Published in final edited form as:

Public Health Nurs. 2014 November ; 31(6): 500–507. doi:10.1111/phn.12160.

We Stop for No Storm: Coping with an Environmental Disaster and Public Health Research

Elizabeth Reifsnider, PhD, WHNP-BC, PHCNS-BC, FAANP, FAAN [Nancy Melvin Professor and Associate Dean for Research],

College of Nursing and Health Innovation, Arizona State University, Phoenix, AZ

Sheryl L. Bishop, PhD [Professor, Director, Biobehavioral Research Laboratory],

University of Texas Medical Branch at Galveston, School of Nursing, Galveston, TX

Kyungeh An, PhD., RN [Associate Professor, Adult Health and Nursing Systems],

Virginia Commonwealth University, Richmond, VA

Elnora Mendias, PhD, RN [Professor (emeritus)],

University of Texas Medical Branch at Galveston, School of Nursing, Galveston, TX

Kristen Welker-Hood, ScD RN [Senior Program Associate],

Leadership for Healthy Communities, District of Columbia

Michael W. Moramarco, MA [Project Coordinator], and

College of Nursing and Health Innovation, Arizona State University, Phoenix, AZ

Yolanda R. Davila, PhD, RN [Professor]

University of Texas Medical Branch at Galveston, School of Nursing, Galveston, TX

Elizabeth Reifsnider: Elizabeth.Reifsnider@asu.edu; Sheryl L. Bishop: sbishop@utmb.edu; Kyungeh An: kan@vcu.edu; Elnora Mendias: noniemendias@gmail.com; Kristen Welker-Hood: Kristen@leadershipforhealthycommunities.org; Michael W. Moramarco: Michael.Moramarco@asu.edu; Yolanda R. Davila: yrdavila@utmb.edu

Abstract

Coping with natural disasters is part of the public nurse's role and the public health nursing researcher is doubly challenged with continuing to conduct community-based research in the midst of the disaster. The PHN may provide service along with attempting to continue the research. The challenges faced by public/community health nurse researchers as a result of hurricane Ike are discussed in order to provide lessons for other public/community health researchers who may be affected by natural disasters in the future. It is important to consider challenges for recruitment and retention of research subjects after a disaster, impact of natural disasters on ongoing research, and opportunities for research to be found in coping with natural disasters. A community-based study that was in progress at the time of hurricane Ike will be used as an example for coping with a natural disaster. We will present "lessons learned" in the hope of helping researchers consider what can go wrong with research studies in the midst of natural disasters and how to proactively plan for keeping research reliable and valid when natural

disasters occur. We will also discuss the opportunities for collaborations between researchers and the community following any disaster.

Keywords

Natural disaster; hurricane; public health nurse; public health research; WIC

Introduction

In the midst of the turmoil and tragedy that disasters bring to bear are opportunities for growth, innovation and creative problem solving. The demand for effective responses is especially critical for health care providers who are simultaneously victims of the disaster and first responders. When these same individuals are also responsible for a large student population and protecting the integrity of various research endeavors, the challenges are manifold. In this paper, we aim to detail the challenges faced by public/community health nurse researchers as a result of hurricane Ike, one of the most costly hurricanes to ever hit the United States, in order to provide lessons for other public/community health researchers that may be affected by natural disasters in the future. It is important to consider challenges for recruitment and retention of research subjects after a disaster, impact of natural disasters on ongoing research, and opportunities for research to be found in coping with natural disasters. A community-based study that was in progress at the time of hurricane Ike will be used as an example for coping with a natural disaster. We will present “lessons learned” in the hope of helping researchers consider what can go wrong with research studies in the midst of natural disasters and how to proactively plan for keeping research reliable and valid when natural disasters occur. We will also discuss the opportunities for collaborations between researchers and the community following any disaster.

