Using community-based, ethnographic methods to examine risk perceptions and actions of low-income, first-time mothers in a post-spill environment

Christopher A. Mundorf[*,iD] and **Maureen Y. Lichtveld**[iD]

Department of Global Environmental Health Sciences, Tulane University School of Public Health and Tropical Medicine, New Orleans, LA, USA

Abstract

Following the 2010 Gulf Oil Spill, area pregnant women were thought to be at-risk for poor health outcomes from the stress of managing health actions in this post-disaster environment. Research directed by an ongoing community– academic partnership sought to explore the specific role of culture in environmental risk protection actions among low-income pregnant women. As a part of the first-phase of a mixed-methods cultural study, community health workers (CHWs) used freelisting methods to survey low-income, first-time mother ($n = 20$) for the threats in the environment and relevant protective actions. Then, a separate pile sort activity ($n = 31$) was used to further investigate these cultural topics. Results elicited a diverse range of threats, protective actions, and sources of support across socio-demographic groups. Results also showed a culturally tailored conceptualization of threats in the environment. Exploring beliefs among a diverse population helps to uncover cultural differences in a population. Results will aid in developing culturally tailored policies and interventions, and increase the relevance of such interventions to address community concerns. Moreover, incorporating CHWs into the research process enhanced researcher literacy, and fostered mutual trust between the community and researchers.

Introduction

The explosion at the Deepwater Horizon drilling rig off the coast of Louisiana in 2010 led to the largest oil spill in history (Goldstein, Osofsky, and Lichtveld 2011). To manage the unprecedented amount of oil, officials deployed dispersant chemicals, and employed thousands of locals to help with the clean-up effort (Biello 2010). The disaster caused

[*]Corresponding author. cmundorf@tulane.edu.
ORCID
Christopher A. Mundorf [iD] http://orcid.org/0000-0002-8780-9122
Maureen Y. Lichtveld [iD] http://orcid.org/0000-0001-9264-883X

damage to the region's ecosystem, impacted the local economy, and incited unprecedented concern for the physical and mental well-being of residents (Peres et al. 2016). Public health concerns focused on both the direct and indirect effects of the disaster. Directly, contact with crude oil and dispersant were believed to result in adverse health effects (Solomon and Janssen 2010). Indirectly, the social and economic effects were believed to burden the mental and psychosocial health of those directly involved in the fishing and tourism industry, and the entire region through a depressed local economy (Osofsky, Palinkas, and Galloway 2010).

Self-reported symptoms such as 'burning in nose, throat, or lungs; sore throat; dizziness; and wheezing' were reported by women partners of the oil spill workers (Peres et al. 2016). Additionally, potential oil spill-related impacts, such as increased anxiety, depression, and post-traumatic stress affecting community health, were described (Osofsky, Osofsky, and Hansel 2011). The economic stressor caused by the oil spill was also shown to increase the stress levels (Peres et al. 2016). Beyond these findings, qualitative research found uncertainty within the population about the long-term ecological, economic, and health effects (Cherry et al. 2015). Similarly, qualitative interviews demonstrated unhealthy behaviour changes (drinking and smoking) that lead to more physical and emotional issues (Cherry et al. 2015).

To direct post-oil spill research, the Institute of Medicine highlighted women of reproductive age and pregnant women as a population of specific concern, due to their increased risk for developing adverse health effects after this event (Institute of Medicine Committee to Review the Federal Response to the Health Effects Associated with the Gulf of Mexico Oil Spill 2010). Driven by this focus, and a widespread regional concern, a collaborative between researchers and community members in Southeast Louisiana formed to answer three health concerns of the affected community:

1. 'Are mothers and children safe?'

2. 'Is the food safe to eat?'

3. 'Is the air safe to breathe?'

The Transdisciplinary Research Consortium for Gulf Resilience on Women's Health (GROWH) – supported through a grant awarded by the National Institutes of Health – was created to examine these questions while utilizing a community-based participatory research (CBPR) model to inform research goals and disseminate results to community members. Integral to the CBPR approach was an active engagement with the community advisory board (CAB), which was involved from the study's design to dissemination (Lichtveld and Arosemena 2014). In addition to providing feedback on the primary research aims of GROWH, the CAB identified supplementary study pursuits. Among many other research interests, the CAB called for a more sophisticated incorporation of culture into the study of post-spill health studies. Particularly, the CAB recommended an examination of how culture influenced post-oil spill health and well-being in this at-risk population, and how culture differed between communities.

Discussions with community advisors led to a working hypothesis that a potential stressor for pregnant women and mothers in the region was the burden of navigating many environmental health threats. Research seeking to examine how risks are perceived has been carried out in populations of mothers in other regions (Crighton et al. 2013; Laferriere et al. 2014). However, no study has approached this issue with mothers in a post-disaster setting, or among the unique population of southeast Louisiana. To fill this research gap, the two primary aims of this paper are to (1) document how community-driven research questions were investigated through the use of ethnographic methods and (2) determine the environmental threats that are most salient to this community of women.

