ASSESSMENT OF COMMUNITY HEALTH AND ENVIRONMENTAL RISK PERCEPTIONS IN THE NEIGHBORHOOD OF MANCHESTER, HOUSTON, TX

A Dissertation

by

GARETT THOMAS SANSOM

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Chair of Committee,	Jennifer Horney
Committee Members,	Philip Berke
	Eva Shipp
	Thomas McDonald
Head of Department,	Dennis Gorman

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ABSTRACT

This project explored three main dimensions: to assess if community members can accurately predict areas of poor environmental conditions, to better understand differences in perceived environmental health risks among racial groups, and to assess the impact of time lived in a community with environmental justice issues concerning mental and physical health. Previous research has shown that white males tend to perceive the risks of environmental exposures as being lower than do women and members of minority populations; this is often called the 'white male effect'. In addition, communities of low socioeconomic status (SES) and racial minority neighborhoods shoulder an unfair burden of exposure to urban pollution related to industrial buildings, waste facilities, and poor infrastructure. A cross-sectional study was conducted and survey data was collected from residents of Manchester, a small neighborhood in Houston, TX. Water sampling was conducted in thirty zones within the neighborhood. Our survey (N=109) utilized questions around perceptions of environmental risk as well as the 12 item Short Form Health Survey version 2 (SF12v2) to assess the general mental and physical health of the community.

The community as a whole had reduced physical health scores compared to the national average in the U.S. There was also a correlation between the time residents had lived in the neighborhood and a reduction in their physical health scores, after adjusting for age, race, and gender (coef=-0.27, p-value <0.001). In contrast to previous research, our study showed that non-white individuals perceived a lower environmental health risk compared to their white counterparts. For instance, adjusted for age, non-white respondents perceived the risks of flooding as a potentially harmful exposure to be lower

than did white individuals, at a statistically significant level (OR=0.34 95%CI=0.12-0.93 p=0.04). Finally, the water sampling showed elevated levels of heavy metals in the surface water sampling, confirming the concerns of the community collected through neighborhood outreach programs. This project shows some evidence that racial differences in perceived environmental harm are either reduced or reversed when environmental conditions are taken into account. It also suggests that when looking at macro-level conditions in this community, physical health can be negatively impacted simply by the length of time spent in the neighborhood.

DEDICATION

This dissertation is dedicated to my loving and brilliant wife, Lindsay Catherine Sansom, without whose support I would never have pursued a vocation as wonderful and fulfilling as public health. Also to our children, Mackenzie and Benjamin Sansom, whose humor, wit, and sass helped me through the tough times.

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Many individuals and groups have been vital with the implementation of this project, but none more so than the Resilience and Climate Change Cooperative Project (RCCCP) and the individuals in the Green Ambassadors from Furr High School. The RCCCP group offered direction, feedback, and the opportunity to conduct research in the Manchester Neighborhood and my sincere thanks goes to every member of this group. The incredibly bright and driven students in the Green Ambassadors assisted with the creation and execution of data collection and my gratitude cannot be over stated for their assistance.

A special thanks to all of my classmates, colleagues, and professors over the years for helping me grow into a better researcher and individual. Finally, I wanted to thank my Mother and Father for always being supportive even during the months and years where it seemed there was no end to my schooling in sight.

NOMENCLATURE

µg/L	Microgram per Liter
ATSDR	Agency for Toxic Substances & Disease Registry
CI	Confidence Intervals
CVAA	Cold Vapor Atomic Absorption
LCS	Laboratory Control Samples
LCSD	Laboratory Control Sample Duplicates
MCS	Mental Component Summary
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NELAP	National Environmental Laboratory Accreditation Program
NGO	Nongovernment Organizations
OR	Odds Ratio
PCS	Physical Component Summary
RCCCP	Resilience and Climate Change Cooperative Project
SES	Socioeconomic Status
SF12v2	12 item Short Form Health Survey version 2
t.e.j.a.s	The Texas Environmental Justice Advocacy Services

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1. INTRODUCTION

The purpose of this study was to explore three areas under the purview of environmental health research within a neighborhood that typifies environmental justice communities. This includes performing environmental sampling of standing water to assess for contaminants and confirm community concerns over poor ecological conditions, characterize the general mental and physical health of the community, and describe the role that race and gender play on environmental perceptions of harm. This research utilized participatory-based research approaches which further bridged the gap between local citizens, action oriented interest groups, and academic research.

This section will cover the core concepts and previous research that has formed the foundation for this study. The specific gaps in the literature, as well the goals of the investigation, will be explored and provide the justification for the project as a whole. While research has grown in the fields of community health, environmental equity, and the underpinnings behind differing perceptions of harm, there are many areas lacking any findings or only provide initial or uncertain results.

1.1 Background

1.1.1 Environmental Perceptions

Certain groups perceive the same environmental exposures as having differential risks to their health and wellbeing (Finucane et al. 2000). Previously published research results demonstrate that, even in areas containing good environmental conditions, women

and disadvantaged racial minorities tended to have greater perceptions of risk than did white males (Davidson 1996). This appears to be associated with socio-political factors (Leiserowitz 2006).

It has been suggested that this differential risk perception is a by-product of community culture, which in part is dictated through institutionalized treatment. Issues of power, status, trust in government and science, as well as lived experiences, can lay the foundation of how individuals perceive environmental harm. These attitudinal concepts are associated with gender and race likely due to treatment of these groups by those in positions of power. These difference in perceptions and the role that demographics plays, has been shown in the research fields of disaster preparedness, community response and cohesion, environmental advocacy, and environmental justice.

1.1.2 Disaster Preparedness

Preparing for natural disasters at the state, county, and local level has been shown to reduce morbidity and mortality compared to areas that are not adequately prepared (Tierney et al. 2001). An important facet of disaster preparedness is community engagement and participation in the planning and execution of hazard mitigation plans (Godschalk et al. 2010). Taking into account the demographics of communities can assist in utilizing local community talent or communication in the event of a disaster.

The difference in perceptions of risks can be seen in the work of West and Orr (2007) when looking at coastal community's willingness to evacuate during a hurricane. Women who responded to the survey were 12 percent more likely to comply with a government evacuation notice than their male counterparts. Furthermore, minority women were 31 percent more likely to obey an evacuation report from media sources

than white males. Similar research was conducted by Elliot and Pais (2006) in the aftermath of Hurricane Katrina in New Orleans; it also concluded that willingness to evacuate was linked with race and class.

In a study of resident perception and willingness to take action to address climate change, O'Connor et al. (1999) demonstrated that risk perceptions are not generally a good surrogate for general environmental beliefs. This presents opportunities for intervention even with "non-believers" who may still be willing to take personal actions related to addressing climate. In coastal communities in particular, Dolan and Walker (2006) found that local and traditional knowledge is key to support of policy making and planning to address climate change and sea level rise. These results underscore the importance of properly understanding the community and individuals involved to mitigate the impacts of natural disasters on communities.

1.1.3 Community Response and Cohesion

Strong community engagement and social cohesion have been shown to increase environmental stewardship through growing the amount of organizations and environmental intervention strategies in some neighborhoods (Roussos and Fawcett 2000), adaptation to environmental impacts such as climate change (Ebi and Semenza 2008), as well as the working knowledge of communities (O'Fallon and Deary 2002). However, the willingness to actively approach and acknowledge poor environmental conditions is influenced by the makeup of communities.

In a study using a pooled national sample of the U.S., Kalof et al. (2000) found that whites were significantly less likely to endorse pro-environmental beliefs than blacks

or Hispanic individuals. Another study conducted by Jones and Rainey (2006) illustrated that blacks were significantly more concerned about local environmental conditions ($p<0.001$) than whites.

The concern for local environmental conditions appears to translate into proactive movements in certain communities. Minority populations are more likely to form local groups to address environmental concerns than white populations (Jones et al. 2014), even if state and national nongovernmental organizations for environmental advocacy are overwhelmingly white.

1.1.4 Environmental Advocacy

Over the past few decades the creation of environmental advocacy organizations has dramatically increased as the knowledge of potential physiological and psychosocial harm has been disseminated throughout the population. While many nongovernment organizations (NGOs), government agencies, and foundations have succeeded with improving community's knowledge and environment, little attention has been paid to racial inclusion. In a report that surveyed 191 environmental non-profits, 74 government environmental agencies, and 28 leading environmental grant making foundations, Taylor (2014) demonstrates that while 36 percent of the U.S. population is comprised of people of color, only 16 percent of staff at these environmental agencies are racial minorities. Furthermore, while racial minorities support environmental protection at a higher rate than whites they experience less outreach and perceive less benefit in joining than their white counterparts.

The lack of participation in advocacy groups by minority populations could partly explain the lack of commitment to disadvantaged subgroups by these populations as a

whole. In his study on representation of the disadvantaged in advocacy groups Strolovitch (2006) showed that of the over 12,000 organizations listed as advocacy groups that less than 5% are public interest groups and less than 4% are identity-based organizations representing groups such as women and racial minorities. This is further illustrated when disadvantaged-subgroups perceive that they are positively affected less than half compared to majority populations in regards to effectiveness of environmental advocacy organizations.

1.1.5 Environmental Justice

The systems surrounding environmental justice research and activism are both broad and deep. It has been well established that minority communities share a larger burden of industrial pollution than white populations within the United States. Over the last several decade grassroots activism has attempted to educate, empower, and change communities of color throughout the United States. While these efforts have been slow and challenging that have changed out politicians and the public view these issues. Environmentalism is now linked with social justice and civil rights issues largely due to the work of non-white communities organizing for change (Bullard and Johnson, 2002).

Satterfield et.al. (2004) showed that there is a drastic difference in the perceived risk as well as acceptance that minority communities are exposed to industrial pollutants more. When asked if hazardous facilitates are more common in minority communities only 50.4 percent of white males agreed, while 66.5 percent of nonwhite males agreed. This division is shown in gender as well, with 71.6 percent of nonwhite females agreeing with the previous statement compared to slightly above 50 percent for males.

1.1.6 The White Male Effect

It has been demonstrated in multiple settings that women and minorities tend to view environmental risks as more dangerous than white males within the United States. This phenomenon has been termed the "White Male Effect." That environmental risks tend to be viewed as lower by men than women have been demonstrated in many prior studies (Brody 1984; Steger and Witt 1989; Gwartney-Gibb sand Lach 1991; Flynn et al. 1994). For example, in analyzing the results to a national survey, Finucane et. al. (2000) explained that previous research showed that this difference with white males was due to 30 percent within this group that viewed nearly all environmental hazards as having a very low risk. Exploring racial differences in environmental risk perception began more recently. Findings have also encouraged researchers to better understand why the white male effect seems to hold true in different regions and economic classes in the United States.

The predominant explanation for this difference is that white males within the United States have more power over their environment and are involved to a greater degree in the creation, management, and benefits of technology and industrial pursuits and therefore are more likely to see the benefit than health risks (Finucane et al. 2000). Another explanation states that cultural differences between groups are the cause of this different perception. Due to white male's risk skepticism and hierarchical and individualistic nature, when activities that are integral to their identity are threatened they will under perceive the inherent risk. Cultural protective cognition, according to Kahan et al. (2007), is what explains this difference because white male cultural is inherently linked to technocratic endeavors in a way that women and minority populations are not.

1.1.7 Community Health

Previous research has demonstrated disparate exposures to environmental risks from the lived environmental conditions of individuals among those of low SES and minority communities within the U.S. (Bullard 2000; Bullard 1983; Anderton et al. 1994; Bryant and Mohai 1992) This has created communities that live with increased levels of air, water, and soil pollution. Communities within these neighborhoods have been shown to have a variety of negative health outcomes. In one study that was conducted in the Bronx, New York City, Maantay (2007) found that those living near noxious land use were 66 percent more likely to be hospitalized for asthma related illness. Wendell et al. (2006) found that communities with high proportions of low SES and racial minority residents have multiple obstacles to overcome high obesity rates; including the existence of food deserts, a lack of safe walkable streets, and cultural conditions.

1.1.8 Neighborhood of Manchester Community Characteristics

Manchester, Texas, is a small neighborhood in eastern Houston located on the Houston Ship Channel. It is within Houston's super neighborhood 65 Harrisburg/Manchester is primarily Non-White Hispanic and has endured numerous issues with flooding (Houston Chronicle 2001), air pollution (Houston Chronicle 2014), and health concerns (Houston Department of Health and Human Services 2003). Houston Ship Channel communities are at particularly high risk of impacts from the nexus of exposure to hazardous substances and natural disasters. For example, within one mile of the Manchester neighborhood, there are 21 facilities that report to the EPA's Toxic Release Inventory: 11 large quantity generators of hazardous waste, four facilities that treat, store, or dispose of hazardous wastes, nine major dischargers of air pollution, and

eight major storm water discharging facilities. The area is also highly vulnerable to the impacts of natural disasters, both socially and physically. Houston has been divided into 88 separate areas called “Super Neighborhoods,” these neighborhoods include a council that serves as a forum for community concerns. Manchester is within Super Neighborhood 65 as part of the Harrisburg/Manchester Park neighborhood. The population of the Manchester Super Neighborhood is 98% minority, with a median income that is one-third less than the City of Houston overall. Only six percent of residents have obtained a Bachelor’s degree (City of Houston Planning and Development Department 2014). Floodplains along the Sims Bayou have increased by 15 percent since 1980, due to increases in development and impervious cover like concrete and asphalt, while expected sea-level rise could expose another 35,000 residents in Ship Channel neighborhoods to flooding (Ordonez 2015).

Based on these characteristics, and an existing relationship with community-based environmental justice and education groups, the Manchester neighborhood was selected as a case study location in which to assess the impact of living over time in this area on the physical and mental health of the community, environmental risk perceptions, and confirm or deny community concerns through water analysis.

1.1.9 Resilience and Climate Change Cooperative Project

The Resilience and Climate Change Cooperative Project (RCCCP) is a multi-year collaborative research and engagement venture. The core goal of the RCCCP is to create a fundamentally different way to identify and tackle critical disaster resiliency and climate change challenges that threaten coastal cities around the world. This project was created within the RCCCP as the public health facet of this team. Ongoing research

through the RCCCP is being conducted on the climate, infrastructure, community engagement, and civic policy in Manchester and other communities within Texas.

1.2 Study Rationale

1.2.1 Environmental Health Perceptions

The complex reasons for racial and gender differences in environmental risk perception needs further exploration, particularly in highly vulnerable communities like Manchester. Despite multiple studies and theories on the how and why different populations perceive environmental risks differently there is still a clear opening for improvement. Environmental health vulnerabilities of Harrisburg/Manchester include close proximities of residential development to industrial areas (City of Houston Planning and Development Department, 2014), inadequate and antiquated drainage systems (Ordonez, 2015), and relatively poor air quality (Mayor's Task Force on the Health Effects of Air Pollution, 2006). There is reason to believe that the underpinning causative claims made by these publications may be missing part of the reason. Previous studies have failed to link the answers with actual environmental conditions present in the lives of those answering the questions.

The white male effect has been shown to exist in national, state, and local surveys when answering questions about perceptions. The following are a sample of questions from previous research that have demonstrated this effect:

Table 1.1 Sample of Affirmative Responses by Race

Source	Statement/Question	Participants (n)	Percent (%)	
			White percent of people who agree	Non-White percent of people who agree
Finucane et al. 2000	People living near a nuclear power plant should not be able to vote to close down the plant	859	34.3%	12.9%
Brent, K. 2003	Is pollution from waste water a serious issue	774	18.2%	27.4%
Marshall et. al. 2006	Is water pollution a serious problem?	798	67.9%	76%

While these questions target risk perceptions, they fail to account for the actual environmental conditions of the participants in their neighborhood or immediate surroundings. For example, it is likely that white respondents are more likely to live in areas that are not as severely impacted by these environmental hazards as communities of color are and that is why they view the risk as lower. Certain studies have begun to show evidence that the cause of the difference in perception may not be social or cultural differences in power, but that those differences are confounded by the living conditions of white populations.

When researchers Olofsson and Rashid (2011) looked at Swedish society, in which disproportionate exposures to industrial pollutants with differing racial groups is not as distinct as it is in the United States, they found that the differences in perceived environmental risks mostly vanished. Furthermore, when researcher Marshall et al.

(2006) surveyed deep-south coastal residents, an area characterized with industrial water pollution, the difference between groups was less pronounced when both minority and majority groups experienced similar environmental pollution.

This study differentiates itself from previous research because it links individual answers about perceived environmental risks to actual environmental conditions surrounding the homes of participants. The highly engaged community of Manchester will act as a case study to the idea that communities, regardless of racial background, develop their environmental risk perceptions based upon their actual environmental conditions. Furthermore, minority populations may even be less concerned about environmental harm because these communities have lived with poor conditions for generations and have adopted these conditions as normal. This research with attempt to show evidence for the concept of generation norms acquired through generations of exposure amongst minority populations.

1.2.2 Community Mental and Physical Health

There has been research done showing evidence that communities living in and around industrial sites, as well as other polluting entities, have a higher proportion of specific negative health outcomes. In one study that was conducted in the Bronx, New York City, Maantay (2007) found that those living near noxious land use were 66 percent more likely to be hospitalized for asthma related illness. Wendell et al. (2006) found that communities with high proportions of low SES and racial minority residents have multiple obstacles to overcome high obesity rates; including the existence of food deserts, a lack of safe walkable streets, and cultural conditions. However, little research

has been done on the overall physical and mental health of communities within these neighborhoods in relation to the amount of time individuals live within the boundaries of the neighborhood.