Hurricane Ike—part of an active Atlantic storm system that featured 16 named storms and 6 consecutive storms that made U.S. landfall—struck Galveston, Texas, as an intense Category 2 storm on September 13, 2008 leaving a trail of damage from Texas to the Midwest. It was the fourth most destructive hurricane to make landfall in the United States. It made landfall on Galveston Island and cut directly across the campus of the University of Texas Medical Branch (UTMB) engulfing the island in a 7 to 14 foot storm surge. All activities at UTMB were severely affected necessitating a mandatory evacuation of entire campus including 13,000 faculty and staff, and 469 patients (of which 80 were neonates) from four hospitals on the campus; 3000 students and suspension of classes for all four schools: nursing, medical, health professions, and graduate schools; and suspension and interruption of all research studies (e.g., all research animals had to be relocated inland disrupting experimental conditions) (Maybauer, Menga, Asmussen, & Maybauer, 2011). Damages from Ike in US coastal and inland areas were estimated at \$29.5 billion (2008 USD) and it has been the most costly hurricane in Texas (Berg, 2009). It was categorized as a Category 2 by wind but a Category 5 by the storm surge, which flooded more than 75% of all buildings in Galveston and 90% of the buildings on the UTMB campus. Hurricane force winds spread over a 510 mile area (Maybauer et al., 2011), with the eye passing directly over the eastern end of Galveston Island. Hurricane Ike was responsible for 195 deaths; 74

in Haiti, 112 in the United States, with 23 people unaccounted for (Berg, 2009). Hurricane Ike's immense size caused destruction from Louisiana to near Padre Island, Texas, a distance of almost 430 miles. But, according to the more meaningful Integrated Kinetic Energy or IKE scale developed at the National Oceanic and Atmospheric Administration (NOAA), Ike received the highest rating ever estimated (5.6 on a scale of 6) compared with a 5.1 score for hurricane Katrina. The industry publication, *Weatherwise*, noted that Ike's rating on the new IKE scale makes it the strongest hurricane ever documented in the North Atlantic Basin (Beven & Brown, 2009).

The hurricane's devastation severely impacted the physical, environmental, economic, and health and social service subsystems of the community. The early phases of recovery were hindered by a lack of water, electricity, food, gasoline, sanitation, basic communication, health and social services, and also by unsafe or demolished housing and buildings. Later phases of recovery were similarly hindered by the continued lack of adequate housing, health and social services, employment, and a state and national economic downturn.

Residents, focused on survival and recovery, returned to inadequate housing and a floundering economy. The need for relocation and temporary housing created a transient population. One year later, approximately 20% of the original pre-Ike Galveston population of 58,000 failed to return and 25% of the pre-Ike businesses failed to reopen. The loss of research sites and research participants, along with the fore-mentioned factors, brought research studies pre-Ike to a halt post-Ike for numerous community-based researchers.

Since all areas of the country are vulnerable to some type of natural disaster, if not from hurricanes, then from tornados, flooding, fire, ice storms, etc., the lessons learned about emergency preparedness for research with human subjects can benefit researchers from all areas of the country. Some disasters result in the loss of study population and samples, and others result in loss of research materials. In order to successfully adapt to natural disasters and capitalize on the opportunities in them, researchers need to consider various options. We will present our experiences in coping with on-going and new community-based research studies during a weather-related disaster.

Effects of Displacement

According to the 2000 United States Census, there were 57,247 people, 23,842 households, and 13,732 families residing in the city of Galveston. As the largest employer on the island and surrounding communities prior to hurricane Ike, the University employed more than 13,000 people. Following the displacement caused by hurricane Ike, the population of Galveston city was 47,762 (US Census Bureau, 2012). The 'missing' population was of significant concern since it represented a potential threat to existing community and clinical research programs who had recruited participants from the region as well as future research proposals that relied on a diverse population distribution. In 2000, Galveston had over 22% of residents living below the poverty line, compared to a Texas state average of 16% and a national average of 12.7% (U.S. Census). It soon became clear that hurricane Ike had disproportionately impacted low-income people in Galveston County as they had fewer resources to deal with displacement and damage to personal property. For instance, many

