New York and New Jersey but also in the 13 states declared by FEMA as affected areas. We looked at events and practices that occurred before, during and after the storm, and identified a number of Lessons Learned and opportunities for improvement. This includes the need for a detailed review of existing disaster plans focusing on functionality rather than regulatory compliance.

We found a need for uniform hospital bed definitions which would simplify evacuations. A major challenge

was that many of the out-of-area ambulances were not familiar with the city's hospitals, so patients weren't always transported to the appropriate facility. Current patient tracking systems which rely on wrist bands didn't allow hospitals to fully track a patient's final destination. In addition, hospital staffing after the hurricane was problematic. When access to the city was restricted by Law Enforcement, hospital support staff were not allowed to enter. Some of the Best Practices we identified included monitoring school closures and their impact on staffing levels, GIS mapping of staff home addresses to identify issues with staff reporting to work, having staff and volunteers cross-trained in multiple tasks and reassigning employees from closed offices to other functions.

*"Hospitals plan and train for patient surge, taking in patients but they aren't that good at evacuating patients out of the hospital"*

*– Hospital disaster planner*



*Ambulances wait outside a New York City hospital (Photo Credit: TransCare Ambulance)*

## *Hurricane Sandy in the Rockaways, Queens: Response and Recovery for Access to Primary Care*

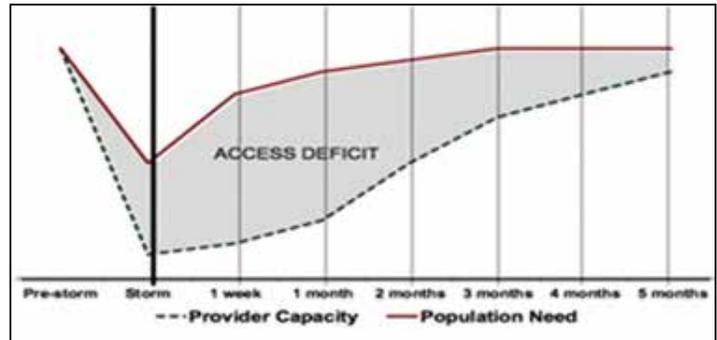
*Margaret Potter, University of Pittsburgh*

Disasters can disrupt primary care services, resulting in a gap between the ability of healthcare providers to deliver care, and the increased healthcare needs of the population. **This gap is called the access deficit.** The impact of Superstorm Sandy on primary care capacity in the Rockaway Peninsula, Queens, New York provides a unique case study for understanding the access deficit and how to reduce it.

**HAZEL (hazard-area primary care locator)** is a modeling tool designed to simulate primary care strategies implemented and/or considered during and after Superstorm Sandy in the Rockaways; with further development, HAZEL can become widely available to help in restoring post-disaster primary care access for other locales.

**HAZEL parameters** describe the **access deficit** for primary care services resulting from the dynamics of provider capacity and population need during and after a disaster. Data include: population demographics, evacuation patterns, health insurance source and status, healthcare utilization, local infrastructure, primary care sites, pharmacies, topology, and relevant laws, policies, and emergency orders. The HAZEL model for Superstorm Sandy in the Rockaways can be adapted for other geographic settings and other future disasters.

HAZEL decision-support applications display progress toward restoring reducing the access deficit. Experi-



*Conceptual representation of relationship between provider capacity and population need for primary care before and after Superstorm Sandy.*

ments with HAZEL—such as situating mobile medical vans, waiving health plan restrictions, or changing emergency transportation orders—produce measurements of the access deficit. By modifying access parameters alone or in combination, the user can evaluate effects of back-up systems, alternative service plans, and policy modifications on the overall access deficit.



*HAZEL model visualization of access deficit distributed among Rockaways zip-codes, color-coded by %-age residents without access to primary care on day 24 of simulated hurricane impact.*

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## SESSION II-B: MENTAL HEALTH OUTCOMES

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The studies presented in this chapter focus on mental health (and sometimes physical health) problems experienced by those exposed to Hurricane Sandy. These studies focus on different populations, pregnant women in New York City, responders to the World Trade Center disaster who live in Nassau and Suffolk counties, and a sample of the general population residing on Long Island, Queens and Staten Island. Information for these studies was gathered using surveys, hospital admission data, interviews, routine examinations, psychometric assessments and structured clinical interviews.

Although the specific methods varied for each study, there are several common themes. First, there was substantial Hurricane Sandy related stress reported, as well as objective exposure to potentially stress triggering events such as of loss of property, electricity, and shortages of food and gasoline. Second, the degree of exposure to Hurricane Sandy was strongly related to

the reported levels of subjective stress. Third, pre-event characteristics, including demographics such as sex and socioeconomic status, and pre-event mental health status, such as having a history of depression and anxiety, were associated with Hurricane Sandy reported stress and mental health difficulties. Fourth, the roles of social support and resilience are modifiers of the relationships between the objective stress and pre-event characteristics and Hurricane Sandy reported stress.

These studies also demonstrate that mental health issues, particularly those related to stress, are of concern during natural disasters. This ongoing research will target intervention strategies in communities at high risk for natural disasters and will inform emergency preparedness in terms of targeting high risk groups for mental health services. It will also try to assess the long term psychological and physical well-being of the populations exposed to Hurricane Sandy.



*DMAT MA-2 Provides Medical Care at Special Needs Shelter (Photo Credit: [www.flickr.com/photos/phegov](http://www.flickr.com/photos/phegov))*

## ***Effects of a Major Climatic Event—Superstorm Sandy—On Pregnancy Outcomes and Telomere Length***

***Pam Factor-Litvak and Catherine Monk, Columbia University***

Major climatic events, such as hurricanes, appear to be increasing due to the consequences of global warming. Such events are likely associated with increased psychological stress. On October 29, 2012 Superstorm Sandy, a major hurricane, devastated the mid-Atlantic region of the United States, particularly the New York City/New Jersey area. Pregnant women are considered a vulnerable population and there is increasing evidence that acute psychosocial stressors may be associated with adverse pregnancy outcomes, such as decreases in birth weight and decreases in gestational length. Further, maternal exposure to stressful events may be associated with decreases in leukocyte telomere length (LTL) in the newborn. LTL is a measure of the length of the tips of the chromosomes, and some think that it is a marker of cumulative stress. In the case of newborns, LTL would reflect characteristics of the parents and possibly capture stress during the in utero period. Capitalizing on a birth cohort which was recruited in the time period surrounding the event, we are examining associations between exposure to Superstorm Sandy and pregnancy outcomes and newborn LTL.

