5-2017

The Influence of Sociodemographic, Location, and Health Characteristics on Environmental Risk Perception

Alicia Michel Scalia
Clemson University, amscali@g.clemson.edu

THE INFLUENCE OF SOCIODEMOGRAPHIC, LOCATION, AND HEALTH CHARACTERISTICS ON ENVIRONMENTAL RISK PERCEPTION

A Thesis
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
Applied Sociology

---

by
Alicia Michel Scalia
May 2017

Dr. Catherine Mobley, Committee Chair
Dr. Ye Luo
Dr. Kenneth Robinson

ABSTRACT

Environmental risk perception is how much risk people perceive as existing due to environmental hazards. This is a topic relevant to our time, a time of environmental policy shifts and concern about pollution, and is an important concept for policy makers to understand. This study explored the following questions: Do sociodemographic characteristics, such as gender, race, age and education, influence environmental risk perception? Do location characteristics, such as if the area surrounding the home is polluted or not, and length of residence, influence environmental risk perception? And finally, do health characteristics, both self-rated health and diagnosed conditions, influence environmental risk perception? This research aimed to expand the understanding of environmental risk perception by using sequential multiple regression to examine these three categories of variables. The data used for this study was collected by Dr. Ard, at the Ohio State University, via mail surveys of Ohio residents in 2015-2016.

The results indicate that environmental risk perception is influenced by gender and race, and that these two variables remained significant across all three models. Woman and minorities scored higher on the environmental risk perception scale than men or white respondents. This suggests that policy makers and social impact analysis should focus on, and be sure to include the knowledge of, women and minorities in interventions focusing on environmental risk perception. Additionally, it suggests that a lack of power and authority could play a powerful role in shaping environmental risk perception, given the results on gender and race.

ACKNOWLEDGEMENTS

First, I would like to thank my thesis chair, Dr. Catherine Mobley, for her continued support through my graduate career and professional development. She offered numerous rounds of detailed comments, guidance and ideas, as well as invaluable encouragement and deadlines. Without her mentorship and input, this thesis would not have been completed, and I am extremely grateful for her time and commitment to helping me complete this degree. I am also eternally grateful for Dr. Kerry Ard, from the Ohio State University, and for her allowing me to use her data set. Without her, and the data she collected through her survey, I would not have been able to pursue a thesis so closely aligned with my interests.

I am also grateful to Dr. Luo for her invaluable help in sorting out my methodology, and her guidance both through coursework and this thesis. I am appreciative of the opportunities she provided me in learning about methodology and SPSS. I would also like to thank Dr. Robinson for his insight into policies and social impact analysis. Their suggestions and input gave me a better understanding of social science research in general, and the applied uses for sociological research. I will take these lessons and experiences into the workforce, and be better prepared.

Finally, I would like to thank my friends and family for their support, particularly my fiancé, David, for supporting me through this process while also pursuing his own master's degree. I would also like to thank my fellow graduate students and cohort, Tamara, Allison, and Rachel, for their support, understanding, and venting sessions that helped keep the stress at a bearable level.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT.)

Page

CHAPTER ONE

Introduction

Environmental concerns are among the most pressing issues in the modern era. While levels of exposure to chemicals and pollution may vary across time and place, the general public is still becoming increasingly concerned with air and water pollution caused by power generation, chemical runoff, transportation, and industrial facilities. In 2015 the World Health Organization (WHO) stated that 92% of the world's population lives in places where the air pollution exceeds the WHO recommend limits, and 80% of the endangered population lives in an urban setting (WHO, 2015). Air pollution in the U.S. has been decreasing since the 1970s, but this decline has slowed in recent years (Correia, Pope, Dockery, Wang, Ezzati, & Dominici, 2013). Indeed, according to the American Lung Association (2014), nearly half of the U.S. population lives in an area with unhealthy levels of air pollution.

Social science research has noticed distinct trends involving the location of industrial and other pollution-producing facilities. Research has shown that the siting decisions for these facilities are often related to race and class, and that these two factors have influenced siting for more than two decades (Bullard, Mohai, & Wright, 2008; Kershaw, Gower, Rinner, & Campbell, 2013; Pastor, Sadd, & Hipp, 2001). Census data and other studies have confirmed that minorities and people of lower socioeconomic status are disproportionately affected by hazardous waste facilities and pollution (Bullard et al., 2008; Gray, Edwards, & Miranda, 2013). Despite knowledge about the location of

environmental hazards, there is little research that incorporates the location of the respondents in relation to the hazards, and how location affects risk perception.

The goal of this thesis was to contribute research-based knowledge to further understand the influence of sociodemographic characteristics, location of residence, and health variables on environmental risk perceptions. This thesis explored the relationship between those three key variables, informed by the literature, and environmental risk perception. The proposed research utilized a unique data set collected in Ohio by Dr. Kerry Ard from the Ohio State University. In particular, the thesis aimed to expand the knowledge about the role of location and health in influencing environmental risk perception.

It is important for both stakeholders and the affected population to understand how risk perception forms, in order to create effective communication channels (Elliott, Cole, Krueger, Voorberg, & Wakefield, 1999; Harclerode, Lal, Vedwan, Wolde, & Miller, 2016; Pidgeon, 1998). This is especially important because the public understands and perceives risk differently than the scientific community (McComas, 2006). For example, one study found that people are more concerned about risks that are extremely dangerous, but not likely to happen, while researchers and professionals are more concerned with likely risks that have long-term effects (Slimak & Dietz, 2006). Despite these differences in perception, research shows that environmental issues are best resolved when the government, researchers, and citizens work together, and such collaboration requires effective communication (Ramirez-Andreotta, Brusseau, Artiola, Maier, & Gandolfi, 2014).

More understanding about what influences the perception of environmental risks could allow those in power, such as politicians, policymakers, city planners and others, to better address the concerns of those affected, and potentially reduce the perception of risk or the risk itself. The results can expand the literature on theoretical approaches to risk perception, place-based theories, and environmental racism, as well as inform policy and practice, such as social impact analysis (SIA). SIA is a way to predict and evaluate potentially negative consequences of policies, interventions, and developments on humans and the environment (Becker, 2001; Vanclay, 2003). There are three primary reasons for conducting SIA: (1) to help ensure equity in decision making as part of the democratic process, (2) to make sure the benefits of an intervention outweigh its costs, and (3) to ensure that local knowledge is incorporated into the decision making process (Vanclay, 1999).

It is important to view findings about perception of environmental risk within a community context because the community itself and location both help shape risk perception (Elliot, et al., 1999; Harrington & Elliott, 2015). The results of this thesis could illuminate how risk perceptions are affected by the sociodemographic makeup, location, and health of a population. Furthermore, this study could help ensure that any solutions account for how risk perception is formed, can better inform SIAs, and ultimately increase the effectiveness of SIAs (Claeson, Liden, Nordin, & Nordin, 2013; Dalton, 1999; Egondi et al., 2013).

CHAPTER TWO

Literature Review

This literature review starts with a brief discussion of the definition and construction of perception of risk as it relates to environmental and health factors, and is followed by the theories that inform the research. The discussion then moves into an overview of the predictors and influencing factors related to perception of environmental risk. In particular, the following three groups of risk perception predictors are reviewed: sociodemographic characteristics, location and place of residence, and health. Study implications are then discussed.

Perception of Environmental Risk

Risk perception has been defined as, "people's beliefs, attitudes, judgments, and feelings, as well as the wider cultural and social dispositions they adopt towards things that [they] value" (Pidgeon, 1998, p. 5). Social science research has widened the previously narrow definition of risk perception, introducing the idea that risk perception is often influenced by the social or cultural group to which the person belongs, the context of the hazard, and the physical and organizational factors of the hazard (Harclerode et al., 2016; Masuda & Garvin, 2006; Pidgeon, 1998). Environmental risk perceptions are localized, which means that the physical place and social context where the people who are experiencing the risk live and work is crucial in shaping their perceptions (Bickerstaff & Walker, 2001). First-hand or personal experience, such as seeing smog or runoff, is also central in shaping risk perception, more so than second-

hand knowledge from experts (Bickerstaff & Walker, 2001). It is also clear that they way laypersons perceive and understand risk is different than how experts perceive and understand risk (McComas, 2006; Slimak & Dietz, 2006). This difference is important to highlight if effective communications strategies are to be developed, and if risk perception is to be understood (Ramirez-Andreotta et al., 2014).

People who do not feel secure or people who are marginalized often perceive more risk (Olofsson & Ohman, 2015). This point is supported by research that found inequality between genders and ethnicities results in differing levels of risk perception (Olofsson & Rashid, 2011). Therefore values and vulnerability could play an important role in risk perception, and has been found to be mediated by social and demographic characteristics (Olofsson & Ohman, 2015). Research also suggests that how people feel about risks influences their judgment and choices regarding risk behavior, and that these feelings are influenced by gender and age (Loewenstein, Weber, Hsee & Welch, 2001).

The psychometric model understands differences in risk perception through the differences in the perceived risks, not the differences in the individuals experiencing the risks (Slimak & Dietz, 2006). The focus is on investigating the differences between air and other pollution risks, rather than the differences between people who are perceiving the air and water pollution risks.

Theoretical Frameworks for Understanding Risk Perception

This section is divided into four different theoretical sections. The first section discusses the social amplification of risk framework, followed by cognitive approaches,

trust and world views, then placed-based theories, and ends with a discussion of environmental racism.

Social amplification of risk framework. Risk is commonly understood as being embedded in social context (Cutter, Boruff, & Shirley, 2003; Masuda & Garvin, 2006). The social amplification of risk framework (SARF) states that "psychological, social, and institutional factors influence risk perceptions and behavior through a network of socially mediated communication channels" (Masuda & Garvin, 2006, p. 438). The SARF framework, developed by Kasperson and colleagues (1988), was meant to be used to understand how seemingly minor risks could result in major social impacts through the perception that the risk is actually great. The channels through which SARF is communicated can be either formal or informal, for example through the media or word-of-mouth, respectively (Kasperson et al., 1988; Kasperson, 2015; Pidgeon, Kasperson, & Slovic, 2003; Masuda & Garvin, 2006).

