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ETHNIC DIFFERENCES IN RISK: EXPERIENCES, MEDICAL NEEDS, AND ACCESS TO CARE AFTER HURRICANE SANDY IN NEW JERSEY

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Abstract

This survey investigation assessed an economically challenged and largely minority population regarding concerns, evacuation status, medical needs and access to care during, and after, Hurricane Sandy by ethnicity status for patients using New Jersey's Federally Qualified Health Centers (FQHC). Data obtained contribute to understanding risk from disasters, and improving environmental justice for vulnerable populations following disasters. FQHCs provide medical and dental services for 5% of New Jersey's population; 95% of those served are uninsured, underinsured, or live below the poverty level. Economically vulnerable individuals are more at risk and were disproportionately harmed by Sandy. There were ethnic differences in days evacuated, days without power and heat, self-rating of personal/family impact, center use, need and access, and interruptions of care and medications. Hispanics and Blacks reported needing centers significantly more than White population. Primary medical conditions were diabetes, asthma, hypertension, and arrhythmia and heart disease, which did not vary ethnically. Understanding medical needs and concerns of vulnerable populations may help policy makers and practitioners prepare and respond promptly to disasters, reducing risk, and building resiliency for the medical care system.

Keywords

Preparedness; Hurricane Sandy; Access to Care; Environmental Justice; Federally Qualified Health Centers

INTRODUCTION

A fundamental feature of environmental justice is that disasters, whether war or weather, disproportionately harm socially vulnerable populations (James et al., 2010; Bryant and Mohai, 1992). This investigation focused on risk from the interface between weather disasters and health. Hurricane *Sandy* hit the Northeastern United States in late October 2012, severely affecting New Jersey and New York coastal communities. There were record ocean storm surges and flooding along bays and rivers (Neria and Shultz, 2012). *Sandy*, often referred to as a “Superstorm” was one of the largest, most damaging storms on record, with a massive diameter twice the size of Hurricane *Katrina* (Abramson et al., 2015). Further, unique was the ‘landfall’ angle, which was nearly perpendicular to the Jersey shoreline (a once in a 714 year event, Hall and Sobel, 2013), resulting in an unprecedented storm surge. *Sandy* affected an estimated 60 million people in 24 states, levelling homes of both the rich and poor (Neria and Shultz, 2012). Cutter and Finch (2008) also emphasized “social vulnerability” with poor communities coping less well and recovering more slowly than the affluent who have more support and options. There were 159 deaths directly attributable to the storm. In New Jersey, over 345,000 housing units were destroyed with over \$70 billion in damages to residential, commercial and public buildings and infrastructure (Halpin, 2013). Many individuals who ignored mandatory evacuation orders were displaced from homes during the storm due to surges, flooding, and loss of power (Freedman, 2013; Burger and Gochfeld, 2014b). Other subjects faced by cold, darkness, and lack of food and water, evacuated after the storm had passed. Even 2–3 years later, some people were still displaced. Serious health conditions, emotional distress, and grief consequently follow such disasters. Needs assessments are critical for recovery and understanding post-disaster mental health (Kessler et al., 2008; North et al., 2012; Swerdel et al., 2014, 2016). Boscarino et al. (2014) interviewed 200 Jersey shore residents 6 months after *Sandy* and found that (1) 31 % experienced post-traumatic stress disorder (PTSD) or depression, (2) sought mental health support, or (3) used psychotropic medications. Stress from an event such as *Sandy*, increase rates of reportable diseases (Greene et al., 2012). Cultural features and behaviors also enhance personal and community risk (Burger and Gochfeld, 2014a; 2014b; Burger et al., 2017, in press).

Within 100 days after *Sandy*, 756 people living along the Jersey Shore and inland New Jersey were interviewed regarding health and safety concerns (Burger and Gochfeld, 2014a). These subjects interviewed were geographically, but not necessarily economically, vulnerable. Interviewees reported that during the storm these individuals had been most concerned regarding agents of destruction (e.g., flooding 38 %), followed by survival and health (37 %), and personal property damages (36 %); interviewees were able to provide more than one answer. Future preparedness concerns included survival needs (food and water, 38 %), possessions (33 %), actions (securing possessions, cutting trees, moving cars, buying generators, 15 %), and evacuating themselves or others (18 %, Burger and Gochfeld, 2014b). Stress and anxiety were the most frequently reported symptoms among shore residents in that study (13 %, Burger and Gochfeld, 2014a).

Access to health care is particularly critical for patients with severe and/or unstable (=“brittle”) medical conditions, where interruption of chronic care or lack of acute care

might result in death (Kelman et al., 2015). In many communities road transportation came to a standstill for days after *Sandy*, preventing access to clinics and impeding late evacuations to shelters. In some cases mobile units were sometimes deployed to attend to victims (Lien et al., 2014).