Context of risk perception of environmental threats

Underpinning health behaviour strategies are the perceptions of environmental threats, therefore, public health research has often incorporated risk perception research (Aswani et al. 2015). A dominant model in risk research is the psychometric paradigm, which advances the idea that attributes of a threat (how it is understood, how it affects children) all influence its ultimate perception (Slovic 1987). Moreover, risk perception research has also shown that threats are also evaluated differently by people, according to the socio-cultural context in which the individual lives (Bickerstaff and Walker 2001). For example, gender and racial differences regarding environmental perception are influenced by an individual's cultural context (Kahan et al. 2007). Other studies have noted risk perception differences among low-income population (Boholm 1998). Direct experience with the threat in question has shown to have a major influence on the subsequent risk perception (Whitmarsh 2008).

Environmental risk perception has only recently been investigated using systematic and formal qualitative research methods. A recent study used freelisting and pile sorting concerning words associated with climate change, and found that while communities shared a common understanding of risk, social–ecological factors affected the local perception of vulnerability and threats (Hesed and Paolisso 2015). Similarly, Raithatha and colleagues deployed methods showing that vaccine fears fit into the risk perception psychometric paradigm model of dread (Raithatha et al. 2003). A recent systematic investigation into cultural environmental health perceptions found widespread gaps in how the public comprehends threats in the environment (Bales and Lindland 2014). While the American public had a narrow, dominant model for thinking about environmental health threats, only a weak model existed for strategies to address those threats. Most relevant, Bales and Lindland identified models of the environment focused on contaminant exposures linking the most salient environmental threats to exposure to contaminants 'chemicals, artificial hormones and steroids, heavy metals, pollen' (Bales and Lindland 2014).

Within the context of oil spills, risk perception studies focused on the 1989 Exxon Valdez oil spill found long-term concerns among those with strong ties to the resources most affected by the spill. Particularly, cultural differences existed in how the threat was perceived and the stress was expressed (Palinkas et al. 1992).

Exploring risk perception in the environment of southeast Louisiana helps to put the threat of the oil spill in the context of a range of other regional concerns. Hurricanes are an annual threat, and the legacy of the 2005 Hurricane Katrina exposed issues of differential risk for

women across racial and income lines (Zotti et al. 2012). The area has a long history of chronic environmental contamination, as exemplified by an 85-mile stretch of heavy industrial activity along the Mississippi River referred to by communities as 'Cancer Alley' (Bullard 1990; Marshall, Picou, and Schlichtmann 2004). The region has long been associated with poor air quality from high industrial activity, as Louisiana is ranked fourth in the country for total onsite air releases of chemicals and pollutants (United States Environmental Protection Agency 2013). Recent disasters have played a role in air quality and air quality perceptions. Specifically, in the aftermath of Hurricane Katrina, the overwhelming presence of mold as an asthma allergen led to several studies exploring the air quality impact on children's health (Grimsley et al. 2012). Additionally, residents expressed concern regarding exposure to other chemicals following the hurricane clean-up (Frickel and Vincent 2007). The 2010 oil spill sparked community concerns regarding outdoor air quality (Goldstein, Osofsky, and Lichtveld 2011). From a social environmental perspective, New Orleans has a challenging burden of community violence (Sweeney, Goldner, and Richards 2011). While community violence has experienced a decrease since Hurricane Katrina, it remains a key concern among residents, often surpassing other public health concerns (Hamel, Firth, and Brodie 2015).

Methodology

Research into culture and ethnographic methods

To investigate this community-driven research question, our study team utilized a series of qualitative methods used in the field of anthropology. Qualitative methods were believed to be essential to gain an in-depth comprehension of the risks in the environment from the perspective of this group of women, rather than presupposing the appropriate risks or actions through a set survey (Murray et al. 2006).

Culture is often defined in cognitive anthropology as the knowledge needed to function adequately in particular context and society (Dressler 2004). Individuals assign meaning and generate protocols on how to act and think in certain situations, and many individuals will turn to peers to inform these cultural models (Ross 2004). Ethnographic methods are a set of common tools used by anthropologists in the study of a cultural model – referred to as a cultural domain (D'Andrade 1995). A cultural domain analysis is used to elicit the terms a population uses to describe a topic, and the meaning that is used to distinguish how terms are considered similar.

Two frequently used ethnographic methods were utilized to advance the cultural domain analysis for this study. First, using a freelisting exercise, participants were asked to name items matching a description related to a chosen topic. Freelisting is commonly used to identify the elements of a cultural topic and help calculate the importance (salience) of terms within the topic (Thompson and Juan 2006). Next, an unconstrained pile sort exercise was used, where participants indicated how terms generated in the freelisting are grouped together on the basis of similarity.

Study population inclusion criteria

The ethnographic methods were administered to a sample of women participating in the GROWH research project titled, *Building Community Resilience through Disaster Mobile Health*. Central to this project's intervention study was the use of community health workers (CHWs) as a source of messaging, health collection, and personal support. In the GROWH study, CHWs were first trained through a comprehensive curriculum, and then were assigned to two separate cohorts of Women, Infants, and Children (WIC)-eligible women ($n = 237$) across two study cohorts. Throughout the study, CHWs were tasked with providing informal counselling and social support remotely and face-to-face (Lichtveld and Arosemena 2014).