SARF argues that risks are place-based, involving place attachment, and the communication of risk is heavily influenced by culture and demographic characteristics, such as gender, race, age, and socioeconomic status, of individuals experiencing it (Harrington & Elliott, 2015; Kasperson et al., 1988; Masuda & Garvin, 2006; Pidgeon et al., 2003). Masuda and Garvin (2006) found that place-based risks are socially constructed through complex networks often attached to place, and that place mediates risk perception. SARF also results in behavioral responses, called secondary impacts (Kasperson et al. 1988; Kasperson, 2015; Pidgeon et al., 2003). Examples of these impacts are mental perceptions, attitudes, changes in how risk is perceived and

monitored, impacts on businesses, and more (Kasperson et al., 1988; Kasperson, 2015). These impacts are perceived by the community, and the residents can in turn amplify the risk again, which can lead to a third wave of impacts and amplifications (Kasperson et al., 1988; Kasperson, 2015).

Cognitive approaches, trust, and world views. Cognitive approaches to risk perception are also beneficial for understanding individuals' perception of environmental risks. Cognitive approaches, like SARF, are a way to understand how individuals create and perceive risk through different processes and channels (Keller et al., 2011). For example, the cognitive models of optimistic bias and availability heuristics both help to explain *why* people create and understand environmental risk and therefore form environmental risk perceptions (Tversky & Kanhneman, 1983; Weinstein, 1987). In order, optimism bias is when people rank their own risk from a hazard as less than the risk the same hazard poses to others (Weinstein, 1987). Availability heuristic states that people are more likely to perceive risk if they can easily picture it or if it has happened recently (Tversky and Kahneman, 1983). For example, China's worsening air quality and its health consequences have been in the news recently, therefore people might be more likely to perceive air quality in their own area as a threat. However, all of these models are often influenced by the amount of knowledge the people have about the risk, or how familiar they are with it (Keller et al., 2012).

Dalton's (1999) study found that the way in which environmental risk is communicated, either with a positive or negative bias, influences how dangerous the exposure is perceived to be. Additionally, research has shown that minorities often feel

they lack power and protection from both local or federal laws and regulations surrounding industrial facilities, which could increase minorities perception of environmental risk (Bullard et al., 2008; Omanga, Ulmer, Berhane, & Gatari 2014). Understood a different way, the "White Male Effect" states that white males are less concerned about environmental health risks (Finucane, Slovic, Mertz, Flynn, & Satterfield, 2000; Marshall, Picou, Formichella, & Nicholls, 2006; McCright & Dunlap, 2013). Originally noted in 1994 (Flynn, Slovic, & Mertz, 1994), more recent research has expanded this approach, and found that vulnerability and cultural worldview are responsible for the white male effect (Marshall, 2004; Satterfield, Mertz, & Slovic, 2004).

Trust between the sources of information or pollution producers and the public who is perceiving the risk also plays an important role in risk perception. Three important factors that influence trust as it pertains to environmental risk communication are: knowledge and expertise of those affected regarding the issue, honesty, and concern (Peters, Covello, & McCallum, 1996). However, the influencing factor of trust is also moderated by the type of institution producing the pollution, or communicating with the public. For example, Peters and colleagues' (1996) research on trust and credibility in industries, government, and citizen groups indicated government commitment to fixing the issues was the most important factor in influencing trust, while for industries the most important factor was concern for the public safety.

Place-based risk perception. The SARF framework argues that risk perception is place-based, and the communication of risk is heavily influenced by the culture and

demographics of those experiencing it (Harrington & Elliott, 2015; Kasperson et al., 1988; Masuda & Garvin, 2006; Pidgeon et al., 2003). This means that because risk perception is influenced by *where* the risk is perceived, and by the cultural and demographic makeup of those experiencing the risk, it can vary greatly between and within locations. This framework can also explain why those risks the scientific communities deem small become large issues inside a community, and produce higher levels of risk perceptions than scientists would expect or would warrant necessary (Pidgeon et al., 2003). In other words, the SARF framework attempts to explain risk perception both as an objective event and as something that is socially constructed (McComas, 2006).

Thus, place attachment is an additional component that is worth considering when attempting to understand risk as a placed-based phenomenon. Place attachment is the connection one feels to one's home and community, and has been found to be beneficial for the community (Anton & Lawrence, 2014; Brown & Raymond, 2007; Mesch & Manor, 1998). There are numerous similar concepts, such as place identity, community attachment, social bonding and others (Anton & Lawrence, 2014). However, there is not one clear definition of place attachment, and its dimensions, but it is often measured through how much interaction an individual has with the place, and size of the place (Anton & Lawrence, 2014). Place attachment has also been found to be linked to pro-environmental behavior and attitudes, meaning the more a person becomes attached to their home, or community, the more environmentally conscious they become (Vaske & Kobrin, 2001). Research has also found that older people, who are more likely to have

resided in their home longer than younger people, have higher levels of place attachment (Hidalgo & Hernandez, 2001; Lewicka, 2010). Women have also been found to have higher place attachment than men (Hidalgo & Hernandez, 2001).

Environmental racism. The theory of environmental racism brings together several of the above ideas, namely that: people are likely to perceive more risk if they can easily picture the hazard, minorities experience risk differently, the demographic makeup of a community matters in the creation of risk perception, and that trust is a crucial element in risk perception. In particular, environmental racism could aid in explaining why neighborhoods with higher concentrations of minority residents are also offered less protection against the industries and pollution, which then leads these residents to experience and perceive more risk (Bullard et al., 2008).

Environmental racism links together these aspects by drawing attention to the location of environmental hazards and racism. Environmental racism is defined as the discrimination in environmental policy that allows minority communities to be targets for toxic waste facilities, and the process of excluding minority people from leadership positions inside ecology movements (Chavis & Lee, 1987; Pellow, 2000; Taylor, 2000). Environmental racism as a term and movement helps to link racism with environmental issues affecting the lives of marginalized people, and the actions these individuals take against those issues (Taylor, 2000). It follows then that minorities are more likely to be exposed to hazardous facilities, resulting from the decision to locate hazardous sites in minority neighborhoods and because minorities are less likely to be protected by those in power. Therefore minorities would perceive more risk than those non-minorities who are

not exposed, who are more protected by those in power, and who are therefore less vulnerable.

Predictors of Environmental Risk Perception

The literature suggests that there are differences in perception of environmental risks based on several key characteristics, which fall into three categories: sociodemographic characteristics, location and health. Each of these categories is briefly covered below. Together these variables could potentially affect perception of environmental risk.

Sociodemographic Characteristics. Studies have identified several key sociodemographic variables that impact environmental risk perception. The following section of this literature focus on those sociodemographic variables included in this study. In particular, the project investigated the influence of gender, race, age, and education on environmental risk perception.

Gender. According to the literature, women are more knowledgeable and concerned about health risks, the environment, and health consequences of environmental hazards, and have higher levels of risk perception (Flynn et al., 1994; Gallina & Williams, 2014; Marshall et al., 2006; Schultz, 2001; Sessa, Giuseppe, Marinelli, & Angelillo, 2009). Women are also more concerned about the environmental impact of risks on their health and the health of their families, and are more likely to change their behavior because of perceived environmental impact (Elliot et al., 1999; Gallina & Williams, 2014; Raphael, Taylor, Stevens, Barr, Gorringe, & Agho, 2009).

There are several possible explanations for the gender effect. One case study found that mothers reported higher risk perception than fathers did (Marcon, Nguyen, Braggion, Grassi, & Zanolin, 2015). This shows that having children could be a more important influencing factor for environmental risk perception for women than for men. The gender effect could be related to the gendered division of labor, as research shows that women take on more domestic duties when compared to men (Tindall, Davies, & Mauboules 2003). Additionally, Mohia (1992) found that girls are raised, or socialized, to be more nurturing and caring when compared to the way boys are socialized. It is possible that women perceive more environmental risk because they are brought up to be nurturers, and to be concerned for their family's health (McCright, 2010), and they spend much of their adult lives looking after their family's health and well-being (Davidson & Freudenburg, 1996).

Further insights on the influence of gender are offered by the white male effect, which states that white men are more accepting of risks to their health from environmental sources, as compared to women and black males (Marshall, 2004; Marshall et al., 2006). Additionally, this theory has been supported by other research stating that this trend is due to white men not seeing themselves as vulnerable, when compared to women or minorities, and because of how white males view themselves as privileged and secure (Kahan, Braman, Gastil, Slovic, & Mertz, 2006; Marshall et al., 2006; Satterfield et al., 2004). When considering health risks caused by industrial pollution, white males tend to view the economic gain from such risks as more important than the risks themselves (Marshall et al., 2006). Conversely, a study done by Xiao and

McCright (2012) found that concern for safety and the perception of how much impact a hazard could have on social and financial security greatly influence the perception of risk, and that there is a difference between how much risk men and women perceive.

However, research conducted in Sweden found that inequality, both between genders and different ethnic groups, is a better explanation for the differences shown through the white male effect, and propose that "social inequality effect" rather than "gender effect" is a better term for this phenomenon (Olofsson & Rashid, 2011). The researchers state that this is a more accurate perspective as differences at the societal level, and how society frames or applies gender, affect risk perception, rather than the biological makeup of the person per se (Olofsson & Rashid, 2011).