Metrics of disaster effects on health care include emergency room visits (He et al., 2016; Kandace et al., 2016), physician or clinic visits (Martin, 2015; Pantea and Lin, 2015), pharmacy use (Sharp et al., 2016), changing incidences of diseases and mortality (Greene et al., 2012; Swerdel et al., 2014), hospital discharge data bases (Rajan et al., 2015), and patient surveys on access to care (this study), among others. Addressing the physical and mental health needs of vulnerable populations (e.g. elderly, low income, minority) is an important environmental justice and public health goal. The lack of preparedness of health systems for such disasters emphasizes the need to address risk, rapid recovery, and resiliency through disaster preparedness planning, investments, training, and drills (Jan and Lurie, 2012; Redlener and Reilley, 2012; Ben-Ezra et al., 2014).

The Federally Qualified Health Centers (FQHC) in the U.S., often referred to as Community Health Centers, serve economically and socially vulnerable populations (NJPCA 2017). Approximately 95% of the clients are uninsured, underinsured or earn less than 200% of the Federal Poverty level (\$22,113 for a family of 4 in 2012)(United Way, 2012). FQHC offer a wide range of primary care and serve approximately 5% of New Jersey's population (NJPCA, 2017). Affordability is provided by the sliding payment scale, but also physical access is essential. Physical access to the clinics during disasters is an important consideration for preparedness, response during a disaster, recovery following a disaster, and long-term resilience. At the time of our interviews, New Jersey had 23 FQHCs operating more than 100 clinical facilities. These are distributed around the State, many in urban areas. *Sandy* destroyed some, closed most for days, and left few unscathed. Physical damage and economic hardship had a disproportionately high impact on economically challenged families in New Jersey (Halpin, 2013).

In this study nearly 600 patients at 7 FQHC facilities (Fig. 1) were interviewed who sustained impacts ranging from medium to very high from *Sandy* (Table 1). This report addresses experiences and responses by ethnicity. Interviewees self-identified their ethnicity status using U.S. Census Bureau groupings. Dependent variables of interest included (1) whether patients needed to get to a center, (2) whether their center was open, (3) transportation availability, (4) any interruption in their access to medical care (doctors, others), and access to medicines. Understanding the needs and concerns of patients is a first step to understanding their risk, improving health care access, and increasing resiliency, and identifying differences as a function of ethnicity helps to identify vulnerable populations. Previously, Burger et al (2017) examined the perceptions of Hispanics with respect to access to care, medical needs and their understanding of the relationship between ecological barriers and coastal flooding. The intent of the present investigation was to compare among ethnicities, particularly medical conditions.

The study was part of a larger study *Health and Mental Health Consequences of Superstorm Sandy* conducted by the NJ Department of Health, in conjunction with the New Jersey

Medical School, Rutgers University, and the New Jersey Department of Human Services. Our study was approved by the Board of the New Jersey Primary Care Association which represents the FQHCs, the Rutgers Institutional Review Board (Protocol E14–319, and the New Jersey Department of Health. The study was funded by the Centers for Disease Control and Prevention.

METHODS

The NJ Primary Care Association, then (2014) directed by Kathy Grant-Davis, is an umbrella organization for the NJ FQHCs. The investigators made a presentation to the Board of Directors to explain the proposed study and receive feedback, recommendations, and permission to proceed. The Board suggested the Centers that represent different vulnerabilities to storms and *Sandy*. The directors of individual FQHCs were contacted for permission to interview patients in their facility. Interviews of patients were conducted at 7 facilities operated by 6 FQHCs. The 7 facilities represented a range of *Sandy* impacts from medium to very high (Table 1). At each facility there was a section of the waiting room, alcove, or separate room where patients were interviewed with privacy while waiting for their appointment.

The Centers selected for interviews were (Figure 1): 1) Eric B. Chandler Health Center in New Brunswick, Middlesex County, 2) CHEMED in Lakewood, Ocean County, 3) Horizon Health Center in Jersey City, Hudson County, 4) Monmouth Family Health Center in Long Branch, Monmouth County, 5) Neighborhood Health Center in Plainfield, Union County 6) Neighborhood Health Center in Elizabeth (Union County), and 7) Ocean Health Initiatives in Toms River, Ocean County.

Interviewers were trained and conducted pilot interviews. Four of 7 interviewers spoke Spanish as a first language, and a Spanish version of the questionnaire was prepared and tested for inter-interviewer reliability. Interviews were conducted using a form (English or Spanish), including some open-ended questions. The interview form contained several sections: demographics, concerns, center use, usual transportation to the center, overall *Sandy* impact on home and family, existing medical conditions, access to the center, access to doctors, interruption of care or medications during or after Sandy, and evacuation status. Ethnicity status used U.S. Census Bureau categories and respondents were requested to self-identify as “White” (White non-Hispanic), “Black” (Black or African-American, non-Hispanic), or “Hispanic” (Hispanic or Latino). For this study individuals are referred to as “Whites”, “Blacks”, and “Hispanics”. There were only 8 Asians in the sample, and these were not included in the statistical analyses. Other ethnic groups (e.g. Native Americans, Pacific Islanders) were not encountered. The focus of the present investigation was on evacuation, transportation, access to Centers, doctors and medications, and overall concerns as a function of ethnic group.

