Master's Thesis

Improving Disaster Preparedness in NYC through Widespread Education

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Abstract:

The New York City Office of Emergency Management (NYC OEM) cites the following natural events as hazards to the NYC area: hurricanes and coastal storms, earthquakes, extreme heat, flooding and winter weather. In addition, there are other unnatural events (i.e. terrorist threats, radiation, fires) that pose hazards to the safety of the general public. Since the turn of the century, there have been a handful of major natural and unnatural disasters that have impacted NYC, and the public’s response reflected a lack of intuitive knowledge of how to react appropriately.

The purpose of this paper is to determine if the outreach programs offered by disaster planning organizations in NYC can be improved upon to increase widespread education in emergency preparedness. It will focus on what steps are taken in preparation for large-scale disasters that are, by FEMA’s definition, “low probability - high consequence events,” particularly in consideration of predicted population growth rates and the impending threat of climate change. Finally it will reflect on the challenges this poses for urban planners working in NYC and what contributions they can make for a safer and more sustainable future.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABBREVIATIONS</td>
<td>4</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>5</td>
</tr>
<tr>
<td>BACKGROUND</td>
<td>6</td>
</tr>
<tr>
<td>CHALLENGES FOR URBAN PLANNERS</td>
<td>12</td>
</tr>
<tr>
<td>LITERATURE REVIEW</td>
<td>17</td>
</tr>
<tr>
<td>INSTITUTIONAL HISTORY OF EMERGENCY MANAGEMENT</td>
<td>23</td>
</tr>
<tr>
<td>RESEARCH DESIGN</td>
<td>28</td>
</tr>
<tr>
<td>FINDINGS FROM INTERVIEWS</td>
<td>30</td>
</tr>
<tr>
<td>FINDINGS FROM SURVEYS</td>
<td>37</td>
</tr>
<tr>
<td>CONCLUSION AND RECOMMENDATIONS</td>
<td>42</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>52</td>
</tr>
<tr>
<td>APPENDIX A</td>
<td></td>
</tr>
<tr>
<td>APPENDIX B</td>
<td></td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>ABBREVIATIONS:</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARC</td>
<td>American Red Cross</td>
</tr>
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<td>CCC</td>
<td>Citizens Corps Council</td>
</tr>
<tr>
<td>CERT</td>
<td>Community Emergency Response Team</td>
</tr>
<tr>
<td>COOP</td>
<td>Continuity of Operations Planning</td>
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<td>DCAS</td>
<td>Department of Citywide Administrative Services</td>
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<td>DOITT</td>
<td>Department of Information Technology and Telecommunications</td>
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<td>FEMA</td>
<td>Federal Emergency Management Agency</td>
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<td>ICT</td>
<td>Information and Communications Technology</td>
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<td>LEED</td>
<td>Leadership in Energy and Environmental Design</td>
</tr>
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<td>NCCC</td>
<td>National Civilian Community Corps</td>
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<tr>
<td>NHMP</td>
<td>Natural Hazards Mitigation Plan</td>
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<td>NYC EDC</td>
<td>New York City Economic Development Corporation</td>
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<td>NYC OEM</td>
<td>New York City Office of Emergency Management</td>
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<td>USGBC</td>
<td>US Green Building Council</td>
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<td>WTC</td>
<td>World Trade Center</td>
</tr>
</tbody>
</table>
INTRODUCTION

It is understandable that people have a panicked reaction when unexpected events occur, but in New York City (NYC) there is a heavy reliance on emergency responders for even minor events and people seem to lack the initiative to plan for the unexpected and the intuition to respond appropriately when emergencies happen. Complacency replaces active disaster preparedness when there are long time lapses between major events and presents a challenge for emergency management agencies. This research paper will offer a comparative analysis of the outreach efforts that have been put forth by disaster planners in NYC and the actual level of education and preparedness of citizens. It aims to shed light on where there are discrepancies and cite reasons why it is problematic for effective city-wide emergency planning. Primarily, the paper seeks to answer the question: How effectively do emergency management organizations in NYC educate and prepare individuals for disasters?

There are many existing outreach programs in place, and the purpose is to determine if there are gaps in the trickle-down effect of information-sharing from emergency responders to community groups to individuals. The role of information and communications technology (ICT) and social media will also be considered to discover how it has influenced education campaigns and how these tools can be used to further improve communication between emergency planning agencies and communities.

This paper will first present a historical analysis of natural hazards that have threatened the NYC area over the past few centuries and how population and development growth have increased the complexity of preparedness planning. It will discuss the evolution of government strategies and policies in regard to these complexities, in addition to how certain catastrophic events shaped changes within this structure. Through interviews with organizations, and surveys of individuals living and working in hazard-prone areas of NYC, information will be
presented on how preparedness at all levels occurs and how well it reflects large-scale initiatives of the City. After identifying gaps in communication and information, a list of recommendations will be presented for how to bridge the gap between high-level and community-level planning.

BACKGROUND

NYC does not regularly experience major natural disasters, so it is understandable that the average New Yorker may not consider it a physically vulnerable place and therefore does not pay much attention to preparedness efforts put forth by planning agencies. However, maps depicting coastal storm tracks, flood zones and earthquake fault lines around NYC reflect similar physical vulnerabilities as other cities famous for their experience with natural disasters (Appendix A, Figures 1 and 2).

NYC is the most densely populated major city in the U.S. with over eight million people in just over 300 square miles\(^1\), which greatly increases the complexity in the planning process to handle emergencies. Over the past half-century, sprawl into the outer boroughs and major investments in new development contributed to such a rapid increase in population density. In the past, though, people were not as physically vulnerable as they are today for two primary reasons: 1) people now inhabit the coastal zones more densely, and 2) the city is structurally built out much more than it was a century ago.

Natural events that impact the NYC region regularly include extreme heat in the summer and snowstorms in the winter. While these present their own challenges, the city has been exposed to these events much more frequently than hurricanes or earthquakes. With the

\(^1\)Source: US Census
complexity of NYC’s utilities, public transportation systems and growing population, emergency management plans for both regular and infrequent events must continually be updated to ensure efficient responses in an ever-changing city.

**Hydrologic Events and Climate Change**

Tropical storms that affect the east coast of the United States form off the west coast of Africa in the Atlantic Ocean, and as they spin in a westward direction along the equator, they frequently become hurricanes during warmer climate seasons. The Earth’s rotation creates the Coriolis Effect\(^2\), which forces the storm to curve in a northeasterly direction, putting the Caribbean and the east coast of the U.S directly in its path. Although hurricanes seem to batter states in the southern half of the country more frequently, NYC is right in line with typical hurricane tracks and is therefore also at risk of experiencing them periodically. (Appendix A, Figure 3).

The five boroughs of NYC have a total of approximately 520 miles of coastline\(^3\), over half of which is open space used by the general public and which attracts millions of tourists annually. Though the coastline offers many economic development opportunities, the location and geography of NYC make it particularly vulnerable to high winds, flooding and hurricanes. Recent waterfront development initiatives by the City are creating a challenge for emergency planners as more people are being encouraged to inhabit the coasts, with flood insurance packages providing a sense of security for them.

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\(^2\) The Coriolis effect results from earth’s rotation causing freely moving objects to veer toward the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

\(^3\) Source: Vision 2020: NYC Comprehensive Waterfront Plan
The last major hurricane to make a direct hit on NYC was a Category 3 storm in 1938, named the “Long Island Express,” that killed approximately 700 people and produced storm surges of 25-35 feet\(^4\). Although hurricanes are relatively rare occurrences, they do have a history in the region and must not be overlooked as NYC continues to develop its coastal areas. There have been at least three tropical storms over the past century (in 1972, 1999 and 2011) that made landfall in NYC, causing property damages and fatalities. The U.S. Government estimates that if a Category 3 storm such as the Long Island Express hit NYC today it would cause $40 billion in damage\(^5\).

When a hurricane does strike the NYC area directly, the water surge can be increased significantly because of the geographic nature of the coastlines of New York City and New Jersey. Their positions in the Atlantic Ocean form a right angle, named the New York Bight\(^6\), which could direct the hurricane and its associated storm surges right into the bays of the Hudson River just south of lower Manhattan, where vulnerability to flooding is already very high (Appendix A, Figure 4).

In 2010 researchers for the Intergovernmental Panel on Climate Change (IPCC) ran thousands of storm simulations within a 125 mile radius of lower Manhattan to more accurately predict the impact of sea level rise on storm surges. They found that a high intensity storm moving close to NYC would produce a surge of over 15 feet at the Battery, and that because of the Bight, even a weak storm moving farther from the coast could produce flood elevations of around 15 feet within the City. A 1995 study by NASA showed that a Category 3 hurricane could create surges of over 20 feet at JFK Airport, the Lincoln Tunnel entrance and at the Battery, as well as a 16 foot surge at La Guardia Airport\(^7\) (Appendix A, Figure 5). If the planet continues to

\(^6\) OEM Coastal Storm Plan
get warmer as scientists predict it will with climate change, the world is likely to experience less frequent but more intense storms and heavier rains\(^8\) which will only exacerbate the storm surges.

Predicting which parts of the City will be most vulnerable to flooding and storm surges is very challenging for disaster planners because there has been insufficient elevation data in the past that limited the accuracy of flooding predictions. Using new technology (light detection and ranging) more recently, the City has acquired more precise land and building elevations, which has greatly improved its ability to assess risk and propose accurate mitigation plans. Much of lower Manhattan (and the surrounding area) is less than 16 feet above mean sea level (MSL) with seawall protection at only five feet above MSL\(^9\). With recorded storm surges in NYC coastal regions of up to 30 feet, the existing seawalls are insufficient barriers to protect people and property from major flooding.