Race. Researchers have found a higher perception of environmental risk among non-whites than whites (Finucane et al., 2000; Macias, 2015; Marshall, 2004; Marshall et al., 2006). As reported in the discussion on environmental racism, research shows that African Americans are more concerned about their neighborhoods' environmental problems, and this is explained by the fact that African Americans often live in neighborhoods disproportionately affected by pollution (Mohai & Bryant, 1998). Additional investigations have revealed that conservative white males have significantly lower levels of concern about environmental risks (Finucane et al., 2000; Marshall et al., 2006; McCright & Dunlap, 2013). Whittaker and colleagues (2005) discovered, over a 21-year span, that Latinos are becoming more concerned about environmental issues and pollution, but there is only weak evidence for the same trend among African-Americans. This could mean that over time Latinos concern for the environment is increasing, but

African American concern levels are staying the same. Macias (2015) also found that Latinos, Mexicans and African Americans perceive more risks from air pollution caused by automobiles and industrial sources. This study also claims that after controlling for socioeconomic characteristics, race and ethnicity were often no longer significant. However, the author also states that it is difficult in the real world to separate the effects of race and socioeconomic status.

Research conducted in Kenya shows that people living in lower economic conditions are aware of their increased risk, but feel disempowered to improve their conditions, and over time, accept the disadvantage and exposure (Omanga et al., 2014). Brown (1995) offers a concise summary of two arguments that explain why minority residents suffer disproportionately from environmental hazards, that of causality and that of drift. The causality argument states that minority or poor communities are directly targeted when siting decisions about environmental hazards are made (Brown, 1995). The drift argument states that minority and poor residents often move into areas with more hazards (Brown, 1995). The idea behind causality is that the land is generally cheaper and therefore more attractive to the industries and the drift explanation is that these residents have fewer housing options and they are forced to move into more polluted communities (Ash & Fetter, 2002; Bullard, 2000). Additionally, minorities have less access to resources to fight the pollution coming into their neighborhoods, and face greater barriers preventing them from moving to less polluted neighborhoods (Ash & Fetter, 2002).

Age. The literature is mixed about the effect of age on environmental risk perception as it relates to health. On one hand studies suggest that the relationship

between age and perception of environmental risk is an inverse U-shape. This means that people under the age of 25 are often not concerned with environmental risk, but people between the ages of 25 and 55 have an increase in risk perception. However, this trend only holds true until the age of 55, when risk perception decreases again. For example, research indicates that people between the ages of 25-55 have an increase in risk perception, and that people between the ages of 35-44 were more likely to have made lifestyle changes in response to perceived environmental risk (Raphael et al., 2009). However, respondents older than 55 reported lower levels of risk perception when compared to younger age groups (Raphael et al, 2009). Other studies reveal that age is negatively correlated with environmental risk perception (Botzen, Aerts, & van den Bergh, 2009; Schultz, 2001; Toma & Mathijs, 2007).

Education. Sessa et al. (2010) found that lower education is associated with higher risk perception, and other studies show that higher education is associated with lower risk perception, which is a negative inverse relationship (Savage, 1993; Shi & He, 2012). Research on climate change and global warming indicates that knowledge about the causes and issues related to global warming results in less perceived risk associated with global warming (Brody, Zahran, Vedlitz, & Grover., 2008). An older study by Crowe (1968) found that respondents with higher education had a more complex understanding of air pollution, but did not perceive many effects from it. A more recent study done in China on perceptions of air pollution found that individuals with more education wanted more to be done to improve air quality (Zhang, et al., 2014). However, the literature also states that education could be a proxy for income and social class,

which makes it more complex to determine the relationship between education and risk perception (Marcon et al., 2015). Research on the effect of education on risk perception is mixed, as education is often related to income or other markers of socioeconomic status.

Location. Everyday experiences with air pollution, through the senses, have been noted to be important for how people learn about and perceive air pollution (Bickerstaff, 2004). Based on the literature on sensory experience, visual stimuli and connection to place as outlined in the theories related to place attachment and SARF, the variables used to measure location in this thesis are: types of environments visible or within walking distance of the home, and length of time living in the home.

In their study of increases in food allergies in Canada, Harrington and Elliott (2015) developed and applied a framework of environmental health risk in which they define the term "place" as "the backdrop against which the public experiences emerging environmental risk" (p. 288). This study used this understanding of place, but used the term location, and used where the respondents live as their location (i.e., where they experience emerging risk). This framework allows researchers to understand perception of risks in relation to the environment, and more specifically to the environment in which the respondents live (Harrington & Elliott, 2015; Masuda & Garvin, 2006).

Visibility of pollution and pollution sources. Researchers have argued that people rely more on their own experiences with pollution, and not expert or other forms of second-hand knowledge, to inform their risk perception (Bickerstaff & Walker, 2001). For example, seeing pollution, both in the air as smog or hazes, and in the home, is particularly impactful (Bickerstaff, 2004). Moffatt et al. (1999) found that people often

perceive pollution through changes in or damage to the surrounding environment, such as changes in vegetation and animal life.

Respondents seem to perceive less risk when they live near a hazard as compared to those who live further away (Marcon et al., 2015; Venables, Pidgeon, Parkhill, Henwood, & Simmons, 2012; Weiner, MacKinnon, & Greenberg, 2013). One explanation for this pattern is that residents perceive less pollution in their neighborhood if they have a strong connection to the neighborhood (Bickerstaff & Walker, 2001). Similarly, Marcon et al.'s (2015) research on the effect of risk perception on the study of health outcomes demonstrated that people living in industrial areas did not have an increase in risk perception. However, less than half of the people who lived in industrial areas actually reported that they lived in an industrial area, suggesting a lack of understanding about key concepts related to their place of residence (Marcon et al., 2015). Another study found that residents' perceived distance from toxic waste disposal sites was more strongly associated with levels of concern than actual distance (Howe, 1988). However, perceived distance explained less than 5% of the variance in concern scores (Howe, 1988).

Research also indicates that individuals living in polluted areas are more worried about pollution (Burger, 2005; Claeson et al., 2013; Moffatt, Mulloli, Bhopal, Foy, & Phillimore, 2000). A study on risk perception of global warming found that those who lived close to obvious risks, such as along a coast, perceived more risk from global warming than those who did not live near an obvious risk (Brody et al., 2008). Research

has also found that people who reside in polluted areas might underestimate the health risks associated with the pollution (Grasmück & Scholz, 2005).

Length of residence. Numerous studies have found that people who have lived in an area or home longer have higher levels of perceived risks than those with shorter residencies. However, this increase in perception of risk might depend on how polluted the area is perceived to be. For example, a study looking at polluted rivers found that men who had lived in the area longer believed the creek to be more dangerous (Brody, 2004). Another study investigating lead paint exposure found that residents who had lived in their home for more than ten years considered exposure more risky than those who lived in their homes for a shorter amount of time (Harclerode et al., 2016).

Additional research shows that people who feel a strong connection to their home are more aware of and concerned about the environmental risks associated with their location (Gallina & Williams, 2014). This is due to sense of place, or of feeling connected to the location and environment, and more awareness of the pollution and toxin issues (Gallina & Williams, 2014; Harclerode et al., 2016). Elliot and colleagues (1999) conducted research in an urban industrial neighborhood in Hamilton, Ontario, Canada; their sample consisted of people who had lived in the neighborhood a mean of nineteen years, half of whom had resided there more than fifteen years. Their study found that industrial pollution is an issue that would make residents move out of their neighborhoods, and one third stated it was something they would change in their neighborhood if they could (Elliott et al., 1999).

However, Grasmück and Scholz (2005) found that locals who have lived in polluted areas longer have lower levels of risk perception, or accept the perceived risks more than new residents. The lower level of risk perception was due to those respondents believing they had enough information about the risks, and therefore were uninterested in learning more, and also having lower emotional concern about the perceived risks than newer residents (Grasmück & Scholz, 2005). Another explanation for this phenomenon is that residents who are constantly being exposed to a risk become desensitized to that risk over time (Weiner et al., 2013). This effect was found to be strong enough to overcome differences in gender, meaning that both men and women who live nearby sources of environmental threats become desensitized to them over time (Weiner, et al., 2013).

Self-Rated Health and Diagnosed Health Conditions. There are numerous health risks associated with air and water pollution exposure. Air and industrial pollution have a long history of causing illness, such as cardiovascular and respiratory diseases, and death, both from short- and long-term exposure, across the globe (Dominici et al., 2006; Khafaie, Yajnik, Salvi & Ojha, 2016; Ristovski et al., 2012). Water pollution can also have adverse effects on human health, such as cancer, and can contaminate the food supply (Gavrilescu, Demnerova, Aamand, Agathos, & Fava, 2015; Hendryx, Conley, Fedorko, Luo, & Armistead, 2012; Lu et al., 2015). Omanga and colleagues (2014) studied environmental awareness and perception of pollution and their relation to specific health hazards in a developing, rural country. They found that residents had a universal concern for pollution. The respondents were generally more worried about industrial, air,

and water pollution and its effects on health than they were with other risks (Harclerode et al., 2016; Omanga et al. 2014).

Health perceptions could impact how people view and interact with their environment. For instance, if a person perceives themselves to be in poor health, or has been diagnosed with one or several health conditions, they might be more fearful of pollution. Understanding this relationship is particularly important when developing and implementing effective community-based health interventions. This section discusses two health-related measures: self-rated health and diagnosed health issues.

Both perceived health and diagnosed health conditions could be seen as a form of agency or power over the local environment. Agency means that those perceiving risk have the ability to change or influence their surroundings through their behavior (Bickerstaff, 2004). Research has found a strong link between people's ability or belief that they can influence their environment and their perception of environmental risk (Bickerstaff, 2004). Respondents who perceive themselves to be in good health, or who do not have any diagnosed conditions, could feel more agency, and therefore perceive less risk.