When patients arrived at the Centers for appointments, subjects either went to a general waiting room or a departmental waiting room. Interviews were conducted on all days of the week, at all times of day that facilities were open. Patients were approached in the order they entered the waiting rooms. Interviewers approached patients, identified themselves from

Rutgers University (the State University is familiar to many New Jersey residents), asked permission to interview them, and informed them that their participation was entirely voluntary, that no individual identifiers would be recorded, and that they could terminate the interview at any time. The refusal rate was less than 15%, often because they were called in for their appointments. Interviews were conducted in an area that allowed privacy without interfering with clinic operations. The interview normally required about 15–20 min, although many were longer when patients wanted to talk about their experiences or frustration with lack of government response to their plight (delayed action on monetary grants or claims, mold in their house, and harrowing experiences). The results are based upon 584 interviews: Hispanic/Latino=335, non-Hispanic white =140, and non-Hispanic Black =109).

Patients were asked to rate the impact of *Sandy* on them personally on a scale of 0 (none) to 5 (most severe), and whether or not they had interruption of services. In addition to reporting patient's assessment of their need for medical services, and interruption of medical services and medications, a "medical need" composite score was computed based upon whether a patient needed: 1) medicines, medical services, drug refills, or 2) access to a doctor, to the Center, to an emergency room, or a pharmacy, and whether a patient 3) had a "brittle" medical condition based on their answers to several of the questions. The "brittle" medical conditions including diabetes, kidney disease or dialysis, heart arrhythmia, asthma, seizure disorder, blood clots, cancer, infections, need for oxygen, and HIV treatment were identified as conditions where even a few day interruption in treatment might exert serious consequences.

After initiation of our study and identification of our target Centers, Halpin (2013) summarized the relative damage of Hurricane *Sandy* to 553 of New Jersey's 565 towns, which allowed placement of the study population within a state context (Table 1). Six of 7 sites that were identified occurred in the 5 worst hit counties (Halpin, 2013). The 7 facilities were then ranked based upon Halpin's community ratings: 1) hardest hit impact, 2) community hardship rank, and 3) household hardship rank. From this the 7 sites were divided into "very high impact", "high impact", or "medium impact" (Table 1). Indeed, few of the State's FQHC facilities were in "low impact" communities.

Analysis involved examining overall population means, and division of population by ethnicity category. Analyses included calculating frequencies and % , means and standard deviations, Kruskal-Wallis One Way Analysis of Variance (ANOVA) analysis, and 95 % confidence intervals (SAS, 2005).

RESULTS

Demographics, Evacuation and General Impacts

There were no marked ethnic differences in % females, or mean age of interviewees (Table 2). However, significantly fewer Hispanics were U.S. born (10%) compared to Blacks (83%) and Whites (80%). Only 15 % of the Hispanics interviewed identified English as their first language (while for all others, it was > 90%). There were no marked ethnic differences in % patients who were told to evacuate (by State or local officials), or % that did evacuate (Table

2). Overall 17% were told to evacuate before the storm, but only half did so. Eventually 17.3% did evacuate, many during or after the storm.

There were no significant ethnic differences in % that evacuated before, during, or after the storm. Patients who evacuated before *Sandy* did so because they were “told” to do so (47 % of those who evacuated). Others, however, either evacuated during (24 %) or after (28 %) *Sandy*. The main reason for evacuating after *Sandy* was lack of electricity, heat, water, or food. Whites were absent from their homes for significantly longer than others and had significantly more days without electricity than others (Table 2). There were also differences in self-rating of impact. Although the differences were not marked, Hispanics rated their impact greater than did others (Table 2).

Center Use, Access, Medical Issues, and Medical Conditions

There were ethnic differences in how long patients had been utilizing the FQHCs, and % that had used the Centers before *Sandy* (Table 2). Whites reported going to any FQHCs for only 4 years, while others employed these Centers for 6–8 years. Similarly, at the time of *Sandy*, fewer than half of the Whites were using the center where the interviews were conducted, less than for the other groups (Table 2). The method that patients used to get to the Centers varied significantly by group. Most Whites came by car, while more Hispanics walked to Centers. This is important because for most of the Centers road access had been closed to cars for varying periods after the storm. Walking was the only option, often involving detours around downed branches and utilities wires.

One of the main objectives was to determine whether there were ethnic differences in patients’ needs to access the Centers or other facilities during *Sandy*, and whether they had interruption of medicines, treatments, or clinical services. A significantly lower % White patients reported needing their Center or any hospital services during *Sandy* than did others (Table 2). There were no significant group differences in % patients that reported interruption of medicines during *Sandy*, or in the composite medical need score, although Whites were less likely to report interruption of medical services during *Sandy* (Table 2). This suggests that there was differential recognition of medical need as a function of ethnicity, and identifies the importance of asking questions in different ways so that actual medical need can be assessed.