The Coastal Storm Plan\(^10\), the City’s plan for hurricane response, was released in 2000 by the NYC Office of Emergency Management (OEM) and was last revised in 2007. The response and recovery efforts after Hurricane Katrina battered New Orleans brought new challenges (and lessons learned) to light that NYC incorporated into its revised plan, such as evacuation plans for the special needs population and for pets. OEM estimates that a strong hurricane could require the evacuation of up to 3 million New Yorkers and sheltering of over half a million\(^11\). The Coastal Storm Plan provides a roadmap to help residents evacuate flood zones or find shelter, disseminate information, get help to those with special needs, and guide the City in its response and recovery efforts.

\(^8\) Nature Geoscience | VOL 3 | MARCH 2010 | www.nature.com/naturegeoscience
\(^9\) Source: American Meteorological Society (June, 2008)
\(^11\) Source: Vision 2020: NYC Comprehensive Waterfront Plan
In preparation for coastal storms, the NYC OEM also developed a *Natural Hazard Mitigation Plan* (NHMP) in 2009 to improve the City’s resilience to erosion, flooding and other threats posed by a major storm. The NHMP is updated every five years and involves the cooperation of dozens of city, state and federal partners, as well and businesses in both the private and public sector. In addition to plans for physical resilience (i.e. upgraded infrastructure or maintained seawalls), it lays out plans to acquire federal funds for mitigation.

**Earthquakes**

There are at least eight fault lines that lie in relatively shallow locations under Manhattan and deeper ones in the outer boroughs. It is not surprising that the average New Yorker isn’t prepared for an earthquake and/or doesn’t know how to act in response to one, since they are not regarded by most as a threat to this region. But history and geology tell a different story that earthquakes can and do occur in the NYC metropolitan area. As urban development has grown so rapidly in the last century, planning for earthquakes has been largely overlooked.

Even though earthquakes do not present a common threat to the NYC area, there were at least three significant ones (magnitude M 5.0 or higher) that caused minor damage between 1737 and 1884. In those years though, there were so few settlements and no skyscrapers that damage was limited to some crumbled chimneys and fallen bricks from building exteriors. Since 1884, the landscape of NYC has changed so much it isn’t comparable when considering how an earthquake of M 5.0 would affect the city today. It’s debatable whether a M 6 or 7 earthquake could ever strike, but since the region has already experienced at least three M 5.0 events, it is realistic that stronger ones could occur. “There is no one alive now to remember that last one, so people tend to forget. And having only a partial 300-year history, we may not have seen

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12 Source: Earth Institute, Columbia University
everything we could see. There could be surprises—things bigger than we have ever seen” (Armbruster, 2008).

Earthquake recurrence intervals vary greatly, as earthquakes of comparable magnitude can occur anywhere from every few years to every 1,500 years. The unpredictability of earthquakes and insufficient information to analyze recurrence intervals make planning for these events near impossible. In NYC a M 5.0 magnitude quake could be anticipated at least once every 100 years, and because of its urban density, FEMA places NYC in its top 40 list of U.S. cities most at-risk for earthquake damage13. Population density is around 27,000 persons per square mile14, and skyscrapers no longer dot the landscape, but define it. As a result, seismic risk in NYC has grown substantially and faces risks comparable to those of cities more physically vulnerable to earthquake events.

In actuality it isn’t the occurrence of an earthquake itself that presents a threat in NYC, but it would be collapsed buildings and unreinforced infrastructure that weren’t built to handle the stresses of an earthquake’s energy that cause the greatest loss of life and property. Regulatory codes that require earthquake-resistant construction have only been in place since 199515, so over half of Manhattan’s buildings are not equipped to withstand the forces of a significant event. NYC still has thousands of old, Victorian-era brownstones and unreinforced tall buildings, so the threat of collapse is very real in even a minor rumble. Even if buildings don’t fully collapse, high rise buildings could shower dangerous debris (bricks, glass, etc.) onto the streets, posing an additional hazard for pedestrians, cyclists and vehicle occupants.

Another physical hazard is the amount of old, hard rock (Manhattan bedrock) underneath the City’s surface layers that could transmit the energy of an earthquake over long

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13 Source: FEMA
14 Source: US Census
distances\textsuperscript{16} and therefore cause more damage than expected. Iconic buildings such as the Empire State Building and the World Trade Center (WTC) towers were set in bedrock when they were constructed, but a considerable number of high rise buildings were grounded in softer soils that could liquefy under the stress of an earthquake and cause a building collapse.

Lastly, the Indian Point nuclear power plant is located just 24 miles north of NYC (Appendix A, Figure 6) near intersections of recently identified, seismically active areas that could pose a nuclear threat in the event of an earthquake. What is most unsettling though is the lack of public knowledge of the natural hazard of earthquakes in NYC and more importantly, how to respond should one ever occur. Regular drills and widespread education campaigns have saved millions of lives in earthquake-prone regions of the world, and it should be part of preparedness campaigns in NYC as well.

**CHALLENGES FOR URBAN PLANNERS**

*People are flocking to the waterfront*

Since 1992, NYC planners have been promoting new development on the waterfront which has resulted in over 20,000 new residential waterfront units, 1 million new residents, 70 rezonings and approximately 3,000 acres of land affected\textsuperscript{17}. The current waterfront development plan is the *Vision 2020: NYC Comprehensive Waterfront Plan*, which encourages residential and economic development on the waterfront, in addition to policy changes to support developments and improved resilience to natural disasters and climate change. As active members in the development process, planners must be aware of what the appropriate mitigation actions are to ensure public safety in the event of a natural disaster.

\textsuperscript{16}Source: Earth Institute, Columbia University

\textsuperscript{17}Source: Vision 2020: NYC Comprehensive Waterfront Plan
Thousands of these residents and businesses who sought the luxury of waterfront property are located within the 100-year flood plain. This means that areas within this boundary have a 1% annual probability of experiencing inundation due to water levels exceeding the base flood elevation\textsuperscript{18}. Specifically, this translates to an approximate storm surge of 5.7 feet above mean tide level that would occur once a century. 500-year floods zones are areas in which a storm surge of approximately 9 feet would occur once every 500 years, or having an annual probability of 0.2 percent. Unfortunately these elevations must be updated as climate change poses new threats to NYC. Planners must educate themselves accordingly since existing barriers intended to improve public safety are no longer adequate, particularly for waterfront properties. With climatologists’ predictions of annual increases in water levels around the city, planning for development on the coastlines would require knowledge of safe heights for protective barriers.

The Federal Emergency Management Agency (FEMA) determines official geographic boundaries for areas at risk of experiencing flooding in the event of different storm events, such as the 100-year and 500-year storms. FEMA’s Flood Insurance Rate Maps (FIRM) delineate these boundaries which are used as the basis for the National Flood Insurance Program. In NYC there are over 215,000 residents and 185,000 jobs located within the 100-year flood zone and over 475,000 residents and 290,000 jobs within the 500-year flood zone\textsuperscript{19}.

Simulation models for NYC have shown that 100-year flooding could begin to recur every 3-20 years, and 500-year flooding every 25-240 years\textsuperscript{20}. At the moment Manhattan’s seawalls are approximately 5 feet high, which will fall short of protecting residents and property should any of the predicted storm surge levels occur. Planning for more frequent and larger

\textsuperscript{18} Base Flood Elevation is the minimum water elevation at which flooding will occur
\textsuperscript{19} Source: Vision 2020: NYC Comprehensive Waterfront Plan
\textsuperscript{20} Lin, N., Emmanuel, K., Oppenheimer, M., &Vanmarcke, E. (2012).Physically based assessment of hurricane surge threat under climate change.\textit{Nature Climate Change}(2012), Published online 14 February 2012.
hydrologic events based on climate change projections may prove costly in design and maintenance, but could save numerous lives and prevent economic loss in the long run. Seawall maintenance is already a continuous process that involves funding, permits and skilled laborers for repairs. Infrastructure on the waterfront is constantly exposed to many extremes and incurs a lot of damage, which will only get worse with climate change.

In 2007, Mayor Bloomberg released PlaNYC\textsuperscript{21}, a document that established goals for a more sustainable city by 2030 in consideration of climate change, population increases and economic growth. Part of this effort includes preparations for a population increase of approximately 1 million people\textsuperscript{22}, including affordable housing and the appropriate infrastructure to accommodate them. As urban planners participate in the implementation of this ambitious plan, it is important to ensure development is proposed in safe areas, and that developments incorporate mitigation measures (e.g. earthquake-resistant construction and sufficient seawall barriers).

**The Changing Face of Communication**

Organized responses to disasters have been inherent within families, communities, organizations, cities, and countries for many centuries. Survival skills that were learned through experience with natural and man-made events have been developed as human beings evolved and societies transformed. However, traditional disaster planning at the community scale is no longer the norm since governments formalized the disaster planning process in a system that primarily involves civil servants. What used to be knowledge passed on between generations is relatively lost as reliance on the disaster planning capacity of the public sector has taken its place.

\textsuperscript{21} PlaNYC website: http://www.nyc.gov/html/planyc2030/html/about/about.shtml
\textsuperscript{22} The increase is based on population projections calculated by NYC Department of City Planning. Total projection is 9.1 million people in 2030, based on US Census data in 2000 and 2005.
place. This shift from localized planning to government-level planning has left a large gap in awareness and education amongst individuals. The additional shift in communication between people from face-to-face to the virtual presents both challenges and opportunities for planners.