Omanga et al. (2014) found that individuals who believe themselves to be in good health had lower environmental risk scores on the scale created for their study. Research has also found that knowledge of environmental issues and the family's health were the most important factors for explaining perception of environmental risks (Omanga et al., 2014). This supports the argument that those who feel that they have agency, through their own good health, their family's good health, and knowledge of the issues, perceive

less risk than those who are in poorer health or have less knowledge about the perceived risks.

There is also literature on the influence of environmental conditions, such as pollution, on self-rated health and actual diagnosed conditions (Kipen & Fiedler, 2002; Spurgen, Gompertz & Harrington, 1996). Moffatt and colleagues' (2000) analyzed a survey that investigated community concerns about health risks from local industries. The results indicated that respondents who were worried about industrial pollution reported more illnesses than those who were not worried about industrial pollution. This supports the idea that the perception of risk from pollution is mediated by both perceived pollution and perceived health risks (Claeson et al., 2013; Shusterman, 1992). Another common mediator between health and perceived risk is annoyance, such as unpleasant smells, associated with perceived pollution; however annoyance is very individualistic and is often influenced by demographic characteristics and prior exposure (van Thriel, Kiesswetter, Schaper, Juran, Blaszkewicz & Kleinbeck, 2008).

Overall, there is an absence of literature on how health impacts environmental risk perception, a gap this thesis hopes to partially fill. The following section look at how risk perception influences health as it is worth understanding this relationship because it can help to shed light on other important variables and relationships. Research has found that people who perceive more pollution or lower neighborhood quality rate their health worse or record more negative health symptoms than those who perceive less pollution or higher quality neighborhoods (Poortinga, Dunstan & Fone, 2007; Stenlund, Liden, Andersson, Garvill & Nordin, 2009). Moffatt and colleagues'(2000) research also

indicated that both worry about the industries and proximity to them influenced self-reported illness. Research shows that people who live in polluted neighborhoods considered air pollution as posing the greatest risk and being the most likely to affect their health, meaning that perceived air pollution is associated with perceived health risk (Elliot et al., 1999, Egondi et al., 2013; Omanga et al., 2014). Respiratory health issues are often cited as the most common perceived effect, with other physical and psychological effects of air pollution ranking slightly lower (Elliot et al., 1999). This study includes measures of health, and risk perception that are related to air pollution.

Self-rated health, a more subjective measure, has been used in numerous surveys to comprehend participants' understanding of their own health in relation to perceived environmental risks. Diagnosed health conditions, a more objective measure, in particular lung and heart conditions, hypertension, and cancer, was used because these conditions have been routinely found in people who live in polluted environments.

Potential Implications of Research

There are several potential implications of this research, particularly in terms of SIA. SIA was originally created in 1969 for planning purposes, but has since been expanded to be more proactive, that is to identify issues before they happen (Esteves, Franks, & Vanclay, 2012; Vanclay, 2006). According to Schooten and colleagues (2003): SIA incorporates several aspects, health and social wellbeing, quality of living environment, economic impacts, cultural impacts, family and community impacts, institutional impacts, and gender relations. The areas more relevant to this thesis are health and social wellbeing and quality of living environment. SIA is used to help

understand negative consequences of purposed interventions, as mentioned before, and in order to understand the consequences it is important to know the people being targeted and receive their input (Becker, 2001; Vanclay, 2003). SIA has been used around the world to help understand the potential outcomes of various projects, policies, and interventions. For example, SIA has been used in China to ensure an equitable distribution of risk and compensation for residents impacted by the construction of a dam (Wang, Lassoie, Dong, & Morreale, 2013), and in the United States to better understand if telemedicine impacted low and high SES participants differently (Shea et al., 2013).

In order to create effective policies, it is important that the people being targeted by SIA be included in the planning process, and that researchers understand the culture of those people. Becker and colleagues (2004) argued that the people who are affected, those that would be perceiving risks, should be involved in the SIA process if the interventions are to be successful (Barrow, 2000). There are numerous ways for the public to be involved, such as collecting information, empowering the locals involved or those who will be affected, and involvement with actual policy development (Barrow, 2000).

SIA is often critiqued because it does not place enough importance on the social and cultural forces, which influence the effectiveness of the interventions, such as public policies and programs (Du Pisani, & Sandham 2006; Torriti, 2011). The main challenge is that even though the issue, of not placing enough importance on social and cultural forces, is known not enough information is collected during the SIA process. As a result, there is often not enough information available to address the actual need and complexity

of the problems being addressed by SIA (Albergaria & Fidelis, 2006; Canelas, Almansa, Merchan, & Cifuentes, 2005).

SIA can help to identify intended and unintended impacts, both good and bad, of proposed interventions or programs. This thesis could illuminate what characteristics influence how people who are affected by hazards perceive risk, and therefore highlight areas where SIA should focus. One implication of this research is that it could provide more information about sociodemographic, location, or health characteristics that influence risk perception, particularly for those individuals residing in polluted areas.

CHAPTER THREE

Research Hypotheses

Based on the literature review, and previously discussed theoretical approaches, this thesis investigated several different sets of hypotheses. The first hypothesis examined sociodemographic variables, the second set examined location variables, and the final set examined health variables. These variables were introduced into the analysis model in stages, as outlined more thoroughly in the methods section.

Hypothesis 1 – The influence of sociodemographic variables on environmental risk perception.

The literature indicates that certain sociodemographic variables affected an individual's perception of environmental risk. This study, however, only looked at four of these variables: gender, race age, and education level. Studies show that women have higher perception of risk than men (Sessa, et al., 2010, Schultz, 2001). The literature indicates that there would be higher perceptions of environmental risk among minority respondents versus white respondents (Macias, 2015; Whittaker, 2005). Research has also shown that minorities, and people with lower socioeconomic status, often live in neighborhoods with more pollution and industry (Bullard et al., 2008). However, Bowen (2002) asserted that there is conflicting evidence about whether this is a national trend. Also, Macias (2015) claimed that in a real-world setting, it is difficult to separate education, income and other socioeconomic factors from race. The literature regarding the relationship between age and environmental risk perception is conflicting. The

literature regarding education states that there is a negative relationship between amount of education received and environmental risk perception. Therefore, I hypothesize that:

H1: The environmental risk perception score is related to sociodemographic variables, such as gender, race/ethnicity, and education, but not age.

H1 a. Women have higher environmental risk perception scores than men.

H1 b. Minorities have higher environmental risk perception scores than non-minorities.

H1 c. There is no relationship between age and environmental risk perception.

H1 d. Education is negatively associated with environmental risk perception.

Hypothesis 2 – The influence of location variables on environmental risk perception.

The literature shows that people are often not aware of the distinct characteristics of their neighborhood (i.e., whether the neighborhood is predominantly industrial or non-industrial), and this lack of awareness could impact their risk perception (Marcon et al., 2015). This point is further supported by research that indicates that perceived distance from pollution sources is more important than actual distance, when looking at perception of environmental risks (Howe, 1988). Types of pollution and local knowledge also play an important role in people's perception of environmental risks (Brody, 2004). Long-term residents cite industrial pollution as something they would reduce in their neighborhoods if they could (Elliot et al., 1999). The sample population for the current study was partly drawn from a community that lived close to an industrial area. Therefore, given all this information and the study population, I hypothesize that:

H2: The types of environments close to the respondent's home, and the length of time residing in that location, are associated with respondents' environmental risk perception.

H2 a. Individuals residing in a polluted area report higher levels of environmental risk perception than those who do not reside in a polluted area.

H2 b. Length of residence is positively associated with environmental risk perception.

Hypothesis 3 – The influence of health variables on environmental risk perception.

The literature suggests that an individual's self-reported health condition is associated with perception of risk. Research shows that those who report more illnesses are more worried about pollution and environmental conditions, while those who believe themselves to be in good health are not as concerned (Moffatt et al., 2000; Omanga et al., 2014). Research also shows that air pollution is considered very dangerous to health, and respiratory issues are the more commonly cited perceived health issue caused by pollution (Elliot et al., 1999; Omanga et al., 2014). The following hypotheses are proposed for the third model:

H3: Self-rated health and having diagnosed conditions is associated with environmental risk perception.

H3 a. Self-rated health is negatively associated with environmental risk perception.

H3 b. Having diagnosed health conditions results in higher environmental risk perception.

H3 c. Having family members with diagnosed health conditions results in higher environmental risk perception.

CHAPTER FOUR

Methods

The main purpose of this research is to better understand the relationship between sociodemographic, location and health variables and perception of environmental risk. This section below discusses the methods and variables used to explore this relationship. First, the instrument and sample used in this study are discussed. Secondly, the dependent and independent variables are described, and the coding mechanism for this study is then explained. Third, the statistical analysis software and the statistical methods used are briefly outlined.

Data Source

The data for this thesis comes from a study conducted by Dr. Kerry Ard, at The Ohio State University, titled: "The Role of Gender Inequality in Unequal Exposure to Air Pollution and Resulting Health Outcomes." This study, conducted in Ohio from December 2015 through September 2016, focused on women and single mothers and their exposure to air pollution. Dr. Ard's research was funded through a grant from Coca-Cola Inc. as a part of the Coca-Cola critical difference for women grants for research on women, gender, and gender equity.

The respondents were Ohio residents living within and outside of an area exposed to air pollution from industrial facilities (Ard, 2014). This quasi-experimental study used a two-stage sampling design. The survey was mailed to 55 polluted zones, with 43 homes per zone, for a total of 2,365 homes, and to 54 non-polluted zones, with 41 homes per zone, for a total of 2,214 homes, for an overall total of 4,579 homes receiving the survey

(Ard, 2014). In total, 723 surveys were completed for a response rate of 15.7%. Closed-ended surveys have been used in the past in order to gather information on perceived environmental health risks (White & Hall, 2015).