We measured global Sandy stress on a scale of 1-10 for the week of the storm and the week after the storm and high stress was defined as the top quartile. Our results to date indicate that African American and Hispanic women, compared to white women, exhibited higher global Sandy stress as did those with less than a four-year college degree. Reported global Sandy stress increased with the degree of exposure to hurricane spe-



*NDMS Responder checks vital signs of resident following Hurricane Sandy (Photo Credit: [www.flickr.com/photos/phegov](http://www.flickr.com/photos/phegov))*

cific stressors (e.g. loss of property, electricity, shortages of food and gasoline). Further, we found that higher scores on a perceived stress scale, higher scores on a depression scale and higher scores on an anxiety scale were also associated with higher global Sandy stress and those with higher social support and resilience scores were associated with lower global Sandy stress. .

This study improves on previous studies of natural and manmade disasters because we will be able to parse exposure to specific trimesters and to the three months prior to conception; we have place controls, i.e. a cohort being recruited in an unaffected area using exactly the same measures; we have baseline information on maternal perceived stress, depression, anxiety, social support and resilience, and we have an adequate sample size to address the aims. Results from this study have the potential to inform interventions for pregnant women at risk for stressful natural disasters. They may also set the stage for studies to inquire whether prenatal exposure to stressful events is associated with cognitive and behavioral problems in children.



## ***Effects of Hurricane Sandy on the Respiratory and Mental Health of WTC Responders***

***Adam Gonzalez, Stony Brook University***

One of the most vulnerable groups living in areas highly affected by Hurricane Sandy is responders to the attacks on the World Trade Center (WTC) on September 11, 2001 (9/11), many of whom continue to be active responders and, have persistent respiratory and psychological problems, or both, as a result of their response to 9/11. The Stony Brook WTC Health Program provides yearly health monitoring and treatment for WTC-related conditions to a growing cohort of 8,000 WTC responders. Each year we systematically assess physical and mental health conditions. Immediately after Hurricane Sandy, we began screening for Hurricane Sandy-related exposures.

The overall objective of our study is to evaluate levels of exposure to environmental toxins (i.e., mold) and psychological trauma as a result of Hurricane Sandy and their effects on respiratory and mental health in a sample of WTC responders living in Long Island. We have utilized multimodal assessments including self-report, structured clinical interviews, and skin and serum allergy testing. Preliminary data analyses have been conducted with participants from this study (N=1,282) who had monitoring and treatment visits between 11/19/2012 and 2/15/2013. The majority of the sample was male (92%), and the mean age was 49 (SD=8.12). Participants

were administered a structured clinical interview and completed self-report measures to assess severity of Hurricane Sandy exposures, 9/11-related PTSD symptoms and depression. Based on the interview assessment, 13% identified Hurricane Sandy as a traumatic event but none met criteria for Hurricane Sandy-related PTSD; 6% met criteria for current 9/11-related PTSD; and, 6% for major depression (10% with new onset post-Sandy). More than 90% reported Hurricane Sandy damage to their neighborhood; 60% reported damage to their home; 60% experienced financial hardships; and, 45% were without power for at least one week. Eleven percent applied for government financial aid after the hurricane. In addition, 76% feared for safety. Overall, severity of Hurricane Sandy-exposures was associated with increased depression and 9/11-related PTSD symptom severity, with the strongest associations found for financial hardships. Further analyses are underway to evaluate changes in respiratory and mental health pre to post Sandy and the impact of Hurricane Sandy exposures.



*Location of the Stony Brook University WTC Health Program Clinics*

## ***Development of a Vulnerability Profile of the Psychological Sequelae of Hurricane Sandy***

***Emanuela Taioli, Icahn School of Medicine at Mount Sinai; Rebecca Schwartz, Hofstra North-Shore-LIJ School of Medicine; Lisa Murphy, Nassau County Department of Human Services***

Estimates regarding the psychological impact of Hurricane Sandy can be drawn from anecdotal reports, however, reliable data is lacking on the incidence of psychological effects specifically. Project LIGHT represents a collaborative effort between Mount Sinai, North Shore-LIJ and the Nassau County Department of Human Services with the goals of establishing and understanding associations between exposure to the hurricane and various mental health symptoms and diagnoses while also defining subgroups of individuals who were most vulnerable to the hurricane mental health effects. This was accomplished using multiple methodologies including the collection of survey data from a cohort of 669 individuals who reside in Nassau, Suffolk, Queens or Richmond (Staten Island) counties as well as analysis of Emergency Department (ED) data from 23 EDs in Nassau and Suffolk counties. The survey participant population was 64% female, 20% Black and 20% Hispanic. The mean age was 47.6 years old. Out of 30 possible hurricane exposures, participants experienced an average of 3.83 items. The sample had greater psychological difficulties than in the general population: 47.5% experienced probable anxiety, 34.3% experienced probable depression, and 20.5% experienced probable PTSD. Results indicated that greater hurricane exposure was associated with greater symptoms of PTSD, anxiety, depression and generalized stress even after controlling for demographic factors, time since the hurricane and having a history of mental health difficulties. Analyses have also elucidated po-



*Two photos showing Project Light staff in the field (Photo Credit: Rebecca Schwartz)*

tential vulnerability factors such as Hispanic ethnicity, having a history of mental health difficulties and lower educational attainment. A significant drop in ED visit volume was observed on the day the hurricane landed in the region with a sharp spike in the two days following the hurricane. As such, there was an excess of 399 ED visits for physical health diagnoses identified during those two days as compared to the month prior. “Diseases of the respiratory system” was the only diagnosis group that showed a positive trend in post-hurricane versus pre-hurricane diagnoses (+4%). The results of the study are being widely disseminated to stakeholders in the emergency preparedness, mental health provision, and scientific communities. The Project LIGHT website has many visitors as well: <http://www.feinsteininstitute.org/project-light/>. Ultimately, our research will be used to target current intervention strategies as well as to inform emergency preparedness efforts by indicating areas and groups to prioritize in terms of mental health intervention during future natural disasters.