1.2.3 Community Perceptions of Environmental Quality

Recent research has demonstrated many potential benefits of engaging community members and interest groups in the conduct of research and the development of interventions to improve outcomes (Ammerman et al. 2003; Aschengrau et al. 1996; Bluthenthal et al. 2006; kataoka et al. 2006). Traditional approaches to the public assessment of environmental hazards typically have not included local residents in the identification of areas of concern, as they were often viewed as lacking the required expertise to adequately assess risk. The recent growth of community engagement has suggested that these approaches did not produce the same outcomes as studies that engage local knowledge in every phase of research. While systematic reviews have confirmed local and governmental action have been improved with of the participation of local citizens and interest groups, little research has focused on how accurately the problems identified by the community are mirrored in research investigating the concerns of local citizens.

1.3 Significance

In the U.S., minority and low SES populations shoulder a disproportionate burden from environmental hazards compared to the majority (Ruktanonchai et al. 2014; Linder et al. 2008). This is seen with housing that is in close proximity to industrial pollutants (Bullard, 2000), poor infrastructure (Bullard 1990; 1993; 1994; Massey & Denton 1993),

lack of access to outdoor parks, green space, and physical activity settings (Powel et al., 2004), and living in areas that are at high-risk for natural disasters (Peacock et al. 2011; Blaikie et al. 2014; Cutter et al. 2009). Furthermore, minority neighborhoods have less access to quality environmental testing to ascertain what pollutants are present in the community. Previous sections have mentioned epidemiologic research that states minority populations tend to over assess their health risks due to negative environmental conditions; however, there is no quantitative research looking into this question. Thus, identification of environmental conditions in minority neighborhoods and quantitative results discovering how minority populations interpret environmental risks is a clear gap in epidemiologic research, in addition to an unmet need in this community.

Environmental conditions in the Greater Houston area are a concern for individuals, industry, advocacy organizations, and city officials alike. Air quality sampling and evaluation has taken place routinely for decades (EPA 2007). While there is some research on the quality of urban water (Collie, 2007), it is scarce and any meaningful analyses cannot be performed. Assessing the water quality and performing spatial analyses will allow for identification of issues that could be used in future research to assist in determining the health risk of these conditions on communities in this region.

This project pushes the knowledge of population research, in addition to answering a critical need in the community of Manchester. This neighborhood offers an ideal setting in which to address the aims of this research. Manchester is 80 percent

Hispanic and has known pollution and environmental justice issues (City of Houston 2004). The contributions of this project add to the literature by furthering the knowledge about how different groups perceive risks, given actual environmental conditions.

The need to discover the condition of urban water is underscored by the fact that this neighborhood periodically experiences high levels of flooding and the community comes into contact with urban water runoff routinely. Likewise, the perceived risk of minority populations is not well understood. These two facets of the project offer insight individually and provide noteworthy advances when looked at in together The information gained could be transformative in how future health and environmental interventions approach communities, as well as push the knowledge of group behaviors beyond our current understanding.

1.4 Overview of Study Design

The overall strategy was to perform laboratory analysis on urban surface water for specific chemical indicators, assess the neighborhoods health through in-person questionnaires by conducting a complete census in the neighborhood, and identify perceived risk perceptions among different populations. This utilizes a cross-sectional study design to link the environmental conditions to survey answers and offered evidence to further the literature in health perceptions, environmental justice research, and lay the foundation for targeted health interventions in the future.

1.5 Data Collection for Environmental Samples

Urban standing water was initially located using the City of Houston's Drainage Ditch and Pooled Water areas, which have already been identified and geocoded using ArcGIS to allow for easy identification of problem areas. Furthermore, partnerships with local advocacy organizations within the neighborhood allowed for resident knowledge to help pinpoint problem areas that they have noticed following rainfalls. The Texas

Environmental Justice Advocacy Services (t.e.j.a.s) group, as well as the Furr High School Green Ambassadors program within Manchester attended multiple meetings, during which our researchers hosted an outreach education program to inform the community about the project and how they could assist. The neighborhood was partitioned into 30 separate clusters and water sampling was conducted within each cluster. Water sampling collection methods outlined by the U.S. Environmental Protection Agency (EPA) Industrial Stormwater Monitoring and Sampling Guidelines (EPA, 2009) was utilized to ensure a quality sample collection procedure was established. The identified samples were collected from as near to the center of the pooled water as was feasible and acquired with a dip sampler that was replaced for each location. The collection team wore a new pair of nitrile gloves for each sample location to ensure no contamination occurred from handling the equipment. Samples were placed into 250 ml polypropylene laboratory containers with an HNO3 preservative and immediately placed into a Styrofoam cooler. The longest any of the samples remained in the cooler was from 9:11am until 1:16pm when they arrived at the laboratory for analysis, well within the timeline required for heavy metal samples.

The samples were sent to A&B Labs, located in Houston, TX. This lab is accredited through the National Environmental Laboratory Accreditation Program (NELAP), which is recognized as meeting all requirements to accurately assess nonpotable water, drinking water, air, solids, biological tissues, and hazardous waste. A&B Lab's accreditation (T104704213-15-13) was valid and up to date during the time of this analysis. The lab provided data on the type and concentration of total metals (As, Ba, Cd, Cr, Pb, Se, Ag), in addition to Mercury (Hg). When analyzing for As, Ba, Cd, Cr, Pb, Se, and Ag the lab used the EPA test method 200.7 for assessing trace metals in

water. For Mercury, the lab used EPA test method 245.1, which is used for the determination of Mercury in water by cold vapor atomic absorption spectrometry (CVAA). Quality control was assured through the use of laboratory blanks, laboratory control samples, and sample duplicates (LCS/LCSD), as well as a matrix spike and spike duplicate (MS/MSD) for all of the samples. There were no unforeseen complications for this section of the research, as all samples met the standards required and none needed to be discarded.

1.6 Survey Data Collection

Previous attempts at collecting survey data from Manchester residents have proven to be quite difficult; with previous researchers receiving fewer than forty participants after days of canvasing the neighborhood. Furthermore, response rates have previously dipped below 50 percent, as many of the residents do not wish to spend time dealing with outside individuals. In order to address these issues, community partnerships that were already established were called upon to assist. Specifically, the Green

Ambassadors and the EpiAssist program through Texas A&M University School of Public Health were chosen to help collect survey data. The Green Ambassadors are a group of teachers and forward thinking students that help mitigate the issues in their community through outreach and environmental stewardship within Manchester and the surrounding areas. The EpiAssist program consists of graduate students in epidemiology who have been trained in outreach and community health. Two separate training sessions were held to ensure quality results from respondents. Fifteen teams were assembled consisting of two or three individuals, with at least one graduate student from the EpiAssist program and at least one Spanish speaker per group.

Due to the relatively small size of the residential area of the neighborhood, less than two miles by one mile, a cluster design survey methodology was determined to be unnecessary. The fifteen teams walked every public road and passed every home within the borders of Manchester to attempt a complete census. Homes that were completely fenced off, abandoned, or seemed unsafe to the interview team were the only homes not approached during the canvasing.

The survey itself was adapted from the epidemiologic 12-Item Short-Form Health Survey version 2 (Kosinski and Keller, 1996) and the Agency for Toxic Substances & Disease Registry (ATSDR) Environmental Exposure Survey (ATSDR, 2010). The epidemiologic 12-Item Short-Form Health Survey (SF12v2) was adapted from the extensively utilized 36-Item Short-Form Health Survey (SF-36). In order to show that the SF12v2 form was a valid substitute, researchers replicated twenty cross sectional and longitudinal studies and produced multiple R squares between 0.911 and 0.918 (Ware et al. 1996). This shows substantial agreement between the two surveys leading many to prefer the shorter of the two. Other researchers have validated the SF12v2 Survey among multiple populations and concluded it produces an accurate representation of the physical and psychological health of the general population with individuals fourteen years of age and older (Jenkinson et al. 1997; Montazeri et al. 2007). Other questions were added to the survey in order to gauge environmental health perceptions and to assess individual's personal opinions on the risks of certain exposures.

Interview data will be linked with information from another aspect of the RCCCP project that is currently working with the community to assess infrastructure quality in the neighborhood using an assessment tool adapted from Gharaibeh and Lindholm (2014)

in future research. This will provide ordinal data on the quality of the homes, streets, and other infrastructure in the neighborhood and offer another exposure variable to assess the individual's environment. The study was reviewed and approved by the Texas A&M Institutional Review Board (IRB2015-0648D).

1.7 Analysis Plan

The geographic data points were geocoded using ArcGIS with the type and concentration of environmental contaminates. In order to assess the exposure for the entirety of the neighborhood, Thiessen polygons have been utilized to create 30 separate zones. This technique is an established method used to assess water pollution concentrations and sources in previous research (Huai-chen et al., 2007) and helped reveal point and nonpoint source pollution and offer information about where the most polluted areas are located. Areas that have elevated levels of heavy metals are shown in the following map. The data collected from the survey within the neighborhood consists of several types of data. Demographic information was either binary (gender), nominal (race, etc.), or continuous (age). Furthermore, vulnerability data was collected on individual's access to a working vehicle (binary), education (binary as either high school/GED, or no high school/GED education), language skills (English or no English). Perceptions of environmental health data consist of binary yes/no variables on if the participant's perception of the items as impacting health or not. Many of the variables within the SF12v2 section contain ordinal data about psychological or physiological health. There were three facets of the analysis; 1) Environmental health perceptions in the context of race and gender, 2) The health of the community as dictated through the

SF12v2 responses, and 3) The vulnerability and concerns of the community in regards to identifying environmental areas of concern.

Environmental health perceptions were collected through survey responses and allowed for individuals to say if exposure to certain environmental conditions (standing surface water, industrial buildings, etc.) can impact the health of individuals or communities. There were two different approaches to assess if race and gender play a role in the perceived health impacts of certain environmental exposures. First, a goodness of fit was be provided using a Pearson Chi Square Test for Independence to assess if there is a relationship between the dependent variable (health perception responses), and the independent variable (race classification as either white or non-white) stratified by gender. The following formula states the approach for this method:

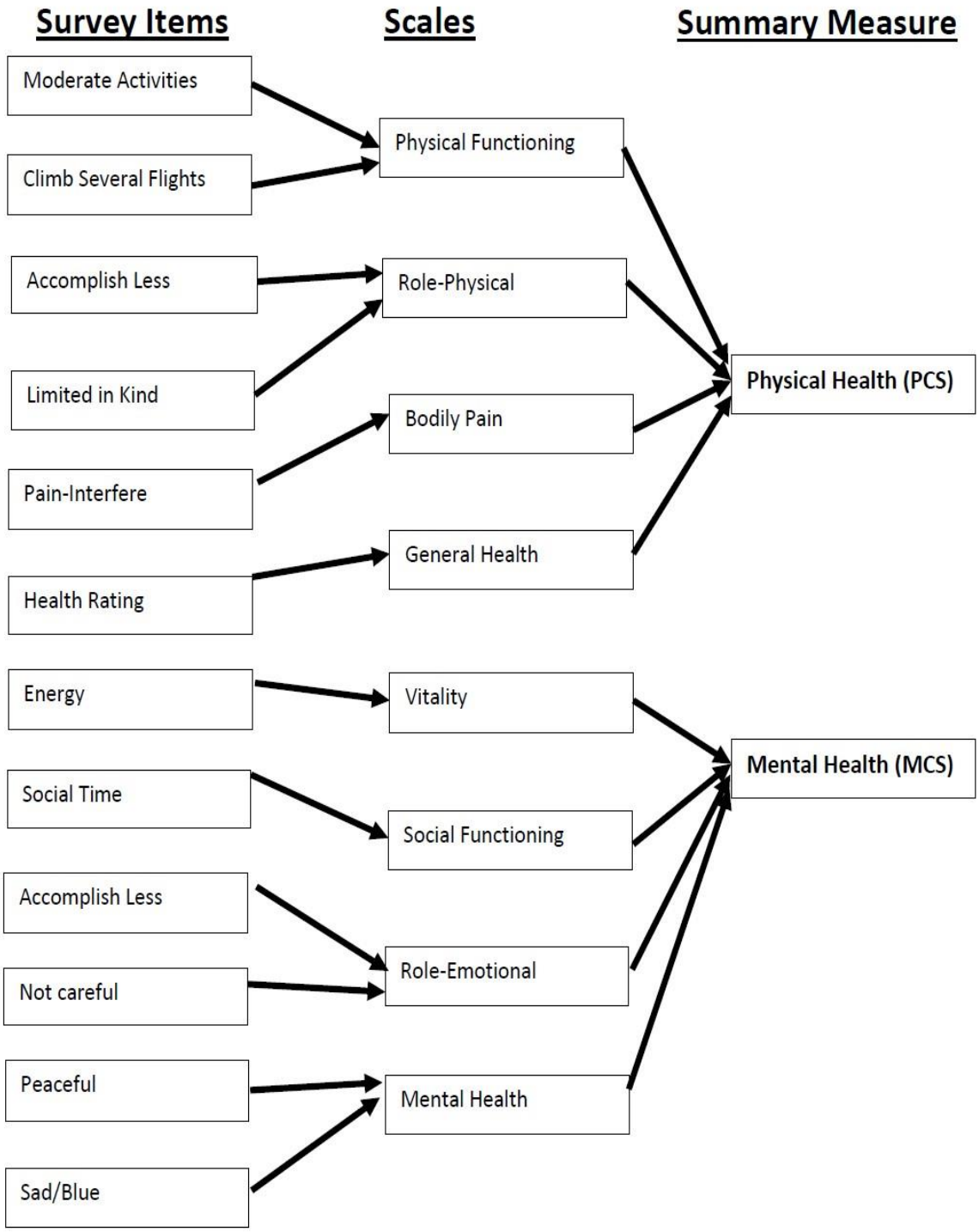
$$X^2 = \sum_{i=1}^{n} \frac{(Oi - Ei)}{Ei}$$

For the next step in this part of the analysis, multiple logistic regression was used to estimate the adjusted relative odds for the outcomes using white men as the referent group. For reporting purposes, the odds ratios were included with their corresponding 95 percent confidence intervals and p-value. This method has been used in previous research on preferences between different racial groups (Ayanian et. al., 1999). A model with two predictors was chosen due to the relatively small sample size (n=109), which did not allow for more adjustments to be completed. The results were adjusted by the age of the participant as previous research has shown that environmental perceptions change with age (O'Connor et al. 1999). The following logistic regression model with two predictors was utilized. Where p=pr (perceived environmental harm), X_1=race, and X_2=age.

$$Log\left(\frac{p}{1-p}\right) = \hat{b}_0 + \hat{b}_1 X_1 + \hat{b}_2 X_2$$

The SF12v2 section of the survey uses a special approach in order to apply the results of these findings to the U.S. population as a whole. The information collected either contributes to the participant's physical component summary (PCS) or a mental component summary (MCS) score. The summary measures are pulled from specific questions within the survey itself, this process is shown in Figure 1.1, which serves to visually represent how the various survey questions play into each of the categories.

Figure 1.1 SF12v2 Selection Criteria



The results from this study can be applied to national MCS and PCS scores due to normalization of the data. By designation, the mean national scores for MCS and PCS is always 50, with a standard deviation of 10. Due to this norm-based method, researchers can quickly compare populations through simple analysis; scores over 50 represent a population with better scores than the national average, and those under 50 are below the national mean. These national scores are updated periodically to allow for continued reliability.

The indicator variables and aggregate scores for the physical and mental summary are then weighted. There are two sets of regression weights, one for physical scales and one for mental scales. Each indicator variable is multiplied by its respective regression weights and then summing the 35 products for the mental and physical scores. This then needs to be normalized to the U.S. population, which is accomplished by adding constants to the mental and physical scores. These constants are normalized with results to the U.S. population and can be seen in Table 1.2 (Ware et. al. 2002). The mean scores of the PCS and MCS was computed and compared to the normalized national score, this allows the data to be stratified by race and gender.

Table 1.2 Weights Used to Score Physical and Mental Scales

Response Choice on Survey	Physical Weight	Mental Weight
Moderate Activities		
Limited a lot	-7.232	3.931
Limited a little	-3.455	1.868
Climbing Several Flights		
Limited a lot	-6.244	2.683
Limited a little	-2.736	1.431
Accomplish less than you like		
Yes	-4.616	1.441
Limited in kind of activities		
Yes	-5.518	1.669
Pain interferes with normal work		
Extremely	-11.256	1.486
Quite a bit	-8.381	1.767
Moderately	-6.505	1.494
A little bit	-3.801	0.904
Your health is		
Poor	-8.374	-1.712
Fair	-5.565	-0.169
Good	-3.023	0.035
Very Good	-1.319	-0.061
Have a lot of energy		
A little of the time	-2.022	-4.889
Some of the time	-1.619	-3.298
A good bit of the time	-1.144	-1.652
Most of the time	-0.423	-0.921
Health interfered with social life		
All of time	-0.337	-6.297
Most of the time	-0.943	-8.261
Some of the time	-0.180	-5.633
A little of the time	0.110	-3.139
Accomplish less than you would like		
Yes	3.043	-6.827
Did not do activities as careful		
Yes	3.044	-6.827
Felt calm and peaceful		
A little of the time	2.904	-7.927
Some of the time	2.372	-6.311
A good bit of the time	1.367	-4.098
Most of the time	0.665	-1.949
Felt downhearted or blue		
All of time	4.614	-16.154
Most of the time	3.416	-10.779
A good bit of the time	2.342	-8.099
Some of the time	1.280	-4.591
A little of the time	0.411	-1.959

Finally, vulnerability was assessed in conjunction with the environmental conditions of the surface water and responses to survey questions. Descriptive and univariate analysis will be performed on specific items (access to a working vehicle, education, primary language, etc.) to understand the general conditions in the community with regards to disaster resiliency. Previous research has shown that these items are correlated with a disproportional impact on certain communities in the event of a disaster (Eiseman et al. 2007; Blaikie and Cannon 2014; Bolin 2007). This will allow for an assessment of the potential risks and concerns should an event occur in the natural disaster prone region.

1.8 Specific Aims

AIM 1: Perform water sampling to assess the heavy metal concentrations of the standing water and map sample locations using the thiessen polygon technique in ArcGIS for the Manchester neighborhood in Houston, TX.