There was a total of 146 missing cases in the regression analysis. In order to understand the missing variables, a binary variable containing all the cases was created, where 1 = missing cases. The Pearson's correlation between this new binary missing variable and the perception of environmental risk scale is weak (.064). For sociodemographic variables : 27 missing cases for gender, 21 missing cases for race, 57 missing cases for age, 34 missing for some college education, and 34 missing for those respondents who had earned a bachelor's degree or higher. For location variables: 71 were missing for the polluted scale and 22 for length of residence. Finally, for the health variables: 2 were missing for family having diagnosed health conditions, 0 for self (respondent) having diagnosed health conditions, and 31 for self-rated health.

The survey is unique in that it oversampled elderly respondents and African Americans respondents. This is suitable because, as discussed above, minority residents are often disproportionately exposed to environmental risks, and the elderly are particularly vulnerable to environmental risks. Therefore it is important to understand their risk perception and how it relates to health in order to improve the communication channels between the government, researchers, and the affected community.

Measures

This section describes the dependent and independent variables, and coding schemes, used in this study. Table 1 summarizes the dependent and independent variables, and their coding schemes, which were used in this study.

Dependent Variable. The main dependent variable for this study is perception of environmental risk. This concept was measured through two questions involving respondents' perceived risks of pollution to their and their family's health. First, respondents were asked to what extent they agree (ranging on a five-point scale, from strongly disagree to strongly agree): "Air pollution is dangerous to me and my family's health."

Respondents were also asked to rank how dangerous five sources of pollution were to their and their family's health: "How dangerous do you think that the following items are to you and your family's health: (1) Air pollution caused by cars; (2) Air pollution caused by industry; and (3) Pollution of rivers, lakes and streams." The possible responses and their corresponding codes were: 0 = not at all dangerous, 1 = not dangerous, 2 = somewhat dangerous, 3 = dangerous and 4 = very dangerous. Responses to these items, and to the question on air pollution in general listed above, were used to create an additive scale that measured perceived risks of pollution with possible scores ranging from 0-16. The Cronbach's Alpha score is .720 for this measure.

Independent Variables.

Sociodemographic Characteristics. This study included some basic and key sociodemographic variables, which research suggests could influence perception of

environmental risk. The literature shows that there are two primary variables that impact perception of risk: gender and race/ethnicity. This study also included age and education as independent variables to help further the understanding about their impact on environmental risk perception. This study was limited to gender as a dichotomous (male (0) or female (1)) choice. This survey included six categories for race: White/Caucasian, Black/African American, Hispanic/Latino, Asian/Pacific Islander, and Other. These choices were recoded into a dummy variable: White/Caucasian (0), all others (1). Age was gathered by asking for year of birth, and then recoded into actual age at the time the survey was taken. Age was used as a continuous variable in order to determine if the relationship indicated in the literature is present. Information on education level was obtained through the question "How much schooling have you completed?" Options ranged from less than 9th grade up to and including graduate degree (MS, MD, JD, and PhD). Education was recoded into three categories: some high school, high school graduate or GED (0), some college or associates degree (1), and bachelors degree and higher (2), and they were dummy coded in regression analysis with some high school or high school graduate as the reference category.

Location. As discussed in the literature review, a respondent's actual proximity to various potential risks could also influence the perception of environmental health risk. Therefore, two survey items were used to indicate location. First, two survey items were used to create a proxy variable for pollution, as this study did not have access to the actual measure included in the survey which divided respondents into polluted and non-polluted zones. The two survey items used to create the proxy were: "Are any of the

following places within walking distance of your home?" The options were "Parks or recreation areas, Industrial areas or factories, Major roadways", with the answer options being "yes" or "no". Regarding visibility, the second question being used by this study is "Can you see any of the following places from your home?" The options were "Parks or recreation areas, Industrial areas or factories, Major roadways", with the answer options being "yes" or "no". Only the responses for industrial areas or factories and major roadways were used for both survey items. These variables were then recoded into an additive scale, which was used as the proxy measure for living in a polluted or non-polluted area as a continuous measure (0-4). The Cronbach's Alpha score is .531 for this measure.

The length of time residents have resided at their current address is also potentially important for predicting perception of environmental risk. This variable was measured through the open-ended survey item "Approximately how long have you lived at you current address?" The responses were recoded to be consistent in measurement, using years and fraction of years, for example one and a half years or one year six months was recoded into 1.5 years. The resulting variable was then used as a continuous measure.

Health. Health was measured through three questions. First, respondents were asked to rate their health ("In general, would you say your health is:"). The five responses range from poor (0) to excellent (4). Two additional questions asked if the respondent or anyone in the household, respectively, had been diagnosed with or taken medication for certain medical conditions over the past year ("Please check the box next to the

condition(s) that you have been diagnosed with, or taken medication for, over the past year" and "Please check the box next to the condition(s) that anyone in your household has been diagnosed with, or taken medication for, over the past year"). These two items have the same response options for health conditions, and allowed multiple items to be selected via a check box next to the condition. This thesis used the following four items: "lung disease, a heart attack or other heart trouble, hypertension/high blood pressure, cancer or malignant tumor". These responses were than dichotomized into not having any conditions (0) to having 1-4 conditions (1).

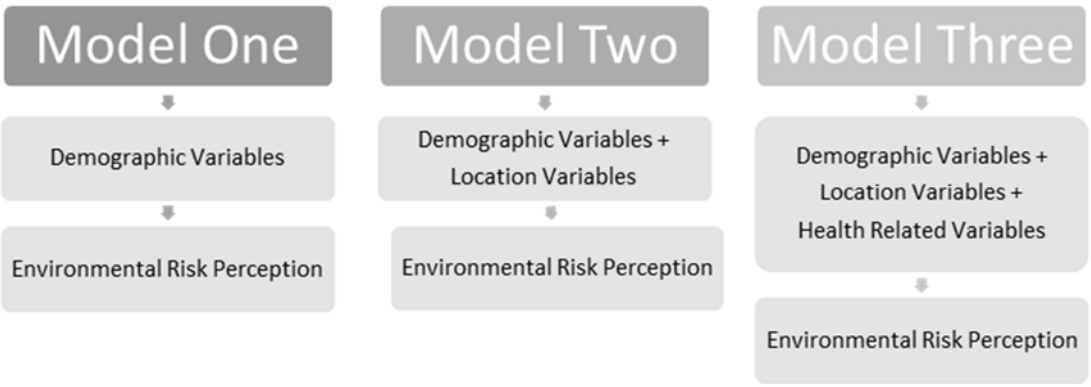
"Table 1 about here"

Analytical Techniques

Descriptive statistics for the independent variables were first calculated and provided to characterize the sample. Then correlation analysis was conducted to determine to what extent each independent variable was associated with the dependent variable. Sequential multiple regression was used for analysis in order to understand and predict the dependent variable, environmental risk perception. The first model included the sociodemographic variables, gender, race, age, and education, to determine to what extent they alone predict environmental risk perception. These sociodemographic variables were used as control variables in the two subsequent models, because they exist before the other variables and can be used as background information. The second model added the location variables: pollution scale and length of residence. The final model added the health variables (the subjective self-rated health and objective diagnosed health

conditions for individuals and their families). IBM SPSS Statistical software Version 24 was used for all analyses. The final analytical model is depicted in Figure 1.

Figure 1 Analytical Model



Descriptive characteristics of sample

The survey was sent to 4,579 homes in Ohio from December 2015 through September 2016. A total of 723 people responded to the survey, resulting in a response rate of 15.7%. The following description serves as a starting point for the analysis. Table 2 gives an overview of the sample and provides frequencies for all of the variables.

Perception of risk was created by combining multiple questions, as outlined in Table 1, into a scale. The scale ranges from 1-16, with 16 being the highest score and therefore representing the highest level of perceived risk. The mean score for perception of environmental risk was 11.53 and the standard deviation was 2.836.

As indicated in Table 2, the sample was 43.1% male and 56.9% female. The sample was composed of 80.3% white/Caucasian respondents, and 19.7% were minority respondents (Black/African American, Hispanic/Latino, Asian/Pacific Islander, and Other,). Table 2 indicates that 22.2% of respondents had a high school education or less,

33.4% received some college or associate's degree, and 44.4% of respondents completed their bachelor's degree or higher. Age was a continuous variable for analysis, and ranged from 19 to 98; the mean age was 55.14 years and the standard deviation was 17.287.

Location was expected to affect respondents' perceptions of risk, and location was measured through two variables: a polluted scale and length of residence. The mean for the polluted scale was 1.66 and the standard deviation was 1.110. Length of residence, like age, was a continuous variable and ranged from less than 1 year to 98 years. The mean length of residence was 16.73 years and the standard deviation was 15.557.

Health was measured through self-rated health, diagnosed conditions of the respondent, and diagnosed conditions of family members in the house. Self-rated health ranged from "poor" to "excellent." The mean for self-rated health was 2.47 and the standard deviation was .887. Two percent of respondents reported poor health, 10.3% reported fair health, 37.3% reported good health, 39.9% reported very good health, and 10.5% reported excellent health. For diagnosed conditions, 62% of respondents reported having no conditions for which they took medication or for which they were diagnosed with in the past year; 38% reported taking medication or being diagnosed with one or more conditions. Nearly 70% (69.1%) of respondents reported that no family members had taken medication or been diagnosed with a condition in the past year, while about 31% (30.9%) reported that a family member had taken medication or been diagnosed with 1-4 medical conditions in the past year.

"Table 2 about here"

CHAPTER FIVE

Results

Bivariate Correlations

Bivariate correlations were conducted to determine if there was a significant bivariate relationship between the dependent variable (perception of environmental risk score) and all independent variables. This test was also done in order to identify any multicollinearity issues that might exist in the data. Only key relationships are discussed in the following section, but the complete results are given in Table 3. The results of the bivariate correlation show a significant relationship between gender and perception of risk ($r = .118$ and $p<.05$); females perceived higher risk than males. Additionally, the results indicate a significant relationship between ethnicity (variable: minority), and perception of risk score ($r = .159$ and $p<.001$); minorities perceived higher risk than whites. All other relationships between the independent variables and perception of environmental risk were not found to be significant. Thus, no multicollinearity issues were detected.