low income residents of Galveston did not have their own personal vehicles and relied on public transportation. The civil authorities organized buses to assist residents without personal transportation to evacuate Galveston Island prior to the storm's landing to shelters in Houston, San Antonio, Austin, and other large cities inland in Texas. However, there was no transportation provided for the residents to return to their homes after the storm had passed. In addition, civil authorities restricted access to the Island to residents with proof of residency, which may have been lost with flooding or not available at the time of evacuation (Ballen, 2009). A large volume of low income rental housing was on the side of the island most vulnerable to the storm surge and was flooded. While the evacuation of residents of these low income properties saved their lives, they lost most of their possessions and their homes with the storm. The city of Galveston, which owned many of the low income housing units that were flooded, subsequently demolished the units after they stood vacant for nearly a year and became health hazards forcing most of the low income residents to find alternative housing. Eventually over 50,000 pre-Ike Galveston residents were approved for participation in government programs following hurricane Ike (Wild, 2009). The magnitude of damage/flooding was both unprecedented and unanticipated. Basic civil infrastructure (power, water, sewerage, gas) was out of commission for much longer than anticipated. Civil authorities decided to keep most non-essential personnel off the island for weeks including researchers who could not return to their research labs and offices. These impacts had severe consequences on all research that was ongoing at the time that hurricane Ike hit the island.

The Institute of Medicine Roundtable on Environmental Health Sciences met in 2005, a year after hurricane Katrina to consider the status of the recovery and ongoing considerations to the public's health and to gain insight on preparedness for future disasters of this magnitude (IOM, 2007). Environmental issues of concern identified in the aftermath of hurricane Katrina included: issues of draining of flooded areas, access to potable water, vector control, reestablishing safe food supply, waste disposal, repair or rebuilding wastewater systems, air quality, worker safety during clean-up and rebuilding efforts, and safe housing. Studies of the environmental health impact from hurricane Ike reported that those hit hardest in the storm were Galveston Island residents reporting injuries occurring from pre-storm hurricane preparedness, during the storm or as part of aftermath during cleanup activities; respiratory illnesses from inhabiting water damaged buildings with mold; carbon monoxide poisoning from improper ventilation of electric generators; psychological impacts from the disaster; and disaster-related illness due to lack of access to potable water and unspoiled food (CDC, 2009; Norris, Sherrib, & Galea 2010; Zane et.al., 2011). In a quantitative survey conducted 17 days after hurricane Ike, researchers found that 45% of households were without electricity, 26% had no regular garbage collection, and 46% reported feeling that their residence was unsafe to inhabit due to mold, roof, and or structural damage, and lack of electricity (Zane et. al., 2011).

One Example: Impact on a community-based intervention study

In April of 2008, the NIH funded study "Reducing Overweight among Galveston WIC Participants" began. The study design called for randomized controlled trial design involving an educational intervention with low income families working with mothers on

reduction of child obesity. The project was designed to recruit from four Special Supplemental Nutrition Programs for Women, Infants and Children (WIC) clinics; two were on Galveston Island and two were nearby on the mainland in Galveston County, with clinics randomized to condition with one experimental and one control being located on the mainland and on the island to reduce location bias. The patient census at these clinics was expected to maintain sufficient numbers separated by locale to minimize confounding. The study recruited its first participant on September 5, only three days before hurricane Ike arrived. In the aftermath of the hurricane, it was apparent that the availability of the proposed subject population had been and would continue to be significantly disrupted by hurricane Ike. Due to the significant damage to the University of Texas Medical Branch, the WIC clinic in the maternity outpatient clinic was permanently closed and its patient population was merged with the Island Community Center clinic in the city of Galveston, which was also damaged but less severely. The two clinics on the mainland were not damaged by Ike but had lower applications for assistance than they had before hurricane Ike, again due to the displacement of low income families from the region. Loss of the four low income housing complexes that were flooded prevented many potential research participants for the research project who had been enrolled in the WIC program from being recruited as they were no longer Galveston residents. Other problems included inability to contact potential research participants because of their lack of telephones, no electrical power at many of the homes, loss of vehicles from flooding which affected ability to get to available clinics, and loss of clients' needed documentation to receive WIC assistance.