Hypothesis: We expect to see increased levels of total metals (As, Ba, Cd, Cr, Pb, Se, Ag) and Mercury compared to monitored surface waters in other areas of the state.

Rationale: Prior research has demonstrated that flood prone neighborhoods of low socioeconomic status experience higher levels of polluted standing water and urban runoff.

AIM 2: Perform in-person interviews to collect physiological, psychological, and perceived health risk information from the community environment utilizing a full canvasing approach of the community.

SUB AIM 2: Stratify interview data by gender and race/ethnicity subgroup to assess for the impact of these demographics on environmental health perceptions.

Hypothesis: We anticipate individuals of a racial minority will report having less concern of poor environmental quality as it relates to their health than white individuals. Furthermore, individuals in this community are expected to suffer from more chronic physical and psychological health issues than the general population.

Rationale: It has been suggested, but rarely quantified with environmental data, that minority individuals have more anxiety for their health from environmental pollution due to having long-term exposures. The relationship between the environment and human health has long been established with regards to pollution and has been shown to have an uneven level of exposures for certain minority groups.

The results of this project will have an important positive impact on the neighborhood participating in the project, in addition to adding to the body of knowledge on community and minority health. It is vital that areas establish the specific health burdens that are present within the community in order for public leaders, health researchers, and policy makers to make informed decisions to improve the lives of those in this region. The proposed project will also provide quantitative evidence to explore potential associations between negative environmental exposures and perceived health in minority communities.

2. CONFIRMING THE CONCERNS OF THE COMMUNITY MEMBERS UTILIZING PARTICIPATORY-BASED RESEARCH IN THE HOUSTON NEIGHBORHOOD OF MANCHESTER

2.1 Introduction

Recent research has demonstrated many potential benefits of engaging community members and interest groups in the conduct of research and the development of interventions to improve outcomes (Ammerman et al. 2003; Aschengrau et al. 1996; Bluthenthal et al. 2006; kataoka et al. 2006). Traditional approaches to the public assessment of environmental hazards typically have not included local residents in the identification of areas of concern, as they were often viewed as lacking the required expertise to adequately assess risk. The recent renaissance of community engagement has suggested that these approaches did not produce the same outcomes as studies that engage local knowledge in every phase of research (Ahmed and Palermo 2010). While systematic reviews have confirmed local and governmental action have been improved with of the participation of local citizens and interest groups (Cook 2008), little research has focused on how accurately the problems identified by the community are mirrored in research investigating the concerns of local citizens. This study uses the neighborhood of Manchester within Houston, TX, as a case study to identify the benefits of using local knowledge to focus of environmental hazard research.

2.2 Background

Across multiple topics, including health care, clinical care, and applying research in novel environments, recent research has shown that interventions that utilize local residents and interest groups have greater success with enacting change in communities (Wilkins et al. 2013; Leshner et al. 2013). In a review of the impact of participatorybased research studies, Cashman et al. (2008) examined the results of a study with Latino men in rural North Carolina where members were involved in every phase of data analyses and interpretation. This health-focused coalition concluded with the creation of an HIV and STD prevention initiative and a capacity building group. Due to the input from the community, specific programs were created and maintained longer than expected from most health intervention education programs.

Another intervention conducted by Bluthenthal et al. (2006) targeted African Americans and Latinos in Los Angeles, CA. to reduce rates of depressive disorders, as well as educate the community on opportunities for help and address the gap between minority and majority populations. This program, with the help of local activist organizations, conducted an initial kickoff event that lead to the identification of many areas of concern, as well as identifying local members who could provide assistance. This pilot study developed into a program that is continuing to address the needs of the community through local services.

Hazard planning and mitigation has also been shown to benefit from broad communal participation in planning. For example, in a study conducted by Stevens et al. (2010), 65 locations throughout the U.S. that experience high levels of natural hazards showed a statistically significant ($p<0.05$) correlation between participation levels and implementation of hazard mitigation techniques. Engaging socially vulnerable groups, in

every stage of hazard planning and mitigation, is particularly important as these groups face additional hurdles of discrimination, class inequality, and view 'outside' interventions with higher levels of distrust and suspicion compared to majority groups (Cutter and Mitchell 2000; Cutter 2006). Another study that examined six disadvantaged communities within the 2003 Hurricane Isabel impact zone under the Emergency Preparedness Demonstration project found that working with community members was invaluable. Researchers Berke et al. (2011) concluded that evidence suggest that "…people have the power to build resiliency of their communities from within."

This case study explores the benefits of community engagement in a community survey on perceptions related to the health impacts of environmental risk. In this project, community engagement techniques were used to better support the expertise of researchers with the local knowledge of community members and organizations already established in the community. This case study uses the concerns of the community, through outreach and neighborhood surveying, to determine if their concerns are confirmed through environmental and population research.

2.3 Materials and Methods

2.3.1 Study Location and Population

Manchester, Texas, is a small neighborhood in eastern Houston located on the Houston Ship Channel. Manchester is primarily Non-White Hispanic and has endured numerous issues with flooding (Houston Chronicle 2001), air pollution (Houston Chronicle 2014), and health concerns (Houston Department of Health and Human Services 2003). Houston Ship Channel communities are at particularly high risk of

impacts from the nexus of exposure to hazardous substances and natural disasters. For example, within one mile of the Manchester neighborhood, there are 21 facilities that report to the EPA's Toxic Release Inventory: 11 large quantity generators of hazardous waste, four facilities that treat, store, or dispose of hazardous wastes, nine major dischargers of air pollution, and eight major storm water discharging facilities (EPA 2015). The area is also highly vulnerable to the impacts of natural disasters, both socially and physically. Houston has been divided into 88 separate areas called "Super Neighborhoods," these neighborhoods include a council that serves as a forum for community concerns. Manchester is within Super Neighborhood 65 as part of the Harrisburg/Manchester Park neighborhood (City of Houston 2015). The population of the Manchester Super Neighborhood is 98% minority, with a median income that is one-third less than the City of Houston overall. Only six percent of residents have obtained a Bachelor's degree (City of Houston Planning and Development Department 2014). Floodplains along the Sims Bayou have increased by 15 percent since 1980, due to increases in development and impervious cover like concrete and asphalt, while expected sea-level rise could expose another 35,000 residents in Ship Channel neighborhoods to flooding (Ordonez 2015).

2.3.2 Community Meeting

This study was a part of the Resilience and Climate Change Cooperative Project (RCCCP) which is a multi-year collaborative research and engagement program at Texas A&M University (The Institute for Sustainable Coastal Communities 2015). The goal of the RCCCP is to create a fundamentally different way to identify and address critical disaster resiliency and climate change challenges that threaten coastal cities. As a part of

this broader RCCCP group, a community engagement meeting was held with local interest groups and individuals within the Harrisburg/Manchester neighborhood during the Spring of 2015. Attendees including representatives from the Texas Environmental Justice Advocacy Services (t.e.j.a.s.), the Green Ambassadors from Houston's Furr High School (Project Learning Tree GreenSchools! 2015), and interested residents of the Harrisburg/Manchester neighborhood. During this community meeting local concerns were reported about issues related to health, the environment, education, and infrastructure. Some of these responses guided the direction of this research.

2.3.3 Survey Sample

Due to the relatively compact geography of the Manchester neighborhood, a complete census was attempted. Trained survey teams walked every public road and passed every home within the borders of Manchester during two data collection days in December, 2015. Homes that were completely fenced off, abandoned, or were deemed unsafe by the interview team were the only homes not approached during the canvasing.

Community partners that were already engaged from the previous meetings and other community engagement and research projects of the RCCCP assisted with survey data collection to help increase response rates. Specifically, the Green Ambassadors from Houston's Furr High School and the EpiAssist program at the Texas A&M University Health Science Center School of Public Health (Texas A&M Health Science Center 2015) volunteered to help collect survey data. Teams were assembled that consisted of two or three individuals; each team included a graduate student from the EpiAssist program and at least one Spanish speaker.

The survey consisted of 24 questions that included demographic information (gender, race, and age) and language proficiency (can anyone in the household speak English well). It also asked questions about the participant's current view about environmental issues that may or may not be impacting their community. These questions included issues of pollution, natural disasters, and infrastructure. The participants were asked if they thought their community had issues with any of the following exposures: living near too many waste facilities, living near too many industrial buildings, living in buildings that need repair, exposure to standing water, and having poor road infrastructure as dictated by potholes. Each response had a binary outcome (yes or no).

The survey in its entirety can be viewed in Appendix 1.

The survey and accompanying informed consent materials were approved by the Texas A&M University Institutional Review Board (#15-0648D).

2.3.4 Surface Water Sampling

The community meeting with t.e.ja.s. and the Green Ambassadors allowed for local knowledge to help pinpoint problem areas that local residents have noticed following rainfalls. The neighborhood was partitioned into 30 separate clusters using the thiessen polygon technique in ArcGIS from the GPS locations and water sampling was conducted within each cluster (Figure 2.1).

Water sampling collection methods outlined by the US Environmental Protection Agency (EPA) Industrial Stormwater Monitoring and Sampling Guidelines (EPA 2009) was utilized to ensure a quality sample collection procedure was established. The identified samples were collected from as near to the center of the pooled water as was

feasible and acquired with a dip sampler that was replaced for each location. The collection team wore a new pair of nitrile gloves for each sample location to ensure no contamination occurred from handling the equipment. Samples were placed into 250 ml polypropylene laboratory containers with an HNO3 preservative and immediately placed into a Styrofoam cooler.

The samples were sent to A&B Labs, located in Houston, TX (A&B Labs 2015). This lab is accredited through the National Environmental Laboratory Accreditation Program (NELAP) (T104704213-15-13). The lab provided data on the type and concentration of total metals (As, Ba, Cd, Cr, Pb, Se, Ag), in addition to Mercury (Hg). When analyzing for As, Ba, Cd, Cr, Pb, Se, and Ag EPA test method 200.7 was utilized for assessing trace metals in water. For Mercury EPA test method 245.1 was used, which is used for the determination of Mercury in water by cold vapor atomic absorption spectrometry (CVAA). Quality control was assured through the use of laboratory blanks, laboratory control samples, and sample duplicates (LCS/LCSD), as well as a matrix spike and spike duplicate (MS/MSD) for all of the samples.

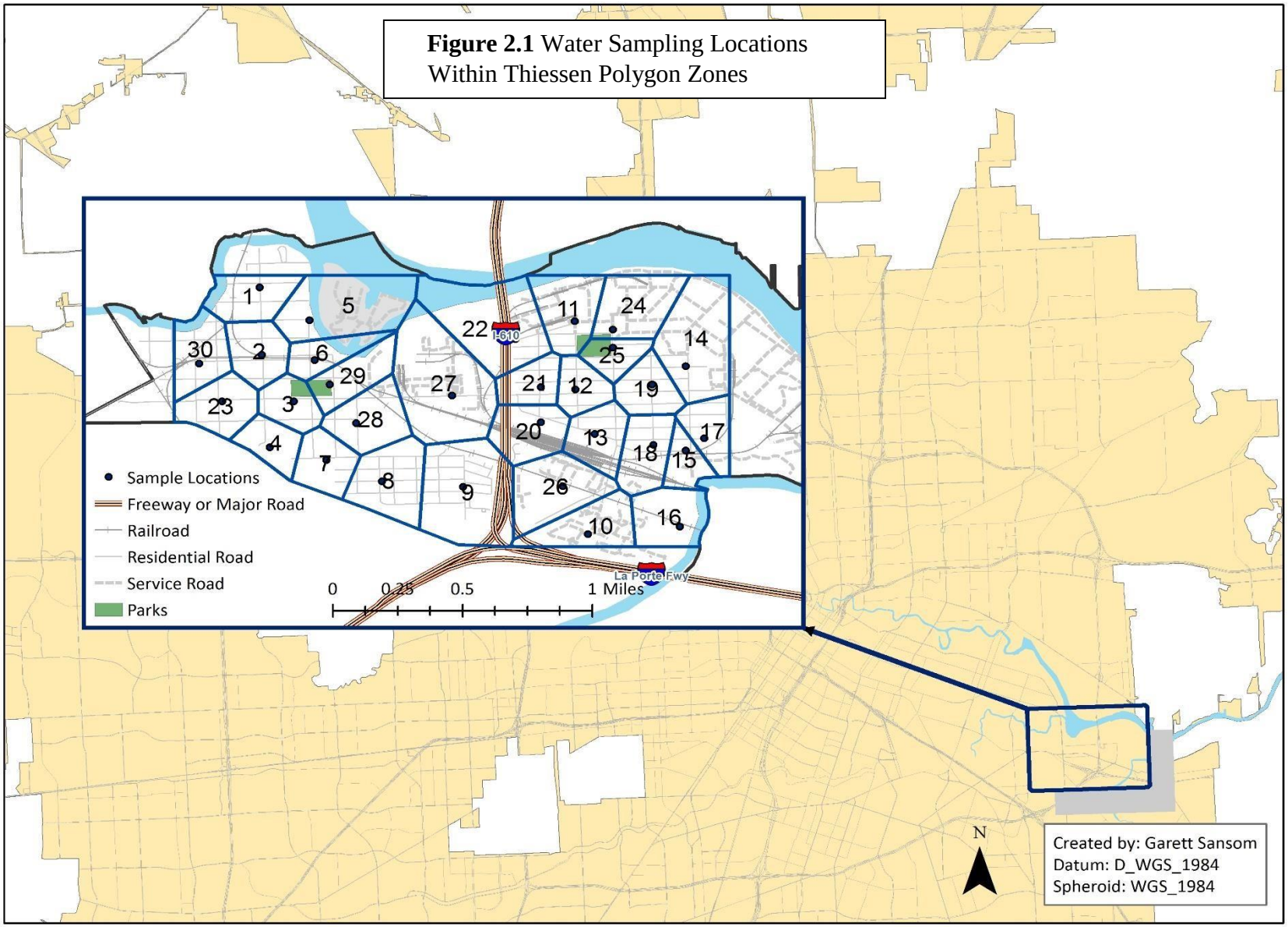


Figure 2.1 Water Sampling Locations Within Thiessen Polygon Zones

2.4 Results

2.4.1 Community Meeting

During the community meeting held in the Spring of 2015 with local citizens, as well as the advocacy and action groups t.e.j.a.s. and the Green Ambassadors, the main interests surrounding public health were on the quality of the environmental conditions, human health impacts, and infrastructure. The abundance of large industrial trucks on residential roads was also mentioned. Drinking water, especially in the public schools, was thought to be far below the quality than they expected. Otherrs mentioned the strong odor in the air and in the surface water, as well as that mosquitoes become quite severe certain times of the year.

2.4.2 Survey Results

Between December 19 and December 26, 2015, 109 (N=109) surveys were collected with an overall response rate of 72.7%. Of the respondents, 28.4 percent (N=31) were completed by non-Hispanic white individuals, 62.4 percent (N=68) Hispanic or Latino individuals, and 8.3 percent (N=9) African American. Approximately half (49.5 percent; N=54) were male and (50.5 percent; N=55) were female. Race was coded as either Non-Hispanic White or Non-White to account for the relatively low amount of responses from African American participants (Table 2.1).

Table 2.1 Sample Characteristics

Characteristics	N (%)
Gender	
Male	54 (49.5%)
Female	55 (50.5%)
Race	
Non-Hispanic White	31 (28.4%)
Hispanic or Latino	68 (62.4%)
African American	9 (8.3%)
Age in Years	
Mean (SD)	45 (15.98)
Age in Groups	
< 35	34 (31.5%)
36 – 50	28 (25.9%)
51 – 69	38 (35.2%)
70+	8 (7.4%)
Language	
Spanish	55 (50.5%)
English	54 (49.5%)

The survey results allowed for the identification of perceived community issues within their neighborhood (Table 2.2). On all issues, the majority of the community felt that the identified areas in the survey were a problem in their neighborhood. While waste facilitates and industrial buildings surround the residential areas of Manchester, there was a difference between the responses on whether it was a problem. Of the respondents 79.82% (N=87) thought there were too many industrial buildings, while 68.81% (N=75) thought waste facilitates were a problem. The survey also showed that standing water within the neighborhood was of concern, with 70.64% (N=77) of respondents identifying it has a problem. Infrastructure was also identified as an issue of concern in two ways; 69.44% (N=75) of respondents felt that too many homes in the neighborhood needed

repairs and 69.72% (N=76) claimed that road infrastructure, as dictated by potholes, was a problem in the community.

Table 2.2 Total Number and Percent of Identified Problems Through Surveying in the Neighborhood of Manchester in Houston, TX in 2015 by Issue

Issue	N	%
Does your neighborhood have too many waste facilities	75	68.81
Does your neighborhood have too many industrial buildings	87	79.82
Does your neighborhood have flood related issues (standing water)	77	70.64
Do too many homes in your neighborhood need repair	75	69.44
Does your neighborhood have poor road infrastructure (potholes)	76	69.72

The survey results allowed for the identification of perceived community issues within their neighborhood (Table 2.2). On all issues, the majority of the community felt that the identified areas in the survey were a problem in their neighborhood. While waste facilitates and industrial buildings surround the residential areas of Manchester, there was a difference between the responses on whether it was a problem. Of the respondents 79.82% (N=87) thought there were too many industrial buildings, while 68.81% (N=75) thought waste facilitates were a problem. The survey also showed that standing water within the neighborhood was of concern, with 70.64% (N=77) of respondents identifying it has a problem. Infrastructure was also identified as an issue of concern in two ways; 69.44% (N=75) of respondents felt that too many homes in the neighborhood needed repairs and 69.72% (N=76) claimed that road infrastructure, as dictated by potholes, was a problem in the community.