Women were originally recruited for the GROWH project during either their first or second trimester of pregnancy of what would be their first child. At the time of their inclusion for this supplemental study, many of the women were in their third trimester. Additionally, women were required to be eligible participants of the WIC program (a service for low-income families in the region), and were also required to be residents of a six-parish region in Southeast Louisiana parish that was determined to be most affected by the Gulf oil spill.

Stratified sampling was deployed to maximize a roughly equal diversity across race, region, and age (Table 1). Twenty mothers were selected from this cohort to complete the freelisting exercise. Thirty-one mothers were selected from this cohort to complete the pile sort exercise. All 20 of the mothers who participated in the freelisting also participated in the pile sort, with an additional 11 mothers recruited to increase the sample size of the pile sort.

Using CHWs to inform research

Using a nested study design, pairing with the CHWs strengthened the study methodology. Their relationship with women in the GROWH cohort justified the CHWs as ethnographers to improve study recruitment, by creating a comfortable atmosphere for participants to respond to question. The partnership with the CHWs was also believed to support study interpretation, as they came from the same study area as participants, and would be able to offer insight into the findings.

Data collection

Overall, three cultural topics (domains) were analyzed. They were collected by asking the following freelisting prompt questions:

1. (*Threats in the environment*) 'What are the things in the environment that threaten mothers and children in your community?'

2. (*Ways to manage threats*) 'For each of these things in the environment, what are ways that mothers prepare or respond?'

3. (*Sources of support*) 'For each of the things in the environment, who do other mothers typically turn to for information and support?'

Responses were pooled, standardized, and coded using the help of the CHWs to judge which statements referred to the same concept. CHWs also assisted in settling which exact phrasing should be used for each concept. While efforts were made to keep original

phrasing, a number of specific terms were collapsed to generate categories when it was deemed appropriate by the CHWs (e.g. merging 'mother,' 'cousin- in-law,' and 'brother' into a single category 'family').

After compiling results from several participants, the cultural importance of each item was measured by either the average rank on each participant's list, or the frequency mentioned across all participants' lists (Weller and Romney 1988). Relative importance is also measured by a combination of both rank and frequency through the Smith's index rank salience (Smith and Borgatti 1997). Smith's salience is based on the assumption that participants will list items of greater salience first, and is calculated by accounting for the number of participants who mention an item, the average position each item was given, and the length of the participant's list (Daley 2007). This score is calculated through ANTHROPAC 4 – a statistical software used for cultural domain analysis – (Borgatti 1996) as a scale (0–1) variable.

The most salient terms developed from the freelisting study component were then used in the pile sorting activity. Items were typed on index cards. Using the same nested sampling frame of the freelisting, a slightly larger sample of mothers ($n = 31$) were handed a set of cards by a CHW and asked to sort them into similar piles. CHWs recorded any comments the participants made, and during the analysis stage, these comments helped in interpreting the meaning of clusters. This was then repeated for each topic covered in the freelisting exercise.

Data generated from the pile sorting study component were analyzed through nonmetric multidimensional scaling (MDS) calculated through ANTHROPAC 4 (Borgatti 1996) and UCINET (Borgatti, Everett, and Freeman 2002), which converts similarity of items (whether the items are placed in the same pile) into a measure of distance. MDS helps identify underlying dimensions of meaning that are being used to understand terms (Collins and Dressler 2008). The measure of the goodness of fit in MDS is referred to as 'stress', which assesses how well the mapped solution represents the original similarity matrix of responses. Generally, the lower a stress value, the better the fit (Weller and Romney 1988). The item-by-item similarity matrix was applied using a hierarchical analysis design to determine the relationship between phrases and to confirm which phrases were included in which cluster. All data were collected from May to June 2014.

Results

For the first domain, a total of 67 threats were listed, with 7 being mentioned by at least 30% of the mothers. Table 2 shows the top 20 responses for the threats in the environment. 'Hurricanes' and 'violence in the community' were two of the top responses. The threat of hurricane had highest salience score of responses (0.453 compared with 0.442), while violence had highest average rank (2.91 compared with 3.18) (Table 2).

To investigate any systematic regional differences, the freelist results were reanalyzed separately for women in the metro region of southeast Louisiana (Jefferson, St. Bernard, and Orleans parish) and the rural region (Plaquemines, Lafourche, and Terrebonne parish). Table

3 shows the top 10 most salient responses stratified by region. No extreme differences were found within the top responses, as hurricanes and community violence were both one of the most salient responses for both regions. Some minor differences were found: 'drug activity' was a more salient among metro mothers; 'problems with other mothers' was more salient for rural mothers. Additional stratified analysis was conducted but did not show differences across race and age. Similarly, the top hazards were reported consistently across each demographic group.

For the second domain, 83 protective actions were listed, with 9 of those being mentioned by at least 20% of the women. Because actions were listed in conjunction with a listed hazard, there was tremendous variability in the type of actions listed. Table 4 shows the top five responses according to the two most overwhelmingly salient environmental threats: hurricanes and community violence.