## SESSION II-C: RECOVERY WORK AND RESILIENCE IN VOLUNTEERS AND CITIZENS

The devastation delivered by Hurricane Sandy required heroic recovery and rebuilding efforts. As the waters receded, service providers, contractors, community residents and volunteers immediately began to restore power and services, remove the debris and muck, and reconstruct their homes and businesses. Four research teams have characterized risks and challenges faced by these “recovery workers” to recognize Sandy’s impact on them and their communities and to describe practical/efficient pathways toward greater resilience and risk mitigation. Key observations and conclusions were noted by all four teams. “Recovery workers” ranged from trained public service professionals to volunteers with scant experience in remediation/recovery tasks associated with disasters. Few understood or were trained for the hazards they faced, or utilized protective gear and practices. Recovery workers faced dangers ranging from acute risks (falls, cuts, electrocution, infections) to health threats from the mold, asbestos, and myriad of chemicals now displaced by the storm’s fury. Professional workers operated long shifts with failing communication systems, alongside untrained workers.

Communities were unaware of the potential chemical and biological risks that may have been present and front-line health workers had no efficient way to relate people’s health problems (immediately after the storm or over the following months) to their recovery work experiences. These four teams have detailed these findings and characterized on-site acute hazards and exposures due to mold and fugitive chemicals, including asbestos and displaced industrial chemicals. With such vital information, officials can identify areas of high risk. Unions and public health organizations can accomplish effective training and protection strategies for construction workers, healthcare workers, public sector workers, and community members. It is important that front-line medical professionals can anticipate the health consequences associated with these disasters and that public health records clearly document patients’ histories of involvement in storm recovery efforts. The findings of these four teams are relevant to communities throughout the nation as they prepare for future disasters.



*Left: vehicles crushed by trees following Hurricane Sandy. Right: workers clean out a flooded business (Photo Credit: Neptune Township, N.J.)*

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## ***SEIU Union Resiliency Coordinators Pilot Program***

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### ***Mark Catlin, SEIU Education and Support Fund***

Our pilot program, began in August 2013, is led by the SEIU Education and Support Fund (SEIU ESF) with partners representing almost 250,000 healthcare workers at acute care hospitals, clinic, nursing homes and home care employers in the region. The key goal of this pilot program is to empower front-line workers in areas impacted by Hurricane Sandy to improve preparedness for emergencies through their local union, at their workplaces, and in their communities. This effort is led by front-line workers volunteering to serve as Union Resiliency Coordinators (URCs) who are trained and supported in this work by their union. URCs are front-line worker resiliency champions who work at healthcare and other facilities to help ensure that policies and plans that have been put in place post-Sandy increase

resiliency, especially in the areas of training, occupational health and safety and worker involvement. URCs also work with their local community leaders and organizations to help increase the resiliency of the community to future Sandy-type disasters. The program has trained more than 300 union leaders and members, including almost 100 as URCs.



*Union Resilience Coordinator training (Photo Credit: Mark Catlin)*



## ***Evaluating the Needs, Knowledge and Health Impacts of Three Worker Populations During and After Super-Storm Sandy***

***Margaret Lumia, New Jersey Department of Health***

As a direct result of the effects of Hurricane Sandy in New Jersey, seven work-related fatalities occurred and occupational injuries increased during storm clean-up and recovery efforts. This project is evaluating and analyzing existing data systems, and conducting focus groups and surveys among three worker populations to reduce or eliminate adverse health impacts, identify gaps in existing data sources and provide recommendations for educational and outreach materials.

We collected data from all NJ hospital and emergency department visits among 18-65 year olds who had experienced an accidental injury. The data were grouped by county and categorized as having high, medium, or low impact from Sandy and the visit was considered work-related if it was identified as Workers Compensation. The rate of work-related injuries in Sandy's high impact area increased after the hurricane. Based on timing and type of injury, the most consistent increases were associated with rebuilding and recovery rather than the initial response.

Focus groups and surveys were used to characterize response worker issues associated with Sandy's impact in NJ. To date, six focus groups were held with 59 participants from the Emergency Medical Services and Tree Care Industry. Preliminary results suggest that although these worker groups need to be ready to "face the un-



*Downed power lines in New Jersey after Hurricane Sandy (Photo Credit: FEMA/Liz Roll)*

expected" in their day-to-day jobs, during the storm they faced additional hazards, such as contaminated floodwaters, downed power lines, storm damaged trees, and extra-long shifts. Training, communication, personal protection equipment, and team work are of the utmost importance to keep workers safe during storm response and recovery.

*"...power lines that still had current. Since there was a lot of water, I was afraid."*

*– Spanish-speaking tree care worker focus group participant*

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## ***Impact of Health Department Worker Safety Training on Health Impacts After Sandy***

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***Michael J. Reilly, DrPH MPH (Principal Investigator), New York Medical College***

Providing just-in-time worker safety training programs for non-traditional responders to disasters, including “do-it-yourself” homeowners and volunteers, as well as issuing personal protective equipment (PPE) may be an effective public health intervention to reduce the rates of post-disaster illness and injury in resilient communities. This study evaluates the physical and mental health outcomes among those that remediated contaminated homes following Hurricane Sandy to learn more about occupational illnesses associated with coastal storm recovery and to determine if health department occupational safety training may have reduced the incidence of illness and injury in this population.

We conducted a field survey of nearly 600 homeowners and volunteers who performed mold remediation activities and participated in NYC Department of Health sponsored worker safety training programs to

determine possible exposures and health effects. For each enrolled case, controls matched from census block groups are being identified to compare rates of illness or injury in a non-trained group versus the group that received health department intervention.