How people communicate has changed drastically over the past ten to fifteen years with the introduction of numerous types of technology into our everyday lives. Computers and cell phones are rapidly becoming the primary means by which people communicate with each other in today’s world. Although this has increased connectivity locally and globally, the inclusion of more vulnerable populations (e.g. elderly and lower income residents) who rely on their social capital23 to gather information may be overlooked. It is no longer necessary to interact with another human being to find out information, and this must be considered when thinking about the most effective means of spreading emergency preparedness information to the general public. The way in which people are informed during and immediately after major disasters is now a constantly changing variable in disaster planning as new technologies are regularly introduced to the market.

**NYC Case Studies**

As if to test the preparedness of NYC’s emergency responders, three rare and major natural events occurred within just two months in 2011. Hurricane Irene made landfall in August in NYC and the surrounding area, causing major flooding, downed trees, power outages and a handful of deaths. Just one week later, a M 5.8 earthquake whose epicenter was in Virginia rocked the city and caused a widespread chaotic response for a small part of the day but no

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23 Social capital in this sense refers to family, friends, neighbors and anyone else the elderly rely on to receive information or to reach out to when help is needed.
damages. In October, 2011, an unseasonal snowstorm battered NYC, which also caused power outages and downed trees.

The amount of advanced warning people had to prepare for these three occurrences ranged from none at all to a few days, and the public response to each event was very different. Since Hurricane Irene arrived after days of advanced warning, people had adequate time to stock up on emergency supplies or evacuate if necessary. Although the snowstorm arrived unusually early in the year, it was forecast at least a few days in advance and is a hazard to which people in NYC have a relatively intuitive response.

On the other hand, the earthquake that shook NYC mid-day in August 2011 caused no loss of life or serious property damage, but the response of New Yorkers told a clear story about the preparedness of its citizens for this type of event. Social media sites were flooded with panicked users, cell phone networks were jammed, and streets were packed with self-evacuated employees. According to FEMA, the most appropriate response during an earthquake is to “drop, cover and hold on”\(^{24}\). They also recommend staying indoors if people are already there and to move away from buildings, which was not the reaction of New Yorkers. People who fled outdoors for safety reasons were actually making themselves more vulnerable had glass or bricks fallen off building exteriors\(^{25}\).

This indicates a weakness in education regarding disaster preparedness for earthquakes (in this case), which could be improved upon by planners. It is impractical to suggest the average person will know what to do in every possible situation, but it is not unrealistic to expect that people will have a general idea of how to respond and who to connect with during emergencies. To achieve this goal, planning must occur at all levels of society in order to have an informed and prepared community when unexpected events present themselves.

\(^{24}\) Source: Ready.gov website: http://www.ready.gov/earthquakes

\(^{25}\) Source: New York Times
LITERATURE REVIEW

This literature review focused on some general theories about the complex nature of disaster planning, as well as challenges faced by planners and other people working in this field. Since the objective of this thesis is to research improvements to widespread education in NYC, this review also presents insight into how and why a well-educated and prepared public reduces complacency and increases resilience of a population.

Kirschenbaum (2004) provides an historical analysis of how people have shifted from planning for disasters as families and communities to relying on governments to plan for disaster mitigation, response and recovery. In his research, Kirschenbaum highlights the gap in perception of the threat of disasters between emergency management organizations and potential victims. He encourages more community-level planning and better education campaigns as key factors in closing that gap and provides supporting evidence as to why planning agencies are failing to respond appropriately when unexpected disasters strike. Regardless of the inherent knowledge of a local community, public officials may not design efficient disaster plans until after a disaster strikes and often take a reactive planning approach instead of a proactive one.

Kiel (1995) of the University of Texas presents an in-depth analysis of how people respond during chaotic times with emphasis on the mathematical breakdown of linear versus non-linear dynamics. Disasters are generally non-linear situations, meaning that it is difficult to predict the magnitude of an event and its impact on society. If each disaster were the same, it would be relatively easy to anticipate the necessary capacity for a certain type of event, but that is rarely, if ever, the reality of an emergency. Therefore, it is almost impossible to plan accurately for the number of emergency responders who will be needed, among other management complexities.
The delivery of emergency response services is often comprised of many people trying to do what they normally do, but with more efficiency and speed, and in an environment that is unfamiliar to them. Tierney (1985) of the California Seismic Safety Commission cites that the biggest challenges for responders are the unpredictability and infrequency of disasters. With daily emergencies occupying the time of emergency responders, practicing responses to major catastrophes is less of a priority and therefore not as routine. Given these circumstances it is understandable that during disasters there is often a lack of intuitive response by both responders and the general public, who are attempting to react in ways that may seem counter-intuitive to training for everyday emergencies.

“Chaos theory” is a term used by mathematicians to describe systems that are unpredictable because they are highly sensitive to minor deviations in conditions. This theory has unraveled a new understanding of human dynamics and the part they play in disaster planning. Disasters do not happen every day and inherently create a chaotic situation, so understanding the logic behind the types of responses people have is helpful in thinking of ways in which the chaos can be better managed. In everyday work of medical professionals and emergency responders (i.e. police), there is a level of predictability in how to treat people or respond to their needs for frequent emergencies such as car accidents or house fires. However, when a large-scale disaster strikes it disrupts this predictability because the scope of its impact is an unknown variable.

Similarly, Drabek (1985) of the University of Denver discusses the differences in institutional structure as demands vary greatly between daily emergencies and uncommon disasters. He specifies challenges in emergence response that apply within America, which

include “localism, lack of standardization, unit diversity and fragmentation27.” In this country there typically isn’t a centralized authority responsible for all emergency preparedness and response. For example, schools, hospitals, and (at a larger scale) cities each has its own plan for emergencies. Despite the coordination that occurs at a higher level of government, there is fragmentation among those bodies that is a potentially grave problem, especially during the immediate disaster response phase. As a public good, safety is ultimately the responsibility of the local government, where politics often impact the quality of localized structuring of emergency responses.

Kapucu (2005) of the University of Central Florida studied the evolution of disaster management networks in NYC in response to the World Trade Center (WTC) attacks in 2001. He explores the dynamics of inter-organizational collaboration when extreme events occur and emphasizes the value of strong networks in preparation for future events28. In the aftermath of 9/11 it was evident that, while collaboration was an obvious strength during the response, there were patterns that highlighted certain subtleties in the existing communication network. Cross-sectoral collaboration seemed weak in comparison to intra-sector collaboration. For instance, public sector organizations worked together closely and easily with other public agencies, as did private sector companies with each other and non-profit organizations with each other. FEMA and the NYC Office of Emergency Management were central actors in the coordination efforts, but many of their partners (in private and non-profit sectors) were not collaborating as easily amongst themselves. This presents a challenge when agencies might need to share resources but must go through those central actors to make connections. The extra step may result in lost time or unused assets in a situation where neither can afford to be lost.

27 Source: University of Denver, Thomas Drabek (1985)
28 Kapucu, N. (2005), Interorganizational Coordination in Dynamic Context: Networks in Emergency Response Management. University of Central Florida
The notion of trust comes into play when extreme events occur because collaborators must rely on their partners for support. Kapucu argues that linkages and trust need to be fostered between emergency management agencies for there to be successful collaborations in planning for the future. He encourages governments to provide incentives for improved information-sharing between public, private and non-profit organizations. He states that by encouraging ongoing collaboration there will be more trust between them that will lead to improved collaborative efforts during the response and recovery phases of a disaster. Lastly, the integration of resources can be more easily managed when all actors share a common operational understanding during a response.

Moynihan of the University of Wisconsin – Madison (2005) also presents strong evidence in favor of network strengthening and the need for collaborative efforts between multiple organizations in preparation for disasters. He researched how organizations can remain effective for infrequent emergency scenarios. He argues that strong networks provide a certain flexibility to handle disasters and the challenges that are presented that are beyond the capabilities of any single organization (Moynihan, 2005). He highlights how in the aftermath of 9/11 homeland security has stressed the importance of strong networks so that clearer instructions and carrying out of commands can be efficient in future emergency situations.

By using collaborative networks more effectively, Moynihan cites four success factors that explain how multilateral agencies were able to “coordinate their activities” and “act decisively29” in response to an unexpected disease outbreak among poultry livestock in California in 2002-2003. These four factors are: 1) creating trust and mediating its importance; 2) using and adapting the Incident Command System; 3) learning and communicating basic procedures; and 4) making use of innovative technology (Moynihan, 2005). These factors align

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with Kapucu’s ideas about why collaboration and networks are so important, and how regular inter-agency coordination heightens the level of preparedness of a city for unexpected and/or infrequent events.

In the months following 9/11, the complexity of the organized recovery was impressive, particularly where resource-sharing was efficient. Evacuations were orderly, which could be attributed to years of training and heightened awareness of the WTC towers’ tenants (Kapucu, 2005). Since the 1993 bombing, the threat of terrorism was much more real for those living and working in and near the towers. So for the most part, there were relatively calm and organized responses by both tenants and responders. Fortunately complacency wasn’t too great of a problem for those who had considered what to do should another attack occur.

Redlener (2006) of Columbia University has done extensive research on why Americans in particular aren’t prepared for the next big disaster and describes the problem of complacency of the average citizen. He states that one of the most misunderstood challenges of disaster planning is how to effectively engage citizens in the process. People are overly dependent on public safety officials when an emergency happens because they are resistant to preparing individually, despite warnings and easy access to information and resources. He states that even in the 1950’s and 1960’s when people were strongly advised to construct bomb shelters in preparation for unexpected acts of war, very few heeded those warnings and did anything in preparation.