Although able to resume recruiting relatively soon after hurricane Ike landed, albeit from temporary research offices set up in the homes of the research team, the research was hampered by numerous difficulties. The WIC clinics in Galveston County resumed operations two months after the hurricane, but their numbers of participants were notably reduced due to the displacement of WIC population. The Galveston WIC office unofficially estimates that their WIC caseload dropped by over 1,000 per month from the same time pre-Ike. The study was designed to recruit 100 mother-child dyads but was only able to recruit 56 due to the loss of population. The study sample was designed to reflect the pre-Ike demographics of Galveston Island and be equally composed of Hispanic, white non-Hispanic, and African American children. The population of African Americans in Galveston County was largely concentrated in the City of Galveston, and they resided in residences that were in the area of town most heavily affected by the storm surge and resultant flooding. With that housing removed, the low-income African American community was widely dispersed and was not available at the Galveston WIC clinics for recruitment. Consequently, the available population of African American mothers and children for recruitment from the WIC program was severely curtailed.

In addition to sample availability, the WIC clinics were obviously focused on helping clients and so space for research assistants to recruit was severely limited. Some of the research staff evacuated and had residential damage of their own and were not able to return to work on the study. The temporary research office contained all of the subject files in a locked file cabinet, the protocol manual, all the associated research equipment (mainly teaching tools), and all correspondence.

Displacement has many impacts. In addition to the loss of potential research participants completely removed from the locality, many of the clients that came to the WIC clinic for assistance post-storm were only temporarily residing in the county and planned to move on soon. They wanted WIC assistance for a limited period of time and participating in a longitudinal study was not of interest to them. Many WIC clients lost transportation (their cars flooded or the limited public transportation was completely disrupted) and had to depend on others to get to clinics as they were living with relatives, or had many relatives living with them.

The loss of the clinic on the Island left the research team with only three clinics from which to recruit and required the design to be altered after recruitment began, necessitating seeking approval for changes from NIH to a quasi-experimental design randomizing families within all clinics into both study conditions and subsequent amendments to the IRB approvals. However, even these adaptations could not completely overcome the negative impact on participant availability that had existed subsequent to Ike as the research team was not able to complete the revised enrollment strategy and closed enrollment with 30 control subjects and 26 intervention subjects.

At the recommendation of our statistician, we immediately created a hurricane Ike Impact Questionnaire to determine the impact of hurricane Ike on the living situation of our subjects. The questionnaire included questions about residential damage from the hurricane, federal (FEMA) assistance required, and evacuation experiences. We collected data on the hurricane experiences for one year following the hurricane (October 2008 to October 2009) from a total of 31 participants who were recruited in that year.

The severe impact of the disruption caused by hurricane Ike on WIC participants is evident from Table 1.

Nearly all research participants evacuated to various places and subsequently returned to damaged homes. More than a third registered with the Federal Emergency Management Agency (FEMA) either for housing or temporary assistance. Participating in a study on childhood obesity would obviously be a low priority for parents who are worried about feeding and keeping their children safe in damaged housing and uncertain job prospects. This addition provided us an opportunity to explore the impact of a natural disaster, especially in homes with young children, on the outcomes of an intervention promoting healthy eating and physical activity. While research opportunities may be hard to see when devastation is prominent, research undertaken post-disaster can be adapted or modified to examine both the impact of the disaster and how participants coped with adversity.

Overcoming challenges to conducting research after a disaster and lessons learned

The research team employed a variety of methods to cope with challenges to continuing the study. Among these were close communication with the local health department authorities, outreach to community groups to locate potential research participants, alliances with similar programs for low-income children such as Head Start, contacts to other WIC

agencies with access to additional populations, modifications to the research plan to adjust to the need for additional research participants, and assistance from the National Institutes of Health/National Institute of Nursing Research.

Emergency Preparedness in Community Research

The disaster reinforced the importance of having all documentation safely stored away from potential flooding and having multiple ways to reach research partners. Maintaining communication with all parties (IRB, funders, recruitment sites, etc.) is important and should be fast and clear. There was an impetus to openly discuss needs and potential solutions with everyone who might potentially benefit the research continuation. It was necessary to be creative in ways to access research participants and utilize research staff when recruitment could not occur in the manner planned.