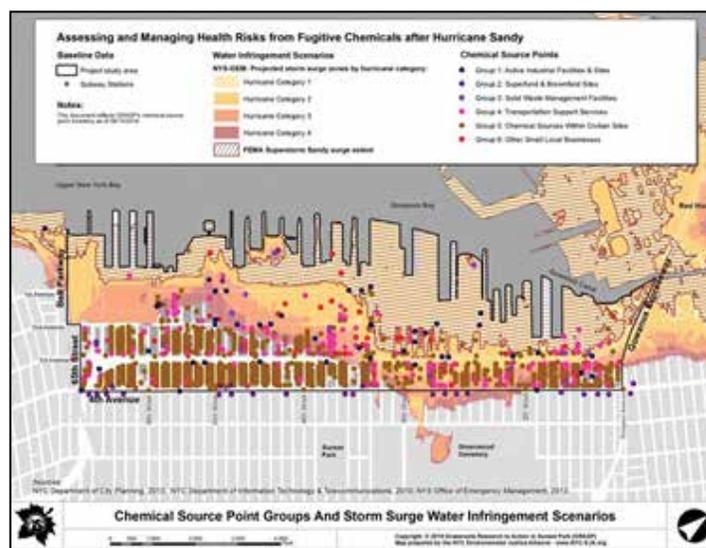
The results of this study will allow us to answer questions such as: What is the distribution and determinants of occupational-related illness among non-traditional responders to disasters, including “do-it-yourself” homeowners and volunteers; and Does health department sponsored worker safety training that is available to the public limit the incidence and severity of illness and injury in this population following a disaster such as Hurricane Sandy. Health departments can use this information to better understand what kind of training or services will be most useful to homeowners following a disaster.



## Assessing and Managing Health Risks from Fugitive Chemicals After Hurricane Sandy

**Regina Shih, RAND Corporation**  
**Chris Chaisson, The Lifeline Group**

Immediately after the severe flooding and devastation of Hurricane Sandy the task of recovery began throughout the New York City Significant Maritime Industrial Areas (SMIAs). The waters had swept through the heavy industrial and marine facilities lining the coast and flooded the residential communities just beyond the industrial fences. As the waters receded, community residents and volunteers immediately began to remove the debris, muck, water, soaked building parts and contents and reconstruct their homes and businesses. Our task has been to address community concerns about “fugitive” chemicals – dislodged from nearby industrial sites and dispersed throughout community via storm waters. We identified six categories of chemical sources vulnerable during storm event water infringement for these SMIAs ranging from industrial, transportation and even residential sites. We constructed a listing of the chemicals likely to be at the industrial sites, their vulnerability and likelihood of dislodgement under different storm conditions. We mapped the terrain of Sunset Park, in Brooklyn, New York to define where the fugitive chemicals could spread and calculated how much of some of those chemicals could be in the muck and debris. Using photos, videos, social media postings and a community survey we characterized the tasks undertaken to clean up after the storm as well as the work practices of the workers and volunteers—what they were wear-



ing, how long and how they worked, if and how they used protective gear, how dirty/wet they got and how they cleaned up afterwards. Together with what we know about possible health effects for some of these chemicals, we could assess the probable exposures and possible health concerns associated with such exposures. Those risk profiles demonstrate the advantages of simple protective gear and work practices, and illustrate the need to consider “fugitive chemical” risk as part of the community response during future natural disasters. The project underscored the advantages of sophisticated scientific tools deployed to the service of community-led research, and the need to address uncertainties and information gaps encountered in the risk assessment process.

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## SESSION III-A: REDUCING MORBIDITY AND MORTALITY

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Hurricane Sandy resulted in deaths, injuries and other health consequences for many people who were exposed to the storm. The studies presented in this chapter focus on characterizing Hurricane Sandy's impacts on the physical and mental health of people in New Jersey, New York State, and New York City during and after the storm. While the methodologies used by each study team varied, information was primarily gathered through existing sources including hospital admissions data, emergency room visit data, prescription fills data, weather and power outage records, mortality records, and surveys. Additional data about Hurricane Sandy experiences were collected directly from residents.

The studies describe the ways in which Hurricane Sandy impacted the physical and mental health of individuals in the New York/New Jersey area. Deaths and injuries resulted from drowning, carbon monoxide

poisoning, and other causes in flood zones. Increases in various health outcomes such as carbon monoxide poisonings, asthma emergency room visits, prescription refills, dialysis and mental health outcomes were observed. Differences were also observed in Sandy-related health outcomes by sub-populations and demographic groups.

Public health professionals should tailor preparedness messages to specific audiences so that they understand the risks and how best to prepare. Individuals and communities can benefit from taking steps to prepare themselves better for future emergencies. Hospitals, clinics and pharmacies should continue to address infrastructure issues that led to operational challenges during Hurricane Sandy. Emotional support resources should be readily available to those who experience future disasters.



*Responders with DMAT MA-2 treat patients in the aftermath of Hurricane Sandy (Photo Credit: [www.flickr.com/photos/phegov](http://www.flickr.com/photos/phegov))*

## Impact of Hurricane Sandy on Morbidity and Mortality in New York City

Charon Gwynn, New York City Department of Health and Mental Hygiene

Hurricane Sandy caused environmental hazards, widespread power outages, and disruptions in healthcare access. This research uses existing data sources to investigate the impact of Hurricane Sandy on mortality, injuries, mental health, and evacuation behaviors in New York City (NYC).

Most injury deaths occurred within Evacuation Zone A and were primarily caused by drowning. Overall, more deaths than expected occurred in the periods during and after the storm when compared to number of deaths occurring during the same time periods from the previous 4 years.

Within the inundation area, mental health conditions (serious psychological distress or post-traumatic stress disorder) were higher among residents who experienced

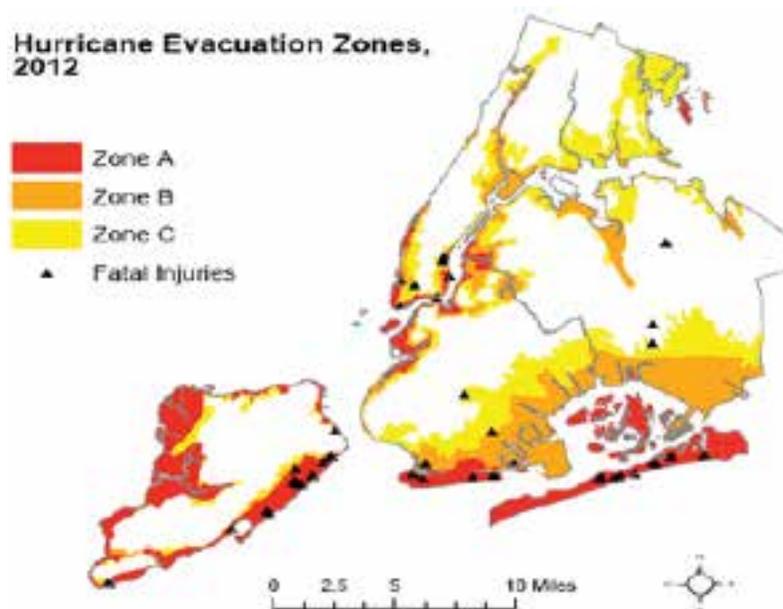
Hurricane Sandy-related traumatic events such as physical injury, household damage and displacement.