In NYC in particular, Redlener comments on how New Yorkers rarely follow guidelines on how to be prepared for major disasters. It isn’t until an event as dramatic and unexpected (such as 9/11) shocks people into action that they will generally prepare emergency kits and take other actions that should be part of regular disaster preparedness. Unfortunately it isn’t

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30 Kaplan, M. (2010). Why Americans aren’t prepared for the next mega-disaster. Smart planet
long before complacency replaces interest in individual preparedness. He claims that even though the government does launch major education campaigns, such as Ready New York, the amount of information disseminated to prepare for every type of disaster is overwhelming. It turns people off and questions whether or not inundating the public with information for all-hazard preparations is the right approach. In addition to information overload, there is the question of social inequalities and the fact that “being prepared” could present an economic burden for a poor family.

In trying to understand what it even means to “be prepared,” another challenge is that there is no one definition. Should people be prepared for every type of emergency that could ever happen? Is someone prepared when three days’ worth of food and water have been stockpiled? It is impossible to answer yes or no to these questions, which makes it challenging for planners to improve the public’s level of preparedness. Without having specific costs and parameters tied to the notion of “being prepared,” it is challenging to keep people interested and engaged in the process.

Redlener connects some of the problems of complacency in America with American culture, too. Since we no longer invest in mega-projects for long-term gains (i.e. national highway systems and other infrastructure projects), we are no longer a culture that invests in and plans for the future on such a large scale. And on a more individual level, nobody wants to think about or invest in disaster preparedness if it disrupts their lives in any way. He uses the example of wearing a seatbelt to emphasize his point, in that today we automatically put on our seatbelts when we enter vehicles. This was not the case before tens of thousands of people died in car accidents to the point that it is no longer an inconvenience but a heightened awareness of the dangers of not wearing one. The fact that major disasters are rare occurrences has the unfortunate effect on people’s willingness to heed preparation guidelines for the exact same reason. If it is not an immediate concern, people don’t feel the need to invest
in mitigation strategies and prefer to focus on more pressing problems in society, such as high unemployment rates or health care costs.

In the U.S., complicated political structure and a heavy reliance on government (by citizens) to respond when emergencies occur have generally lessened the public's willingness to play a role in disaster preparedness. No matter how prepared we are for disasters institutionally, this does compromise the resiliency of a country. In Israel, England and Spain for example, there is a much higher level of citizen engagement in the planning process, which increases their capacity to respond to and recover from emergencies very quickly. Our country has much more geographically-specific disaster mitigation plans. Miami is much more prepared for hurricanes than most hurricane-prone cities in the country, and San Francisco is one of the more prepared earthquake-prone cities. Even with an extraordinary police force and emergency management team in NYC though, citizen engagement and awareness is not very high, which increases its vulnerability to both natural and man-made hazards.

INSTITUTIONAL HISTORY OF EMERGENCY MANAGEMENT

Legislation for emergency management in the United States can be traced back to the early 1800’s, when a town in New Hampshire needed assistance responding to, and recovering from a major fire. From that point on, laws were enacted as needed in response to other natural disasters throughout the country. It wasn’t until the 1930’s when the Federal government became increasingly involved in trouble-shooting major problems in the nation, that more formalized teams of personnel to handle disaster planning and response were created. By the middle of the 20th Century, America continued to grow in size and population, and development
was rapidly changing its landscape. Natural disasters struck many times during this period, and in response, local, state and federal agencies created government agencies that operated independently of each other to manage the relief efforts. In addition, hazardous material transport, nuclear power plants, wars and other unnatural sources of potential disasters posed new threats and spawned another layer of emergency planning that complicated an already complex web.

In the 1960’s and 1970’s, legislation such as the National Flood Insurance Act (1968) and Disaster Relief Act (1974) represented the changing mentality towards disaster preparedness and response. Homeowners were encouraged to purchase flood insurance, which instilled a sense of safety to, at a minimum, one’s property during hydrologic events. The President was granted authority to declare certain local disasters as national emergencies, which would free up funds and other resources to respond to events. Gradually, the state and federal bodies were officially being given the responsibility of disaster planning and management, and the burden was more or less taken off localities and individuals.

In an effort to centralize the efforts of these many agencies, the Federal Emergency Management Agency (FEMA) was born in 1979, and preparedness for both natural disasters and civil defense came under their control. In 1988 the Robert T. Stafford Disaster Relief and Emergency Assistance Act was signed into law to amend the 1974 Disaster Relief Act. Its main purpose was to encourage a more orderly and properly coordinated response to a disaster by the federal government to assist state and local governments in providing the quickest most efficient help to citizens. This amendment allowed financial and physical assistance by FEMA to be available to an affected region when a president declares a disaster.

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31 Source: FEMA
Today there are almost 7,500 staff members\(^\text{32}\) of FEMA who provide planning and recovery assistance for the entire country of over 311 million people.\(^\text{33}\) Throughout its existence, partnerships with local public agencies and non-profit groups have encouraged more centralized planning at the local level. Reliance on outreach using local networks has become a more realistic approach to effective disaster planning. In fact in March 2012, FEMA introduced a partnership that was established with the Corporation for National and Community Services (CNCS) to increase its capability at a more local level and to increase the reliability and diversity of people working in disaster management. The partnership created a unit of FEMA comprised of 1,600 members of the AmeriCorps National Civilian Community Corps (NCCC)\(^\text{34}\), volunteers aged 18-24 who operate within the federal agency who devote their service to disaster preparedness, response and recovery.

New York City (NYC) experienced a similar evolution of disaster planning development at the city level, which stemmed from World War II. A civil defense office was established in the 1940’s and 1950’s to prepare the city for threats of war, particularly atomic attacks. The agencies that grew out of this initial attempt at planning for disasters were expanded to include fire, police, transportation and health experts. As threats of war faded, the emergency services agencies evolved to include civil preparedness for all types of disasters – natural and unnatural – that could strike the area. In 1984, the Office of Emergency Management (OEM) was established under the NY Police Department’s control, but jurisdiction changed hands from the police to Mayor Giuliani in 1996. The Director of NYC OEM reported to the Mayor and continues to do so today. In light of the events of September 11, 2001, OEM was given departmental status (in November 2001) and has since been functioning as an autonomous government agency.

\(^{32}\) Source: FEMA website
\(^{33}\) Source: US Census
\(^{34}\) Source: http://www.nationalservice.gov/
NYC Office of Emergency Management (NYC OEM) Programs

Today the NYC OEM is comprised of approximately 200 staff members, who are charged with coordinating disaster management plans for a city of over 8 million people and around 900,000 businesses.\(^{35}\) The scale of emergency plans that must be established and carried out to ensure public safety is staggering when considering how relatively small this organization is. However, the strength of OEM lies in its vast network and strategy for connecting people. Through constant communication and collaboration with other public, private and non-profit agencies, OEM is able to disseminate information very quickly during emergencies and free up resources as needed to respond to the multitude of emergency situations that arise in NYC.

The Watch Command at OEM monitors news, weather reports, and other information regarding public safety 24 hours a day, 7 days a week. When an event is anticipated (i.e. a hurricane) or has occurred (i.e. a major fire or interruption of subway service) the Watch Command’s responsibility is to respond by engaging the necessary persons or organizations. They have a direct line of communication with the NYC Police and Fire Departments, FEMA, the National Weather Service, and the Federal Aviation Administration (FAA) so they can be kept apprised of events as they happen and/or reach out for help when needed.

In NYC, it is rare to find people who don’t use technology. To reach even more people in today’s world, disaster planners are expanding their use of ICTs and social media, which is contributing to new approaches in the planning process and better communication. There are many tools that can be used to educate, coordinate, and disseminate information quickly and efficiently. Most, if not all organizations have Facebook pages, Twitter accounts and YouTube videos to maximize exposure to individuals through social media. The popularity of these sites

\(^{35}\)Source: US Census
provides new opportunities in the world of disaster management to connect with hundreds of thousands of people instantaneously and a means for receiving direct feedback from the public.

To educate the public, OEM offers a range of services so that people of all age groups and vulnerabilities have access to information, at the very least. OEM’s outreach and citizen engagement programs include the Ready New York campaign, the NYC Citizen Corps Council, Community Emergency Response Teams (CERT), COOP plans for private businesses, volunteer training and Cross-Cultural Outreach. Together these programs target a variety of groups of people in NYC and create a strong network of engaged citizens, volunteers and leaders. The three major responsibilities of OEM are to prepare NYC for emergencies, coordinate emergency response and recovery, and educate and inform the public. Although OEM has a vast array of services it provides, this paper will focus on its programs that involve coordination and communication with other agencies and with the general public.

The Ready New York campaign is the biggest grassroots efforts of OEM that is aimed at improving the level of preparedness of the average citizen. It provides at least 15 easy-to-understand guides (available in multiple languages) for how to respond to a variety of emergency situations. Presentations are given to community groups, schools, and businesses, and there are a plethora of tools available on the OEM website to test people’s knowledge on preparedness planning. In partnership with the Ad Council, advertisements for the Ready New York campaign can be found online, in print, on billboards and on the radio.

36 Source: NYC OEM website: nyc.gov/oem
37 Source: nyc.gov website
RESEARCH DESIGN

This paper’s main focus is on the outreach efforts of emergency management organizations and whether or not there can be improvements to widespread education in NYC for disaster preparedness. To understand those efforts, interviews were conducted with personnel from emergency management organizations in the government and non-profit sectors. Based on the interview responses and information publicly available on the organizations’ websites, surveys were created for residents of NYC. By comparing survey answers with the interview responses, the effectiveness of outreach campaigns can be evaluated, and areas of improvement will be identified.