Finally, for the third domain, 31 sources of support and information were given by the 20 women, with 9 sources being mentioned by at least 20% of the group. Table 5 shows the top 10 most salient responses. Family was the most common response, as it was listed by 70%, which gave it a salience score of 0.441.

To further investigate the domain of environmental hazards, 11 salient responses were selected to be further analyzed using the pile sort. Figure 1 presents the MDS illustration. Terms that appear close together indicate that participants saw these terms as similar. The low stress level (0.045) indicates that this image is a good fit for the data. Pile sorting results showed that across a diverse sample, the 11 threats were organized into three separate clusters. The mostly closely related threats are the physical hazards, such as bad drivers, drugs in the community, and community violence. On the other side of the MDS chart were the natural threats, which appear to separate into two groups. One dealt with storm-related issues, such as mosquitoes, hurricanes, and flooding. Finally, the last cluster dealt with air and water contamination issues: outdoor air pollution, indoor air pollution, radiation, cigarette smoke, and water pollution. The classification of these clusters is supported by participants comments recorded by CHWs, as mothers frequently used terms like 'storms,' 'community,' and 'air' to explain why they made similar piles. A hierarchical cluster analysis confirmed these three groupings, and the hierarchical cluster boundaries are superimposed over the pile sort results on Figure 1.

Discussion

In designing the freelist prompt to include the phrase 'the environment,' it was our intention to yield responses related to traditional environmental health issues, such as air, water, food contaminants. However, for women in this sample, 'the environment' evoked a broader range of items and threats, many of which are often not included in typical risk research (e.g. 'lack of activities for kids,' 'problems with other mothers'). This inclusion of physical, non-chemical threats persisted even when stratifying responses across age, race, and region.

This is contrary to studies discussed earlier that found Americans generally understood the environment to be seen as dominated by chemical and environmental contaminants (Bales

and Lindland 2014). Likewise, our findings also differ from a recent mixed-methods study that explored perceived environmental risks among mothers in Ontario, which found mothers in their study community focused on traditional threats (e.g. household products, air, water, food), with little evidence of the physical hazards seen in the results of this manuscript (Crighton et al. 2013; Laferriere et al. 2014). While the prompting question of these studies seemed similar to this study, it is unclear if some responses in either study were dropped, or if a subtle difference in question affected the content of responses. Alternatively, the observed difference in results may reflect a real difference in the perception of risks for mothers in southeast Louisiana.

It is possible that this pattern of responses may be reflective of the general low socioeconomic levels of the study population. One of the requirements of WIC membership is meeting a low-income threshold, and as a result, women in the GROWH study report extremely low household income levels (Hassan 2014). As discussed, risk is perceived in the sociocultural context of the individual, which has been found to differ by income (Boholm 1998). Therefore, a social context that a low-income pregnant woman lives in may be more concerned with threats experienced more directly and imminently (e.g. financial stressors, violence), rather than those that are somewhat invisible (e.g. pollution, lead exposure).

Another finding of note was the complete absence in the lists of several traditional environmental health threats (e.g. household products, lead, pollen, food contaminants), as well as no threat directly attributed to the effects of the 2010 Gulf oil spill. Some evidence exists for a more limited appraisal of environmental health threats: while an awareness and concern associated with direct events (e.g. air pollution, floods), was identified, limited concern was voiced for the larger threats that may be caused, or effected by those events (e.g. climate change) (Whitmarsh 2008). Similarly, while concerns in the immediate aftermath regarding the oil spill were high within directly affected subpopulations (e.g. fisherfolk, clean-up workers), at the time of data collection (May–June 2014), our study participants of low-income pregnant women expressed concern for more potential secondary effects (e.g. financial troubles, air and water quality).

Despite the differences, pile sorting added in confirming threats within a consistent organizational structure, as women consistently organized certain threats together. Conforming with the risk paradigm literature, women indicated that diverse set of environmental threats were grouped according to the physical characteristics of the hazard (Slovic 1987).

Limitations

Due to the study design, several factors may potentially limit the external validity of this research. Study participants had been receiving text-based health care and hurricane messages as a part of GROWH intervention. While few of the text messages matched the information provided by the free list, it is possible that the GROWH project intervention provided these women with increased awareness of certain hazards, protective actions, and sources of support. Another limitation of this paper is the small sample size. While 20 informants are adequate for freelisting (Weller and Romney 1988), a larger sample would

have allowed for greater stratification across demographic groups, and examine, and further examine domains where there is less agreement.

Implications of findings

Results indicate several implications for policy-makers and the research community. Much of the post-oil spill policy has been directed toward traditional environmental science and environmental health concerns(Colwell et al. 2014). Based on our results, environmental concerns for this at-risk study population encompass a broader range of threats that are currently garnering less attention, such as financial stresses, or road traffic hazards (e.g. bad drivers). From an environmental policy and public health research perspective, there is a growing motivation in environmental health to expand the incorporation of non-chemical stressors into traditional cumulative risk assessment (Lewis et al. 2011). There is a similar movement to broaden the definition of 'the environment' to include four broad domains: natural, built, social, and policy (Juarez et al. 2014). The results also support the continued pursuit of incorporating cultural factors in assessing perceived risks, especially in communities with high cultural diversity.