The strong agreement between all of the identified issues on the survey was also reflected with different gender and racial categories (Table 2.3). The agreement between

these categories is strongest with concerns surrounding living near too many industrial buildings. On the other issues of waste facilities, standing water, poor infrastructure, and buildings that need repair, Non-Hispanic White individuals believed in a higher proportion than their counterparts in the survey that their community had a problem with this issues. Of the Non-Hispanic White participants 83.87% (N=31) of individuals claimed that their neighborhood had a problem with standing water compared to the lowest group, nonwhite respondents, where 65.39% (N=78) thought the same.

Table 2.3 Identified Problems in Neighborhood Stratified by Race and Gender.

Issue	N	n(%)
Too many waste facilities		
Non-Hispanic White	31	24(77.42)
Nonwhite	78	51(65.39)
Male	54	37(68.52)
Female	55	38(69.09)
Too many industrial buildings		
Non-Hispanic White	31	23(74.19)
Nonwhite	78	64(82.05)
Male	54	43(79.63)
Female	55	44(80.00)
Flood related (standing water)		
Non-Hispanic White	31	26(83.87)
Nonwhite	78	51(65.39)
Male	54	40(74.07)
Female	55	37(67.27)
Too many buildings that need repair		
Non-Hispanic White	31	24(77.42)
Nonwhite	77	51(66.23)
Male	53	36(67.93)
Female	55	39(70.91)
Poor road infrastructure (potholes)		
Non-Hispanic White	31	24(77.42)
Nonwhite	78	52(66.67)
Male	54	38(70.37)
Female	55	38(69.09)

2.4.3 Surface Water Sampling

The results of the water quality sampling indicated that there were concentrations of barium in every location sampled, arsenic was present in eight locations, chromium in ten, lead in twelve, and mercury in two areas (Table 2.4). Many of the locations exceeded the levels set by the EPA with the national recommended water quality criteria for chronic exposure for aquatic life (EPA 2015). The levels of lead in the surface water samples showed a great amount of variety, and in one instance, levels were far above state and national levels. Of the twelve locations identified to contain lead, one of the samples had a level of 1,448(µg/L), and two other locations had levels exceeding 100 (µg/L). While mercury was only identified in two of the zones, each location had a concentration of 10 (µg/L). It is important to note that zone 4 had elevated concentrations of every found contaminant within the sampling criteria. While silver was tested for, no concentrations were high enough to allow for verification within this neighborhood.

Table 2.4 Heavy Metal Concentrations (µg/L) in 30 Zones in the Neighborhood of Manchester, TX

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Arsenic				180*								38			11
Barium	60	85	544	3296	57	88	65	194	74	125	95	130	176	75	110
Chromium			46	363*										11	
Lead		17*	183*	1448*			17*					34*			
Mercury				10*											

Zone	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Arsenic	14		13		17				150*	10					
Barium	274	88	452	153	176	135	299	731	136	46	132	180	55	209	940
Chromium	17		15		14		27	111*						15	31
Lead	66*		299*		55*		49*	98*						41*	33*
Mercury														10*	

*Levels above National Recommended Water Quality Criteria for Chronic Exposure for Aquatic Life

2.5 Discussion

Our cross-sectional study was designed to evaluate if the concerns of local interest groups and residents would be verified through environmental sampling and community surveys. The findings of this research suggest that not only did local citizens and interest groups understand the issues within their neighborhood but that using the local knowledge already present within the community improved the quality of research by pinpointing problem areas.

The concerns expressed to the RCCCP specifically indicated a concern for the quality of the standing water, this concern was echoed across genders and racial composition in the survey responses, and this apprehension proved to be justified from the lab analyses. Several of these zones have issues with many of the heavy metals, specifically Zone 4 which had high levels of arsenic, barium, chromium, lead, and mercury. It should be noted that Zone 29, which had elevated levels of lead and chromium, as well as detectable amounts of barium and chromium, is in a public park heavily utilized by residents.

While these findings offer a troubling insight into the environmental conditions in the Manchester neighborhood, it also underscores the importance of utilizing local knowledge in every stage of environmental and public health research. The relatively high response rate to the survey, identifying surface water as a concern, and the sample site locations were all highly influenced by the buy-in of community members.

This case study has several important limitations. This was a cross-sectional study, and therefore only provides data on surface water conditions at a single point in time. Additionally, the perceptions of the residents were gathered at a single meeting, although these concerns have been well documented by previous studies (Texas

Department of State Health Services 2015; Air Alliance Houston 2014), also ship channel community assessment published by air alliance houston – you should be able to find them in Google). The survey was also interviewer administered; some research indicates that individuals tend to respond differently when speaking with an individual compared to self-administered surveys (Eschbach et al. 2004; Hammer et al. 2007). Despite the relatively high response rate, a small total amount of participants completed the survey, reducing our statistical power (N=109). Non-Hispanic Whites were overrepresented in our survey responses as compared to the U.S. Census data on race and ethnicity of Manchester residents (City of Houston Super Neighborhoods 2014). NonHispanic Whites were more likely to complete the survey than their Non-White counterparts, which could cause selection bias within this study if Non-Whites' concerns about the environment were substantively different that the Non-Hispanic White residents.

While additional research is needed to assess the value and application of community engagement and participatory research, this study strongly suggests that using the ordinary knowledge of residents within local areas is highly valuable during every step of environmental and population research. Furthermore, these findings illustrate the environmental justice concerns that affect so many communities in the U.S. The environmental conditions within Manchester may be somewhat unique, but the experience of its resident's likely echo those of other U.S. communities characterized by environmental justice issues.

3. EVALUATING THE IMPACT OF RACE AND GENDER ON ENVIRONMENTAL RISK PERCEPTIONS IN THE HOUSTON NEIGHBORHOOD OF MANCHESTER

3.1 Introduction

Prior research in the U.S. has demonstrated that racial and gender groups perceive the potential risks from the same environmental exposures differently from one another(Finucane et al. 2000; Davidson and Freudenburg 1996). The largest differences in perceptions of environmental harm have been seen with white males, who typically view the potential health risks of environmental exposure as much lower than their gender or racial counterparts (Flynn et al. 1994; Brody 1994; Steger and Witt 1989; Gwartney-Gibbs 1991). This has been attributed to male predominance in positions of political, social, technological, and economic power (Kahan et al. 2007). However, there is increasing evidence that gender and race may play a smaller role in determining an individual's perceptions of potential environmental risks as compared to the community and generational experiences with one's lived environment (Olofsson and Rashid 2011; Marshall et al. 2006). It is our hypothesis that communities living for generations in areas characterized by poor environmental conditions could create cultural norms that make these populations less likely to recognize potential environmental harms. These poor environmental conditions are experienced far more by minority communities than majority populations. To address the inconsistency of these findings, a cross-sectional study was conducted in the neighborhood of Manchester in Houston, TX.

3.2 Background

Prior research has shown disparate perceptions of potential harm from environmental exposures in several settings, with white males tending to have the lowest perception of risk. For example, differences in perceived risk between races, as well as acceptance of living in communities that are exposed to industrial pollutants have been documented by researchers in studies within the urban settings of Philadelphia, PA (Johnson 2002) and in rural northern California (Norgaard 2007). This phenomenon has been termed the "White Male Effect" (Flynn et al. 1994). The predominant explanation for this difference is that white males within the U.S. have more power over their environment and are involved to a greater degree in the creation, management, and benefits of technology and industrial pursuits and therefore are more likely to see benefits rather than health risks (Finucane et al. 2000). Another explanation for differences in risk perception may be cultural differences between groups. Due to white male's risk skepticism and hierarchical and individualistic nature, when activities that are integral to their identity are threatened they will underestimate the inherent risk. Cultural protective cognition, according to Kahan et al. (2007), is what explains this difference, because white male cultural identity is inherently linked to technocratic endeavors in a way that the identity of women and minority populations are not.

While this phenomenon has been studied in multiple settings, the majority of research is set in large geographic areas that do not take into account the actual environmental conditions in which the individuals answering the questions live. There has been some evidence to suggest that differences in perceptions of environmental harm is more closely related to the specific area in which individuals live, rather than their race or ethnicity. For example, in a study of Swedish society in which disproportionate

exposures to industrial pollutants with regard to differing racial groups is not as distinct as it is in the U.S., Olofsson and Rashid (2011) found that differences in perceived environmental risks mostly vanished. Within the U.S., when surveying deep-south coastal residents living in an area characterized by industrial water pollution, Marshal et al. (2006) found the difference between groups was less pronounced when both minority and majority groups experienced similar environmental pollution. Furthermore, according to Satterfield et al. (2004) when asked if hazardous facilitates are more common in minority communities only 50.4 percent of white males agreed, while 66.5 percent of nonwhite males agreed in one study. This division is shown in gender as well, with 71.6 percent of nonwhite females agreeing with the previous statement compared to slightly above 50 percent for males. This gap between beliefs and empirical evidence further demonstrates that these different groups are living in different environmental conditions. Generational conditions of living in areas characterized by poor environmental conditions may well create expectational norms among minority groups that accept poorer conditions than their white counterparts.

To better understand the effects of gender and race on risk perception, we conducted in person interviews with residents of a small geographic community in Houston, TX, where all individuals experience a similar relationship with their environmental conditions regardless of race. A goal of this study was to determine whether perceived risks are a continuation of environmental justice issues that have permeated the racial minority experience within the U.S. for decades or if the white male effect would be shown to exist even in this community.

3.3 Materials and Methods

3.3.1 Study Location and Population

Manchester, Texas, is a small neighborhood in eastern Houston on the Houston Ship Channel (Figure 3.1) that is primarily Non-White Hispanic and has endured numerous issues with flooding (Houston Chronicle 2001), air pollution (Houston Chronicle 2014), and health concerns (Houston Department of Health and Human Services 2003).

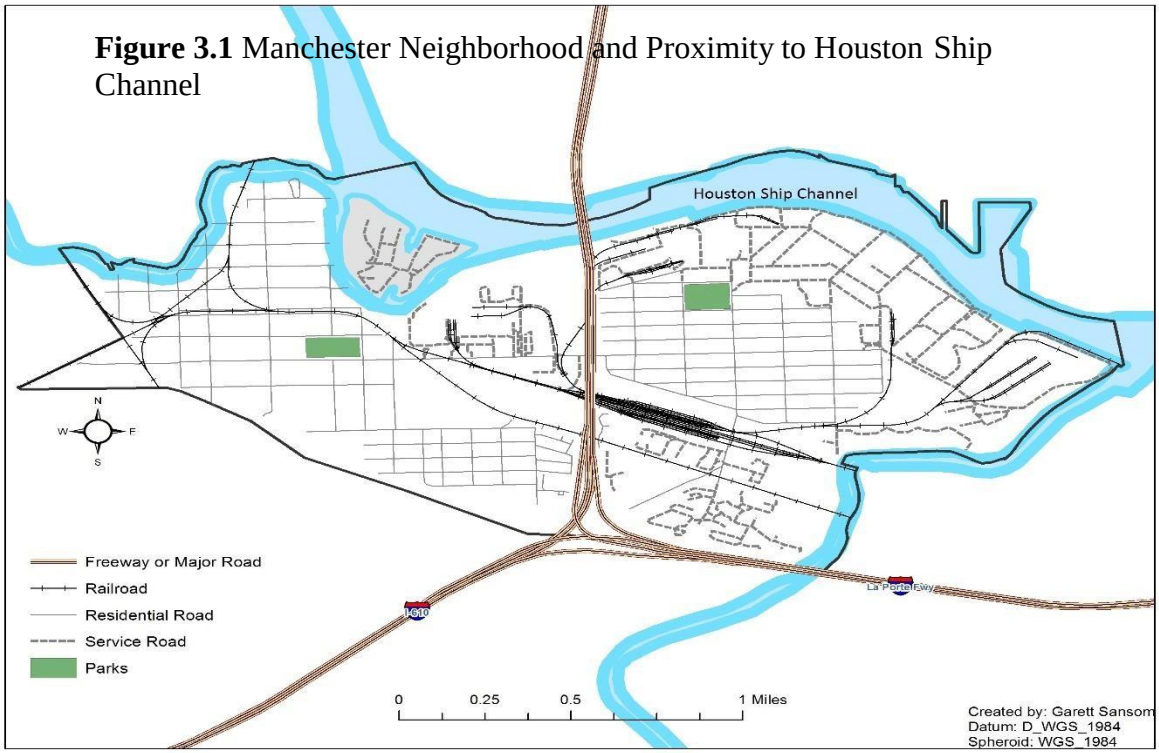


Figure 3.1 Manchester Neighborhood and Proximity to Houston Ship Channel

Houston Ship Channel communities are at particularly high risk of impacts from the nexus of exposure to hazardous substances and natural disasters. For example, within 1 mile of the Manchester neighborhood, there are 21 facilities that report to the EPA's Toxic Release Inventory: 11 large quantity generators of hazardous waste, 4 facilities that treat, store, or dispose of hazardous wastes, 9 major dischargers of air pollution, and 8

major storm water discharging facilities (EPA 2015). The area is also highly vulnerable to the impacts of natural disasters, both socially and physically. The population of the Manchester Super Neighborhood is 98% minority, with a median income that is one-third less that the City of Houston overall. Only 6% of residents have obtained a Bachelor's degree (City of Houston Planning and Development Department 2014). Floodplains along Sims Bayou have increased by 15% since 1980, due to increases in development and impervious cover like concrete and asphalt, while expected sea-level rise could expose another 35,000 residents in Ship Channel neighborhoods to flooding (Ordonez 2015).

Based on these characteristics, and an existing relationship with communitybased environmental justice and education groups as part of the Resilience and Climate Change Cooperative Project (RCCCP) at Texas A&M University, the Manchester neighborhood was selected as a case study location to assess if differences in environmental harm persist between racial and gender groups given everyone has similar experiences with environmental conditions.

3.3.2 Survey Sample

Due to the relatively compact geography of the Manchester neighborhood, a complete census was attempted. Trained survey teams walked every public road and passed every home within the borders of Manchester during December 2015. Homes that were completely fenced off, abandoned, or were deemed unsafe to approach by the interview team were the only homes not approached during the canvasing.

Community partners already engaged with the broader RCCCP project assisted with survey data collection to help increase response rates. Specifically, the Green

Ambassadors from Furr High School in Houston, TX, and the EpiAssist student volunteer program at the Texas A&M University Health Science Center School of Public Health (Texas A&M Health Science Center 2015) were chosen to help collect survey data. Teams were assembled that consisted of two or three individuals each with graduate students from the EpiAssist program and a Spanish speaker as language barriers have been shown to be an issue in this community.

The survey consisted of 24 questions that included demographic information (gender, race, and age) and language proficiency (can anyone in the household speak English well). Questions related to perceptions of environmental harm surrounded issues of pollution, natural disasters, and infrastructure. The participants were asked if they thought exposure to the following issues could negatively impact their health; living near too many waste facilities, living near too many industrial buildings, living in buildings that need repair, exposure to standing water, and having poor road infrastructure as dictated by potholes. Each response had a binary outcome (yes or no). The survey in its entirety can be viewed in the Appendix.

Race was coded as either Non-Hispanic White or Non-White to account for the relatively low amount of respondents from African American participants. Age was categorized by generational group to account for potential differences in attitudes and experiences between these groups. They were placed either in the millennial group (being born between 1980 and 200), Generation X (born between 1965 and 1980), the baby boomers (born between 1946 and 1964), and finally the mature generation (born between 1927 and 1945). These categories were selected as previous research has shown key different between attitudes of different generations (Kowske et al. 2010; Howe and Strauss 2000; Ryder 1965; O'Connor et al. 1999).

After giving oral informed consent, individuals were asked a serious of questions and responded whether or not they felt that exposure to these items could cause negative health impacts. Participants were also asked if they felt that their neighborhood had a problem with specific exposures. The survey was interviewer administered between the team and the respondent. The survey and accompanying consent materials were approved by the Texas A&M University Institutional Review Board (#15-0648D).

3.3.3 Statistical Methods

Descriptive statistics were calculated for each variable. Logistic regression was utilized to estimate the relative effect of race on environmental health perceptions and multiple logistic regression was used to adjust for the different generational age categories. Comparisons were made between racial groups as well as grouping different race and genders. While males were used as the referent group.

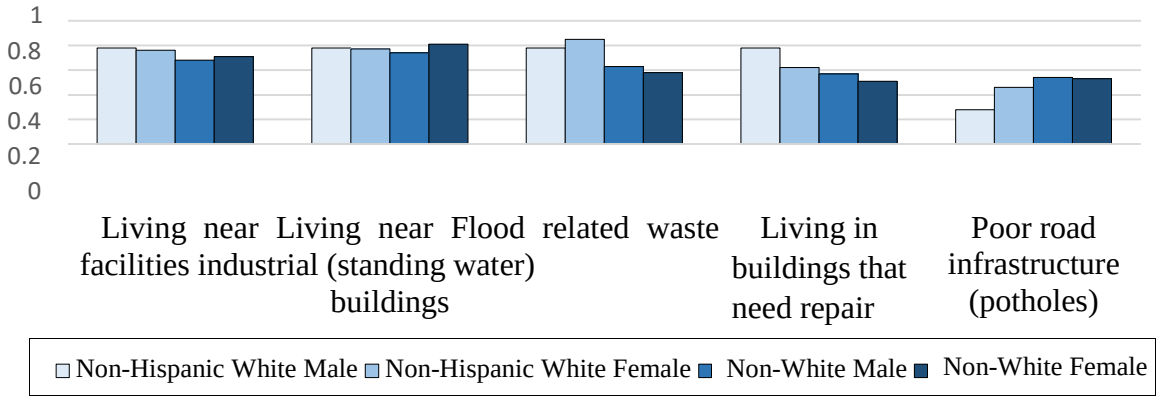
3.4 Results

Between December 26, 2015, 109 (N=109) surveys were collected with an overall response rate of 72.7%. Twenty-eight percent (N=31) were completed by non-Hispanic white individuals, 62.4% (N=68) Hispanic or Latino individuals, and 8.3% (N=9) African American. There was an almost even split between male, 49.5% (N=54) and female, 50.5% (N=55) respondents. Table 2.1 Provides additional community characteristics.