Most of the background research for this paper was done through general theoretical research on disaster management and more practical research on the natural physical threats in the NYC region. Interview participants worked in the NYC Office of Emergency Management (OEM), the American Red Cross (ARC) of Greater New York, and at the NYC Economic Development Corporation (EDC).

The voluntary, self-administered surveys were offered to employees and residents of lower Manhattan within Community District 1 (CD 1), which was the study area targeted for data collection (Appendix A, Figure 7). Due to its excessive vulnerability to flooding and hurricanes, and its recent experiences with acts of terrorism at the World Trade Center (in 1993 and in 2001), this study area was chosen to see if citizens living and working in one of the more vulnerable parts of NYC are proactively disaster planning in their own lives (Appendix A, Figure 8). Specifically the neighborhoods in CD 1 are: Battery Park City, Civic Center, Financial District, Greenwich South, Seaport and Tribeca.

The survey respondents included attendees of Community Board Committee meetings, elderly residents living in the Southbridge residential complex and employees of the NYC
Economic Development Corporation (EDC). Survey respondents were sought at Community Board meetings because local residents attend them, and typically these are members of the public who are more engaged in the issues concerning their neighborhoods. The Southbridge residents were a particularly interesting group for this study because they represent the elderly, a vulnerable group of people for whom it is very challenging to plan for emergencies. Employees of EDC were selected because they work within CD 1 but don’t live there, so they might consider disaster preparedness differently than residents in the study area.

The objective of the surveys was to assess how respondents perceive physical vulnerabilities in NYC and to find out how much they prepare in their own lives. The questions drew on information that is publicly available on OEM and ARC websites to develop a comparison between advice offered by emergency management with the actual knowledge and preparedness of citizens. Additionally the survey garnered information on how people communicate during and after emergencies to identify trends in how people access information.

Eight people from two emergency management agencies in NYC (OEM and ARC) and one member of security from EDC were interviewed to develop a base understanding of how they educate and prepare New Yorkers (and city employees) for emergency situations. Interviewees were targeted based on their involvement in outreach and/or coordination efforts, and they were recruited either over the phone or via email. Interviews were conducted in person and each one took between thirty minutes and one hour. Nine open-ended questions were used as a guide to open up a discussion, and each participant elaborated on his/her role as well as the department’s role (Appendix B, Figure 1). The primary objective of the interviews was to collect first-hand accounts of the challenges facing disaster planners in NYC and to understand what efforts have been made thus far to improve public safety and education regarding disaster preparedness.
Staff members from OEM who participated in this study work in the following departments/sectors: Community Outreach, Continuity of Operations Planning (COOP), the Watch Command, and Communications. At ARC, representatives from the following departments participated in the interviews: Mass Care and Logistics and Community Outreach. Since EDC is included in the COOP plans for city agencies, its Department of Security and Emergency Management and the COOP liaison also shared information for this study.

**FINDINGS FROM INTERVIEWS**

One common theme that was apparent in discussions with all interviewees is that the use of networks and communities in spreading information is the most effective way to reach as many people as possible. As previously mentioned, OEM has a staff of 200 who plan for emergencies in a city of over 8 million people and 900,000 businesses. In the United States though, NYC actually has the largest OEM and the most unique circumstances. Its density, coastlines and concentration of economic assets make it one of the most complex cities in the world from the perspective of emergency management. In light of this, it is obvious that really the only way to ensure information gets disseminated as widely as possible is by building relationships with local organizations and community leaders so that information can trickle down appropriately.

**Notify NYC Program**

OEM began a pilot program in 2009 called Notify NYC that supports all of the more recent initiatives of the outreach coordinators. The Watch Command processes up to 15,000
emails every month\textsuperscript{38} from agencies concerned with public safety, and this system made it possible to directly inform the public of an event that might impact city operations. OEM sends out mass messages to registered users via text messages, emails, and/or phone calls to keep them informed of events such as street closures, police emergencies or important weather-related bulletins. Notifications are also linked to OEM’s Twitter account, so anyone following OEM “tweets” will also be able to get that information. The media also picks up OEM tweets and quote Notify NYC alerts in the news, which is another means by which to reach a greater percentage of the public.

Within a couple of days of the news that Hurricane Irene would hit NYC (in August, 2011), the number of Notify NYC users spiked by approximately 13,000 persons, which was a substantial sign that the program was effectively becoming a means by which to inform the public instantaneously. As of February 2012, there were approximately 87,000 people receiving alerts directly to their cell phones or computers and 37,000 following on Twitter\textsuperscript{39}, comprised of members of the public as well as media outlets. The added strength of the Notify NYC program is that by communicating directly with the public, users can pass on information and expand the network so that there is a ripple effect of information sharing throughout the City. Over 1,600 messages have been activated to date, with an average of 60 messages per month\textsuperscript{40}.

After monitoring declining trends in registered users though, it was apparent that people didn’t want to receive alerts for every type of event in every borough of NYC. The number of registered users gradually dropped off after Hurricane Irene because people were fatigued by receiving so many messages. As OEM moves forward from the pilot program, it will use a new approach in which it will be able to geocode and map registers, users and their locations. This will allow OEM to identify an area that would be affected by a certain event and target

\textsuperscript{38} Data obtained through interviews at OEM in February 2012.
\textsuperscript{39} Data obtained through interviews at OEM in February 2012.
\textsuperscript{40} Data obtained through interviews at OEM in February 2012.
messages only to those users within that area. In other words, messages will be sent out based on the location of problem, which should increase user registration and ultimately the effectiveness of information-sharing.

Beginning in April, 2012 a new technology will be required in every cell phone in the U.S. called the Commercial Mobile Alerting System, an interface for the Wireless Emergency Alerts (WEA) service. WEA capable phones will allow users to receive up to a 90-character text message with alert sounds even when the cell phone networks are congested or backlogged, as they often get during emergencies. People will not have to opt into the plan since the technology will be required in every phone, and alerts will be categorized Presidential, AMBER or Imminent Threat (i.e. severe weather-related). People will be able to opt out of all alerts except Presidential ones, but this technology is meant to ensure that people can receive necessary and accurate information during major emergencies.

Community Outreach

At OEM, the Red Cross, and other smaller organizations, Community Outreach Departments work in this capacity to build networks of people throughout NYC. They coordinate events regularly to bring together community and organizational leaders and train volunteers to act locally for safe and organized responses to disasters. The biggest effort by the outreach teams in NYC to spread information for preparedness is the Ready New York campaign. It includes 15 specific guides for preparedness in a variety of circumstances and is used as the basis for many presentations given by outreach coordinators.

As the coordinating body for emergency response in NYC, OEM brings together its partner organizations concerned with the preparation, response and recovery phases of
disasters. They offer a number of workshops and symposiums to train community leaders, businesses and other organizations, and engage the public in conversations about disaster preparedness. By collaborating with ARC, faith-based organizations, and other non-profits and community groups, OEM is strengthening its partnerships throughout the City. The stronger its networks are, the easier it will be to ensure that information dissemination is more widespread during an emergency. Neighbors helping neighbors is the logic behind these programs, which can decrease the reliance on emergency responders in situations where communities have the capability to help each other. When they do need to reach out for extra help though, informed and connected community leaders will know who to contact for the appropriate assistance.

The Citizens Corps Council (CCC) and Community Emergency Response Teams (CERT) are comprised of community volunteers who take on leadership roles when emergencies occur. They act as liaisons to OEM to help spread information and ensure public safety in times of need. OEM hosts an annual Disaster Volunteer Conference that draws over 300 participants and encourages information-sharing and network building amongst those most involved in preparing for disasters. In addition OEM offers training seminars for these leaders and engages in weekly and monthly communications with Citizen Corps member businesses and individuals, respectively.

Social Media and Communications

Facebook and Twitter have become popular social networking sites, especially for those seeking instantaneous information. OEM and ARC each have Facebook pages and Twitter accounts that offer helpful tips for being prepared, as well as updated information as news is happening. As of February 2012, OEM had approximately 15,000 followers on Facebook and 37,000 on Twitter, many of whom are media outlets. The OEM Facebook page offers an “OEM
Tip of the Week” in addition to other information about training seminars and organizational events. Its Twitter presence is solely represented by the Notify NYC alerts.

To reach people who may not use social media frequently or at all, OEM communicates information to the news station NY 1 at least once daily and much more frequently when there is an emergency. They also share information with a handful of radio stations on both AM and FM frequencies. As with other departments, the Communications team relies on person-to-person sharing of information so that those who get their first-hand information from OEM sources will share it with their personal networks.

To promote preparedness, there are also many applications online that are easily accessible to the general public and which supplement the in-person efforts made by the Community Outreach Department (i.e. Ready New York pamphlets and info-sessions). For example, OEM developed a Facebook application called “My Meeting Place” that encourages family members to plan where to meet in case of separation during an emergency and is an available tool even when cell phone networks get congested. Lastly, the Communications team has begun to explore the use of crowdsourcing to develop new ways in which to communicate with more people. With communications in the digital world constantly evolving, easy access to the public offers a unique opportunity to collect ideas and expand the communication efforts of OEM that may otherwise be challenging to improve because of bureaucratic processes that must be overcome first.

One interesting fact that came up during a few interviews was that as a government agency, OEM is only permitted to operate its website through the nyc.gov server. They do not have an autonomous site, and their website within the nyc.gov domain gets an average of 3,000 hits per day\textsuperscript{41}. Once the announcement was made regarding evacuations for Hurricane Irene,

\textsuperscript{41} Data obtained through interviews at OEM in February 2012.
the nyc.gov site was overwhelmed with visitors looking for flood maps and evacuation zones. The server crashed from a surge of over one million visitors and was down for about four hours. In response, OEM posted the evacuation zone maps as image files on Facebook and Twitter to increase access to them and provide backup sources while the nyc.gov server was restored. This signals one potential area of improvement moving forward in the digital era. Seeing such dramatic surges in online presence when an emergency happens or is anticipated is a clear sign that the need for an autonomous site during disasters may be necessary.