"Table 3 about here"

Sequential Multiple Regression

The following section looks at the influence of the independent variables, for each of the three models, on the dependent variable, perception of environmental risk. The first model looks at sociodemographic variables: gender, race, age and education level. The second model adds in location variables: pollution scale and length of residence. The final model adds in the three health variables: self-rated health, family diagnosed

conditions, and personal diagnosed conditions. Sequential multiple regression was used to study the influence of those independent variables on the dependent variable of perception of environmental risk.

The first model is shown in the left column of Table 4. It explores the relationship between gender, race, age, and education level on perception of environmental risk score. The second model is given in the middle column, and the final model is given in the right column.

"Table 4 about here"

This first model explained 3.5% of the variance in perception of environmental risk, and was shown to be statistically significant $F(5, 572) = 5.141$, $p < .001$. Gender was found to be a statistically significant predictor across all three models ($p < .01$ for all models), and women were more likely than men to perceive environmental risk perception across all three models, as indicated by the positive coefficients ($\beta = .619$, .615, and .607 respectively). Similar results were found for race, which was statistically significant across all three models ($p < .001$ for all three models), and the positive coefficients mean that minorities perceive more risk than whites across all three models ($\beta = 1.213$, 1.204, and 1.204, respectively).

Education was not found to be statistically significant for any of the three models ($p > .05$), and the relationship was negative for respondents who reported having some college education ($\beta = -.028$, .024, and .035) and positive for those who reported having a bachelor's degree or higher ($\beta = .402$, .405, and .452). These were dummy coded, with high school degree or less equally zero, therefore the results indicate that respondents

with less than a bachelor's degree perceive less risk than those respondents with a high school diploma or less. Additionally, the results indicate that those with a bachelor's degree or higher perceive more risk than those with a high school diploma or less. Finally, age was not found to be statistically significant across all three models ($p > .05$), and was found to have a weak, positive relationship with environmental risk perception ($\beta = .006$, .005, and .003 respectively).

The second model explained 3.3% of the variance, and was shown to be statistically significant $F (7, 570) = 3.811$, $p < .001$. The polluted scale was not statistically significant for either model ($p > .05$), and was found to have a weak, positive relationship with environmental risk perception ($\beta = .042$ and .043). This indicates that the more polluted the perceived environment, the more risk is perceived. Length of residence was also not found to be a statistically significant predictor of environmental risk perception ($p > .05$ for all models), and was found to have a weak, positive relationship ($\beta = .007$, and .007). This suggests that the longer a resident lives in the home, the more environmental risk they perceive.

The third and final model explained 3% of the variance, and was shown to be statistically significant $F (10, 567) = 2.795$, $p < .01$. Self-rated health was not statistically significant ($p > .05$), and was found to have a weak, negative relationship with environmental risk perception ($\beta = -.040$). This indicates that as a respondent's score for self-rated health increases, their environmental risk perception decreases. Personal diagnosed health conditions was also not statistically significant ($p > .05$), and was found to have a weak, positive relationship with environmental risk perception ($\beta = .002$).

Finally, diagnosed health conditions for family members was not found to be statistically significant ($p > .05$), and was found to have a weak, positive relationship with environmental risk perception ($\beta = .283$). The results for diagnosed health conditions, both for the respondent and their family, suggest that having a diagnosed condition increases the amount of environmental risk that is perceived.

CHAPTER SIX

Discussion

The main goal of this thesis, as discussed in previous chapters, was to investigate what variables influence environmental risk perception. In order to gain an understanding on this topic, this thesis examined the influence of sociodemographic variables, such gender, race, age and education and environmental risk perception. Other variables included were location, which was measured through visibility and distance from pollution producers (via a pollution scale) and length of residence, and health variables, including self-rated health and diagnosed health problems.

This study attempted to highlight influencing factors on environmental risk perception, so that more effective measures at reducing it could be created in the future. Other studies have investigated these factors, particularly sociodemographic and certain location variables (Botzen et al., 2009; Finucane et al., 2000; Gallina & Williams, 2014; Macias, 2015; Sessa et al., 2010 Xiao & McCright, 2012), but few have conceptualized them as this study did, and even fewer have consider the effect of health on environmental risk perception. A few of the most important findings in this study were that gender and race remained significant through all three models, which is supported by others studies (Bullard et al., 2008; Finucane et al., 2000; Marshall, 2004; Marshall et al., 2006; Olofsson & Rashid, 2011).

Another important findings was that location was not found to be significant. This findings is interesting because it suggests that place attachment might not be as significant as the literature suggests (Anton & Lawrence, 2014; Harrington & Elliott,

2015; Kasperson et al., 1988; Masuda & Garvin, 2006; Pidgeon et al., 2003; Vaske & Kobrin, 2001). This implies that something else about location is significant in predicting environmental risk perception, and is worth exploring further.

Discussion of the Results

The literature review provided evidence that there would be a relation between certain sociodemographic, location, and health variables and environmental risk perception. This thesis supported some of those findings, involving sociodemographic variables, but not all, and did not support findings involving location or health variables.

Sociodemographic Characteristics. The literature review on risk perception suggests that the sociodemographic variables used in this study, such as gender, race, age, and education, are important for predicting environmental risk perception. As mentioned previously, one of the key findings in this study is that gender and race remained significant predictors for all three models, and confirms sub-hypothesis 1a and 1b. The results indicated that women and minorities perceive more risk when compared to men and white respondents respectively. Most of the literature suggested that women would perceive more environmental risk than men. The results from this thesis confirm these studies, but they do not explain why women perceive more risk than men.

The research on gender differences in risk perception has produced results such as the "white male effect" and "social inequality effect" (Marshall, 2004; Marshall et al., 2006; Olofsson & Rashid, 2011). The white male effect claims that men have more power, authority, and control over their day-to-day lives, and that environmental hazards are perceived as more beneficial by and for white males, and therefore they are less

concerned with environmental risks (Finucane et al., 2000). However, these differences in perceptions and control are not biological in nature, but social, and therefore Olofsson and Rashid (2011) argue that this phenomenon should be called the "social inequality effect".

There has also been work into why women in particular perceive greater environmental risk than men. As mentioned in the literature review, having children increases women's environmental risk more than it does men's environmental risk perception (Marcon et al., 2015). The literature suggests that women often take on the roles of caregiver for children, and other domestic responsibilities, and this could make them more sensitive to environmental risks that could impact their children or families (Tindall et al., 2003). Traditional gender roles, women as the caregiver working inside the home, and men as providers working outside the home, teach girls to be more nurturing than boys from a young age (Mohai, 1992). These different gender roles could partially explain why women perceive more environmental risk than men in this study, but a more nuanced examination would have to be conducted to confirm this idea.

This study found that minority respondents perceived more environmental risk than white respondents. The findings reinforce previous research on the relationship between race and perception of environmental risk perception (Finucane et al., 2000; Macias, 2015; Marshall, 2004; Marshall et al., 2006; Mohai & Bryant, 1998), and confirmed this study's sub-hypothesis 1b. This was found in all of the sequential multiple regression models. This result could be explained by the lack of power or control that minorities perceive having over their lives and environment, as suggested by previous

work (Ash & Fetter. 2002; Bullard et al., 2008; Finucane et al., 2000). However, this study did not include measures of either power or trust.

The literature regarding SARF stated that certain demographic variables would be relevant for how risk is communicated (Harrington & Elliot, 2015; Kasperson et al., 1988; Masuda & Garvin, 2006; Pidgeon et al., 2003). The results, that both gender and race were significant in predicting levels of environmental risk perception, suggests that some attention should be given to the communication networks concerning environmental risk perception for both gender and race. SARF also states that "psychological, social, and institutional factors influence risk perceptions and behavior through a network of socially mediated communication channels" (Masuda & Garvin, 2006, p. 438), and gender and race would influence the psychological and social makeup of individuals and their communication networks.

There has been some work on why gender and race impact risk perception, but little attention has been given to how they affect the SARF (Marshall, 2004; Marshall et al., 2006; Olofsson & Rashid, 2011). Special consideration could also be given to the intersectionality of gender and race when studying how culture and demographic characteristics impact environmental risk perception and risk communication. This is highlighted by the work on the "white male effect" and the "social inequality effect" which state white men perceive the least amount of risk because they have the most control and benefit the most, which suggests that minority women would perceive the most environmental risk.

This research supports the work on environmental racism, which suggests that discrimination against minorities in the siting of environmental hazards continues to exist. The literature argues that minorities perceive more risk because of their location, which is often closer than non-minorities to environmental hazards, and because of the lack of protection they perceive, or actually receive, from those in power (Bullard et al., 2008; Chavis & Lee, 1987; Mohia & Saha, 2015; Pellow, 2000). The environmental racism literature brings together these ideas: the lack of power held by minorities, the lack of protection received from officials and those in power, the lack of trust between minorities and those in power, and the siting of hazards in or near minority communities (Bullard et al., 2008; Chavis & Lee, 1987; Mohia & Saha, 2015; Omanga et al., 2014; Pellow, 2000; Peters et al., 1996).

Trust and power have been found to be particularly important in environmental risk perception (Olofsson & Rashid, 2011; Peters et al., 1996). Furthermore, Omanga et al. (2014) found that people who live in poorer areas are often aware of the environmental risks around them, but they feel disempowered to improve the conditions and learn to live with the risks. Additionally, the availability heuristic states that people are more likely to perceive risk if they can easily picture it the hazard, or if something has recently happened (Tversky and Kahneman, 1983). According to the environmental justice literature, minorities often live closer to the hazards, making the risks easier to picture, and therefore minorities may perceive more risk.