Disasters also reinforce that subject rosters should be created before an emergency and distributed to ALL trial personnel and that rosters should be available in a secure online site that is accessible to all personnel (e.g. an Excel file). As part of the pre-disaster planning, trial personnel rosters with contact information should be created and distributed to all trial personnel. Emergency contact cards should be created and provided to research participants that include the PI and coordinator's name, phone number, email, address, study name, and identifying numbers.

An emergency contact procedure should be developed and disseminated to study staff that describes how to care for themselves and their families first to ensure their own safety, then how to communicate with each other and where all the study information is located and how to retrieve it. Redundancy in staff training will facilitate preservation and recovery efforts if some of the staff have suffered loss or injury in the emergency. If multiple staff know important procedures, the study can continue with the temporary absence of essential personnel.

It is important to plan for a potentially varying intervals of interruption with a short-term minimum of 3–4 days, also in addition to a longer term in case of major catastrophe. The pre-hurricane disaster plan for our study was for 3–4 days but that was not long enough for a disaster that affected 75% of city infrastructure and a majority of the population. It is also vital to document all research assets (any unique instruments, tools, intervention items, etc.) prior to any disaster to secure reimbursement for losses. Keep top priority (after physical safety) for maintaining participant data or samples.

Difficulties inevitably arise after a disaster as community members who may be research participants, are either temporarily or permanently displaced through evacuation, relocation, and loss of housing and employment. In the wake of the disaster, participants experience a drastic change in priorities, with everyday survivorship taking precedence. In the aftermath, a research team may quickly find limitations in their current recruitment and retention procedures. It is in the best interest of the research team to incorporate recruitment and retention strategies into the protocol prior to the start of research related activities and experience of a disaster. Researchers can increase study participants' trust, gain continued engagement and retention by identifying participants with significant unmet community

human services needs (shelter, health and medical, food, water, transportation etc.) and facilitate connecting them to safety net programs and resources put in place to help with the response. In the case of large-scale disasters community members in need of help are often difficult to identify by emergency providers brought in from out of area during the relief response. Researchers with community member rosters (study participants and household members) can fast-track the identification of high risk individuals that ought to be targeted for assistance.

Recruitment and Retention of Participants

To maximize recruitment into a study post-disaster, efforts should be made to incorporate multiple and geographically distant sites as well as traditional community aid sites such as churches and food pantries. Providing assistance to original recruitment sites to get them up and running may also benefit recruitment efforts. This may entail literally rolling up your (and your students') sleeves to assist with the clean-up process, providing needed supplies and skill sets along with moral support and encouragement during the rebuilding phase. Your presence and restorative efforts will be noted, appreciated, and demonstrate your interest and commitment to the health and well-being of the target community.

Researchers' involvement in a community's revitalization efforts following a natural disaster can facilitate not only a community's recovery but also the researchers' projects. Opportunities are available to provide services while re-establishing/reconnecting with pre-disaster research sites and populations or establishing new post-disaster sites and populations. Standard recruitment and retention procedures are inadequate in a post-disaster environment. There is a need to develop "contact and follow-up" procedures tailored to accommodate a displaced and transient post-disaster population.

A review of the literature has identified several strategies developed to enhance participants' retention in routine circumstances. These become even more important should a disaster occur. Strategies include the collection of participants' home, work, and cell phone numbers, primary and alternate email addresses, and phone numbers of close friends and relatives outside of the immediate vicinity. Contact information should be updated at each study contact to maintain currency and accuracy. Distribution of self-addressed, stamped envelopes containing participants' changes of address information at the time of enrollment (and other predetermined points of time) is another way of keeping current with changes in participants' mailing and email addresses and phone numbers (Brannon et al., 2013; Nicholson et al., 2011). The provision of small incentives to participants who update their contact information also helps keep contact information accurate and current, thus enhancing retention (Nicholson et al., 2011). Updated contact information can be stored in a data management system, such as Microsoft Access, and used by research staff to track and contact participants in need of follow-up and continued study participation (Barnett, Aguilar, Brittner, & Bonuck, 2012). Enrollment is also a good time to provide participants verbal and written information identifying the timing and (small, incremental increases) amount of study incentives. Reminder cards, containing the time and amount of the next incentive, can be distributed at the end of each study session, thus serving as motivation to continue in the study (Nicholson et al., 2011). Enrollment is also an ideal time to provide participants with a