Community Outreach at ARC of Greater New York mimics closely the efforts of OEM. Although they have their own programs and networks, a lot of information-sharing between disaster management agencies help form one cohesive effort to educate and prepare the public. ARC offers readiness materials and promotes the Ready New York campaign in its presentations to schools, faith-based organizations and other community groups. They provide training to volunteers who are individuals or corporate groups and expand their network within NYC through the many services they offer. To formalize their support, ARC has a Memorandum of Understanding (MOU) with partner agencies who participate in their training program entitled “Ready When the Time Comes.”

ARC considers its ability to connect with vast networks one of its greatest strengths in being prepared. Since they have a close working relationship with OEM and a large presence at the community level, they have the capacity to respond quickly and efficiently when emergencies happen. Oftentimes at the scene of an event, they will engage in quick team meetings with OEM, the NYPD, the FDNY and other emergency responders to determine the best plan of action. OEM has the capacity to free up physical assets of the city, such as schools for temporary shelters, and ARC has the capacity to mobilize an army of volunteers who are trained and ready to help.
In terms of leveraging social media and technology into the work they do, ARC of Greater New York has a Facebook Page and a Twitter account that is directly connected to their internal affairs department to track and share programs they are implementing. In the aftermath of a fire or other localized disasters, ARC has an online application called “Safe and Well” that allows people to share their location, which is posted to ARC’s Facebook and Twitter pages. This helps loved ones find each other and emergency responders prepare a post-disaster plan more accurately based on those updates.

ARC offers an iPhone application called “Shelter View” that helps people find open Red Cross Shelters during evacuations. The most recent utilization of this service on a city-wide scale was during Hurricane Irene, when people could have easily viewed on a map where the closest evacuation shelter to their home was located. In addition, the Red Cross uses mobile banking (direct money transfers) to raise money when it is needed for a large-scale disaster relief effort, as it did for the relief work in Haiti after the 2010 earthquake. This is a very easy and rapid means by which to get funding to operate quickly in an emergency situation.

Post 9/11 Impacts on Preparedness

As was the case for most businesses in lower Manhattan after 9/11, EDC strengthened its emergency planning procedures in a number of ways. Some new technologies were introduced into the process, but as with OEM and ARC, a lot of focus was put on strengthening its connections to other agencies and collaborating within its network.

In addition to emergency supply kits, every EDC employee is given a blackberry telephone. It provides access to email, but is also used by security personnel to communicate important alerts including messages during 9/11 (via BB PIN) when networks were congested.
As this congestion limited communications between agencies, every city agency has since acquired 800 Mega Hertz frequency radios that will provide a direct line of communication with OEM and other agencies should networks fail again in a disaster scenario.

Since its inception in 2009, Notify NYC messages from OEM are distributed by security personnel via email at EDC. In addition, since 2002 an emergency notification system called “Send Word Now” has been utilized by EDC and other city agencies that alerts employees via email and text message on their blackberry phones. This system is functional 24/7, so if employees are home when an emergency happens, GIS mapping can be used to locate them and assist in carpooling (or other services) in the event of an evacuation or disruption to public transit systems.

FINDINGS FROM SURVEYS

In total, 31 respondents participated in the voluntary self-administered surveys for this research paper (Appendix B, Figure 2) and were targeted because they either lived or worked in the study area of lower Manhattan. Of the 31, 15 respondents worked in the area and lived in other parts of NYC, and 16 lived there and were either retired or also worked in lower Manhattan. Of those who indicated they live in the study area, 100% have been living there at least 6 years, and 88% of them have been living there for over 10 years. Locations of respondents’ work and home neighborhoods can be found in Appendix A, Figure 7.

There were eleven questions on the survey, comprised of dichotomous (yes/no), multiple choice and rank order scaling questions. The purpose of the dichotomous and multiple choice questions was to see whether or not people follow the advice of emergency management organizations, what sources people use to gather information during disasters, and how
frequently they consider disaster preparedness in their lives. Four questions pertained to how people responded and received information during two recent events – Hurricane Irene and the earthquake in August, 2011. Since there were at least a few days of advanced warning for the hurricane and the earthquake was unexpected, it was anticipated that trends in how people received their information would differ. The remaining questions gathered more general information about individual preparedness to get a sense of how informed people are and how frequently they consider the threat of disasters.

The rank order scaling questions were intended to measure people’s perceptions of the physical vulnerabilities that threaten NYC versus their perceptions of how prepared NYC is for them (institutionally). In each question, there were eight (8) different events/threats that people were asked to rank in order from 1 to 8. For vulnerability, 1 represented the event to which NYC is the most vulnerable and 8 the one to which NYC is the least vulnerable. For preparedness, 1 represented the event for which NYC is most prepared and 8 the one for which NYC is least prepared. Unfortunately, half of the respondents did not fully understand how the survey was asking them to rank the events, and therefore answers to these two questions could not be properly analyzed. Some people ranked them appropriately but about half of the respondents ranked each event individually on a scale from 1 to 8, which presents a different contextual meaning to the numerical value.

Pertaining to how people responded to Hurricane Irene, 26 out of 31 respondents were not advised to evacuate their homes and 5 were. Of the 5 who were, 3 stayed with a family or friend and 2 did not evacuate. When asked how people stayed informed of the impact of the hurricane during and after the storm, responses varied greatly, and some offered multiple sources, so 31 respondents provided a total number of 53 answers. The intention was to understand what sources people use for information when they have advanced warning of a natural disaster.
Of the total 53 responses, 41% said they got their information from TV news sources, of which the most popular stations were NY 1 and the Weather Channel. 23% of respondents got their information from internet news and emergency management websites, of which the most popular were nyc.gov, NY Times and NY 1. 15% stated they got their information from the radio and 9% stated they used social media as a source of information. 11% selected “other” as their choice for how they received information, which primarily included friends, family, neighbors and building doormen and security.

When asked what people’s first response was to the earthquake, the intention was to capture how people intuitively seek information when an unexpected event occurs. Out of 31 responses, 19% stated they turned to TV news for information, of which most people cited NY 1 as the primary station. There was an equal distribution of 13% amongst the three choices of social media, internet news sources and radio. Facebook, NY Times and NY 1 were cited as the websites people used for these choices. 10% of the responses were “other” and specified that they followed their company’s emergency evacuation procedures. Finally, 32% of respondents said they did nothing in response, or that they did not experience the earthquake in NYC.

About half of the respondents who have been living in NYC for over 10 years reside in the Southbridge Towers, just south of the Brooklyn Bridge and slightly west of one of the designated evacuation zones of Hurricane Irene. This community was constructed as Mitchell Lama housing in the late 1960’s that has a large percentage (an estimated 25%42) of elderly persons who have been living there since it was opened. Given this demographic, it was not surprising that there was a large number of people who rely on the radio or TV for information, as opposed to an internet source. In addition, knowing that many of these same individuals rely on their building personnel and neighbors is very helpful in considering how the more vulnerable populations stay informed and receive help should an evacuation be necessary.

42 Data obtained through conversations with South Bridge security personnel
In both questions regarding the manner in which people seek information, TV news had the highest percentage of responses, and NY 1 was the most noted station that people follow. This is positive to note since this is the news station with which OEM has the most contact on a regular basis.

When asked how frequently they research information on disaster preparedness, 52% of the 31 respondents selected “only when a disaster strikes or is anticipated.” 26% said they never research information even though they know what resources are available, 13% said they do not know what resources are available, and only 10% stated that they frequently do research.

This data is well-aligned with the challenges perceived by disaster planners, in that the majority of people think about how to be prepared for an emergency only when one is upon them. 13% seemed like a relatively high percentage of people who stated they do not know what resources are available, which could indicate room for improvement in certain outreach efforts. Once again, given that a large percentage of respondents were elderly, it is likely that they are the ones who feel the least prepared or aware of resources in a disaster situation. The amount of outreach effort to the elderly and other vulnerable communities could be explored further to discover the most effective way to educate and prepare these populations.

The last multiple choice question asked respondents to identify which actions they have planned with members of their households to be prepared for an emergency. The choices were deliberately selected from the suggested actions that are posted on both OEM and ARC websites and included in their readiness materials during presentations. However, the names of these organizations were not identified anywhere in the survey. The choice of actions were: exit routes from your home; where to meet in case of separation; family members or friends with whom you can stay in case of displacement; out of state contact person to connect with if local
cell phone networks are down; and how to assist disabled, elderly or non-English speaking family members. If a respondent did not select any choices, he/she was counted as having selected “none of the above.”

Out of 31 respondents, many selected more than one action, providing a total of 50 responses. 24% of respondents did not select any answer and were therefore counted as “none of the above.” Another 24% of respondents stated that they plan exit routes from their homes, and 20% have designated family and friends with whom they can stay in case of displacement. 18% of respondents stated that they’ve planned where to meet other household members in case of separation, and 12% cited out of state family members to contact in case local networks are down. Only 2% of respondents stated they have planned how to assist vulnerable family members.

This data supports the previous question and the challenge that people don’t plan for emergencies when they are not anticipated, since the majority of respondents did not select any preparatory actions at all. It is reasonable to consider that in times of need people are in touch with, and rely on, their personal networks in times of need, which is supported by the 20% of respondents who have cited family and friends with whom they can stay in case of displacement. Since the trickle-down effect of network-to-network connections is an aspect imperative to the disaster planning process, this piece of data is supportive of that plan.