Therefore, it is possible that the minorities, in this study population, perceive more risk because they do not trust the sources of information or those in power, or

because the minority respondents do not feel like they have enough power over their environment. This study was not able to determine what came first, the hazards or the people, and therefore cannot stay if the drift or availability argument put forth by Brown (1995) is accurate in this case. Although this study did not include measures of power or trust, the findings suggests that they could be potentially important, and should be included in future work.

Becker et al. (2004) stated that those residents who perceive risk need to be included in the intervention process if successful interventions and policies are to be created; and this thesis suggests that those most affected, and those who perceive the most risk, are women and minorities. More work needs to be done in order to discern if minorities are perceiving more risk because of their location, which is not supported by this research, or if minorities continue to perceive, or receive, a lack of protection from governing officials, or perceive a lack of power or authority as suggested by environmental racism literature (Chavis & Lee, 1987; Bullard et al., 2008; Mohia & Saha, 2015; Pellow, 2000). A critique of SIA is that it rarely gives enough attention to social and cultural factors, so if interventions or policies are to be created which address environmental risk perception, the results of this study suggest that policies should focus on gender and race.

This study's findings on gender and race can be applied in a number of ways, such as: informing policy decisions about programs that are aimed at reducing risk perception, and to help focus studies on risk communication networks in order to better understand risk perception and what influences it. Reducing and understanding risk

perception would be important for stakeholders who are trying to introduce new products, build new facilities, or otherwise make changes that could make the target audience apprehensive. Risk perception cannot be reduced or removed by being ignored; therefore it is important that policy makers, city planners, or others understand how to disseminate information and what audiences should be targeted.

This research argues that minorities and women need to be included in the discussions about, and be the target of environmental risk perception reduction programs. Additionally, because women and minorities often have the least power and often stand to benefit the least from environmental hazards, policies and SIA should aim to empower and protect women and minorities.

The literature was mixed regarding the influence of age on environmental risk perception, and while this study did find the relationship to be positive, which is in line with some of the research, age was not a statistically significant factor in predicting environmental risk perception. This could be due to the low response rate of the survey, or because roughly 60% of the respondents were above the age of 50. These results confirmed sub-hypothesis 1c, and the relationship was consistent across all 3 models, but the results were not significant.

The literature suggested that education was an important predictor of environmental risk perception: the more education a person received, the more knowledgeable they were, and thus the less risk they would perceive. This study found a positive relationship between education and risk perception for those with a bachelor's degree or higher, but the relationship was not statistically significant. However, the

results for those with only some college were negative, but were also not significant. Therefore the findings for this study were mixed, and the final sub-hypothesis 1d was not confirmed by this study, and this was found in all of the models. Prior to final analysis, education was categorized a number of different ways, however education level was still not statistically significant.

Location variables. The literature on location and perception of environmental risk examines several of different location variables, often including what can be seen, or what residents otherwise have direct experience with, such as road ways or factories. These factors are often statistically significant predictors of environmental risk perception. However, other studies suggest that living inside or near polluted areas decreases the level of perceived risk, the logic being that residents become desensitized to such risk over time (Marcon et al., 2015; Venables, et al., 2012; Weiner, et al., 2013). This thesis studied the effect of pollution producers (i.e. major road ways and factories) that were either visible and/or were within walking distance of the respondent's home. However, these types of pollution producers were not statistically significant predictors of environmental risk perception. These results refute some of the literature (Bickerstaff, 2004; Claeson et al., 2013; Moffatt et al., 2000; Venables et al., 2012), and support other studies (Marcon et al., 2015).

Therefore, sub-hypothesis 2a was not supported by this study. Instead, contrary to previous research (Marcon et al., 2015; Venables et al., 2012) this study showed a positive relationship between the pollution scale and environmental risk perception, although it was not statistically significant.

The literature also indicated that length of residence was a significant predictor of environmental risk perception. Most studies found that respondents who lived in the area longer perceived more risk than new residents (Harclerode et al., 2016). However, some studies found that those residents who resided in the area longer were more accepting of the risks (Grasmück & Scholz, 2005; Weiner et al., 2013). This current study found a slight positive relationship between length of residence and perception of environmental risk, which refutes some of the literature (Grasmück & Scholz, 2005; Weiner et al., 2013), but again this relationship was not statistically significant. Therefore sub-hypothesis 2c was not supported by the data.

This result suggests that, at least for this population, being able to see environmental hazards or living near them does not influence environmental risk perception; rather, other factors were more important. Thus, researchers should focus less on the residential differences of respondents, and focus more on the demographics of those in the communities. As mentioned earlier, place attachment might not be as important as previously thought, but it is possible that the communication networks inside those communities that are nearby environmental hazards could influence environmental risk perception.

This result could also be due to the way these variables were conceptualized, the types of hazards, or other variables not considered in this study or by the survey used. Additionally these findings could result from the possibility that those respondents who continue to live near hazards are less concerned, and those who perceive more risk move away. These results could indicate a need for a more standardized method of measuring

and operationalizing location, or it could indicate the people are not perceiving the environmental risks around them as being dangerous. If it is the latter, than SIA or future research should focus on discerning why these residents are not perceiving, or understanding, the risks that are around them. Understanding why residents are not perceiving threats could be just as important as understanding what makes residents perceive more risk.

Health variables. The literature on the effect of health conditions on environmental risk perceptions was limited, while the literature on how environmental risk perception affects health perception was more robust. This study hypothesized that those in better health, either perceiving their health to be better or having fewer diagnosed conditions, would have more agency and would therefore perceive less environmental risk. The results from the regression analysis support these hypothesis, with self-rated health having negative results and diagnosed conditions having positive results. However, the results did not indicated a statistically significant relationships between the health variables and environmental risk perception. Therefore none of the sub-hypotheses in hypothesis 3 were confirmed. The findings did show that the relationship between self-rated health and environmental risk perception is negative. That is, the higher someone rated their health the lower their perception of risk, or conversely the lower they rated their health the more risk they perceived. This finding is in line with the work on agency and health, but again it was not a statistically significant finding.

These findings suggest that more research into how health influences environmental risk perception needs to be conducted. It is possible that only certain

health conditions affect environmental risk perception, which this study was not able to discern. Additionally, the negative relationship, even though it was not significant, between self-rated health and environmental risk perception suggests that there could be a relationship between agency, health, and environmental risk perception.

Overall the findings from this study indicate that there is little significant connection between location or health measures and environmental risk perception. This implies that policy creators, those planning interventions or programs, and SIA should continue to focus on sociodemographic variables, at least for this population. Additionally, it could be useful for SIA to study why those respondents in this community who should have perceived more risk, such as those living near hazards or those with health conditions, did not perceive higher levels of risk.

Limitations and Suggestions for Future Research

This study has several limitations. To begin, the response rate for the survey was low (15%). Additionally, the data was collected from different areas in Ohio, and the sample size is not large, meaning these findings are not generalizable to the entire U.S. population.

There could potentially be problems with how perception of environmental risk was conceptualized in the survey, through the questions asked, or operationalized for the purposes of this study. For example, the questions used to create the variable, environmental risk perception, was focused on how dangerous different hazards were to the respondents' or their families' health. The respondents could have understood the term health in different ways, or have not known how to reconcile the idea of the

pollution being very dangerous to their children, but not dangerous to an adult, when answering the survey questions. Furthermore, as shown in table 2, there were very few respondents who score below 6 on the environmental perception of risk scale.

There is also the potential problem of reverse causation between perception of environmental risk and health. It is difficult to determine, with the information provided, if people who are sick are more vulnerable to environmental hazards, and therefore perceive more risk, or if people who perceived more environmental risk were also more worried about the impact on their health as a result. The relationship could be, as available literature suggests, that environmental risk perception influences health, rather than the reverse, which was investigated in this study. Therefore, it would be useful for future studies to attempt to better address causal direction, and to possibly use another medium or more focused survey questions to better understand this relationship, or identify influencing health conditions.

Furthermore, the way location was conceptualized, through the use of "walking distance", is not standardized, meaning it was up to the respondent to determine what was walking distance for them. This leaves room for interpretation on the part of the respondent, and it is impossible to know what those variations in understanding could be. The same problem could have existed for the question regarding visibility, as there was not a standard for eye sight, nor were the respondents told to look from a particular place in the home to identify visible risk producers (i.e., roads and factories). Additionally, there could have been issues with the types of hazards used in the survey, other variables

not considered in this study, or used by the survey. As mentioned previously, there needed to be a more standardized conception for visibility and walking.

This original data set does contain location specific information, which would separate the respondents into polluted and non-polluted zones. However, this location-specific variable was not ready in time to be included as part of this study. The proxy variable created for polluted and non-polluted locations may be flawed, given that it had to rely solely on the respondent's interpretation of what was visible or within walking distance of their home; thus this study was limited in that there was no actual measure of distance from pollution producers.

Future studies could include more uniform measures of location, by including the site-specific information involving geographic information system (GIS) data. GIS information could be included so more objective and precise measures of distance of homes from hazardous sites or pollution producing facilities and location information can be used.

The polluted scale was conceptualized a number of different ways during the initial stages of analysis, for example: including parks, and was dichotomize into polluted and non-polluted variables, both with and without parks. However none of these conceptualizations were found to be statistically significant in the regression models. Education was also conceptualized a number of different ways, e.g. by categorizing separately individuals who had not completed high school and those who had, and with different variables for those who had earned more than a bachelor's degree. Yet, still none of these variations proved to be statistically significant in the regression models.