Patients were asked whether they had been diagnosed with certain major medical conditions (Table 3). The conditions reported most frequently were diabetes, asthma, arrhythmia, high blood pressure, and hypertension. The rate of diabetes was highest in Blacks and rate of hypertension was lowest in Whites. While our questionnaire asked about the respondent’s medical conditions, many also indicated that asthma was a major issue for their children. Many of the Hispanic respondents noted that they “do not go to the clinic unless they are sick,” and do not go just for routine management of conditions like asthma or diabetes unless they have “trouble” or “attacks”.

Main Concerns during and immediately after *Sandy*

Patients were asked an open-ended question: “what were your major concerns during and immediately after *Sandy*.” They could give more than one answer (Table 4). Chi square tests

were performed on the 10 most common concerns, and the overall chi square p value equaled the Bonferroni critical value $P=0.005$. Individual concern differences are shown by asterisks. Major concerns (family, survival, safety and food) were similar among groups albeit with different rankings. Hispanics were most concerned about family and survival, while Blacks were most concerned about family and safety, and Whites were most concerned about survival and then family (Table 4). Hispanics were more concerned about food shortage than others. Whites were more concerned about possessions, but less concerned about drinking water than others.

DISCUSSION

When disasters strike, there are both physical and psychological risks and consequences, which are widespread, vary in severity, persist for a long time, and reflect the unique features of the event (Shultz et al., 2016). Factors that affect the physical and psychological consequences include whether, when, and how people evacuated; whether they had adequate food, water and medical supplies; whether they had relatives or friends to stay with (as opposed to shelters), and whether they had access to medicines and medical care. These are the factors examined in this study. Clients of the FQHCs represent a vulnerable environmental justice community, within which commonalities across ethnic groups may be greater than differences.

Sandy Effects and Evacuation

Evacuation rates were determined for a number of populations exposed to *Sandy*, including in the New York City area, which was similarly exposed to devastation from the storm (Schwartz et al., 2016). Among 243 New York respondents, 13 % evacuated, 78 % lost electricity, and 9 % were unable to access medical care (Schwartz et al., 2016). This compares with 17 % evacuations and over 90 % electricity-loss for the present study (N=584). However, FQHC sites that were expected to be impacted communities were selected (Halpin, 2013).

The decision to evacuate vs shelter-in-place is a complex phenomenon, and involves demography, geography, evacuation routes, risk perceptions (by government and individuals), social influences, and psychological processes (Riad et al., 1999), among other factors. Experience with prior storms, trust of government and media, and the ‘trustworthiness’ of forecasts is known to influence decisions. There was 5 days advance notice regarding the severity of Hurricane *Sandy*, billed as a “*Superstorm*” or “*Frankenstorm*” and people in many communities were told to evacuate immediately. Even so, only about half of the patients who were told to evacuate did so before *Sandy*. Many reasons were given for not evacuating: including “We heard about different predictions from different models”, “I did not believe it would be so bad”, “I lived through Hurricane *Irene* with no damage”, and “I am tough”. Worry about looting or about pets were frequently mentioned. Several Hispanic patients reported: “where we come from [Caribbean], we have them [hurricanes] all the time and we don’t worry about it,” or a variant of “it is God’s will.” However, once *Sandy* hit, there was flooding, no electricity, no clear roads, and no open local stores, and pharmacies and gas stations were closed or relegated to a cash-only

economy. Many patients evacuated during or after the storm, some never to return. *Sandy* was followed by 5 days of low temperatures. Sudden loss of communication with family and friends, and lack of information regarding severity of the event drove individuals to evacuate as best they could. Landline phones failed. Batteries in cell phones and portable radios ran down and could not be purchased. Streets were blocked with trees and downed wires, and people could not purchase gas even to run car radios. Pharmacies, hospitals and health centers were closed. Electronic records were inaccessible for days after the storm. This is clearly an environmental justice correlate of disaster response, as the FQHCs are specifically set up to provide health care for vulnerable, less affluent communities (see below).

Access to Medical Care and Supplies

Limited access to and use of medical facilities following disasters, especially severe hurricanes, has been an impediment to health care. It is proposed that access has several components: 1) wanting or needing to get medical care or supplies, 2) being able to get to medical care or supplies, 3) having medical care available, and 4) having medical supplies available (e.g. pharmacies open, supplies in stock). The interviews showed that many individuals were worried about basic needs (food, water, heat) more than about medical care.