Evacuation Zone A residents were ordered to leave. Although most people knew they lived in an evacuation zone, the majority stayed<sup>1</sup>. Older adults (> 65 years) were less likely to evacuate than younger adults (18-24 years). People living on higher floors were less likely to evacuate than those living on lower floors<sup>2</sup>.

Findings are being used to guide emergency response and preparedness efforts.

<sup>1</sup>Gibbs, L. and C. Holloway (2013) Hurricane Sandy After Action Report: Report and Recommendations to Mayor Michael R. Bloomberg. [New York, NY: City of New York](#)

<sup>2</sup>Brown, S. and H. Parton (2014). "Evacuation in New York City During Hurricanes Irene and Sandy." New York City Department of Health and Mental Hygiene: Epi Data Brief (51).



New York City Evacuation Zones during Hurricane Sandy. Created by the NYC DOHMH with data from the New York City Office of the Chief Medical Examiner

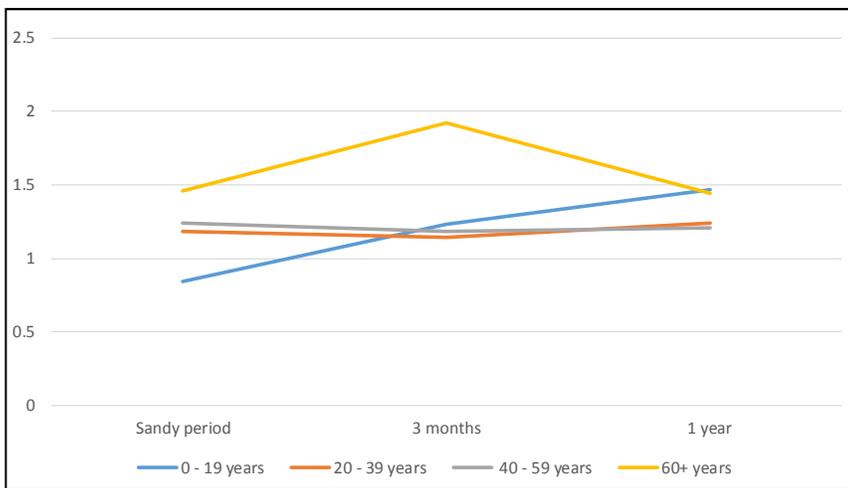
## Assessing Health Effects and Risk Factors After Hurricane Sandy in NYS

**Shao Lin, New York State Department of Health**

In New York State, Hurricane Sandy was responsible for 53 deaths, 2.2 million residential power outages, and damage to over 300,000 homes. We conducted a comprehensive study to understand how this large-scale disaster impacted mortality and multiple health outcomes of residents in the eight impacted counties during Sandy, three months, and one year later. We have been collecting and analyzing information from a wide range of sources, including hospitalizations and emergency room visits, Medicaid prescription fills, weather and power outage records, and survey responses from residents who experienced oil spills in their homes. Using these data sources we evaluated a range of health outcomes, such as mental health, injury, cardiovascular- respiratory diseases, carbon monoxide

(CO) poisoning, water-borne/food-borne diseases, dialysis and total mortality. Results like the samples below will help emergency planners and residents alike to better prepare for future weather-related disasters.

In general, our preliminary findings show significant increased risks of certain mental health outcomes (anxiety and psychosis), injury, CO poisoning, and dialysis immediately after Sandy, but no significant increases in hospital admissions due to cardiovascular-respiratory diseases or water/food-borne diseases. We also found significant differences by demographics and timing in Sandy-health risks. For example, during the storm, falls were most common among elderly adults, and car accidents were most common among children and youth.



*Elderly adults were at the highest risk for suicide during the storm, but children and youth were at the highest risk one year later. Risk of self/harm/suicidal ED visits by age group at three time periods in three affected counties (Nassau, Suffolk, and Westchester) vs. rest of NY State (1 = no change in risk)*

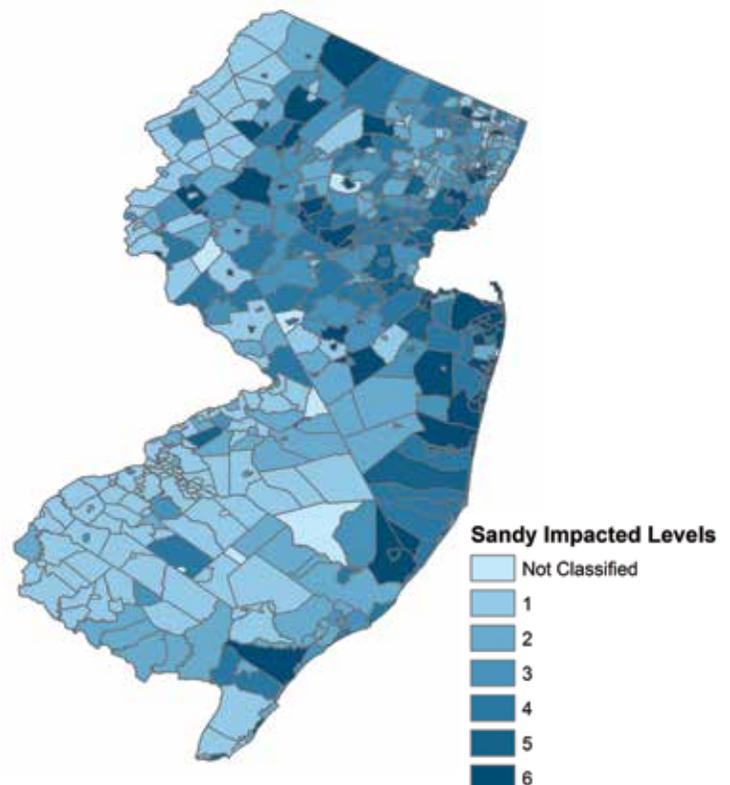
Many residents reported that they had no help with cleaning up oil spills on their property, or understanding of how to safely clean it up themselves. They also reported experiencing symptoms such as headache, eye irritation, nausea, anxiety, and depression after their exposure to the oil and vapors.