The majority of all respondents, regardless of race or gender, felt that living near waste facilities and industrial buildings could cause negative health outcomes. The largest differences in perceptions were with road infrastructure, where 27.8% (N=5) of white males said it was a health concern compared to white females (46.1%; N=6), non-

white males (54.3%; N=19) and non-white females (53.7%; N=23). In the other categories the responses remained consistent, with non-Hispanic white males having the most concern compared to other groups (Figure 3.2).

Figure 3.2 Mean Risk Perception by Race and Gender



When comparing Non-White participants to Non-Hispanic White individuals, the overall perception of environmental harm was lower for minority populations. Table 3.1 shows the crude and adjusted odds ratios (ORs) and 95% confidence intervals (95% CI) for each of the environmental exposures mentioned in the survey. On all exposures, with the exception of poor road conditions, the non-white group perceived a lower health risk than Non-Hispanic Whites. Exposure to standing water associated with flooding was significantly associated with a lower health risk by minority residents, with a statistically significant decrease in risk perception (OR=0.34; CI= 0.13-0.94). Adjusting for the generational age of the participants did not impact the direction of the associations.

Table 3.1 Odds Ratios (OR) and 95% Confidence Intervals (CI) of Environmental Health Perceptions of Harm to Oneself or Community in the Neighborhood of Manchester in Houston, TX in 2015 by Issue

Issue	OR	95% CI	p-Val	Adj. OR*	95% CI	p-Val
Living near waste facilities						
Non-Hispanic White	1.00	Reference		1.00	Reference	
Non-White	0.67	0.25-1.78	0.42	0.66	0.25-1.75	0.40
Living near industrial buildings						
Non-Hispanic White	1.00	Reference		1.00	Reference	
Non-White	0.83	0.29-2.36	0.73	0.83	0.29-2.34	0.72
Flood related (standing water)						
Non-Hispanic White	1.00	Reference		1.00	Reference	
Non-White	0.35	0.13-0.94	0.03**	0.34	0.12-0.93	0.04**
Living in buildings that need repair						
Non-Hispanic White	1.00	Reference		1.00	Reference	
Non-White	0.48	0.19-1.18	0.11	0.47	0.19-1.14	0.09
Poor road infrastructure (potholes)						
Non-Hispanic White	1.00	Reference		1.00	Reference	
Non-White	2.12	0.89-5.01	0.09	2.07	0.87-4.90	0.09

*Adjusted by generational age (<35, 36-50, 51-69, 70+)
** Significant at <0.05

Table 3.2 shows the results of comparing Non-Hispanic White males to each gender and racial category. Analyses of reported perceptions of environmental harm to one's personal health or the health of the community indicated that on issues of living near industrial buildings, living near waste facilitates, and living in buildings that need repair, Non-Hispanic White males showed the greatest concern. On issues of exposure to standing water, Non-Hispanic White females were 57 percent more likely to shows concern than their male counterparts (OR=1.57; 95% CI=0.24-10.22). The main exceptions were the issue of living with poor road infrastructure, where Non-Hispanic

White females, Non-White males and females, all perceived increases in potential harm. It is important to note that each of the points failed to produce statistically significant differences between any group, likely due to the limited sample size.

Table 3.2 Odds Ratios (OR) and 95% Confidence Intervals (CI) of Environmental Health Perceptions of Harm to Oneself or Community Grouped by Race and Gender.

Issue	OR	95% CI	P-Value
Living near waste facilities			
Non-Hispanic White male	1.00	Reference	
Non-Hispanic White female	0.95	0.17-5.22	0.95
Non-White male	0.62	0.17-2.34	0.48
Nonwhite female	0.69	0.19-2.53	0.58
Living near industrial buildings			
Non-Hispanic White male	1.00	Reference	
Non-Hispanic White female	0.67	0.11-3.99	0.66
Non-White male	0.58	0.14-2.47	0.46
Nonwhite female	0.83	0.19-3.55	0.79
Flood related (standing water)			
Non-Hispanic White male	1.00	Reference	
Non-Hispanic White female	1.57	0.24-10.22	0.64
Non-White male	0.45	0.12-1.64	0.23
Nonwhite female	0.38	0.11-1.35	0.14
Living in buildings that need repair			
Non-Hispanic White male	1.00	Reference	
Non-Hispanic White female	0.46	0.09-2.21	0.33
Non-White male	0.38	0.10-1.39	0.15
Nonwhite female	0.30	0.08-1.07	0.06
Poor road infrastructure (potholes)			
Non-Hispanic White male	1.00	Reference	
Non-Hispanic White female	2.23	0.49-9.99	0.30
Non-White male	2.91	0.86-9.86	0.09
Nonwhite female	3.15	0.96-10.42	0.06

3.5 Discussion

Our cross-sectional study was designed to evaluate whether there was evidence of the so-called white male effect in a small geographic area in Houston, TX, where the environmental conditions are well known, and the lived environmental experience was

similar for each racial group within the study. The findings of this research suggest that this effect does not hold in this population. Within the surveyed population in

Manchester, TX, minority populations tended to under report perceived health problems associated with certain environmental exposures compared to Non-Hispanic White groups. These results were not attenuated when adjusting for gender; Non-Hispanic White males often reported the highest level of concern. These findings lend support to the hypothesis that minority groups are less likely to report a problem with even egregious environmental conditions due to cultural norms surrounding these communities from generations of poor environmental living conditions discussed at length in environmental justice research (Bullard 2000; Bullard 1983; Anderton et al.
1994; Bryant and Mohai 1992).

The strength of this study lies with the well-documented problems with the quality of air, standing surface water, proximity to waste and industrial buildings, and infrastructure conditions in this small neighborhood. Furthermore, partnerships with local students and volunteers to conduct survey data collection ensured that language and cultural boundaries did not pose a problem in receiving quality data. A response rate of 72.7% (109/150), a high proportion within a small geographic neighborhood of this kind, further demonstrated the interest within the neighborhood around environmental health issues.

This study has several limitations. Despite the relatively high response rate, a small total number of participants completed the survey, reducing our statistical power and our ability to adjust by multiple confounders (N=109). Non-Hispanic Whites were over-represented in our survey responses as compared to the U.S. Census data on race and ethnicity of Manchester residents. Non-Hispanic Whites were more likely to

complete the survey than their Non-White counterparts and this could have caused selection bias within this study. The use of trained, local volunteers and Spanish speakers was an effort to address this potential bias.

3.6 Conclusion

The results of our small case study suggest that the white male effect may not be seen with different racial or gender groups who experience the same environmental conditions. Furthermore, the reduction in perceived risk from minority populations in this study suggests that long-term cultural norms may inform individuals' opinions about the health risks of various environmental exposures. Gender and racial perceptions of environmental harm will require additional research to better understand how individuals and communities view their lived environment and its impact on their health.

4. THE IMPACTS OF EXPOSURE TO ENVIRONMENTAL RISK ON PHYSICAL AND MENTAL HEALTH IN A SMALL GEOGRAPHIC COMMUNITY IN HOUSTON, TX

4.1 Introduction

Researchers of environmental justice have conclusively shown that minority populations shoulder an undue burden of exposure to industrial buildings (Bullard 2000), waste facilities (Bullard 1983; Anderton et al. 1994), and urban pollution (Bryan and Mohai 1992; Perlin et al. 1999) compared to majority populations. Further, those with low socioeconomic status, regardless of race, live in areas characterized by poorer environmental conditions at levels exceeding those in the upper socioeconomic status groups (SES) (Adler and Newman 2002; Bullard 2000). While many studies have shown the negative health effects of living in environmentally compromised neighborhoods (Morello-Frosch et al. 2001), they most often focus on social determinants of health, personal habits, or specific exposures even though these only account for a small amount of negative health outcomes (Brulle and Pellow 2006; Macintyre et al. 1993; Lantz et al. 1998). More recent studies have begun to utilize a multidisciplinary approach to treat and analyze macro-level issues within communities (Hofrichter 2004). In order to characterize the impact of living over time in a community that typifies the problems seen with environmental justice, a cross sectional study was conducted in the neighborhood of Manchester, a low income, majority minority neighborhood in Houston, TX.

4.2 Background

Previous research has demonstrated disparate exposures to environmental risks from the lived environmental conditions of individuals among those of low SES and minority communities within the U.S. (Bullard 2000; Bullard 1983; Anderton et al. 1994; Bryant and Mohai 1992) This has created communities that live with increased levels of air, water, and soil pollution. While efforts to change this situation have been slow, environmentalism is now linked with social justice and civil rights issues largely due to the work of non-white communities organizing for change (Bullard and Johnson 2000). According to Evans and Kantrowitz (2002), the main predictor of exposure to poor environmental living conditions was race/ethnicity and low SES. Similarly, a study in Southern California performed by Morello-Frosch et al. (2002) found that race was a strong predictor for the locations of poor air quality and hazardous waste facilities. Differences in the perception of environmental harm also exists. A study by Satterfield et.al. (2004) demonstrated differences in perceived risk, as well as acceptance by minority communities that they are exposed to industrial pollutants more. When asked if hazardous facilitates are more common in minority communities, only 50.4 percent of white males agreed, while 66.5 percent of nonwhite males agreed. These differences were shown in gender as well, with 71.6 percent of nonwhite females agreeing with the previous statement compared to slightly above 50 percent for males (Satterfield et al. 2004).

Communities within these neighborhoods have been shown to have a variety of negative health outcomes (Diez et al 2001; Morello-Frosch et al. 2002). In one study that was conducted in the Bronx, New York City, Maantay (2007) found that those living near noxious land use were 66 percent more likely to be hospitalized for asthma related

illness. Wendell et al. (2006) found that communities with high proportions of low SES and racial minority residents have multiple obstacles to overcome high obesity rates; including the existence of food deserts, a lack of safe walkable streets, and cultural conditions (Wendell et al. 2006). However, little research has been done on the overall physical and mental health of communities within these neighborhoods in relation to the amount of time individuals live within the boundaries of the neighborhood.

4.3 Materials and Methods

4.3.1 Study Location and Population

Manchester, Texas, is a small neighborhood in eastern Houston located on the Houston Ship Channel. Manchester is primarily Non-White Hispanic and has endured numerous issues with flooding (Houston Chronicle 2001), air pollution (Houston Chronicle 2014), and health concerns (Houston Department of Health and Human Services 2003). Houston Ship Channel communities are at particularly high risk of impacts from the nexus of exposure to hazardous substances and natural disasters. For example, within one mile of the Manchester neighborhood, there are 21 facilities that report to the EPA's Toxic Release Inventory: 11 large quantity generators of hazardous waste, four facilities that treat, store, or dispose of hazardous wastes, nine major dischargers of air pollution, and eight major storm water discharging facilities (EPA 2015). The area is also highly vulnerable to the impacts of natural disasters, both socially and physically. Houston has been divided into 88 separate areas called "Super Neighborhoods," these neighborhoods include a council that serves as a forum for community concerns. Manchester is within Super Neighborhood 65 as part of the

Harrisburg/Manchester Park neighborhood (City of Houston 2015). The population of the Manchester Super Neighborhood is 98% minority, with a median income that is onethird less than the City of Houston overall. Only six percent of residents have obtained a Bachelor's degree (City of Houston Planning and Development Department 2014). Floodplains along the Sims Bayou have increased by 15 percent since 1980, due to increases in development and impervious cover like concrete and asphalt, while expected sea-level rise could expose another 35,000 residents in Ship Channel neighborhoods to flooding.

Based on these characteristics, and an existing relationship with communitybased environmental justice and education groups, the Manchester neighborhood was selected as a case study location in which to assess the impact of living over time in this area on the physical and mental health of the community.

4.3.2 Survey Sample

Due to the relatively compact geography of the Manchester neighborhood, a complete census was attempted. Trained survey teams walked every public road and passed every home within the borders of Manchester during two data collection days in December, 2015. Homes that were completely fenced off, abandoned, or were deemed unsafe by the interview team were the only homes not approached during the canvasing.

Community partners that were already engaged with ongoing research projects assisted with survey data collection to help increase response rates. Specifically, the Green Ambassadors from Houston's Furr High School (Project Learning Tree GreenSchools! 2015) and the EpiAssist program at the Texas A&M University Health Science Center School of Public Health (Texas A&M Health Science Center 2015) were

chosen to help collect survey data. Teams were assembled that consisted of two or three individuals each with graduate students from the EpiAssist program and at least one Spanish speaker.

The survey included the 12 item Short Form Health Survey version 2 (SF12v2) that was adapted from the medical outcome study (Tarlov et al. 1989). The SF12v2 has been validated to accurately predict the generic mental and physical health of populations without targeting specific health outcomes and shown to be reliable in U.S. and international populations (Gandek et al. 1998; Lim and Fisher 1999). The SF12v2 has also been applied to ratings of the general mental and physical health of homeless populations (Larson 2002), those with severe mental health (Salyers et al. 2000), immigrant communities in the United States (Grant et al. 2004), and has been used to evaluate general populations in the United States by researchers and state health departments alike (Sallisa et al. 2009; Utah Department of Health 2001). This survey produces a composite score for mental (MCS) and physical health (PCS) between 0 and 100. A norm based algorithm is used to create these composite scores (Ware et al. 2000), which allow for easy comparison between study populations and national averages. The national average score for both mental and physical health is standardized at 50; scores above this represent higher, or healthier, individuals than this average. In addition to these items, demographic information (gender, race, and age) and language proficiency (can anyone in the household speak English less than well) was also collected. The survey and accompanying consent materials were approved by the Texas A&M University Institutional Review Board (#15-0648D) (Appendix B).

4.3.3 Statistical Methods

Descriptive statistics were calculated for each variable, including demographics. Race was coded as either Non-Hispanic White or Non-White to account for the relatively low number of African American respondents. A two-way scatterplot was created for MCS and PCS and time spent living in the neighborhood. A two tailed t-test was conducted to assess if there were difference between respondents and the national score of 50 for PCS and MCS stratified by gender and race. Multiple linear regression was used to assess the impact of time spent in the neighborhood, age, gender, and racial categories on MCS and PCS. Coefficients of the covariates, along with their corresponding 95% confidence intervals (95% CI) and p-values, were reported. Statistics were calculated using STATA 14 and Microsoft Excel.

4.4 Results

Between December 19 and December 26, 2015, 109 (N=109) surveys were collected with an overall response rate of 72.7%. Of the respondents, 28.4 percent (N=31) were completed by non-Hispanic white individuals, 62.4 percent (N=68) Hispanic or Latino individuals, and 8.3 percent (N=9) African American. Approximately half (49.5 percent; N=54) were male and (50.5 percent; N=55) were female (Table 2.1).

When comparing the results from this survey to the national mean scores for MCS and PCS, there were significant difference between the two outcome variables (Table 4.1). For the MCS, women tended to have the lowest MCS scores. Non-Hispanic White women had mean score of 38.42 (p-value <0.001) showing increased levels of mental stress compared to national averages. Non-Hispanic White men had a mean score

of 43.12, which was not significantly different from the national mean. The PCS produced statistically significant results in every group, showing a consistent impact on physical health from negative exposures in this community. Non-Hispanic White males had the lowest mean score with a value of 34.86 (p-value <0.001), producing responses far lower than expected based on national norms.

Table 4.1 Two-Tailed *t* Test of Mean Values of Mental and Physical Composite Scores against National Mean Values

Outcome and Group	*t* value	Mean	95% CI	p-value
Mental Composite Score				
Male	-0.98	48.24	44.61-51.86	0.33
Female	-2.04	47.13*	43.41-49.95	0.05
Non-Hispanic White Male	-2.03	43.12	35.97-50.28	0.06
Non-Hispanic White Female	-3.77	38.42*	31.74-45.11	<0.001
Non-White Male	0.39	50.79	46.70-54.88	0.69
Non-White Female	-0.44	49.24	45.71-52.76	0.67
Physical Composite Score				
Male	-5.94	40.73*	37.60-43.86	<0.001
Female	-5.85	41.77*	38.95-44.59	<0.001
Non-Hispanic White Male	-5.67	34.86*	29.23-40.49	<0.001
Non-Hispanic White Female	-3.49	40.49*	34.54-46.43	0.01
Non-White Male	-3.62	43.67*	40.11-47.22	<0.001
Non-White Female	-4.74	42.18*	38.84-45.51	<0.001

*statistically significant (p-value <0.05)

Plotting the MCS against years lived in the neighborhood failed to produce a correlation between these two variables, (figure 4.1). Plotting the impact that years spent in the neighborhood on PCS showed a highly statistically significant (p-value <0.001) score with a weak negative linear relationship (r^2=0.136). This indicates that the longer an individual lived in the neighborhood the lower their respective PCS became (Figure

4.2).