Of the population interviewed, relatively few (11 %) respondents said that they needed to access their Center during *Sandy* (self-identification). Being able to get medical care is partly an issue of their Centers being open when needed, patients having access to another Center, or to another medical facility. All 7 facilities in this study were closed for at least a day, and some closed for up to 7 days. Thus for all the patients interviewed, access was impossible for one or more days. In the Centers in New Brunswick, Jersey City and Newark, closures were mainly due to local states-of-emergency (all roads were closed except for emergency personnel), which kept provider staff and patients off the roads. Some other Centers were hit harder, and physically damaged, while some satellite facilities were closed for a week or longer---one permanently. In these areas, transportation was impeded longer (Freedman, 2013), which made it an advantage to be able to walk to a Center. Even when Centers opened, professional staff who had to commute long distances could not traverse blocked roads. Staff as well as patients faced lack of access to their FQHCs. The New York City Study noted that approximately 9 % were unable to access medical care (Schwartz et al., 2014). Thus, the situation for the NJ FQHC patients seems to have been more severe than in nearby New York City.

Even after Centers re-opened, many patients experienced some access difficulty. Access to medical supplies is really a two part problem: (1) getting a prescription that can be filled, and (2) having a pharmacy that can fill it. By late 2012 many health systems had migrated to electronic health records and electronic prescriptions. However, electricity was interrupted both outside and inside Centers and pharmacies, delaying access to crucial medicines. Some people were displaced from their previous health care facility and thus did not have access to their prescription, or had only a description or perhaps the name of the drug they were taking. Centers, as well as shelters, tried to provide medications on an interim basis. In hard-hit shore communities, most pharmacies were closed, some for weeks. See (2013) found that in Hoboken (NJ) all of the pharmacies in the City were closed. In many places, loss of

electricity forced reversion to a pre-credit card, cash-only economy which lasted for days. In anticipation of the power outages, some Centers printed out records for scheduled appointments, none of which were given to patients.

Ethnic Differences

Environmental justice and the inequities suffered by minorities and low income individuals is an important societal issue (Mohai et al. 2009; Burger and Gochfeld, 2011; Gochfeld and Burger, 2011; EPA 2018). In this study there are two environmental justice levels: 1) a demographic difference between the populations using the FQHCs and New Jersey overall, and 2) differences within the populations using the FQHCs. The population of patients in the FQHC sample is not typical of New Jersey overall based on the U.S. Census data for New Jersey as of July 2015 (corresponding to the interview period). Our sample self-identified as White (non-Hispanic) 23.6 compared to 56.2% in New Jersey; 18.4 Black (non-Hispanic) compared with 14.8% in NJ, and 56.6 Hispanic compared with 19.7% statewide. Asians were underrepresented at 1.3% in our sample, compared with 9.7% of NJ (US Census Bureau, 2016). The Centers' primarily minority clientele was vulnerable during *Sandy*, as evidenced by the high evacuation rates and objective community impact ratings (Table 1, Halpin, 2013).

Secondly, there were some ethnic differences within the patient groups at FQHCs. The major differences were: 1) Hispanics had a lower % U.S. born than others, 2) among subjects born outside the U.S., Hispanics had been in the US for a shorter period than others, 3) Whites were out of their homes for significantly longer periods and experienced longer periods without power, 4) Whites rated their personal impact lower than Blacks or Hispanics, and, 5) a lower % Whites said they needed the centers, but a composite "medical need" score did not demonstrate a difference in whether patients had identifiable need for access to centers, doctors or medicines, or had interruption of these services.

That a majority of Hispanic respondents were not U.S. born has implications for management of health care and risk communication. Thus, there is a need for public policy makers and risk communicators to pay particular attention to providing target, vulnerable populations with information in Spanish regarding the importance of evacuation, having sufficient medicines, and a plan for dealing with medical needs during disasters. This includes having access to prescriptions when there is no electricity. The Hispanic interviewees represented 18 countries of origin, a significant source of heterogeneity in health status and risks (Pabon-Nau *et al.*, 2010).

Whites were away from their homes longer and were without electricity longer than others, but rated their personal impact lower. This was an unexpected finding, and requires more investigation. A lower % Whites also said they needed their Center during *Sandy*. However, based upon the composite "medical need" score, Whites displayed as much medical need as others. Their response suggests that they had other options or medical facilities that they could turn to. Indeed, their informal responses often reaffirmed this, as more Whites reported evacuating to relatives or friends away from the coast than did the other groups.

In this study of FQHC patients, 4% (Whites) to 12.2 % (Hispanic) self-reported needing the Centers during *Sandy*. However, when all medical need aspects are considered, about 12 % of the FQHC patients interviewed needed medical services during or immediately after *Sandy*. When examined “medical need” as a composite score (brittle conditions, self-identification of needing centers during or immediately after *Sandy*, interruption of medical services or medicines), there were no ethnic differences. This has two implications: 1) in low income neighborhoods where all groups use FQHCs, there are no ethnic differences in medical need and all should be considered in risk communication and resiliency planning, and 2) surveys and interviews of health need requires careful planning and redundancy so that true “medical need” can be determined without relying on a single direct question.