Additionally, results reflect on the need for additional research. Freelisting and pile sorts only offer a limited outline of a cultural domain (Weller and Romney 1988). Hence, it is often only the first of several ethnographic methods used to complete a cultural domain analysis. Future studies can advance a more comprehensive examination of how new mothers interact with the environment; data collected from freelisting will be used to create a rating survey. Completed surveys can be analyzed using cultural consensus analysis, which examines cultural agreement to quantify cultural belief by estimating the cultural competence of the group as a whole and for individual members of the group (Romney, Weller, and Batchelder 1986).

Extending this cultural investigation will advance our ability to answer the original questions proposed by the CAB by documenting how women in this region comprehend environmental management. Differences in cultural beliefs across socio-demographic characteristics may be shown to influence how individuals perceive and address environmental health threats. Future research can assess how health is influenced by cultural decision-making.

Conclusion

We have shown that systematically eliciting cultural knowledge about threats in the environment and can yield nuanced insights into local risk perception. The study showed similarities in the way an at-risk community perceives and categorizes environmental threats, and how those threats are managed. The results reveal the study community's shared understanding of the environment, and indicate a gap in current policy and research.

Broadly this study underscores the benefits of a community–academic partnership throughout the study process. Specifically, this study was strengthened by community collaboration across several facets in the research process:

- *Research development*: The research into cultural differences was dominantly driven by community feedback. The CAB model encouraged researchers to engage in multi-disciplinary methods in order to answer locally relevant research questions.

- *Study design*: Locally trained CHWs were instrumental in the development and interpretation of surveys.

- *Data collection*: Through their ongoing role as health navigators, CHWs had a strong relationship with mothers, which allowed for meaningful discussion.

- *Interpretation of results*: Partnering with CHWs allowed for a valid coding of freelisting responses, as they helped to determine when different responses were actually referencing a similar term.

Engaging CHWs resulted in a sustained and successful collaboration with the study population. Additionally, community collaboration throughout the research process documents the value of community-based participatory research to examine cultural influences on a public's health.

Acknowledgments

References

Aswani, Shankar, Vaccaro, Ismael, Abernethy, Kirsten, Albert, Simon, de Pablo, Javier Fernández-López. Can Perceptions of Environmental and Climate Change in Island Communities Assist in Adaptation Planning Locally? Environmental Management. 2015; 56(6):1487–1501. [PubMed: 26142887]

Bales, SN., Lindland, E. Talking Environmental Health: A FrameWorks Message Memo. Washington, DC: FrameWorks Institute; 2014.

Bickerstaff, Karen, Walker, Gordon. Public Understandings of Air Pollution: The 'Localisation' of Environmental Risk. Global Environmental Change. 2001; 11(2):133–145.

Biello, David. Is Using Dispersants on the BP Gulf Oil Spill Fighting Pollution with Pollution. Scientific American. 2010; 18:22. http://www.scientificamerican.com/article/is-using-dispersants-fighting-pollution-with-pollution/.

Boholm, Asa. Comparative Studies of Risk Perception: A Review of Twenty Years of Research. Journal of Risk Research. 1998; 1(2):135–163.

Borgatti, Stephen P. Anthropac 4. Natick, MA: Analytic Technologies; 1996.

Borgatti, SP., Everett, MG., Freeman, LC. Ucinet 6 for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies; 2002.

Bullard, Robert D. Ecological Inequities and the New South: Black Communities under Siege. The Journal of Ethnic Studies. 1990; 17(4):101. [PubMed: 11617322]

Cherry, Katie E., Lyon, Bethany A., Marks, Loren D., Nezat, Pam F., Adamek, Rachel, Walsh, S. Devon, Fitzgerald, Kristina B., Anbinder, Dina R., Bernacchio, Claire V. After the BP Deepwater Horizon Oil Spill: Financial and Health Concerns among Coastal Residents and Commercial Fishers. Current Psychology. 2015; 34(3):576–586.

Collins, Cyleste C., Dressler, William W. Cultural Consensus and Cultural Diversity a Mixed Methods Investigation of Human Service Providers' Models of Domestic Violence. Journal of Mixed Methods Research. 2008; 2(4):362–387.

Colwell RR, Leinen M, Wilson C, Carron M. The Gulf of Mexico Research Initiative: A New Research Paradigm. International Oil Spill Conference Proceedings. 2014; 2014(1):300123. doi: 10.7901/2169-3358-2014-1-300123.1.

Crighton EJ, Brown C, Baxter L. Jamie, Lemyre J. R. Masuda, Ursitti F. Perceptions and Experiences of Environmental Health Risks among New Mothers: A Qualitative Study in Ontario, Canada. Health, Risk & Society. 2013; 15(4):295–312.

Daley, Christine Makosky. College Men's Knowledge, Attitudes, and Beliefs about Testicular Cancer. American Journal of Men's Health. 2007; 1(3):173–182.

D'Andrade, Roy G. The Development of Cognitive Anthropology. New York: Cambridge University Press; 1995.