Figure 4.1 Mental Health Composite Score by Time Lived in Neighborhood

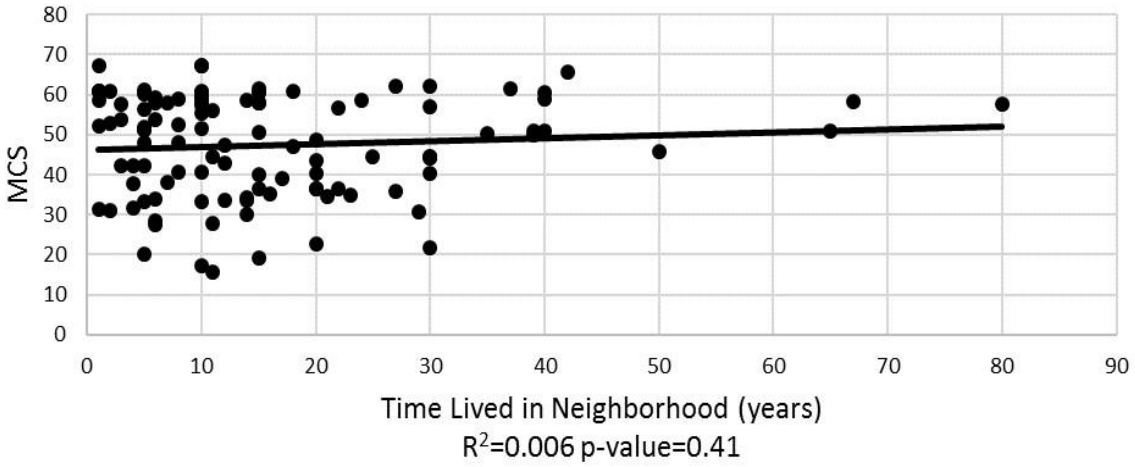


Figure 4.2 Physical Health Composite Score by Time Lived in Neighborhood

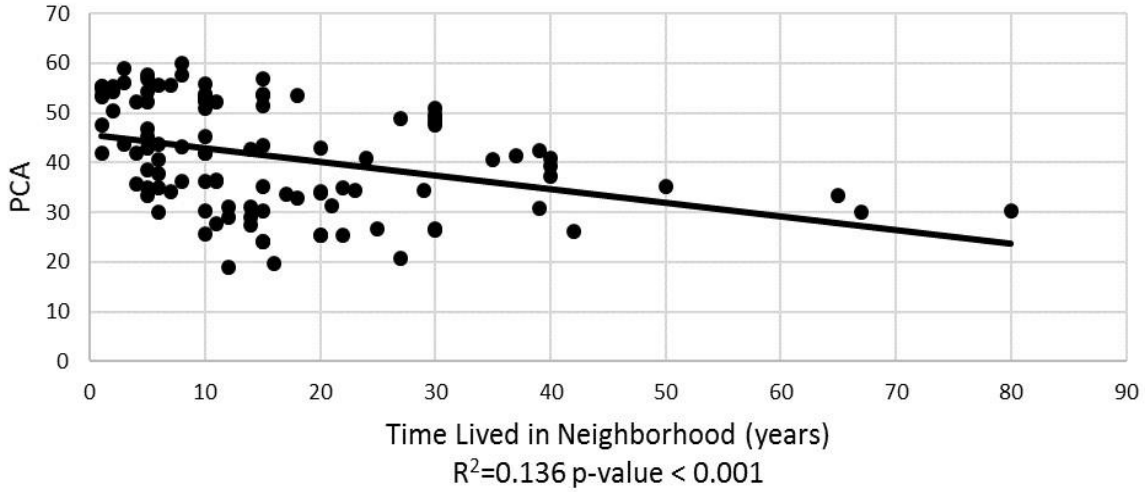


Table 4.2 shows the results of multiple linear regression comparing the covariates age, gender, race, and time lived in the neighborhood on MCS and PCS values. Non-white respondents scored significantly higher on the mental aspect of the survey compared to Non-Hispanic White respondents (coef=8.67, 95% CI 3.49 – 13.85).

For the PCS scores, time spent in the neighborhood was the best predictor for decreases in PCS values even after adjusting for the other covariates in the model (coef=-0.27, 95% CI -0.43 – -0.12). This supports the correlation between PCS and time lived in the neighborhood (figure 4.2).

Table 4.2 Multiple Linear Regression Comparing the Covariates Age, Gender, Race Category, and Time Lived in the Neighborhood on MCS and PCS Values

Group	***coef***	**Std Err.**	**95% CI**	**p-value**
Mental Composite Score				
Gender (female)	-2.28	2.36	-6.95 – 2.39	0.34
Race (non-white) *	8.67	2.61	3.49 – 13.85	<0.001
Time in Neighborhood	0.11	0.097	-0.08 – 0.31	0.25
Age	-0.14	0.09	-0.31 – 0.04	0.12
Physical Composite Score				
Gender (female)	-0.87	1.92	-4.67 – 2.93	0.65
Race (non-white)	0.05	0.07	-0.09 – 0.18	0.51
Time in Neighborhood*	-0.27	0.07	-0.43 – -0.12	<0.001
Age	-0.07	0.07	-0.20 – 0.08	0.36

*statistically significant (p-value <0.05)

4.5 Discussion

The mental health, as measured by the SF12v2, of members of this low wealth, majority minority community in Houston, TX, were relatively in-line with national norms, with the exception of the female residents who had values significantly below the national mean. All racial and gender categories had lower values for physical health when compared to the country as a whole. Contrary to our initial hypothesis, the NonHispanic white participants had the lowest values of PCS, with white males showing the greatest reduction in physical health as time lived in the neighborhood increased.

Increased social and cultural cohesion has been shown to mitigate negative impacts on mental and physical health (Fone et al. 2007; Kawachi et al 1997), which could account for the relatively higher PCS scores in the non-white participants as Hispanic communities have been shown to exhibit increased social ties and community cohesion (Ostir et al. 2003; Eschbach et al. 2004). Patel et al. (2003) conducted a study with older Mexican Americans in the southwestern portion of the U.S. where individuals who lived in a community with a small population of other Hispanic residents rated their health as poorer than their counterparts who lived in a community with a higher proportion of other Hispanic residents. Within the neighborhood of Manchester, Spanish is the preferred language in most homes, restaurants, and convenient stores. Individuals who identify at white may feel more outside of the community due to this lack of language connection with the rest of the community, as the majority of white respondents preferred English over Spanish, in contrast to the non-white respondents. This is only speculation at this point and requires additional research for this reason, as well as the fact not all studies have shown differences in social support with differing racial communities (Mulvaney-Daya et al. 2007).

The time that individuals lived within the community was of particular interest due to the strength of association with reduced PCS scores despite controlling for age, race, and gender. This provides evidence that those living in conditions characterized by environmental justice issues experience additive negative health impacts the longer they stay within their current lived environment. These findings underscore the need for quick and meaningful solutions to assist the most vulnerable populations within the U.S.

There are several limitations that are important to discuss. This was a cross-sectional study so causality between environmental exposures and MCS or PCS scores,

cannot be supported. The survey was also interviewer administered; some research indicates that individuals tend to rate their overall mental and physical health higher when speaking with an individual compared to self-administered surveys (Eschbach et al. 2004; Hammer et al. 2007). Despite the relatively high response rate, a small total amount of participants completed the survey, reducing our statistical power and our ability to adjust by confounders (N=109). Non-Hispanic Whites were over-represented in our survey responses as compared to the U.S. Census data on race and ethnicity of Manchester residents. Non-Hispanic Whites were more likely to complete the survey than their Non-White counterparts, which could cause selection bias within this study.

While more research is needed to tease apart the intricate details between mental and physical wellbeing in the broader context of one's lived environment, these findings further illustrate the unfair conditions in which certain communities live in the U.S. Findings from this study, along with previous findings over the last several decades, serve to indicate the importance of swift movement on environmental change.

5. CONCLUSION

5.1 Summary

The purpose of this project was to test three separate hypotheses. first, that communities living within an area characterized by environmental justice issues would be able to accurately describe the location and areas with poor environmental conditions. Secondly, that due to generational norms created within minority communities in poor environmental neighborhoods, the white male effect would not be witnessed when all participants experience the same living conditions. Lastly, that the longer individuals live in poor environmental conditions the lower their overall mental and physical composite scores would become, as scored by the SF12v2 survey. This final section will touch upon how these hypotheses held after the completion of this project, as well as the future directions with this research and within this study location.

5.1.1 Community Concerns and Participatory Research

Engaging with the community with open meetings, local trainings, and utilizing the talent of the green ambassadors for data collection was more successful than original expectations. During the initial phases of the project the issues surrounding flooding and standing surface water became one of the top concerns that were mentioned during meetings and conferencing. While Manchester has regular air monitoring stations this was the first attempt to analyze the conditions of the standing water. While there has been an increasing amount of projects and publications that use local talent and participation, most have not used the knowledge of these individuals to identify the location of environmental problems.

This has begun to change in certain spheres of scientific pursuits. For example, researchers Bonney et al. (2009) have developed a model in which to engage and train local citizens to both identify and collect ecological data. These new approaches are proving to be quite effective and free-up the time of researchers who would otherwise spend wasted moments locating areas of concern. This was also discovered with this project as the findings showed evidence for the hypothesis that local communities do have their finger on the pulse of environmental harm and concerns within areas that they work and live.

5.1.2 Perceptions of Environmental Harm

While the white male effect seems to hold with populations over a large geographic region, this was not seen when every participant experienced the same living environmental conditions within the neighborhood of Manchester. It was our belief that because minority populations live in environmental justice communities, on average, for generations longer than white families that also live in these areas, that a generational norm would be created within minority groups that would not be seen in white participants. As mentioned, this was the case for this project and showed a gap in our understanding that is not explained by the theories posited by the white male effect. This provides some evidence that living conditions experienced over several generations will become an accepted norm. The main exception to this within this study was conditions surrounding road infrastructure.

Road infrastructure may have been perceived as a higher concern for minority groups because of having a different type of contact with road conditions. The non-white respondent were 20 percent less likely to have access to a working vehicle and more

likely to utilize a bicycle for transportation than white individuals. It could be that the reason they perceived a greater risk from poor infrastructure was due to a more intimate relationship with road conditions.

5.1.3 Physical and Mental Health

The hypothesis that the longer individuals live within Manchester the lower their PCS and MCS scores would be, only held for the physical portion. Counter to expectations the mental scores actually increased slightly over time. However, this increase was only shown with minority populations. One explanation for this seemingly contradictory finding is due to increasing connections amongst these participants. Increased social and cultural cohesion has been shown to mitigate negative impacts on mental and physical health (Fone et al. 2007; Kawachi et al 1997), which could account for the relatively higher PCS scores in the non-white participants as Hispanic communities have been shown to exhibit increased social ties and community cohesion (Ostir et al. 2003; Eschbach et al. 2004).

The PCS did see highly significant findings that provide evidence that the macrolevel conditions within Manchester are correlated with poorer health scores for the citizens. The findings of any cross-sectional study require follow-up to draw any conclusions, and with the relatively small amount of participants in this study it merely underscores the need for replication among additional communities and locations.

5.2 Future Directions

5.2.1 The Neighborhood of Manchester

The neighborhood of Manchester is in need of additional research and community action to understand and improve the local conditions. There are a few specific regions that warrant swift movement. Table 5.1 shows items that the community added to the survey.

Table 5.1 Written in Community Identified Issues

Are there any other problems in your neighborhood?	N
18 Wheelers	7
Strong odor in air	9
Loud noises (car compacting, construction, etc)	4
Drinking water is yellow	4
Mosquitoes	3

Issues identified through survey respondents adding their own concerns

This table shows that the community is also concerned with the overabundance of large vehicles traveling through their neighborhood that already suffers from poor road conditions. Furthermore, the odor in the community is recognizable not only by the citizens but also by the researchers of this team. The most potentially critical item is that four individuals claimed that their drinking water is yellow.

Continued water analysis needs to take place with the drinking water of the community. Manchester's piping infrastructure is antiquated and could conceivably be allowing for leaching from standing water into potable water sources. Furthermore, longitudinal studies need to be conducted to better understand the health of the community free of many of the limitations of cross-sectional research.

5.2.2 Confirming Results

While the results of this project begin to fill research gaps within the knowledge of environmental perceptions of harm, community engagement, and community health, it is limited by the scope of participation and the restricted nature of cross-sectional study designs. The white male effect should be examined in multiple geographic settings of various racial proportions within environmental justice communities and areas of improved environmental conditions. Cohort studies need to be conducted to discover if the time lived in communities produces reduced PCS scores as was seen with this project.

REFERENCES

A&B Labs Houston, TX Environmental and Industrial Hygiene Laboratory Services <http://www.ablabs.com/index.php> (Accessed 2015)

Adler, N. and Newman, K. "Socioeconomic Disparities In Health: Pathways And Policies." Health Affairs. 2002 vol. 21 no.2 60-76

Agency for Toxic Substance and Disease Registry (ATSDR) "TAKING AN EXPOSURE HISTORY" Case Studies in Environmental Medicine SS3046. 2010

Ahmed, S. Palermo, A. "Community Engagement in Research: Frameworks for Education and Peer Review" American Journal of Public Health. 2010 August; 100(8): 1380–1387

Air Alliance Houston. "Air Pollution and Public Health in Galena Park, TX" 2014 Report - produced Global Community Monitor and Air Alliance Houston.

Ammerman, A. Corbie-Smith, G. St George, D. Washington, C. Weathers, B. Jackson-Christian, B. "Research expectations among African American church leaders in the PRAISE! project: a randomized trial guided by community-based participatory research." American Journal of Public Health. 2003;93(10):1720–1727.

Anderton, D. Anderson, A. Rossi, P. Oakes, J. Fraser, M. Weber, E. and Calabrese, E. "Hazardous Waste Facilities "Environmental Equity" Issues in Metropolitan Areas." Evaluation Review, Vol 18 No. 2, 1994

Aschengrau, A. Ozonoff, D. Coogan, P. Vezina, R. Heeren, T. Zhang, Y. "Cancer risk and residential proximity to cranberry cultivation in Massachusetts." AAmerican Journal of Public Health. 1996;86(9):1289–1296

Ayanian, J. Cleary, P. Weissman, J. Epstein, A. "The Effect of Patients' Preferences on Racial Differences in Access to Renal Transplantation" New England Journal of Medicine 1999; 341:1661-1669

Berke, P. Cooper, J. Salvesen, D. Spurlock, D. Rausch, C. "Building Capacity for Disaster Resiliency in Six Disadvantaged Communities." Sustainability 2011, 3(1), 1-20; doi:10.3390/su3010001

Blaikie, P. Cannon, T. Davis, I. "At Risk: Natural Hazards, People's Vulnerability and Disasters". Routledge, 2014 ISBN: 1134528612, 9781134528615

Bluthenthal, R. Jones, L Fackler-Lowrie, N. Booker, T. Jones, F. McDaniel, S. Moini, M. Kamau, R. Williamsn, M. Klap, R. Koegel, P. Wells, K. "Witness for Wellness: preliminary findings from a community-academic participatory research mental health initiative." Ethnicity and Disease 2006;16(1, suppl. 1)

Bolin, B. "Race, Class, Ethnicity, and Disaster Vulnerability" Handbook of Disaster Research Part of the series Handbooks of Sociology and Social Research" 2007 pp 113129. Springer New York DOI 10.1007/978-0-387-32353-4_7

Brent, K. "Gender, Race, and Perceived Environmental Risk: The “White Male” Effect in Cancer Alley, LA" Sociological Spectrum: Mid-South Sociological Association Volume 24, Issue 4, 2004

Brody, C.J. “Differences by sex in support of nuclear power.” Social Forces, 1994 63(1); 209-228

Brulle, R. and Pellow, D. "ENVIRONMENTAL JUSTICE: Human Health and Environmental Inequalities." Annual Review of Public Health Vol. 27: 103-124, 2006

Bryant, B. Mohai, P. "Race and the incidence of environmental hazards." boulder westeview press: 1992

Bullard, R. "Solid Waste Sites and the Black Houston Community." Sociological Inquiry Volume 53, Issue 2-3. 1983

Bullard, R. “Dumping in Dixie: Race, Class, and Environmental Quality.” 3rd 2000, Edition. Westview Press.

Bullard, R. Johnson, G. “Environmentalism and Public Policy: Environmental Justice: Grassroots Activism and Its Impact on Public Policy Decision Making” Journal of Social Issues Volume 56, Issue 3, pages 555–578, fall 2000

Cashman, S. Adeky, S. Allen, A. Corburn, J. Israel, B. Montaño, J. Rafelito, A. Rhodes, S. Swanston, S. Wallerstein, N. "The Power and the Promise: Working With Communities to Analyze Data, Interpret Findings, and Get to Outcomes." American Journal of Public Health: August 2008, Vol. 98, No. 8, pp. 1407-1417.

Centers for Disease Control and Prevention (CDC). "Community Assessment for Public Health Emergency Response (CASPER)" Health Studies Branch - Preparedness and Response for Public Health Disasters <http://www.cdc.gov/nceh/hsb/disaster/casper.htm> (Accessed 2015)

Chu, M. Collie, T. "Quality of Storm Water Runoff from Urbanized Houston

Metropolitan Area Proceedings: The State of the Bay Symposium, III. January 10-11, 2000

City of Houston "Community Health Profiles Community Health Profiles, Manchester." Department of Health and Human Services Office of Surveillance and Public Health Preparedness. 2004

City of Houston Department of Health and Human Services. "Community Health Profiles Harrisburg/Manchester Super Neighborhood." Community Health Profiles 1999-2003

City of Houston Planning and Development Department "Harrisburge/Manchester super neighborhood" <http://www.houstontx.gov/superneighborhoods/65.html> (Accessed 2014).

City of Houston. "Super Neighborhood Resource Assessment." Harrisburg / Manchester 2014

Cook, W. "Integrating research and action: a systematic review of community-based participatory research to address health disparities in environmental and occupational health in the USA." Journal of Epidemiology and Community Health 2008;62:668-676 doi:10.1136/jech.2007.067645

Cutter, S. "Hazards Vulnerability and Environmental Justice." Routledge 2006 ISBN 13: 978-1-84407-310-8

Cutter, S. Mitchell, J. "Revealing the Vulnerability of People and Places: A Case Study of Georgetown County, South Carolina." Annals of the Association of American Geographers. Volume 90, Issue 4, pages 713–737, December 2000

Davidson, D. Freudenburg, W. "Gender and Environmental Risk Concerns A Review and Analysis of Available Research." Environment and Behavior vol. 28 no. 3 302-339. May 1996

Diez, R. Merkin, S. Arnett, D. Chambless, L. Massing, M. "Neighborhood of residence and incidence of coronary heart disease." 2001 N. Engl. J. Med. 345(2):99–106

Dolan, A. Walker, J. "Understanding Vulnerability of Coastal Communities to Climate Change Related Risks" Journal of Coastal Research Special Issue No. 39. Proceedings of the 8th International Coastal Symposium (ICS 2004), Vol. III (Winter 2006), pp. 13161323

Eisenman, D. Cordasco, K. Asch, S. Golden, J. Glik, D. "Disaster Planning and Risk

Communication With Vulnerable Communities: Lessons From Hurricane Katrina" American Journal of Public Health: April 2007, Vol. 97, No. Supplement_1, pp. S109S115.