Self-rated Personal Impact

Respondents were asked “how much did *Sandy* affect you?” (0=not at all to 5=severely). The demographic differences that were identified in this study of patients at FQHCs were not significant compared to differences reported for a study conducted within the first 100 days of *Sandy* for a general population living along the New Jersey shore (Burger and Gochfeld, 2014a; 2014b). The earlier study, conducted at a variety of community centers, represented a geographically vulnerable, but not a socially vulnerable population. Thus the study immediately after *Sandy* did not interview patients who were clearly economically-challenged. Among the respondents interviewed immediately after *Sandy*, Hispanic interviewees also rated their personal impact the lowest, and African Americans rated it the highest. This difference may relate to the impact on the general population residing along the coast (of all economic levels), and a more restricted economic status among persons using the FQHCs. In addition, immediately after the storm, many individuals were focused on property damage, and what needed to be dealt with immediately to make their homes or apartments habitable. . In contrast, by the time of the present interviews, many of the FQHCs patients had already dealt with damage to homes and property in earlier years (Abramson et al., 2015).

Ethnicity affects a number of health responses, including post-traumatic stress (PTSD) and depression (Lowe et al., 2015). Non-Hispanic Blacks and Asians in New York City were more prone to posttraumatic stress and depression than others following *Sandy* (Lowe et al., 2015), especially those residing in high impact areas (Gruebner et al., 2016). The latter study identified both prior experience and geography as important factors in psychological vulnerability and resilience. Abramson et al. (2015) published a consortium study from academic researchers at different Universities. Data were collected by a team of two-dozen community-based interviewers who sampled throughout a 9-county area of New Jersey. Non-Hispanic Whites and Hispanics reported a higher % worsened health since *Sandy*, compared to Non-Hispanic Blacks (about 13 – 14 compared to 8 %), but these differences were not significant (Abramson et al., 2015). Indeed, that study reported few significant ethnic differences, although Non-Hispanic Whites reported significantly lower levels of post-traumatic stress disorder after Hurricane *Sandy*. The odds ratio of experiencing PTSD after *Sandy* was significantly higher for residents of homes with major damage (3.7) compared to minor damage (2.67). Hispanics exhibited significantly higher odds ratio (3.49) compared with others (1.59).

Limitations

Some limitations of this investigation should be noted. First, our interviews were conducted two to three years after Hurricane *Sandy*, and there is a question about recall. However, *Sandy* exerted a devastating effect on most of the individuals living in the areas with the FQHCs, and they clearly remembered the event (which led to long interviews while subjects shared their horror stories and complained about the government's response). In any case, the recall time was similar for different ethnic groups, although the possibility of ethnic differences in recall needs to be investigated. Second, people who moved away due to extreme adverse effects could not be interviewed. Third, individuals who could not get adequate care during or following *Sandy* at the FQHCs may have moved to other health care facilities, and then continued using those facilities. Hence some highly impacted families were probably missed. Patients with severe health problems may have gone to hospitals or other care facilities during and immediately after *Sandy* because of the importance and immediacy of their problems. These patients may never have returned to the Centers.

Public Policy, Management, and Helping Environmental Justice Communities

New Jersey had never experienced such a devastating disaster, over such a prolonged period, with such a widespread loss of power, decreased transportation and infrastructure, and such long periods of evacuation. Moreover, the storm was followed by a week of freezing temperatures forcing many to evacuate for lack of heat after the storm had passed. People did not realize their personal risk. Preparedness had not extended to these unpredicted circumstances. The experience of *Sandy* indicates the need for planning and redundancy for longer power outages, infrastructure damages, property damages, and large scale evacuations, coupled with particular changes to address methods of ensuring adequate health care and availability of medications.

There is a clear need for public engagement, and development of public policies that include adaptation before the onset of a disastrous hurricane, rather than just reactive responses (Wagner et al., 2014). There is a specific need, moreover, to address the risk to vulnerable individuals and communities that are dependent upon health centers such as the FQHC. Patients using these FQHC facilities may not have an option to visit other health centers or private doctors, and many did not have cars to do so. They may, therefore, need to be more prepared, rather than less, to deal with the risk of a severe storm, including disaster relief (Greenberg et al., 2014). It is suggested that public policies need to relate to public health access and care particularly with built in redundancy of facilities, transportation, and electricity for individuals using FQHCs. Up to 20 % of some ethnic groups in this study reported needing medical services or medicines during or immediately following *Sandy*, resulting in a delay in medical care and possible exacerbation of medical conditions because many were in communities without electricity, public transportation, clear roads (e.g. no car traffic allowed), or the availability of their FQHCs.