dedicated study phone line along to make, change, or confirm an upcoming study sessions (Nicholson et al., 2011). Development of a study project's identity and corresponding with participants has been shown to increase participants' identification with and commitment to a research project. Mailings with a project's logo, sent at regular intervals, serve as a visual cognitive reminder of the project and an enhancement of their identification with and commitment to 'their project'. Trademarked logo mailings can be sent out as reminder postcards, birthday and holiday greetings, thank you notes, and periodic newsletters (Nicholson et al., 2011). Brannon et al. (2013) advocate for the mailing of a quarterly newsletter informing participants of a study's progress as it communicates to research participants' value to the project and emphasizes their commitment to bettering the health of their community. Finally in areas in which disaster threats are known, e.g., hurricane season on the coastal areas or earthquakes in earthquake zones, proactively providing research participants with emergency contact information with the study team as well as instructions for activities in the case of a disaster serves to prepare participants for the contingencies that they may face during a disaster. Coupled with admonitions for being prepared for such disasters (e.g., personal evacuation plans, shelter-in-place supplies, fuel for cars and generators), such communications also serve a public health need.

Community Research Collaboration Opportunities

Communities face strong challenges following disasters that even excellent planning and preparation cannot prevent. Disaster planning has the potential to hasten recovery but cannot fully prevent the impact on a community of the following items: Safety of self and family, safety from looting, potable water, food, housing, sanitation, power, transit (local transport disruptions, debris-filled roadways, lack of gasoline), communications (phone, internet, cable, etc.), space for the displaced, health care, supplies, equipment, or people (mental health). There is a priority for researchers and community members alike to take care of one's self, family, and neighbors. It is also important for researchers to acknowledge the necessity of managing fatigue, anxiety, fear, grief, anger, immobilization, and feelings of general helplessness.

It is important to always look for new research opportunities and seize them as they are presented. In order to do this, one must be ready to modify/adapt your ongoing research, be prepared to explore new research directions, or collaborate with other researchers or institutions. Leveraging existing relationships with community partners is crucial because they are as invested in the growth and health of their community as you are in your research. In order to accomplish this, you must identify post-disaster research issues, needs, gaps, current/potential partnerships, and solutions. This also involves keeping in good contact with your institutional review board (IRB) to accommodate any changes in research protocols regarding sites and populations. In addition, one must be ready to negotiate with other institutions regarding the use of alternative populations, labs, or equipment during disaster times. Some examples of taking advantage of the disaster would be to look at community stresses, and for educational institutions, it could be beneficial to assess any impacts (mental, physical, monetary, etc.) upon the student body or institutional community. Educational research can study alternative methods of content delivery when traditional methods have been disrupted by a disaster. Research particular to health care professionals

can assess the emergency response to the disaster itself in regards to the professionals' plans to deliver care during the disaster when their own homes and families are threatened.

Due to the sensitive nature of this kind of research, timing is often crucial. When developing new research, it is good to remember that while immediate research action is ideal, it is not always practical or ethical. If existing research is being adapted, it is possible it may take effect immediately. Timely action is critical to sustain funding and the research program.

Findings/Conclusions

Specific actions that will increase the likelihood of research succeeding in the wake of a disaster includes having call-in systems in place for researchers to communicate with IRB and offices of research support; developing business continuity plans; increasing and supporting researchers' access to communication technology and to financial resources and information about continued funding from national granting agencies. Researchers' involvement in a community's revitalization efforts facilitates not only a community's recovery but also the researchers' projects. As emergent issues arise, opportunities for inquiry and exploration will become evident and enrollment of relevant partners into the investigatory process will also be easier if a researcher is seen as a community member rather than an outsider. Several external research groups approached the Galveston community in the immediate aftermath with research surveys that were commonly perceived as intrusive and invasive by a stressed and overwhelmed community. Yet a similar effort by one of our team focused on the university community was gratefully received as an opportunity to communicate their circumstances.