Elliot, J. Pais, J. "Race, class, and Hurricane Katrina: Social differences in human responses to disaster" Social Science Research Volume 35, Issue 2, June 2006, Pages 295–321

Environmental Protection Agencey (EPA) “Environmental Facts; EnviroFacts” <http://www3.epa.gov/enviro/> (Accessed 2015).

Environmental Protection Agency (EPA). "A Closer Look at Air Pollution in Houston: Identifying Priority Health Risks" Report of the Mayor’s Task Force on the Health Effects of Air Pollution 2007

Environmental Protection Agency (EPA). "Industrial Stormwater Monitoring and Sampling Guide" EPA 832-B-09-003, March 2009 <http://water.epa.gov/polwaste/npdes/stormwater/upload/msgp_monitoring_guide.pdf> (accessed 2015)

Eschbach. K, Ostir, G. Patel, K. Markides, K. Goodwin, J. "Neighborhood context and mortality among older Mexican Americans: is there a barrio advantage?" American Journal of Public Health. 2004; 94(10): 1807-1812.

Evans GW, Kantrowitz E. 2002. Socioeconomic status and health: the potential role of environmental risk exposure. Annu. Rev. Public Health 23:303–31

Feng, Z. Huai-chen, G. Yongm L. Ze-jia, H. "Identification and spatial patterns of coastal water pollution sources based on GIS and chemometric approach" Journal of Environmental Sciences 19(2007) 805–810

Finucane, M. Slovic, P. Mertz, C. Flynn, J. Satterfiled "Health, Risk, and Society" 2:2, 159-172, DOI: 10.1080/713670162, 2000

Flynn, J. Slovic, P. Mertz, C. "Gender, Race, and Perception of Environmental Health Risks" Journal of Risk Analysis 1994. 10.1111/j.1539-6924.1994.tb00082.

Fone, D. Dunstan, F. Lloyd, K. Williams, G. Watkins, J. Palmer, S. "Does social cohesion modify the association between area income deprivation and mental health? A multilevel analysis." Int. J. Epidemiol. (2007) 36 (2): 338 345. doi: 10.1093/ije/dym004

Gandek, B. Ware, J. Aaronson, N. Apolone, G. Bjorner, J. Brazier, J. Bullinger, M. Kaasa, S. Leplege, A. Prieto9, A. Sullivan, M. "Cross-Validation of Item Selection and Scoring for the SF-12 Health Survey in Nine Countries: Results from the IQOLA

Project." Journal of Clinical Epidemiology Volume 51, Issue 11, November 1998, Pages 1171–1178

Godschalk, D. Brody, S. Burby, R. "Public Participation in Natural Hazard Mitigation Policy Formation: Challenges for Comprehensive Planning." Journal of Environmental Planning and Management Volume 46, Issue 5, 2003

Grant, B. Stinson, F. Hasin, D. Dawson, D. Chou, P. Anderson, K. "Immigration and Lifetime Prevalence of DSM-IV Psychiatric Disorders Among Mexican Americans and Non-Hispanic Whites in the United States Results From the National Epidemiologic Survey on Alcohol and RelatedConditions" Arch Gen Psychiatry. 2004;61(12):1226 1233. doi:10.1001/archpsyc.61.12.1226.

Gwartney-Gibbs, P. Lach, D. "Sex differences in attitudes toward nuclear war." Journal of Peace Res 1991 ;28:161–76.

Hanmer, J. Hays, R. Fryback, D. "Mode of administration is important in US national estimates of health-related quality of life." Med Care 2007;45:1171–9.

Houston Chronicle. "Everyone deserves clean air and equal protection from pollution" Published 2014.<http://www.chron.com/opinion/outlook/article/Everyone-deservesclean-air-and-equal-protection-5684461.php> (Accessed 2015)

Houston Chronicle. "Harris County Wet Spots." Published 2001.<http://www.chron.com/news/houston-texas/article/Harris-County-wet-spots2051449.php> (Accessed 2015)

Howe, N. Strauss, W. “Millennials rising: The next great generation.” 2000, New York: Vintage Books

Jenkinson, C. Layte, R. Jenkinson, D. Lawrence, K. Petersen, S. Paice, C. Stradling, J. "A shorter form health survey: can the SF-12 replicate results from the SF-36 in longitudinal studies?" Journal of Public Health Medicine. 1997 Vol. 19, No. 2, pp. 179186

Johnson, B. "Gender and Race in Beliefs about Outdoor Air Pollution." Risk Analysis 2002, 10.1111/0272-4332.00064

Jones, R. Cox, D. Navarro-Rivera, J. "Believers, Sympathizers, & Skeptics Why Americans are Conflicted about Climate Change, Environmental Policy, and Science" American Academy of Religion Annual Meeting, November 22, 2014

Jones, R. Rainey, S. "Examining linkages between race, envrionmental concern, health, and justice in a highly polluted community of color." Journal of Black Studies March 2006 vol. 36 no. 4 473-496

Kahan, D. Braman, D. Gastil, J. Slovic, P. Mertz, C.K. "Culture and Identity-Protective Cognition: Explaining the White-Male Effect in Risk Perception." Journal of Empirical Legal Studies Volume 4, Issue 3, pages 465–505, November 2007

Kalof, L. Dietz, T. Guagnano, G. Stern, P. "Race, Gender and Environmentalism: The Atypical Values and Beliefs of White Men" Race, Gender & Class, Vol. 9, No. 2, 2000

Kataoka, S. Fuentes, S. O'Donoghue, V. Castillo-Campos, P. Bonilla, A. Halsey, K. Avila, J. Wells, K. "A community participatory research partnership: the development of a faith-based intervention for children exposed to violence." Ethnicity and Disease. 2006;16(1, suppl 1)

Kawachi, I. Kennedy, B. Lochner, K. and Prothrow-Stith, D. "Social capital, income inequality, and mortality." American Journal of Public Health September 1997: Vol. 87, No. 9, pp. 1491-1498. doi: 10.2105/AJPH.87.9.1491

Kowske, B. Rasch, R. Wiley, J. "Millennials' (Lack of) Attitude Problem: An Empirical Examination of Generational Effects on Work Attitudes." Journal of Business and Psychology June 2010, Volume 25, Issue 2, pp 265-279

Lantz, P. House, J. Lepkowski, J. Williams, D. Mero, R. Chen, J. "Socioeconomic factors, health behaviors, and mortality". J. Am. Med. Assoc. 279:1703–8 1998

Larson, C. "Use of the SF-12 Instrument for Measuring the Health of Homeless Persons." Health Services Research Volume 37, Issue 3, pages 733–750, June 2002

Leshner AI, Terry SF, Schultz AM, Liverman CT The CTSA Program at NIH: Opportunities for Advancing Clinical and Translational Research. 2013 Washington, DC National Academies Press

Lim, L. and Fisher, J. "Use of the 12-item Short-Form (SF-12) Health Survey in an Australian heart and stroke population." Quality of Life Research January 1999, Volume 8, Issue 1

Maantay, J. "Asthma and air pollution in the Bronx: Methodological and data considerations in using GIS for environmental justice and health research." Health & Place Volume 13, Issue 1, March 2007, Pages 32–56

Macintyre, S. Maciver, S. and Sooman, A. "Area, Class and Health: Should we be Focusing on Places or People?" Journal of Social Policy, Volume 22, Issue 02, 1993

Marshall, B. Picou, J. Formichella, C. Nicolls, K. "Environmental Risk Perceptions and the White Male Effect: Pollution Concerns Among Deep-South Coastal Residents"

Journal ofApplied Sociology/Sociological Practice, Vol. 23 No. 21 Vol. 8 No. 2, Fall-2006: 3 1-49.

Montazeri, A. Vahdaninia, M. Javad Mousavi, S. Asadi-Lari, M. "The 12-item medical outcomes study short form health survey version 2.0 (SF-12v2): a population-based validation study from Tehran, Iran." Health Qual Life Outcomes. 2011; 9: 12.

Morello-Frosch R, Pastor M, Porras C, Sadd J. 2002. Environmental justice and regional inequality in Southern California: implications for future research. Environ. Health Perspect. 110(2):149–54

Morello-Frosch, R. Pastor, M. and Sadd, J. "Environmental Justice and Southern California's "Riskscape" The Distribution of Air Toxics Exposures and Health Risks among Diverse Communities." Urban Affairs Review, vol. 36 no. 4 551-578, 2001.

Mulvaney-Daya, E. Alegríaa, M. Sribneyb, W. "Social cohesion, social support, and health among Latinos in the United States." Social Science & Medicine Volume 64, Issue 2, January 2007, Pages 477–495

Muñoz Ordoñez, L.A., The Effect of Urbanization on the Streamflows of the Sims Bayou Watershed, Master of Science Thesis, Texas A&M University Department of Civil Engineering, College Station, 2015.

Norgaard, K. "The Politics of Invasive Weed Management: Gender, Race, and Risk Perception in Rural California."Rural Sociology Volume 72, Issue 3, pages 450–477, September 2007

O'Connor, R. Bord, R. Fisher, A. "Risk Perceptions, General Environmental Beliefs, and Willingness to Address Climate Change." Risk Analysis June 1999, Volume 19, Issue 3, pp 461-471

Olofsson, A. Rashid, S. "The White (Male) Effect and Risk Perception: Can Equality Make a Difference?" 2011, Journal of Risk Analysis. DOI: 10.1111/j.15396924.2010.01566.x

Ordonez, L. "The effect of urbanization on the streamflow's of the Sims Bayou Watershed." Office of Graduate and Professional Studies of Texas A&M University, Thesis 2015

Ostir, G. Eschbach, K. Markides, K. Goodwin, J. "Neighbourhood composition and depressive symptoms among older Mexican Americans." J Epidemiol Community Health. 2003

Patel, V. Eschbach, K. Rudkin, L. Peek, M. Markides, K. "Neighborhood context and self-rated health in older Mexican Americans" Ann Epidemiol. 2003; 13(9): 620-628.

Perlin, S. Sexton, K. Wong, D. "An examination of race and poverty for populations living near industrial sources of air pollution" Journal Expo Anal Environ Epidemiol, 9 (1999), pp. 29–48

Powell, L. Slater, S. Chaloupka, F. "The relationship between community physical activity settings and race, ethnicity, and socioeconomic status" Evidence-Based Preventative Medicine 135-144, 2004:1(2)

Project Learning Tree GreenSchools! Houston East End Greenbelt <www.eastendgreenbelt.com> (Accessed 2015)

Rivers, L. Arval, J. Slovic, P. "Beyond a Simple Case of Black and White: Searching for the White Male Effect in the African-American Community." Risk Analysis Volume 30, Issue 1, pages 65–77, January 2010

Roussos, S. Fawcett, S. "A Review of Collaborative Partnerships as a Strategy for Improving Community Health" Annual Review of Public Health Vol. 21: 369-402, May 2000

Ryder, N.B. "The Cohort as a Concept in the Study of Social Change." 1965 American Sociological Review 30:843–861.

Sallisa, J. Saelensb, B. Frankc, L. Conwaye, T. Slymene, D. Caina, K. Chapmand, J. Kerrf, J. "Neighborhood built environment and income: Examining multiple health outcomes." Social Science & Medicine Volume 68, Issue 7, April 2009, Pages 1285–1293

Salyers, M. Bosworth, H. Swanson, J. Lamb-Pagone, J. Osher, F. "Reliability and Validity of the SF-12 Health Survey Among People With Severe Mental Illness." Medical Care: November 2000 - Volume 38 - Issue 11

Satterfield, T. Mertz, C. Slovic, P. "Discrimination, Vulnerability, and Justice in the Face of Risk" Risk Analysis Volume 24, Issue 1, pages 115–129, February 2004

Steger, M. Witt, S. "Gender Differences in Environmental Orientations: A Comparison of Publics and Activists in Canada and the U. S." The Western Political Quarterly Vol. 42, No. 4 (Dec., 1989), pp. 627-649

Stevens, M. Berke, P. Song, Y. "Public Participation in Local Government Review of Development Proposals in Hazardous Locations: Does it Matter, and What Do Local

Government Planners Have to Do with It?" Environmental Management February 2010, Volume 45, Issue 2, pp 320-335

Stewart, J. "Dumping in dixie: Race, class, and environmental quality" The Review of Black Political Economy 12/1991; 20(2):105-107. DOI: 10.1007/BF02689929

Strolovitch, D. "Do Interest Groups Represent the Disadvantaged? Advocacy at the Intersections of Race, Class, and Gender" Journal of Politics Volume 68, Issue 4, pages 894–910, November 2006

Tarlov, A. Ware, J. Greenfield, S. Nelson, E. Perrin, E. Zubkoff, M. "The Medical Outcomes Study An Application of Methods for Monitoring the Results of Medical Care." AMA. 1989;262(7):925-930. doi:10.1001/jama.1989.03430070073033

Taylor, D. "The state of diversity in environmental organizations" University of Michigan Natural Resources & Environmental, Green2.0 July 2014.

Texas A&M Health Science Center. "EpiAssist." <http://sph.tamhsc.edu/epi-bio/epiassist.html> (Accessed 2015)

Texas Department of State Health Services. "Assessment of the Occurrence of Cancer in East Harris County, Texas 1995-2012" 2015, Prepared by the Texas Department of State Health Services

TEXAS ENVIRONMENTAL JUSTICE ADVOCACY SERVICES (t.e.j.a.s) <http://tejasbarrios.org/> (Accessed 2015)

The City of Houston. "Super Neighborhoods." <http://www.houstontx.gov/superneighborhoods/65.html> (Accessed, 2015)

The Institute for Sustainable Coastal Communities. "Resilience and Climate Change Cooperative Project (RCCCP)." <http://www.tamug.edu/iscc/RCCCP_Home.html> (Accessed 2015)

Tierney, K. Lindell, M. Perry, R. "Facing the Unexpected: Disaster Preparedness and Response in the United States" 978-0-309-18689-6, 2001.

United States Environmental Protection Agency (EPA). "National Recommended Water Quality Criteria – Aquatic Life Criteria Table " <http://www.epa.gov/wqc/nationalrecommended-water-quality-criteria-aquatic-life-criteria-table> (Accessed 2015)

Utah Department of Health "Interpreting the SF12" 2001 Utah Health Status Survey, Utah Department of Health

Ware, J. Kosinski, M. Keller, S. "A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity." Med Care. 1996 Mar;34(3):22033.

Ware, J. Kosinski, M. Turner-Bowker, D. Gandek, B. "How to Score Version 2 of the SF-12 Health Survey (With a Supplement Documenting Version 1)" Lincoln, RI: QualityMetric Incorporated; 2002.

Ware, John E., Mark Kosinski, and James E. Dewey. How to score version 2 of the SF12 health survey (standard & acute forms). QualityMetric Incorporated, 2000.

Wendell, T. Carlos, P. Jones, L. Kraft, K. "Environmental Justice: Obesity, Physical Activity, and Healthy Eating." Journal of Physical Activity and Health 2006, 3, Suppl 1, S30-S54

West, D. Orr, M. "Race, Gender, and Communications in Natural Disasters" Policy Studies Journal Volume 35, Issue 4, pages 569–586, November 2007

Wilkins CH, Spofford M, Williams N, et al.CTSA Consortium's Community Engagement Key Function Committee Community Partners Integration Workgroup. Community representatives' involvement in Clinical and Translational Science Awardee activities. Clin Transl Sci. 2013;6:292–296

APPENDIX A

PARTICIPANT CONSENT FORM

TEXAS A&M UNIVERSITY HUMAN SUBJECTS PROTECTION PROGRAM

CONSENT FORM

Project Title: Resilience and Climate Change Cooperative Project (RCCCP)
Título del proyecto: Proyecto Cooperativo de Resiliencia y Cambio climático

You are invited to take part in a research study being conducted by Dr. Jennifer Horney, a researcher from Texas A&M University and funded by Dr. Phillip Berke's Startup # 241117-10000. The information in this form is provided to help you decide whether or not to take part. If you decide to take part in the study, you will be asked to sign this consent form. If you decide you do not want to participate, there will be no penalty to you, and you will not lose any benefits you normally would have.

Usted ha sido invitado a tomar parte en un estudio de investigación dirigido por la Dra. Jennifer Horney, una investigadora de Texas A&M University y financiado por la iniciativa #241117-10000. La información en esta forma se proporciona para ayudarlo a decidir si quiere o no participar. Si usted decide participar en este estudio, se le pedirá firmar esta forma de consentimiento. Si usted no quiere participar en este estudio, no habrá ninguna sanción, y usted no perderá ningún beneficio de los que normalmente tiene.

Why Is This Study Being Done?
The purpose of this study is to gather information on the health status of the community along with information about the environmental quality of this neighborhood.

¿Por qué se está haciendo este estudio?
El propósito de este estudio es colectar información sobre el estado de salud de la comunidad así como información sobre la calidad ambiental de este vecindario.

Why Am I Being Asked To Be In This Study?
You are being asked to be in this study because individuals who live in this neighborhood, and are at least 18 years of age, are needed to assess the health of the area.
¿Por qué se me está pidiendo estar en este estudio?
Se le está pidiendo estar en este estudio porque se necesitan individuos que vivan en este vecindario y que al menos tenga 18 años de edad, para evaluar la salud del área.

How Many People Will Be Asked To Be In This Study?
210 people (participants) will be invited to participate in this study locally.

¿Cuántas personas serán requeridas en este estudio?
210 personas (participantes) serán invitadas a participar en este estudio localmente.