Some of the problems faced by this vulnerable population were a lack of transportation, open health centers, lack of medicines, lack of shelters, lack of food/water and electricity. These are problems that can be dealt with by governments. However, while patients themselves need to assume responsibility for their own and family's medical preparedness,

the Centers can help them do this by providing: clear information about evacuation vs sheltering in place, what medical supplies they may need to shelter in place, the nearest shelters (and what facilities they possess), and whether their current FQHC has a generator and the ability to stay open during power outages. The Centers can discuss with each patient how to deal with their own medical needs during an extended disaster (e.g. 2 weeks without electricity). While this information may be available to the public generally, it is suggested that the FQHC may provide it with their normal care, preparing their patients for such an emergency, including dealing with particularly vulnerable children or elders.

One additional problem that requires attention is that many physicians (perhaps most) now email or call in prescriptions and patients no longer have hard copies of them. Thus when patients went to new Centers or shelters, they had no way to obtain necessary medicine. There are also specific actions that might have prevented some of the problems, such as 1) allowing patients to acquire medicines and medical equipment before their prescriptions run out if they will expire within 2–3 weeks of an impending severe storm, 2) providing patient with a list of their prescriptions (with dose/day) that they could retain for emergencies, 3) designating Centers that have backup generators and staff and doctors that live nearby (and Centers accessible without reliance on public transportation), 4) having mobile facilities that are parked far from flooding, 5) having redundancy in centers and other health facilities, 6) providing information on disaster preparation and contingency planning at FQHCs, 7) providing targeted information on health and preparedness in Spanish or other languages as appropriate, and 7) using the vast quantity of research information and after-action reports available after *Katrina*, *Sandy*, *Harvey*, *Irma*, and *Maria* to target issues specific to ethnic groups and other vulnerable populations.

CONCLUSIONS

The FQHCs represent an environmental justice population with increased risk and vulnerability to disasters. The population using the FQHC in New Jersey showed some significant ethnic differences: 1) a lower % Hispanics were U.S. born, 2) those Hispanics who were not U.S. born, were in the U.S. for fewer years than Blacks or Whites who were not U.S. born, 3) Whites were out of their homes and/or without electricity for longer, 4) Whites had used the center for a shorter period than others, and 5) a lower % Whites reported needing the centers during/after Sandy than Black or Hispanics. However, the % with “medical need”, as determined by the investigators, did not vary by ethnic group. Data suggest there is a clear need to understand demographic differences for particular target populations that are at risk (e.g. need to use Federally Qualified Health Centers), and that understanding the differences in medical need requires asking the questions in different ways to understand the complexity of their answers. Further, the interruption of access to care during a disaster, and the need for these services, suggests that public policy makers, local governments, public safety, insurance companies, health care professionals and Federal agencies need to find ways to ameliorate some of these effects before the next disaster, not just after. In addition, specific plans need to be developed for vulnerable populations with no access to other health centers, without cars or public transportation, and without sufficient medications or medical services to last through an extended emergency.

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1.
Map of New Jersey showing the locations of the Federally Qualified Health Centers.

Characteristics of the Federally Qualified Health Centers in New Jersey where patients were interviewed regarding their concerns, responses, and uses of the centers two to three years after Hurricane *Sandy* made landfall in New Jersey. The hardest hit impact, community hardship rank, and household hardship rank are from Halpin (2013). The impact ratings of medium impact, high impact, and very high impact are a composite we developed from Halpin's ratings.

Table 1.

CENTER	COUNTY	HARDEST HIT IMPACT	TOWN	COMMUNITY HARDSHIP RANK	HOUSEHOLD HARDSHIP RANK
		VERY HIGH IMPACT			
Horizon HC	Hudson	10 th	Jersey City	174 th	2 nd
Neighborhood HC	Union	5 th	Elizabeth	102 nd	5 th
Ocean Health Initiatives	Ocean	2 nd	Toms River	5 th	8 th
			HIGH IMPACT		
CHEMED	Ocean	2 nd	Lakewood	259 th	15 th
Monmouth Family Health	Monmouth	1 st	Long Branch	23 rd	19 th
			MEDIUM IMPACT		
Eric B. Chandler H.C.	Middlesex	4 th	New Brunswick	188 th	36 th
Neighborhood HC	Union	5 th	Plainfield	120 th	63 rd

Table 2.

Demographics and other characteristics of interviewees at Federally Qualified Health Centers in New Jersey by ethnicity. There was a total of 600 subjects, but 16 did not identify as one of the three. NS = not significant.