Dressler WW. Culture and the Risk of Disease. British Medical Bulletin. 2004; 69:21–31. [PubMed: 15226194]

Frickel, Scott, Vincent, M. Bess Hurricane Katrina, Contamination, and the Unintended Organization of Ignorance. Technology in Society. 2007; 29(2):181–188.

Goldstein, Bernard D., Osofsky, Howard J., Lichtveld, Maureen Y. The Gulf Oil Spill. New England Journal of Medicine. 2011; 364(14):1334–1348. [PubMed: 21470011]

Grimsley, L. Faye, Chulada, Patricia C., Kennedy, Suzanne, White, Lu Ann, Wildfire, Jeremy, Cohn, Richard, Mitchell, Herman, Thornton, Eleanor, El-Dahr, Jane, Mvula, Mosanda M. Indoor Environmental Exposures for Children with Asthma Enrolled in the HEAL Study, Post-Katrina New Orleans. Environmental Health Perspectives. 2012; 120(11):1600. [PubMed: 22894816]

Hamel, L., Firth, J., Brodie, M. New Orleans Ten Years after the Storm: The Kaiser Family Foundation Katrina Survey. Menlo Park, CA: The Henry J. Kaiser Family Foundation; 2015.

Hassan, Anna. Methods and Successes in Health Promotion for Low-income, First-time Mothers in the Louisiana Gulf Coast: Community Health Workers add the Human Element in Maternal Child Health Mobile Technology. Paper read at 142nd APHA Annual Meeting and Exposition; New Orleans LA. November 15–November 19, 2014; 2014.

Hesed, Christine D. Miller, Paolisso, Michael. Cultural Knowledge and Local Vulnerability in African American Communities. Nature Climate Change. 2015; 5(7):683–687.

Institute of Medicine Committee to Review the Federal Response to the Health Effects Associated with the Gulf of Mexico Oil Spill. Research Priorities for Assessing Health Effects from the Gulf of Mexico Oil Spill: A Letter Report. Washington, DC: National Academies Press; 2010.

Juarez, Paul D., Matthews-Juarez, Patricia, Hood, Darryl B., Im, Wansoo, Levine, Robert S., Kilbourne, Barbara J., Langston, Michael A., Al-Hamdan, Mohammad Z., Crosson, William L., Estes, Maurice G. The Public Health Exposome: A Population-based, Exposure Science Approach to Health Disparities Research. International Journal of Environmental Research and Public Health. 2014; 11(12):12866–12895. [PubMed: 25514145]

Kahan, Dan M., Braman, Donald, Gastil, John, Slovic, Paul, Mertz, CK. Culture and Identity-protective Cognition: Explaining the White-male Effect in Risk Perception. Journal of Empirical Legal Studies. 2007; 4(3):465–505.

Laferriere KA, Crighton EJ, Baxter J, Lemyre L, Masuda JR, Ursitti F. Examining Inequities in Children's Environmental Health: Results of a Survey on the Risk Perceptions and Protective Actions of New Mothers. Journal of Risk Research. 2014:1–17.

Lewis, Ari S., Sax, Sonja N., Wason, Susan C., Campleman, Sharan L. Non-chemical Stressors and Cumulative Risk Assessment: An Overview of Current Initiatives and Potential Air Pollutant Interactions. International Journal of Environmental Research and Public Health. 2011; 8(12): 2020–2073. [PubMed: 21776216]

Lichtveld, MY., Arosemena, FA. In 2014 International Oil Spill Conference. Savannah, GA: 2014. Resilience in the Aftermath of the Gulf of Mexico Oil Spill: An Academic-community Partnership to Improve Health Education, Social Support, Access to Care, and Disaster Preparedness.

Marshall, Brent K., Picou, J. Steven, Schlichtmann, Jan R. Technological Disasters, Litigation Stress, and the Use of Alternative Dispute Resolution Mechanisms*. Law & Policy. 2004; 26(2):289–307. doi: 10.1111/j.0265-8240.2004.00013.x.

Murray, Laura K., Haworth, Alan, Semrau, Katherine, Singh, Mini, Aldrovandi, Grace M., Sinkala, Moses, Thea, Donald M., Bolton, Paul A. Violence and Abuse among HIV-infected Women and Their Children in Zambia. The Journal of Nervous and Mental Disease. 2006; 194(8):610. [PubMed: 16909070]

Osofsky, Howard J., Osofsky, Joy D., Hansel, Tonya C. Deepwater Horizon Oil Spill: Mental Health Effects on Residents in Heavily Affected Areas. Disaster Medicine and Public Health Preparedness. 2011; 5(04):280–286. [PubMed: 22146666]

Osofsky, Howard J., Palinkas, Lawrence A., Galloway, James M. Mental Health Effects of the Gulf Oil Spill. Disaster Medicine and Public Health Preparedness. 2010; 4(04):273–276. [PubMed: 21149227]

Palinkas, Lawrence A., Russell, John, Downs, Michael A., Petterson, John S. Ethnic Differences in Stress, Coping, and Depressive Symptoms after the Exxon Valdez Oil Spill. The Journal of Nervous and Mental Disease. 1992; 180(5):287–295. [PubMed: 1583472]

Peres, Lauren C., Trapido, Edward, Rung, Ariane L., Harrington, Daniel J., Oral, Evrim, Fang, Zhide, Fontham, Elizabeth, Peters, Edward S. The Deepwater Horizon Oil Spill and Physical Health among Adult Women in Southern Louisiana: The Women and Their Children's Health (WaTCH) Study. Environmental Health Perspectives. 2016 doi: 10.1289/EHP.1510348.