## ***Impacts on Health and Mental Health Post-Superstorm Sandy, New Jersey***

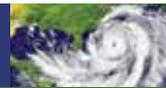
***Christina Tan, New Jersey Department of Health***  
***Amy Davidow, Rutgers University School of Public Health***  
***Stella Tsai, New Jersey Department of Health***

During and following Superstorm Sandy, much of New Jersey experienced interruptions in transportation, electrical outages, commercial and residential damage due to flooding and wind, and environmental damage. While Superstorm Sandy affected all of New Jersey, it did not affect every location in the same way. Our project is designed to assess how the extent of Sandy's impact affected access to medical care, induced psychological stress, and increased exposure to pollutants such as carbon monoxide, ultimately creating adverse effects on health. To detect health effects, we are analyzing data on hospital admissions, emergency room visits, real time syndromic surveillance, phone calls to New Jersey Poison Information and Education System (NJPIES), and mortality records. We are particularly interested in health conditions that are sensitive to interruptions in care, e.g., asthma, among others. In addition to these routinely collected data, we have been collecting population-based data that are specifically related to hurricane experiences among New Jersey's residents as a whole as well as some of the more vulnerable populations within New Jersey, specifically clients of Federally Qualified Health Centers (FQHC). Each data source provides a different angle on health outcomes, but taken together they tell a story. For example, from hospital discharge data, there is evidence of elevated emergency room use by asthmatic patients

in the areas most affected by Sandy; this finding is consistent with experiences related by FQHC clients who reported interruptions in asthma treatment immediately following the storm. Statewide phenomena such as increases in carbon monoxide poisonings were separately identified by both NJPIES as well as syndromic surveillance studies based on real-time emergency department visits. Unmet medical needs, including dialysis, medical refills and supplemental oxygen, identified via syndromic surveillance studies reflect population-based studies of access to care immediately following Sandy.



*Map of New Jersey showing the impact of Hurricane Sandy by municipality. Created by the NJDOH, with data provided by Stephanie Hoopes Halpin of Rutgers University School of Public Affairs and Administration*



## SESSION III-B: TRAINING, MOLD MITIGATION, AND THE HEALTH IMPACTS OF FLOODING

Hurricane Sandy caused extensive flooding throughout the Northeast. Flooding can lead to hazardous working conditions for those who are cleaning up flooded or mold-damaged buildings, or who are working with generators and other electrical equipment. Both recovery workers and families whose homes have been damaged may experience respiratory health impacts from mold due to flooding.

The projects in this chapter tackle the health impacts of flooding from several different angles. Matthew Perzanowski and Maureen Little are comparing the types and quantity of molds found in homes flooded by Hurricane Sandy versus molds found in similar but undamaged homes, and how they may be linked to respiratory symptoms and allergic sensitization, particularly in asthmatic children. Paula Schenck is developing effective messaging and educational strategies for hurricane response and recovery workers, volunteers, home occupants in areas affected by flooding, public health and environmental professionals, and health providers to increase awareness and behaviors designed to lessen the health risk from mold and associated bioaerosol exposure. Barbara McCabe and John Morawetz are both working to train workers and community members to more safely handle flood-related hazards, including mold, electrical hazards, and hazards related to mucking and gutting (removing silt and other debris from a flooded building).

A common theme throughout these projects is the need for accurate and effective information regarding mold and other hazards encountered during Hurricane Sandy clean up and in the prolonged recovery period.

Through research, educational program development, and trainings that have been conducted, these projects have had a direct impact on Hurricane Sandy recovery. As the work continues, the information learned from these studies will continue to benefit communities impacted by Hurricane Sandy and assist communities to prepare for potential devastation from future storms.



*Flooding in New Jersey following Hurricane Sandy (Photo Credit: FEMA/Liz Roll)*

### ***International Chemical Workers Union Center for Worker Health and Safety Education***

***Frank Cyphers, ICWUC Center for Worker Health & Safety Education***

***John Morawetz, ICWUC Center for Worker Health & Safety Education***

The ICWUC Sandy supplemental grant delivered Hazard Awareness training to diverse audiences (AmeriCorps, homeowners, volunteers, nonprofit agencies), expanded working relationships with nontraditional partners, developed Sandy/Disaster trainers and expanded collaborative projects with other NIEHS grantees. This helped ensure that Sandy work was done safely and increased these populations' capacity to respond quickly and safely to future storms. From the July 24, 2013 award to June 1, 2015, 5,224 person hours of training was delivered to 1,258 participants and trainers in 64 classes.

We distributed thousands of the NIEHS Hurricane Protect Yourself booklets, designed Sandy Awareness training, conducted site visits to observe muck and gut operations and developed a Muck and Gut participant packet and trainers' guide. A New Jersey trainer conducted most programs and built ties to NJ Long Term Recovery Groups. Muck and Gut Train the Trainer classes were conducted with the Coalition of Black Trade Unionists and the New England Consortium. Classes use adult education techniques that utilize participants' knowledge and experience to teach key principles in a non-threatening and engaging method to maximize the training relevance and to motivate them to performing disaster work safely.



*Debris piled in the street following Hurricane Sandy (Photo Credit: Luis Vazquez)*

The curriculum was designed around the primary hazards (safety, mold, carbon monoxide, sewage, lead and asbestos), the NIEHS protect yourself booklet and the OSHA list of Sandy fatalities (drowning, falls, struck by vehicles, cutting trees and carbon monoxide). The small group exercises are an ice breaker with participants listing hazards and discussing how to protect themselves and a second where groups review substance fact sheets. Photographs of remediation work are included.



## ***IUOE National Training Fund Safety Training for Hurricane Sandy Response and Recovery***

### ***Barbara McCabe, International Union of Operating Engineers***

Partnering with IUOE local unions throughout the FEMA-declared major disaster states from Hurricane Sandy, the IUOE National Training Fund (NTF) provided hazard mitigation training related to mold, mold removal and hazards associated with portable generator use. Mold awareness training was delivered to 328 students for 1,312 hours of training and generator hazard awareness was delivered to 311 students for 622 hours of training. The trainees were mostly IUOE members who were members of communities destroyed by Hurricane Sandy, workers cleaning up the devastation, and homeowners taking care of their own homes and families. A number of those attendees are still working to get back into their homes.

During mold awareness training, the NTF supplied mold remediation kits for hands-on practice and as a take away trainees could actually use later when cleaning up mold in their community. The NIEHS Mold

booklet was included in the mold kit. The NTF developed a student and instructor manual and PowerPoint presentation with interactive video clips to be used for generator hazard awareness training.