Characteristic	Hispanic/ Latino	African American	Caucasian	X ² (p)
Number interviewed	335	109	140	
Demographics				
% Female	68.4%	66.1%	58.6%	NS
Mean Age	40.3 ± 0.7	41.4 ± 1.3	43.1 ± 1.1	NS
US born	9.7%	82.6%	79.9%	301 (<0.0001)
Years in US ^a	15.6 ± 0.6	19.9 ± 3.0	23.7 ± 3.1	11.1 (0.01)
Sandy effects				
% told to evacuate	15.4%	9.5%	19.2%	NS
% evacuated	17.0%	12.4%	21.5%	NS
Days evacuated ^b	21.6 ± 6.1	20.8 ± 8.6	73.5 ± 22.4	10.9 (0.01)
% still out of house ^c	10.4%	7.7%	25.0%	NS
Days no power ^d	9.4 ± 0.7	8.1 ± 0.7	11.2 ± 1.8	9.7 (0.02)
Self-rating of <i>Sandy</i> impact on patient ^e	3.4 ± 0.1	3.1 ± 0.1	3.0 ± 0.1	9.8 (0.02)
Center Use				
How long going to Center? (yrs)	6.6 ± 0.4	7.7 ± 1.0	4.2 ± 0.4	15.9 (0.003)
% used this center before <i>Sandy</i> ?	58.8%	64.6%	42.7%	20.3 (0.003)
Center visits/year (max)	7.3 ± 0.8 (180)	5.7 ± 0.6 (36)	9.1 ± 2.6 (260)	NS
% needed Center during <i>Sandy</i> ?	12.2%	13.6%	3.9%	8.8 (0.03)
% with any medical need during or immediately after <i>Sandy</i> (composite score)	19.4%	19.3%	13.6%	NS
% with any medical interruption in medical services or medication due to <i>Sandy</i>	9.2%	11.3%	3.8%	NS
% had trouble getting to Center	9.2%	8.0%	2.3%	NS
How do you get to center?				
Car	36.7%	59.2%	81.4%	127 (<0.0001)
Walk	27.0%	13.6%	9.3%	
Taxi	15.7%	1.9%	2.3%	
Friend/Family	5.6%	10.7%	3.1%	
Bus	14.1%	10.7%	2.3%	
Other	0.9%	3.9%	1.6%	

^a If not born in the United States

^b If person had to evacuate

^c If the person had to evacuate and had not returned home at the time of the survey in 2015.

^{d.}Includes 0 days for people without power outages.

^{e.}On a scale of 1 (no impact) to 5(severe)

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Table 3.

Self-identified medical conditions for respondents interviewed at FQHCs by ethnicity.

Diagnosed Medical Condition	Total Sample		Hispanic/Latino		Black		White	
	N	%	n	%	n	%	n	%
Number Interviewed	489		261		96		126	
No medical condition reported	306	62.6	161	61.7	59	61.5%	85	67.5
Diabetes	62	12.7	31	11.9	17	17.7%	13	10.3
Asthma/respiratory	58	11.9	31	11.9	13	13.5%	14	11.1
High Blood Pressure/ Hypertension	27	5.5	18	6.9	7	7.3%	2	1.6
Arrhythmias/heart disease	19	3.9	9	3.4	4	4.2%	5	4.
Kidney disease/dialysis	11	2.2	6	2.3	0	0	5	4.
Cancer	9	1.8	6	2.3	1	1%	2	1.6

All other conditions were reported by 5 or fewer individuals

Table 4.

Main concerns about Hurricane *Sandy* for subject population by ethnicity. Patients were asked about their concerns on an open-ended question. Overall chi square = 0.005 ↑=high value ↓=low value. * = Individual P<0.05.

Characteristic ^a	All Responses	Hispanic/ Latino	African American	Caucasian
Number interviewed	579	320	107	139
Family	44.0%	44.7%	48.6%	39.6%
Survival	39.4%	40.3%	30.8%↓	43.2%
Safety *	26.6%	24.7%	36.4%↑	23.0%
Food *	23.8%	30.0%↑	16.8%↓	15.8%
Medical *	19.7%	24.1%↑	17.8%	12.9%
Possessions *	18.1%	15.3%	16.8%	25.9%↑
Prepare for next *	11.1%	13.8%	4.7%↓	10.1%
No concerns	10.5%	9.4%	9.3%	14.4%↑
Recovery	9.7%	8.4%	12.1%	10.8%
Stress	8.5%	10.0%	9.3%	4.3%↓
Work	7.4%	8.4%	7.5%	5.0%
Transportation	6.0%	5.3%	7.5%	5.8%
Drinking water *	5.7%	8.1%	6.5%	0.0%↓
Spoilage of food	5.0%	5.9%	3.7%	4.3%
Community	4.5%	5.0%	4.7%	3.6%
Evacuate	4.5%	4.4%	3.7%	5.8%
Medications	3.8%	3.8%	4.7%	3.6%
Communication	2.8%	3.1%	2.8%	1.4%
Homeless	2.4%	1.6%	2.8%	4.3%
Security	2.1%	1.9%	4.7%	0.7%
Ecological	1.9%	2.8%	0.9%	0.7%
Money	1.7%	1.6%	2.8%	1.4%
Schools	1.0%	1.6%	0.0%	0.7%
Mold	0.3%	0.3%	0.9%	0.0%
Actions	0.2%	0.3%	0.0%	0.0%
Pets	0.2%	0.0%	0.0%	0.7%

^aPeople can have more than one concern.