The 2% of respondents who plan to assist vulnerable family members is relatively low and is supportive of where the biggest gaps in disaster planning may lie. Helping the disabled, elderly, and non-English speaking communities presents a real challenge for not just disaster planners, but any type of planner. Since their needs are more specific and the number of people needed to help them far exceeds that of a person who does not need assistance, planning for vulnerable populations is more complex and would rely on networks of people much more
heavily. It is a bit concerning that the data suggests only a small fraction of the population
considers these family members in their planning and introduces the problem of how to
effectively get help to vulnerable people who may not have a network of friends and family on
whom they can rely.

In conclusion, inter-agency coordination between emergency management organizations
has been very effective and is constantly improving to stay current with new challenges posed
for planning in NYC. However, improvements can be made in educating the public and
preparing them for disasters, particularly for the more vulnerable populations. The problem of
complacency in preparing for major disasters is the biggest challenge to overcome, but the
following section offers recommendations to improve widespread education, and ultimately
public safety.

CONCLUSION AND RECOMMENDATIONS

This thesis focused on one major question: How effectively do emergency management
organizations in NYC educate and prepare individuals for disasters? The problems of
complacency and the lack of widespread education continue to plague disaster planners.
However there are many current programs that are addressing these weaknesses, and with
continued outreach and collaboration from local partners, this will surely improve with time.
Leveraging innovative technology within existing programs is a relatively simple way to enhance
programs that already have momentum towards increasing awareness. Increased citizen
participation in the process will also encourage widespread education and even stronger
networks that reach the level of the individual.
It is apparent that in NYC, emergency management organizations have experienced major upgrades since OEM was granted departmental status in 2001. The network of public, private and non-profit partners is very impressive in a place as geographically vast and physically complex as NYC, and the heavy reliance OEM has on its partners reflects a high level of trust at all levels. Based on recent emergency situations and through interviews with disaster planners, this reliance has greatly contributed to successful responses that ensured interrupted operations have been able to resume as quickly as possible.

OEM already has a vast network of partners within many sectors, and there is an adequate amount of communication and interagency collaboration happening at the top level. The biggest challenge lies at a more grassroots level in how to improve the education of the general population and get them more engaged in preparedness. In other words, what can be done to achieve widespread education about the physical vulnerabilities of NYC and how to be prepared for them?

Although the City has been fortunate that major disasters strike so infrequently, there is a false sense of security among the general population regarding the City’s physical vulnerability. This makes it very challenging for planners to ensure that the appropriate measures are being taken in preparation for the next big one. Updated policies that enforce mitigation strategies must be implemented now in order to avoid making the same mistakes as other cities that were destroyed due to a lack of commitment by the local government. It is hard to justify investments in preparatory strategies for “what-if” scenarios, but the reality is, as this thesis brings into focus, that disasters do happen in NYC and are only expected to increase in magnitude with population growth and the threat of climate change.
The recommendations made in this paper are intended as integrative solutions for improvements to: 1) effective widespread education of disaster preparedness; 2) expanded use of technology; and 3) assistance for the most vulnerable populations. Through background research, interviews with emergency personnel and surveys of residents, connections were drawn between the perceived and actual challenges of planning for disasters and where improvements can be made. Subsequently, the following recommendations offer opportunities to achieve widespread education about the physical vulnerabilities in NYC and how to prepare for them.

_Incorporate disaster preparedness drills in schools throughout NYC that expand upon existing fire drills._

NYC already incorporates fire drills in its public schools systems. However they would benefit by following the model of preparedness as is done in Japan, where disaster drills aren’t only aimed at preparing students for fires, but for a number of events that threaten their environment.

Japan presents an excellent case study of a country that effectively promotes widespread education starting at a young age. Students in one village were able to escape the tsunami wave that followed the 9.0 magnitude earthquake in 2011 by fleeing to higher ground without the assistance of emergency personnel. Their instinctive reaction was entirely due to the drills they had practiced for many years leading up to the event. Even though a damaging tsunami wave hadn’t afflicted Japan in over 15 years\(^\text{43}\), the general public (including the vulnerable population group of young children) knew that tsunamis were a physical vulnerability.

\(^{43}\) In 1993, a destructive tsunami struck the Hokkaido region in Northern Japan as a result of a M 7.8 earthquake.
after earthquakes. As such, regular drills kept these students prepared even though both the earthquake and tsunami occurred without warning.

Regular disaster drills should be required in schools in addition to, or expanding upon, fire drills. Children should practice how to respond in the event of an earthquake or other unexpected event, and know how to contact family members in case of a school evacuation. When these types of lessons are instilled in people at a young age, they are remembered into one's adulthood and can continue to be passed on from parent to child and throughout communities. NYC OEM already has a strong collaborative relationship with the NYC Department of Education. Thus the promotion of upgrades to the existing preparedness drills should not require more than brainstorming sessions and a few pilot programs before it can be scaled up for all schools within the city.

“Crowdsourcing ideas from communities to actively engage citizens in the planning process.”

Over the past six to seven years, the concept of “crowdsourcing” has become a popular method of gathering information from large numbers of people, usually by leveraging the use of the internet and other technology. One definition of crowdsourcing is “the act of taking a job traditionally performed by a designated agent… and outsourcing it to an undefined, generally large group of people…” 44

Ready New York for Kids, a program offered by NYC OEM, already promotes more fun ways in which children can learn about disaster preparedness such as games and school curriculum that are available in a number of languages. In addition to presentations at schools,

44 Source: www.crowdsourcing.com
though, OEM can expand the types of applications and resources available to children that encourage them to think more independently about preparedness outside of the school environment. For example they could organize contests in school districts to crowdsource children’s ideas about safety in their local communities or even in their households, which would motivate them to think about the topic more seriously.

OEM has already utilized the concept of crowdsourcing through the “What If NYC” design competition in 2008\textsuperscript{45}. Designers submitted ideas on temporary housing for post disaster sheltering needs. This type of initiative does not require much investment and minimal resources but could be used throughout communities to increase awareness of physical vulnerabilities and disaster preparedness. There could be periodic contests through which people are encouraged to research and submit ideas for community readiness plans. The geographic scale of participants could be any size, depending on the end goal of the campaign. Leveraging the amount of technology available to the average person in NYC (i.e. social media or smart phones), civic engagement could be heightened rapidly through public participation using this “free” method of crowdsourcing. Contests and winners could be promoted through the already strong online presence OEM has on social media sites.

\textit{Increase advertising campaigns throughout NYC in subways and other public places where there is high exposure.}

After the M 5.8 earthquake in August 2011 in NYC, the streets were flooded with self-evacuated employees who responded as if it were a fire drill. This was in actuality, the least safe response they could have had in a place where tall brick and glass buildings might have shed debris onto the streets. Most people had no idea how to respond and ended up increasing their

\textsuperscript{45} What If NYC was an architectural design competition in which candidates submitted ideas for post-disaster temporary housing construction.
exposure to potential danger. If there are more visible advertisements spread throughout the city, people will be more informed and gain the capacity to respond more intuitively when unexpected events such as earthquakes occur.

Advertising campaigns could be targeted to promote widespread education about what physical vulnerabilities NYC has. In subway train cars, posters and TV advertisements are currently being used to promote awareness of healthy eating habits, higher education opportunities and even anti-terrorism campaigns. The subway serves many millions of people every day and is a perfect venue for advertising emergency management strategies where it is easy to capture people’s attention. They mustn’t be designed to incite fear in people about impending doom, but educational posters can be displayed that offer a variety of multiple choice quizzes and simple facts about preparedness, similar to what OEM and the Red Cross already offer on their websites. There can also be increased advertising for Ready New York and Notify NYC programs, whose mission is to educate and inform the public.

**Expand the GIS capability of the Notify NYC program to target advertising campaigns in communities with low registration rates.**

Since the Notify NYC program is just completing its pilot phase, there is room for improvement before it implements the next phase. The notion of sending alerts targeted to people affected by a certain event based on their location on a GIS map is a great step forward. This upgrade should improve registration and ensure that the notifications don’t fatigue people to the point that they opt out. Building on the GIS mapping capability, it would be relatively easy to see where there are large gaps in registered users throughout the city. After identifying communities with low percentages of users, advertising campaigns should be targeted in those areas – on subways or in community centers for example. As the program is still relatively new,
it is possible that there are millions of New Yorkers who simply don’t know it exists. Since the City will have already invested in GIS capability for this program once the pilot phase ends, it would be an easy and inexpensive exercise to identify communities in which more outreach can be performed. Collaboration with existing local partners would elevate the success of targeted advertisement in these communities.

**Work with local partners and volunteer networks to design localized plans for assisting the elderly during emergencies.**

Improving plans to assist the most vulnerable populations in times of disaster is a major challenge for planners in NYC. Based on survey responses, there is also room for improvement at the local level. It is impossible for disaster planners to account for every individual who needs assistance in times of need, so the value of networks and the trickle-down effect is absolutely necessary for this effort. Using census data, all homeless shelters, senior care centers, housing communities with large numbers of elderly persons, etc., should be gathered and mapped. OEM, ARC and their partners could target those areas with the highest concentrations of vulnerable populations to identify the biggest challenges, specific to those people and their households, and the most efficient plans to help them during emergencies. Plans should not be wholly dependent on emergency responders, but look at the existing infrastructure and social networks already in place and work towards strengthening them to best serve the special needs populations.