The NTF published an interactive “free” Mold 101 app which can be used “right on the spot” offline to help users identify mold and safely clean it up. The Android version is available in Google Play Store, the Apple version is scheduled to be published to iTunes by July 9<sup>th</sup>, 2015, and the web-based version is available at <http://www.thecde.org/mold/v7/>.



*Instructor at a Generator Hazards Awareness Class in New York State (Photo Credit: IUOE National Training Fund)*

## ***Fungal Exposure in NYC Homes Damaged by Hurricane Sandy and Respiratory Outcomes in Asthmatic Children***

***Matthew Perzanowski, Columbia University***

***Maureen Little, New York City Department of Health and Mental Hygiene***

In New York City (NYC), domestic mold contamination has been a public health concern and the most common residential complaint following Hurricane Sandy (HS). Asthmatic children could be particularly susceptible to adverse health effects from fungal exposures following catastrophic water damage. Previous researchers have concluded that mold and dampness are associated with asthma symptoms. However, most evidence is based on report of dampness or visible mold instead of measured fungal exposure. Thus, it is very difficult to: demonstrate that fungal exposure caused the symptoms; identify the fungal species associated with the health outcomes; and show that specific allergic sensitization contributes to developing or triggering asthma. Historically, making these connections was hindered by the methods for assessing mold exposure. Recent polymerase chain reaction methodology advances may allow us to characterize fungal profiles associated with water damage and long-term changes in domestic fungal profiles, and elucidate the association between fungal exposure and poor respiratory health.

This project is testing the hypotheses that NYC homes with HS damage have different fungal species profiles versus non-impacted homes and that domestic fungal concentrations are associated with asthma symptoms, airflow obstruction and airway inflammation among asthmatic children. Participants living in HS-damaged NYC homes were recruited through door-to-door flier distribution, targeted mailing, and schools in affect-

ed neighborhoods. We observed that several fungal species were more common among the HS damaged homes as compared with a cohort of 350 NYC homes not damaged by HS. We are prospectively following 30 homes with fungi measured in three seasons during a year. With these homes, we observed significant decreases in several of the fungi between the 1st and 2nd visit, including two species that were higher in the HS damaged as compared with HS non-damaged homes. We are finalizing enrollment of 60 asthmatic children in HS-damaged homes and comparing them with about 200 asthmatic children in HS non-damaged homes. Following analyses, we expect to provide vital knowledge about domestic fungal exposure and respiratory health effects following catastrophic water damage in an urban environment.



*Ceiling in New York City home flooded by Hurricane Sandy prior to remediation (Photo Credit: Chris D'Andrea)*

## Recovery from Catastrophic Weather: Mold Exposure and Health Related Training

**Paula Schenck, University of Connecticut Health Center**  
**Marc Croteau, University of Connecticut Health Center**

Severe weather, typified by Superstorm Sandy and flooded buildings, brings attention to respiratory health and the threat from indoor mold/bioaerosols. The UCONN research team is working to:

- better understand why some workers and the public haven't prepared well-enough to respond to the health risks associated with mold/bioaerosols, and haven't utilized protective gear and resilient building practices;
- make carefully-vetted technical materials and risk messaging accessible;
- increase health provider awareness of how bioaerosol exposures during hurricane response and recovery activities may affect health;
- explore the feasibility of having information available on personal devices; and
- disseminate education through multiple channels (including using social media and building synergy with Sandy Science Group contractors) to sustain positive outcomes of the program.

UCONN held five focus groups representing emergency response, public health, construction, faith-based outreach workers, and home occupants. Most participants expressed concern over the burden on those most

vulnerable, and were troubled about health effects from mold. Many expressed confusion about accessing and using hurricane preparedness information, including information about gear such as masks, gloves, and clothing.

With consideration of the themes learned through the focus group encounters, UCONN developed a risk communication strategy, a website *Hurricanes: What You Need to Know About Mold/Moisture/Bioaerosols & Human Health* <http://hurricane-weather-health.doem.uconn.edu/>, and has been holding workshops: *Hurricanes and Mold: The health concerns; reducing personal risk; and re-building homes with resiliency*.

Physicians with an understanding of the relationship of health symptoms with exposure to mold/bioaerosols in the indoor environment will appreciate the value to patient care from addressing the environment as part of treatment and prevention of disease progression. UCONN is developing a CME-eligible education program for physicians on *The Nature of Wet-weather Disasters and Health Risk* with guidance on environmental history-taking, treating patients with mold exposure, and determining medical clearance for participation in mold clean-up and for using respirators.



From left to right: View of Hurricane Sandy from space (Photo Credit: NASA/Robert Simmon), Flooded home in New Jersey (Photo Credit: FEMA/Liz Roll), and magnified mold spores (Photo Credit: EPA/John Martyny)

## SESSION III-C: VULNERABLE POPULATIONS IMPACTED BY HURRICANE SANDY

The studies presented in this chapter focus on resilience after Hurricane Sandy in three vulnerable communities: watermen who fish for a living in isolated communities of the Chesapeake Bay, patients enrolled in opioid treatment programs, and residents of high rise public housing in New York City. While specific methodologies varied, information was primarily gathered through interviews, psychometric assessments, and focus groups with people affected by the storm.

Several common findings emerged across the three studies. First is the critical importance of creating an emergency plan and making sure everyone is familiar with it—this was partially or completely lacking in all three communities. Second is that social networks both inside and outside the community had important positive impacts on material support and emotional health. Third is evidence of the capacity of people to respond

with creativity and resilience to solve problems in an emergency.

The studies also demonstrated the diversity of problems regions face post-disaster. The watermen’s community was vulnerable because of physical and social isolation, economic dependence upon coastal eco-systems, and larger scale emergency planning that overlooked them. The drug rehabilitation patients were more vulnerable than their residential neighbors because of their dependence on critical treatment services. The public housing residents benefited from prior emergency planning, but were vulnerable because they were highly concentrated in buildings not designed to withstand storms and power outages. Overall, our findings suggest that careful emergency planning that stresses the use of social networks and identifies specific risks for vulnerable groups can improve our response to climate-related disasters.