Raithatha, Nick, Holland, Richard, Gerrard, Simon, Harvey, Ian. A Qualitative Investigation of Vaccine Risk Perception amongst Parents Who Immunize their Children: A Matter of Public Health Concern. Journal of Public Health. 2003; 25(2):161–164.

Romney AK, Weller SC, Batchelder WH. Culture as Consensus: A Theory of Culture and Informant Accuracy. American Anthropologist. 1986:313–338.

Ross, Norbert. Culture and Cognition: Implications for Theory and Method. Thousand Oaks, CA: Sage; 2004.

Slovic, Paul. Perception of Risk. Science. 1987; 236(4799):280–285. [PubMed: 3563507]

Smith, J. Jerome, Borgatti, Stephen P. Salience Counts – And So Does Accuracy: Correcting and Updating a Measure for Free-list-item Salience. Journal of Linguistic Anthropology. 1997; 7(2):208–209.

Solomon, Gina M., Janssen, Sarah. Health Effects of the Gulf Oil Spill. JAMA. 2010; 304(10):1118–1119. [PubMed: 20713544]

Sweeney, Catherine K., Goldner, Jonathon, Richards, Maryse H. Exposure to Community Violence and Daily Feeling States among Urban African American Youth. Journal of Prevention & Intervention in the Community. 2011; 39(2):114–131. [PubMed: 21480030]

Thompson, Eric C., Juan, Zhang. Comparative Cultural Salience: Measures Using Free-list Data. Field Methods. 2006; 18(4):398–412.

United States Environmental Protection Agency. Toxic Releases Inventory. Washington, DC: Environmental Protection Agency; 2013.

Weller, Susan C., Romney, A Kimball. Systematic Data Collection. Vol. 10. Newbury Park, CA: Sage; 1988.

Whitmarsh, Lorraine. Are Flood Victims More Concerned about Climate Change than Other People? The Role of Direct Experience in Risk Perception and Behavioural Response. Journal of Risk Research. 2008; 11(3):351–374.

Zotti, Marianne E., Tong, Van T., Kieltyka, Lyn, Brown-Bryant, Renee. Factors Influencing Evacuation Decisions among High-risk Pregnant and Postpartum Women. Nashville, TN: Vanderbilt University Press; 2012.
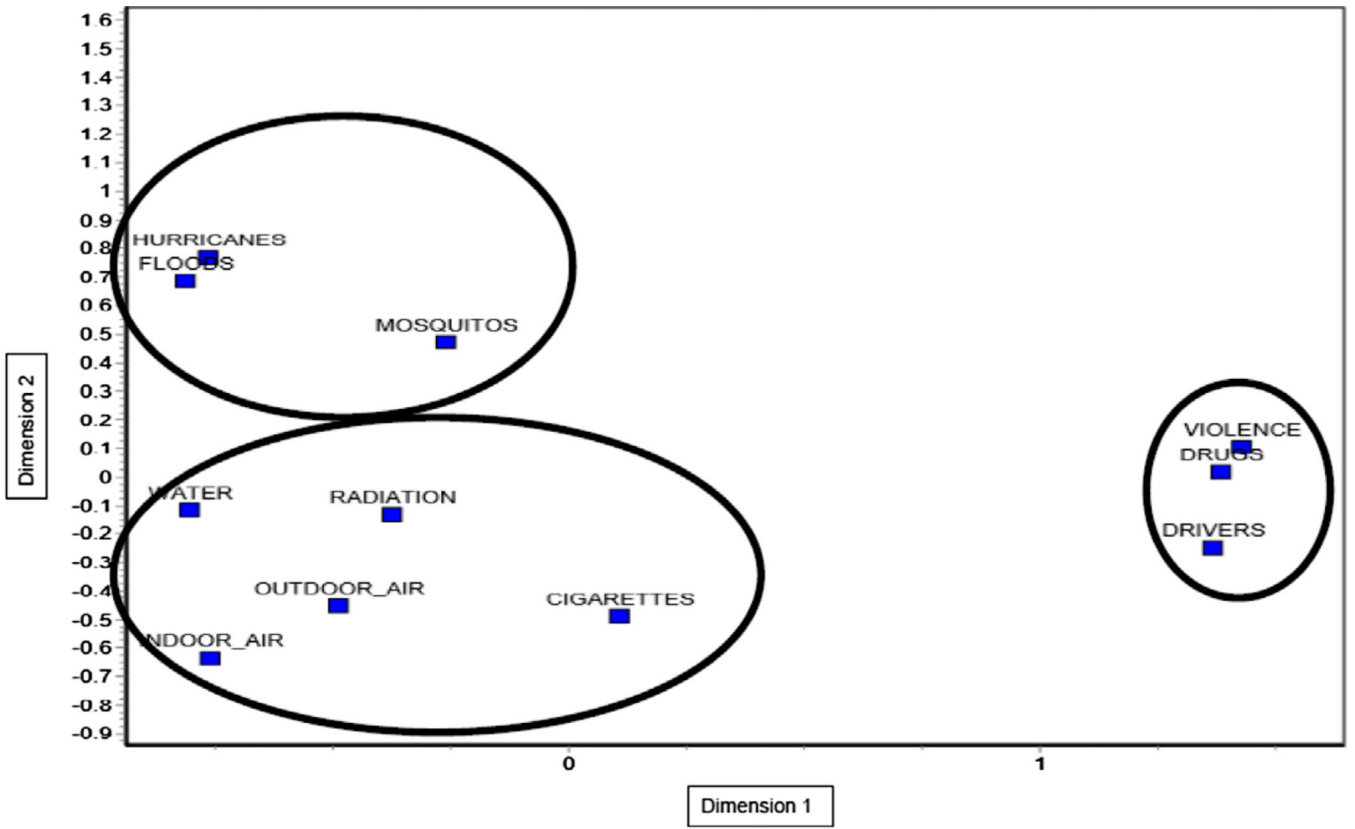
Figure 1.
Multidimensional scale and clusters: threats in the environment.