At the South Bridge Towers for example, the elderly residents rely heavily on their head of security to inform and direct them during emergencies, but he is only one person and there are thousands of people who would need assistance just in that one community. Among the thousands of other, younger residents living in the South Bridge community, volunteer leaders
could be identified within the residential towers who would be responsible for ensuring the safe movement and care of their elderly neighbors during emergencies. This could be piloted in some communities to be scaled up or down throughout NYC depending on the localized needs. Help from CERT leaders, faith-based groups, and other existing community partners of OEM and ARC would be instrumental in coordinating and implementing this effort.

Create and mandate disaster preparedness exams for all employees in NYC.

To improve widespread education on emergency management, NYC should implement a mandated disaster training program that every business incorporates into its operations. In every organization, there should be an online certification program that each employee is required to complete to work in NYC. There is already a precedent in most organizations for people to pass such exams as a sexual harassment training course or agree to certain company policy guidelines. A disaster preparedness training course could easily be introduced as another required certification, but completion and annual renewal should be tracked by OEM.

As the coordinating agency for city-wide disaster management programs, OEM could create a “preparedness exam” for people to take online. They would be able to collect each person’s name and contact information to register them as a trained individual. The program could be set up to automatically remind people to get re-certified annually. In that case, OEM could ensure that the most up to date information is getting passed along, and the problem of complacency among uninformed citizens would be greatly reduced. Not only would this improve widespread public education, but it could be an opportunity for OEM to advertise other programs such as Ready New York, Notify NYC, and the OEM Facebook and Twitter information directly to individuals.
Although this is an ambitious recommendation, it could be a successful program if there is buy-in from decision-makers at the top. In consideration of the likelihood of a more disaster-prone future (i.e. climate change and its impact on storm surges), it is imperative that the city educates people at a broader scale than just those who are already involved in disaster planning. Citizens must be engaged in the process so that public safety becomes an issue everyone cares about and complacency about disaster planning is overcome.

Funding for initial implementation can be sought through FEMA grants, and once established, the regular upkeep of the program should require minimal funding. The program would require an up-front investment in the design and implementation, but maintenance of the program should not burden the OEM staff. The system could be set up to automatically renew and update certifications so that after the initial set-up it should not demand many resources.

*Create a website that OEM can operate during emergencies that is separate from the nyc.gov server.*

To improve the technological services that are already offered by the NYC government, OEM should be granted a site that links from, but is independent of, the nyc.gov server. As evidenced during the Hurricane Irene evacuations in 2011, the existing bandwidth of the nyc.gov server cannot handle the expected number of people who would flood this site during an emergency. There should be a separate server that is activated to provide pertinent information to the general public when a disaster occurs or is anticipated, that can accommodate millions of users at one time. The internet is the most popular means by which people seek information when disasters are anticipated. It is imperative that the City establish an independent site that can handle huge volumes of traffic in these times if the public is
expected to know how to respond. Limited access to information will only hinder this process and overwhelm the capacity of emergency responders.

*Mandate formalized disaster management plans for new developments within the 500-year flood plain.*

As the impending threat of climate change presents new challenges for planners, it would be prudent to promote mitigation strategies before people continue to inhabit vulnerable coastal regions. OEM representatives should be included in the land use planning process for new coastal developments so input on coastal vulnerabilities remains current. No new development should be inhabited before an approved disaster management plan is in place and available to all new residents.

*Upgrade seawall heights throughout all of NYC to accommodate 2050 predictions* *(Appendix A, Figure 5).*

Seawall heights need to be evaluated throughout the entire city in preparation for increased storm surges. Dedicated funding and appropriate policies would ensure that investments today will improve public safety for the future. Even though the hydrologic impacts of climate change do not seem like a pressing concern for the City, the government must take the initiative now to mitigate future damages and loss of life. If we are to learn from mistakes made in other cities such as New Orleans, NYC should not wait until the next major disaster strikes to make these policy changes and investments a priority.
REFERENCES


4. Crowdsourcing website: www.crowdsourcing.com


31. U.S. Census Bureau website: http://www.census.gov/
Figure 1: Tropical Storm Tracks Globally over the past 150 years

Tracks and Intensity of All Tropical Storms

Saffir-Simpson Hurricane Intensity Scale

Source: NASA Earth Observatory, Image by Robert A. Rohde, Global Warming Art
Figure 2: Fault Line comparisons

Fault Lines under NYC area

Fault Lines under San Francisco Bay area

Source: Hofstra University Geology Dept. Source: USGS
Figure 3: Hurricane Incidence Map
Figure 4: New York Bight

The New York Bight is an indentation in the Atlantic coastline.
Figure 5: Projected Inundation Areas in Category 3 Hurricane

Comparing Inundation with Current and Projected (2050s) Sea Level Estimates
Case Study: Category 3 Hurricane (Draft)

- Projected Inundation Zone Estimates (current sea level)
- Projected Additional Inundated Area
  - IPCC B1 (37.5 cm sea level rise)
- Projected Incremental Additional Inundated Area
  - IPCC A1B (47.2 cm sea level rise)


Sea level rise estimates based upon Goddard Institute of Space Studies Atmospheric-Ocean Model using International Panel on Climate Change greenhouse gas emission scenarios for 2050s
Figure 6: New York’s Indian Point Reactor: Affected Areas within potential evacuation radii
Figure 7: Survey Respondent Locations
Figure 8: Coastal Vulnerabilities near Study Area
APPENDIX B
Interviews with Emergency Management Officials

Organization Name__________________________________________________________

Respondent Name (optional)____________________________________________________

Respondent’s Role in Organization (optional)_____________________________________

1. What resources are available to the public to inform them on preparedness planning for their households?

2. Does your organization perform outreach campaigns to educate the public on how to be prepared for emergencies (i.e. natural or man-made disasters)? If so, please explain.

3. How does your organization communicate with the public during emergencies (i.e. social media, text messaging services)?

4. Do you perform evaluations to determine the success rates of your outreach programs, if applicable? If so, please explain the results.

5. Do you identify local community groups with whom you can communicate important information regarding planning for disasters?

6. Is there pressure from city, state or federal sources to perform more outreach campaigns? If so, do they provide financial assistance or other resources to support these campaigns?

7. Do you coordinate with other emergency management agencies in disaster planning? If so, please explain.
8. Regarding recent events:
   a. How did you perceive the response of New Yorkers to the evacuation orders given in preparation for Hurricane Irene in August 2011?
   b. Was the response by the public chaotic after the earthquake in August 2011?
   c. How did you communicate with the public during the snowstorm in October 2011?

9. Is there anything else we have not discussed that you think is pertinent to this topic?
Neighborhood in which you LIVE

Neighborhood in which you WORK

1. How long have you lived in lower Manhattan (if applicable)?
   ___ 0-1 year   ___ 2-5 years   ___ 6-10 years   ___ over 10 years   ___ N/A

2. Were you advised to evacuate your home in anticipation of Hurricane Irene in August, 2011?
   ___ Yes
   ___ No

3. If you evacuated your home in preparation for Hurricane Irene, where did you go?
   ___ Friend’s or family’s house
   ___ Evacuation Shelter
   ___ Hotel
   ___ Other – Please state where: ________________________________
   ___ I did not evacuate.

4. How did you stay informed of the impact of Hurricane Irene during and after the storm (Check all that apply)?
   ___ Social Media (i.e. Facebook, Twitter)
   ___ Internet news. Which source? ________________________________
   ___ Radio. Which station? ________________________________
   ___ TV news. Which network? ________________________________
   ___ Emergency Management website. Which one? ________________________________
   ___ Other. Please state: ________________________________

5. What was your first response after experiencing the earthquake in NYC in August, 2011 (Please check only one):
   ___ Call 911
   ___ Check social media (i.e. Facebook, Twitter)
   ___ Check Internet news. Which source? ________________________________
   ___ Listen to radio. Which station? ________________________________
   ___ Watch TV news. Which network? ________________________________
   ___ Check Emergency Management website. Which one? ________________________________
   ___ Other. Please state: ________________________________
   ___ I didn’t do anything in response.
   ___ I did not experience the earthquake in NYC.

6. Do you own an emergency supply kit?
   ___ Yes
   ___ No
7. Do you know where the city-designated shelter closest to where you live is located, in case of an emergency evacuation?
   ___ Yes (please state where) .................................................................
   ___ No

8. How often do you research information on disaster preparedness?
   ___ Never, even though I know what resources are available
   ___ Only when a disaster strikes or is anticipated
   ___ Frequently
   ___ I don’t know what resources are available

9. Please identify which, if any, of the following have you planned with members of your household in case of an emergency:
   ___ Exit routes from your home and/or neighborhood
   ___ Where to meet in case of separation
   ___ Family members or friends with whom you can stay in case of displacement
   ___ Out of state contact person to connect with if local cell phone networks are down
   ___ How to assist disabled, elderly or non-English speaking family members

10. Please rank the following events on how PHYSICALLY vulnerable you think NYC is to them, IN ORDER from 1 (most vulnerable) to 8 (least vulnerable):
    ___ Earthquakes
    ___ Hurricanes
    ___ Floods
    ___ Extreme Heat
    ___ Severe Snowstorms
    ___ Power Outages (blackouts)
    ___ Exposure to Radiation or Hazardous Materials
    ___ Terrorist Attack

11. Please rank the following events on how PREPARED you think NYC is for them, IN ORDER from 1 (most prepared) to 8 (least prepared):
    ___ Earthquakes
    ___ Hurricanes
    ___ Floods
    ___ Extreme Heat
    ___ Severe Snowstorms
    ___ Power Outages (blackouts)
    ___ Exposure to Radiation or Hazardous Materials
    ___ Terrorist Attack

   Thank you for participating in this survey!