*Workers move a boat that was displaced by Hurricane Sandy (Photo Credit: FEMA/Liz Roll)*



## ***Assessing and Strengthening Post-Storm Resilience in NYC High Rise Public Housing***

***David Evans, Columbia University***

During Hurricane Sandy, many of the high rise public housing projects along the shores of Brooklyn, Queens and Staten Island suffered flooding and loss of all power and water, effectively trapping many vulnerable residents on high floors. We are conducting focus groups with residents living in New York City Housing Authority (NYCHA) buildings to learn how people responded to the storm, whether they made efforts to identify and help other residents at risk, how they responded to requests to evacuate, and to assess social cohesion within the building. We will analyze the results to contrast buildings that showed differing levels of resilience in coping with Sandy. We will use the findings to develop and pilot test training tools that NYCDOHMH and NYCHA can use to better prepare residents to respond

to disasters. We are conducting the focus groups with approximately 100 residents from 10 public housing buildings in three communities that were severely affected by Sandy: Red Hook, Coney Island and Far Rockaway. Partial results from our focus groups suggest that cohesion and resilience during the storm was good, but that emergency preparation by residents was poor both then and now. The primary helpers during the storm were neighbors in the building, but there was substantial support from local community groups. Residents were frustrated at the slow pace of recovery assistance after the storm. Finally, there were significant differences between buildings in readiness to evacuate and residents' perception of response by NYCHA and first responders.

*"I didn't want to go to an evacuation shelter with cots, dogs and people with mental health issues. And people come around, trying doorknobs to see if they can get into your place. Mrs. Jones, our Resident Association president, stayed, so we decided to stay too."*

*– High-Rise Focus Group Participant*



*Temporary shelter for Hurricane Sandy survivors (Photo Credit: FEMA/Patsy Lynch)*

## *Modeling the Interplay of Individual and Community Resilience for Recovery from Hurricane Sandy*

**Lynn Grattan, University of Maryland School of Medicine**  
**Brian Mayer, University of Arizona**

Maryland watermen are commercial fishers, crabbers and harvesters of the Chesapeake Bay. Representing a distinctive, but fading subculture, watermen are challenged by geographic isolation from major population centers, environmental pollution, increased regulatory activity, and marketplace competition with imported fish. After Hurricane Sandy, watermen were further burdened with home and property damage and their livelihoods were shattered as boats and equipment were destroyed or damaged and the ecology of the Chesapeake Bay was spoiled.

This study investigated the connection between the psychological states of watermen and their social networks as they make their way through storm recovery. We studied 200 watermen (and women) using a variety of measures of psychological status including self-reported resilience: that is, did they see themselves as capable of withstanding and overcoming a high level of stress. We also conducted extensive social network surveys – asking people to identify friends and provide information about their friends including whether or not that person could be counted on for emotional, financial, or material support. Results indicated that self-reported resilience was consistently associated

*“It seems like I can’t get it started again. I lost boats, gear and product. I am really struggling.”*

*– A Maryland Waterman*

with better mental health outcomes and overall quality of life. This finding was significantly strengthened by having lots of supportive people in their social networks. Specifically, having friends who live outside of the region, were able to provide reliable information about where to get help, or could help with a financial or equipment loan led to better outcomes.

To help watermen and their community absorb the destructive forces of hurricane disaster intervention efforts should support their determination and problem solving skills; activate networks of out of town friends; and provide practical information as well as bridging financial support and equipment to get the watermen back to work.



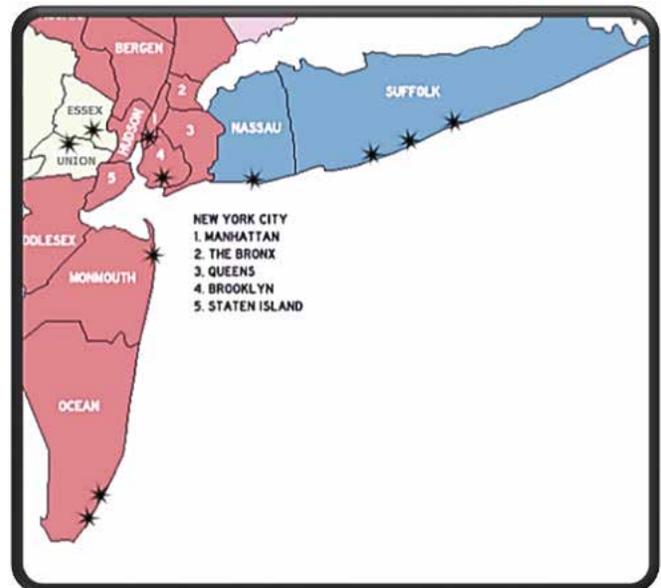
*Locations of the four Maryland counties included in the study*

## Challenges to Opioid Treatment Programs After Hurricane Sandy

**Andrew Rosenblum, National Development and Research Institutes, Inc.**

Our project uses mixed methods to identify knowledge gaps that affected Opioid Treatment Program (OTP) preparedness and response to Hurricane Sandy. The results of our study will be used to develop a set of priorities for future OTP disaster planning. We recruited 9 Sandy-affected OTPs from NY and NJ, most of which submitted emergency manuals for review. Additionally, to gather data about all patients who were in treatment at the time of the storm – including those no longer in treatment – we recruited one community center in Brooklyn and one in Newark that provide syringe exchange in their communities. We collected data from 82 patients through focus groups, from 74 OTP staff members through written surveys, and from OTP Directors and State Opioid Treatment Authorities through in-person interviews. We found that emergency protocols vary in scope and specificity; patients at 4 of 9 OTPs did not know emergency plans were in place. While most eligible patients received take-home medication, doses in many cases were insufficient. Lack of transportation created a serious impediment to treatment. Although most OTPs remained open, many patients had no ability to travel and over half of the

OTPs do not address transportation in their emergency manuals. Communication between patients and counselors was compromised by the storm, and in some cases patients expended great effort to reach an OTP that was closed. Additionally, state and local authorities did not always coordinate services to ensure treatment access. We are in the process of drafting policy recommendations to improve OTP preparedness for future emergencies.



Locations of the nine participating OTP sites in N.Y. and N.J.

“They had already stopped bringing people over here, so I was looking to buy methadone on the streets – I mean it’s just, the pain overwhelmed me, of withdrawing from the methadone so I had no choice, but you know – well, I made the choice to actually buy heroin.”

– Interviewee (Site 5)