Table 1

Nested sampling frame used for freelisting activity.

Category	Sample (n = 20)							
Age	24 years old (8)				<24 years old (12)			
Income	$30 k (4)		<$30 k (4)		$30 k (3)		<$30 k (9)	
Region	Rural (1)	Metro (3)	Rural (2)	Metro (2)	Rural (2)	Metro (1)	Rural (4)	Metro (5)
Race	(1) White	(1) White (2) Black	(1) White (1) Black	(1) White (1) Not-White (Asian)	(1) White (1) Black	(1) White	(2) White (2) Black	(3) Black (2) White

Table 2

Top 20 freelisting responses for 'threats in the environment facing mothers in the community' – sorted by salience.

Item	Frequency (%)	Average rank	Smith's salience (1–0)
Hurricane	55	3.18	0.45
Violence in the community	55	2.91	0.44
Outdoor air pollution	45	5.22	0.28
Indoor air pollution	35	4.42	0.23
Cigarette smoke	35	6.29	0.23
Drugs activity	40	5.88	0.21
Bad/Reckless drivers	30	6.67	0.17
Lack of activities for kids	20	2.75	0.15
Floods	25	6.60	0.14
Problems with other mothers	20	4.75	0.13
Problems with job	20	8.00	0.11
Personal drug use (cigarettes/drugs/alcohol)	25	9.80	0.10
Water pollution	15	3.67	0.10
Crime (vandalism, break-ins)	20	4.50	0.10
Problems with transportation	20	6.75	0.10
Problems with money	25	9.20	0.09
Extreme heat/cold	20	9.50	0.09
Radiation	15	5.67	0.08
Mosquitoes	15	6.33	0.08
Dogs	15	9.33	0.06

Table 3

Cultural salience scores of environmental threats by region.

Item	Metro (*n* = 11)		Rural (*n* = 9)	
	Smith's salience	Salience segment rank	Smith's salience	Salience segmented rank
Hurricanes	0.34	3	0.59	1
Violence in community	0.58	1	0.27	3
Outdoor air pollution	0.34	2	0.20	9
Indoor air pollution	0.24	5	0.22	6
Cigarette smoke	0.13	11	0.34	2
Drug activity in community	0.32	4	0.08	28
Bad/reckless drivers in community	0.17	8	0.18	10
Lack of activities for children	0.08	14	0.22	5
Floods	0.18	6	0.09	22
Problems with other mothers in the community	0.04	31	0.23	4

Table 4

Top freelisting responses for hurricanes and community violence.

Item	Frequency (%)	Average rank	Smith's salience
Hurricanes			
Buy extra supplies to have in house (e.g. food, water)	30	2.83	0.27
Buy supplies in case power goes out (e.g. batteries, flashlight)	25	4.20	0.20
Make a plan of what to do/where to go	20	4.25	0.16
Evacuate when told	15	4.00	0.12
Stick with family/do what they do	10	1.00	0.10
Community violence			
Work with others in the community	30	4.00	0.20
Ask authorities to fix	30	3.50	0.19
Be extra cautious with family	25	7.00	0.15
Move to better community	15	5.00	0.13
Stay inside	25	11	0.10

Table 5

Top 10 freelisting responses for sources of support information.

Item	Frequency (%)	Average rank	Smith's salience
Family	70	2.93	0.44
TV News	40	2.25	0.30
Police	40	3.13	0.25
Internet	30	3.00	0.21
Church/People at Church	25	2.80	0.16
Government services (e.g. WIC)	20	2.25	0.16
Local government leaders	20	2.50	0.15
Friends	25	4.00	0.14
Newspaper	15	4.67	0.09
Community organizations	10	1.50	0.09