Given the susceptibility of natural or manmade disasters to strike any place, the lessons learned about emergency preparedness from those researchers who have lived the experience can benefit researchers elsewhere, and especially in the states which border the Gulf Coast or Atlantic Ocean. Anticipatory contingency planning for disasters can help researchers conduct high-quality research even in dire circumstances. Additionally, staying flexible and open to research opportunities can generate important knowledge about how disasters affect human life within the context of researchers' areas of concern.

References

- Ballen D. Vulnerable Populations. The Institute for Business and Home Safety. 2009; 1(1):1–4.
- Barnett J, Aguilar S, Brittner M, Bonuck K. Recruiting and retaining low-income, multi ethnic women into randomized controlled trials: Successful strategies and staffing. *Contemporary Clinical Trials*. 2012; 33(5):925–932. [PubMed: 22732312]
- Berg, R. National Hurricane Center. Hurricane Ike: November 5 – 9. 2008 (Tropical Cyclone Report). United States National Oceanic and Atmospheric Administration's National Weather Service. 2009 Jan 23. Archived from the original and retrieved on December 9, 2012 from http://www.nhc.noaa.gov/pdf/TCR-AL092008_Ike_3May10.pdf
- Beven JL, Brown DP. The 2009 Atlantic hurricane season. *Weatherwise, The Magazine About Weather*. 2009 Mar-Apr;:36–43.
- Brannon EE, Kuhl ES, Boles RE, Aylward BS, Ratcliff MB, Valenzuela JM, Johnson SL, Powers SW. Strategies for recruitment and retention of families from low-income, ethnic minority backgrounds in a longitudinal study of caregiver feeding and child weight. *Children's Health Care*. 2013; 42(3): 198–213.

- Centers for Disease Control and Prevention. Carbon monoxide exposures after hurricane Ike – Texas, September 2008. Morbidity and Mortality Weekly Report. 2009; 58(31):845–849. [PubMed: 19680219]
- Institute of Medicine. Environmental Public Health impacts of disasters: hurricane Katrina. Washington, DC: The National Academies Press; 2007.
- Maybauer, MO.; Menga, M.; Asmussen, S.; Maybauer, DM. Hurricane evacuations of the University of Texas Medical Branch at Galveston. In: Lupo, A., editor. Recent hurricane research – Climate dynamics, and societal impacts. Rijeka, Croatia: Intech; 2011.
- Nicholson L, Schwirian PM, Klein EG, Skybo T, Murray-Johnson LM, Eneli I, Boettner B, French GM, Groner JA. Recruitment and retention strategies in longitudinal clinical studies with low-income populations. Contemporary Clinical Trials. 2011; 32(3):353–362. [PubMed: 21276876]
- Norris FH, Sherrieb K, Galea S. Prevalence and consequences of disaster-related illness and injury from hurricane Ike. Rehabilitation Psychology. 2010; 55(3):221–230. [PubMed: 20804265]
- U.S. Census Bureau. American FactFinder fact sheet: City of Galveston, TX. 2012. Retrieved July 31, 2014, from <http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>
- Wild AC. Hurricane Ike: Rehabilitation of Affordable Rental Units on Galveston Island. Center for Sustainable Development. 2009:1–25.
- Zane DF, Bayleyegn TM, Haywood TL, Wiltz-Beckham D, Guidry HM, Sanchez C, Wolkin AF. Tracking deaths related to hurricane Ike, Texas, 2008. Disaster Medicine and Public Health Preparedness. 2011; 5(1):23–28. helphelp. [PubMed: 21402823]

Table 1

Results of the Hurricane Ike Impact Questionnaire

Items	N (31)	%
Evacuated	29	90
Nearby family	2	6
Out of town	26	84
Other	3	10
Where stayed		
Family	19	63
Friends	7	22
Hotel	3	10
Shelter	2	6
Days without water	4	12
Homes damaged	22	71
Registered with FEMA	11	37
Required FEMA housing	5	17
Other FEMA assistance	10	33
Injured by hurricane	2	6