What Are the Alternatives to being in this study?
No, the alternative to being in the study is not to participate.

Cuáles son las alternativas para estar en este estudio?
No existe, la alternativa para estar en este estudio es no participar

What Will I Be Asked To Do In This Study?
You will be asked to complete a 15 to 20 minute survey with me right now. This will be the only time you will be required to give any information.

Qué me pedirán hacer en este estudio?
Se le pedirá llenar una encuesta de 15 a 20 minutos conmigo ahora.
Éste será el único momento en el que se le pedirá dar cualquier información.

Will Photos, Video or Audio Recordings Be Made Of Me during the Study? No, the only information to be collected will be from your survey answers.

¿Se tomarán fotos, grabación de video o audio de mí durante el estudio? No, la única información que se colectará serán sus respuestas a la encuesta.

Are There Any Risks To Me?
The things that you will be doing are no greater than risks than you would come across in everyday life. Although the researchers have tried to avoid risks, you may feel that some questions that are asked of you will be stressful or upsetting. You do not have to answer anything you do not want to.

¿Hay algún riesgo hacia mí?
Las cosas que estará haciendo no tienen mayor riesgo que lo que haría en la vida diaria. Aunque los investigadores han tratado de evitar riesgos, usted puede sentir que algunas preguntas serán estresantes o molestas. Usted no tiene que contestar nada que usted no quiera.

Will There Be Any Costs To Me?
Aside from your time, there are no costs.

¿Habrá algún costo para mí?
Además de su tiempo, no existe ningún costo.

Will I Be Paid To Be In This Study?
You will not be paid for being in this study

¿Se me pagará por estar en este estudio?
No, no se le pagará por estar en este estudio

Will Information From This Study Be Kept Private?
The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely and only the principles investigators of this study will have access to the records.

¿La información de este estudio se mantendrá en privado?
Los registros de este estudio se mantendrán en privado. No se incluirán identificadores que lo vinculen a usted en ningún reporte que sea publicado. Los registros de la investigación serán asegurados y solo los principales investigadores de este estudio tendrán acceso a los registros.

Who may I Contact for More Information?
You may contact the Principal Investigator, Garett Sansom, MPH to tell him about a concern or complaint about this research at (979) 436-9387 or at sansom@sph.tamhsc.edu. Jennifer Horney, PhD, to tell her about a concern or complaint about this research at (979) 436-9443 or horney@sph.tamhsc.edu. You may also contact the other Principle Investigator, Dr. Jennifer Horney at horney@sph.tamhsc.edu.

¿A quién puedo contactar para más información?
Usted puede contactar al Investigador principal, Garett Sansom, MPH para decirle sobre su preocupación o queja sobre este estudio al (979) 436-9387 o a sansom@sph.tamhsc.edu. A Jennifer Horney, PhD, para decirle de su preocupación o queja sobre este estudio al (979) 436-9443 o a horney@sph.tamhsc.edu. También puede contactar al otro investigador principal, Dr. Jennifer Horney a horney@sph.tamhsc.edu.

For questions about your rights as a research participant, to provide input regarding research, or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office by phone at 1-979-458-4067, toll free at 1-855-795-8636, or by email at irb@tamu.edu.

Para preguntas sobre sus derechos como participante de investigación, para proporcionar información respecto a la investigación, o si tiene preguntas, quejas, o asuntos sobre la investigación, puede llamar a la oficina del Programa de protección de sujetos humanos de Texas A&M University, por teléfono al 1-979-458-4067, llamada gratuita al 1-855795-8636, o por correo electrónico a irb@tamu.edu.

What if I Change My Mind About Participating?
This research is voluntary and you have the choice whether or not to be in this research study. You may decide to not begin or to stop participating at any time. If you choose not to be in this study or stop being in the study, there will be no effect on your relationship with Texas A&M University.

¿Qué pasa si cambio de opinión acerca de participar?
Esta investigación es voluntaria y usted tiene la opción de participar o no en este estudio. Usted puede decidir no comenzar o dejar de participar en cualquier momento. Si usted decide no estar en este estudio, o dejar de estar en este estudio, no habrá ningún efecto en su relación con Texas A&M University.

STATEMENT OF CONSENT
I agree to be in this study and know that I am not giving up any legal rights by signing this form. The procedures, risks, and benefits have been explained to me, and my questions have been answered. I know that new information about this research study will be provided to me as it becomes available and that the researcher will tell me if I must be removed from the study. I can ask more questions if I want. A copy of this entire consent form will be given to me

DECLARACIÓN DE CONSENTIMIENTO
Estoy de acuerdo en estar en este estudio y sé que no estoy cediendo ningún derecho legal al firmar esta forma. Los procedimientos, riesgos, y beneficios me han sido explicados, y mis preguntas han sido contestadas. La nueva información sobe este estudio me será proporcionada cuando esté disponible y el investigador me dirá si debo ser removido de este estudio. Puedo hacer más preguntas si así lo quiero. Una copia de esta forma de consentimiento completa me será otorgada.

Participant's Signature _____ Date_____
Firma del participante _____ Fecha_____

Printed Name_____ Date_____

Nombre _____ Fecha_____

INVESTIGATOR'S AFFIDAVIT:
Either I have or my agent has carefully explained to the participant the nature of the above project. I hereby certify that to the best of my knowledge the person who signed this consent form was informed of the nature, demands, benefits, and risks involved in his/her participation.

DECLARACIÓN DEL INVESTIGADOR:
Ya sea yo o mi agente ha explicado cuidadosamente al participante la naturaleza del proyecto anterior. Por la presente certifico que, a lo mejor de mi conocimiento, la persona que ha firmado éste consentimiento fue informado de la naturaleza, demandas, beneficios y riesgos que involucran su participación.

Presenter Signature _____ Date_____
Firma del presentador _____ Fecha_____

Printed Name_____ Date_____
Nombre _____ Fecha_____

APPENDIX B

SURVEY QUESTIONNAIRE

Section 1: Thank you so much for taking the time to speak with us, this survey should take less than 15 minutes. I will be asking questions about your neighborhood, your health, and your family. Please answer fully and truthfully. The first section will establish a little about your background.

Sección 1. Muchas gracias por tomarse el tiempo de platicar con nosotros, ésta encuesta debe tomar menos de 15 minutos. Yo le haré preguntas sobre su vecindario, su salud, y su familia. Por favor, conteste completamente y con sinceridad. La primera sección establecerá un poco de sus antecedentes.

Q1 Gender: (interviewer fill in)

❍ Male (1)

❍ Female (2)

Q1. Sexo (llenar por el entrevistador) ○ Masculino (1)

○ Femenino (2)

Q2 Age: Would you mind telling me what year you were born in?

Q2. Edad: ¿Podría decirme en que año nació?

Q3 Ethnicity origin (or Race): Please specify your ethnicity.

❍ Non-Hispanic White (1)

❍ Black or African American (2)

❍ Latino or Hispanic (Puerto Rican, Mexican American, or of Spanish origin) (3) ❍ Other (4)

Q3.Origen étnico (o raza). Por favor, especifique su origen étnico ○ Blanco, no hispano (1) ○ Negro o afro-americano (2)

○ Latino o hispano (Puertorriqueño, mexicoamericano, o de origen español) (3) ○ Otro (4)

Q4 Education: Does every adult who lives in this house have at least a high school diploma or GED?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't Know (88)
- ❍ Refused (99)

Q4 Educación. ¿Todos los adultos que viven en este hogar tienen al menos grado de *High School* (bachillerato) o GED? ○ Sí (1) ○ No (2) ○ No lo sé (88) ○ Se niega a contestar (99)

Q5 Are any adults in the household currently unemployed?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't Know (88)
- ❍ Refused (99)

Q5 ¿Hay algún adulto en el hogar que se encuentre desempleado actualmente? ○ Sí (1) ○ No (2) ○ No lo sé (88) ○ Se niega a contestar (99)

Q6 Does anyone living in this house not speak English well? (If interview has to be conducted in Spanish, select yes without asking)

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don't know (88)
- ❍ Refused (99)

Q6 ¿Hay algún adulto viviendo en esta casa que no hablan bien el idioma inglés? (si la entrevista tiene que ser conducida en español, seleccione sí, sin preguntar) ○ Sí (1) ○ No (2) ○ No lo sé (88) ○ Se niega a contestar (99)

Q7 Do you have access to a working vehicle?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Don’t know (88)
- ❍ Refused (99)

Q7 ¿Tiene usted acceso a un vehículo funcional? ○ Sí (1) ○ No (2) ○ No lo sé (88)

○ Se niega a contestar (99)

Section 2: This section asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. Answer

each question by choosing just one answer. If you are unsure how to answer a question, please give the best answer you can.

Sección 2. Esta sección pide su punto de vista acerca de su estado de salud. Ésta información nos ayudará a dar seguimiento de cómo se siente y cuán bien puede realizar sus actividades usuales, por favor contéstenos lo mejor posible.

Q8 How many years have you lived in this house?

Q8. ¿Cuantos años ha vivido en esta casa?

Q9 How many years have you lived in Manchester neighborhood?

Q9. ¿Cuantos años ha vivido en el vecindario Manchester?

Q10 In general, would you say your health is:

- ❍ Excellent (1)
- ❍ Very Good (2)
- ❍ Good (3)
- ❍ Fair (4)
- ❍ Poor (5)

Q10 En general, usted diría que su salud es:

- ❍ Excelente (1)
- ❍ Muy buena (2)
- ❍ Buena (3)
- ❍ Limitada (4)
- ❍ Mala (5)

Q11 The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?
Q11 Las siguientes preguntas son acerca de las actividades que podría realizar durante un día típico. ¿Su estado de salud actual lo limita en estas actividades? Si es así. ¿Cuánto?

	YES, limited a lot (1) Sí, muy limitado (1)	YES, limited a little (2) Sí, un poco limitado (2)	NO, not limited at all (3) No, no me limita de ningún modo (3)
Moderate activities; such as moving a table, pushing a vacuum cleaner, bowling, or playing golf (1) Actividades moderadas, como mover una mesa, empuja la aspiradora, jugar boliche (bolos), o jugar golf (1)	❍	❍	❍
Climbing several flights of stairs (2) Subir algunos pisos por las escaleras (2)	❍	❍	❍

Q12 During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?
Q12. ¿Durante las últimas 4 semanas, ha tenido usted alguno de los siguientes problemas en su trabajo o en otras actividades diarias regulares, como resultado de su estado de salud físico?

	YES (1) Sí (1)	NO (2) No (2)
Accomplish less than you would like (1) Realizó menos de lo que usted hubiera querido (1)	❍	❍
were limited in the kind of work or other activities (2) fue limitado en el tipo de trabajo o en otras actividades (2)	❍	❍

Q13 During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?
Q12. Durante las últimas 4 semanas, ¿Ha tenido usted alguno de los siguientes problemas en su trabajo o en otras actividades diarias regulares, como resultado de problemas emocionales (como sentirse deprimido o ansioso)?

	YES (1) Si (1)	No (2) No (2)
Accomplish less than you would like (1) Realizó menos de lo que usted hubiera querido (1)	❍	❍
were limited in the kind of work or other activities (2) fue limitado en el tipo de trabajo o en otras actividades (2)	❍	❍

Q14 During the past 4 weeks, how much did pain interfere with your normal work (including work outside the home and housework)?
❍ not at all (1)
❍ a little bit (2)
❍ moderately (3)
❍ quite a bit (4) ❍ extremely (5)
Q14 Durante las últimas 4 semanas, ¿Cuánto ha interferido el dolor con su trabajo normal (incluyendo el trabajo fuera del hogar y el trabajo de casa)?
❍ No ha interferido (1)
❍ Un poco (2)
❍ Moderadamente (3)
❍ Mucho (4)
❍ Extremadamente (5)
Q15 These questions are about how you have been feeling during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks…
Q15 Éstas preguntas son acerca de cómo se ha sentido en las últimas 4 semanas. Para cada pregunta, por favor conteste con la respuesta que se aproxime más a cómo se ha sentido. ¿Cuánto tiempo, durante las últimas 4 semanas…

	All of the time (1) Todo el tiempo (1)	Most of the time (2) La mayoría del tiempo (2)	A good bit of the time (3) Mucho tiempo (3)	some of the time (4) Algunas veces (4)	A little of the time (5) Pocas veces (5)	None of the time (6) En ningún momento (6)
Have felt calm and peaceful? (1) Se ha sentido calmado y en paz? (1)	❍	❍	❍	❍	❍	❍
Did you have a lot of evergy (2) Ha tenido mucha energía? (2)	❍	❍	❍	❍	❍	❍
Have you felt down-hearted and blue? (3) Ha estado decaído y triste? (3)	❍	❍	❍	❍	❍	❍

Q16 During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

❍ All of the time (1)
❍ Most of the time (2)
❍ Some of the time (3)
❍ A little of the time (4)
❍ None of the time (5)

Q16 Durante las últimas semanas, ¿Cuánto tiempo ha interferido su salud física o problemas emocionales con sus actividades sociales (como visitar amigos, parientes, etc)?

❍ Todo el tiempo (1)
❍ La mayoría de tiempo (2)
❍ Algun tiempo (3)
❍ Un poco (4)
❍ En ningún momento (5)

Section 3: This last section will ask you about this neighborhood. Sección 3: Ésta última sección preguntará sobre su vecindario.

Q17 How would you rate the overall air quality in your city now compared to last year?

- ❍ Very Good (1)
- ❍ Good (2)
- ❍ Fair (3)
- ❍ Poor (4)

Q17 ¿Cómo calificaría la calidad del aire en general, en su ciudad, comparada con el año pasado?

- ❍ Muy buena (1)
- ❍ Buena (2)
- ❍ Limitada (3)
- ❍ Baja (4)

Q18 How would you rate the quality of surface water (from rivers, creeks, and water that pools after rain) in this neighborhood?

- ❍ Very Good (1)
- ❍ Good (2)
- ❍ Fair (3)
- ❍ Poor (4)

Q17 ¿Cómo calificaría la calidad del agua superficial (de ríos, lagos, y del agua que se junta después de la lluvia) en este vecindario?

- ❍ Muy buena (1)
- ❍ Buena (2)
- ❍ Limitada (3)
- ❍ Baja (4)

Q19 What do you think are the main causes of water are pollution in your neighborhood? Please select all applicable.

- ❑ Construction (1)
- ❑ Industrial sources (2)
- ❑ Motor vehicles (3)
- ❑ Waste Disposal (4)
- ❑ Other please specify (5) _____

Q19 ¿Cuáles cree usted que sean las principales causas de contaminación en su vecindario? Por favor, seleccione todas las que apliquen.

- ❑ Construcción (1)
- ❑ Fuente industrial (2)
- ❑ Vehículos de motor (3)
- ❑ Eliminación de basura (4)
- ❑ Otra, por favor especifique (5) _____

Q20 To what extent is the water pollution affecting you?

❍ Very much (1)
❍ A little (2)
❍ Not at all (3)

Q20 ¿Hasta qué punto, la contaminación del agua lo afecta?

❍ Mucho (1)
❍ Un poco (2)
❍ Para nada (3)

Q21 In which of the following ways are you affected by the quality of the standing water in your neighborhood? Please select all applicable.

❑ Damage to property (1) ❑ Doing less outdoors (2)
❑ Doing more to stay healthy (3)
❑ Feeling depressed (4)
❑ reduction in value of property (5)
❑ Other please specify: (6) _____

Q21 ¿En cuál de las siguientes formas se ve afectado debido a la calidad del agua estancada en su vecindario? Por favor seleccione todas las que aplican.

❑ Daño a propiedad (1)
❑ Menos actividades afuera (2)
❑ Hace más para mantenerse sano (3)
❑ Se siente deprimido (4)
❑ Reduce el valor de su propiedad (5)
❑ Otra, por favor especifique: (6) _____

Q22 In which of the following ways are you affected by the quality of the streets and other infrastructure in your neighborhood? Please select all applicable.

❑ Damage to property (1) ❑ Doing less outdoors (2)
❑ Doing more to stay healthy (3)
❑ Feeling depressed (4)
❑ reduction in value of property (5)
❑ Other please specify: (6) _____

Q22 ¿Un cuál de las siguientes formas se ve afectado debido a la calidad de las calles y de otras infraestructuras en su vecindario? Por favor seleccione todas las que aplican.

❑ Daño a propiedad (1)
❑ Menos actividades afuera (2)

- ❑ Hace más para mantenerse sano (3)
- ❑ Se siente deprimido (4)
- ❑ Reduce el valor de su propiedad (5)
- ❑ Otra, por favor especifique: (6) _____

Q23 Do you think the following are a problem in your neighborhood Q3. ¿Piensa usted que los siguientes, son problemas en su vecindario?

	YES (1) Sí (1)	NO (2) No (2)
Potholes on the roads (1) Hoyos (baches) en las calles (1)	❍	❍
standing water (2) agua estancada (2)	❍	❍
buildings that need repairs (3) Edificios que necesitan reparaciones (3)	❍	❍
Too many industrial buildings (4) Demasiados edificios industriales (4)	❍	❍
Too many waste facilities (5) Demasiadas zonas de desecho (residuos) (5)	❍	❍

Q24 Do you think the following impact your health?
Q24 ¿Cree usted que lo siguiente impactan su salud?

	YES (1)	NO (2)
Potholes on the roads (1) Hoyos (baches) en las calles (1)	❍	❍
standing water (2) agua estancada (2)	❍	❍
buildings that need repairs (3) Edificios que necesita reparaciones (3)	❍	❍
Too many industrial buildings (4) Demasiados edificios industriales (4)	❍	❍

Too many waste facilities (5) Demasiadas zonas de desehcho (residuos) (5)	❍	❍

Thank you so much for taking the time to complete this survey. Do you have any questions for me?
Muchas gracias por tomarse el tiempo para contestar esta encuesta. Tiene usted alguna pregunta para mí?