Future work could also aim to categorize race into more than just a dichotomous variable, white and minority, and attempt to delve further into the impact of being Hispanic, Asian, and Native American and environmental risk perception. However, the sample size of this study was not large enough to investigate race at this level of detail. Likewise, it was suggested by the literature that mothers might perceive more risk than father. This data set did include a question about whether the respondent had children, but it was not included in this study. Future work could attempt to further break down the differences in environmental risk perception between the genders by including a parenting measure.

Additionally, it is also worth noting the variables that were expected to be significant, given the literature, were not found to be significant. It is worth asking in a future study why variables related to pollution, length of residence, and health were not found to be significant for this population, as there could be an underlying variable not conceptualized in this study. It is important to discover what is significant in influencing environmental risk perception, for this population, if effective intervention measures and policies are to be implemented (Albergaria, & Fidelis, 2006; Cabelas, et al., 2005).

These findings suggest, because only gender and race remained significant, that there could be an underlying interaction between the two variables. It has been suggested, both by the "white male effect" and "social inequality effect", that power, trust, and vulnerability play a role in environmental risk perception. This work supports this idea because minorities and women often lack power and protection, and therefore they could perceive more environmental risk, which was confirmed by this study. Therefore, future

work should focus more on how power and trust are communicated and created for minorities and women, and how these factors influence environmental risk perception.

CHAPTER SEVEN

Conclusion

Environmental issues continue to be some of the most pressing concerns in the modern era, and have been brought even more into focus since the beginning of this particular study due to the political climate. Numerous studies were reviewed for this thesis, and used to inform this study's investigation on what could influence environmental risk perception. Three sub-categories of variables, sociodemographic, location, and health, were created for this study, as suggested by the literature, in order to see if there was a significant relationship between them and environmental risk perception. This thesis had the goal of contributing knowledge specifically on location and health variables and their influence on environmental risk perception. Sequential multiple regression was used in order to test for, and control for, each level of variables as a new set was introduced into the models.

Expanding the literature of what influences environmental risk perception, this study found that only gender and race were significant factors. This relationship is supported by the literature and further supported by frameworks such as the SARF, the white male effect, and environmental racism (Ash & Fetter, 2002; Chavis & Lee, 1987; Marshall, 2004; Marshall et al., 2006; Pellow, 2000). The implications for this finding is that policy makers, and others in power, should especially consider how their policies or interventions will be received by those lacking power; that is, minorities and women. This research implies that power, both held by those affected and by those implementing

change, and trust that the affected populations have in those in power, are crucial elements in opening communication networks.

In order for planning of SIA to be effective, it is vital that the community has input, that its knowledge is incorporated, and that those being affected feel empowered by the decisions being made (Barrow, 2000; Becker, 2004; Vanclay, 1998). The findings of this study could aid policy makers and other stakeholders in focusing on what is crucial, or not, in minimizing environmental risk perception for this population. Additionally, this study suggests that power and trust, as suggested by the results from gender and race, are crucial elements in environmental risk perception, and therefore they should be accounted for when opening and studying communication channels. However, as this study did not include these measures of trust, future work should investigate their influence more deeply.

References

Albergaria, R., & Fidelis, T. (2006). Transboundary EIA: Iberian experiences. *Environmental Impact Assessment Review, 26*(7), 614-632. doi: 10.1016/j.eiar.2006.04.001

American Lung Association. (2014). *State of the Air Key Findings 2010-2012.* Retrieved from American Lung Association website: http://www.stateoftheair.org/2014/key-findings

Anton, C., & Lawrence, C. (2014). Home is where the heart is: The effect of place of residence on place attachment and community participation. *Journal of Environmental Psychology, 40*, 451-461. doi: 10.1016/j.jenvp.2014.10.007

Ard, K. (2014). *The role of gender inequality in unequal exposure to air pollution and resulting health outcomes*. Grant proposal submitted to the Coca-Cola Foundation. Columbus OH: The Ohio State University.

Ash, M., & Fetter, R. (2002). Who lives on the wrong side of the environmental tracks? Evidence from the EPA's risk-screening environmental indicators mode. *Political Economy Research Institute, 50*(1), 1-27. doi:10.1111/j.0038-4941.2004.08502011.x

Barrow, C. (2000). *Social impact assessment: An introduction*. London: Arnold Publishers.

Becker, D., Harris, C., Nielsen, E., & McLaughlin, W. (2004). A comparison of a technical and participatory application of social impact assessment. *Impact Assessment and Project Appraisal, 22*(3), 177-189. doi: 10.3152/147154604781765932

Becker, H. (2001). Social impact assessment. *European Journal of Operational Research, 128*(2), 311-321. doi: 10.1016/S0377-2217(00)00074-6

Bickerstaff, K. (2004). Risk perception research: Socio-cultural perspectives on the public experience of air pollution. *Environment International 30*(6), 827-840. doi:10.1016/j.envint.2003.12.001

Bickerstaff, K., & Walker, G. (2001). Public understandings of air pollution: The 'localization' of environmental risk. *Global Environmental Change 11*(2), 133-145. dio:10.1016/S0959-3780(00)00063-7

Botzen, W., Aerts, J., & van den Bergh, J. (2009). Dependence of flood risk perceptions on socioeconomic and objective risk factors. *Water Resource Research, 45(*10), 1-15. doi:10.1029/2009WR007743

Bowen, W. (2002). An analytical review of environmental justice research: What do we really know? *Environmental Management, 29*(1), 3-15. doi:10.1007/s00267-001-0037-8

Brody, S. (2004). Does location matter? Measuring environmental perceptions of creeks in two San Antonio watersheds. *Environment and Behavior, 36(*2), 229-250. doi:10.1177/0013916503256900

Brody, S., Zahran, S., Vedlitz, A., & Grover, H. (2008). Examining the relationship between physical vulnerability and public perceptions of global climate change in the United States. *Environment and Behavior, 40*(1), 72-95. doi: 0013916506298800

Brown, P. (1995). Race, class, and environmental health: A review and systematization of the literature. *Environmental Research, 69*(1), 15-30. doi:10.1006/enrs.1995.1021

Brown, G. & Raymond, C. (2007). The relationship between place attachment and landscape values: Towards mapping place attachment. *Applied Geography, 27*(2), 89-111. doi: 10.1016/j.apgeog.2006.11.002

Bullard, R. (2000). *Dumping in Dixie: Race, class, and environmental quality*. Boulder, Colorado: Westview Press.

Bullard, R., Mohia, S., Saha, R., & Wright, B. (2008). Toxic wastes and race at twenty years: Why race still matters after all of these years. *Environmental Law Spring*, *38*(2), 371-411. Retrieved from https://sph.umich.edu/symposium/2010/pdf/bullard1.pdf

Burger, J. (2005). Assessing environmental attitudes and concerns about a contaminated site in a densely populated suburban environment. *Environmental Monitoring and Assessment, 101*(1), 147-165. doi:10.1007/s10661-005-9151-z

Canelas, L., Almansa, P., Merchan, M., & Cifuentes, P. (2005). Quality of environmental impact statements in Portugal and Spain. *Environmental Impact Assessment Review, 25*(3), 217-225. doi: 10.1016/j.eiar.2004.02.001

Chavis, B., & Lee, C. (1987). *Toxic waste and race in the United States of America.* New York: New York United Church of Christ, Commission for Racial Justice.

Claeson, A., Liden, E., Nordin, M., & Nordin, S. (2013). The role of perceived pollution and health risk perception in annoyance and health symptoms: A population-based study of odorous air pollution. *International Archive of Occupational and Environmental Health*, *86*(3), 367-374. doi:10.1007/s00420-012-0770-8

Correia, A. W., Pope, C. A., Dockery, D. W., Wang, Y., Ezzati, M., & Dominici, F. (2013). The effect of air pollution control on life expectancy in the United States: An analysis of 545 US counties for the period 2000 to 2007. *Epidemiology, 24*(1), 23–31. doi:10.1097/EDE.0b013e3182770237

Crowe, M. (1968). Toward a "Definitional Model" of public perceptions of air pollution. *Journal of Air Pollution Control Association, 18*(3), 154-157. doi: 10.1080/00022470.1968.10469106

Cutter, S., Boruff, B., & Shirley, W. (2003). Social vulnerability to environmental hazards. *Social Science Quarterly, 84*(2), 242-261. doi:10.1111/1540-6237.8402002

Dalton, P. (1999). Cognitive influences on health symptoms from acute chemical exposure. *Health Psychology, 18*(6), 579-590. doi:10.1037/0278-6133.18.6.579

Davidson, D. & Freudenburg, W. (1996). Gender and environmental risk concerns. *Environmental Behavior, 28*(3), 302-339. doi: 10.1177/0013916596283003

Dominici F., Peng R., Bell M., Pham L., McDermott A., Zeger S., & Samet J. (2006). Fine particulate air pollution and hospital admission for cardiovascular and respiratory diseases. *JAMA, 295*(10), 1127-1134. doi:10.1001/jama.295.10.1127

Du Pisani, J., & Sandham, L. (2006). Assessing the performance of SIA in the EIA context: A case study of South Africa. *Environmental Impact Assessment Review, 26*(8), 707-724. doi: 10.1016/j.eiar.2006.07.002

Egondi, T., Kyobutungi, C., Ng, N., Muindi, K., Oti, S., van de Vijver, S… Rocklöv, J. (2013). Community perceptions of air pollution and related health risks in Nairobi slums. *International Journal of Environmental Resources and Public Health, 10*(10), 4851-4868. doi:10.3390/ijerph10104851

Elliott, S., Cole, D., Krueger, P., Voorberg, N., & Wakefield, S. (1999). The power of perception: Health risk attributed to air pollution in an urban industrial neighborhood. *Risk Analysis, 19*, 621-634. doi:10.1111/j.1539-6924.1999.tb00433.x

Esteves, A, Frank, D., & Vanclay, F. (2012). Social impact assessment: The state of the art. *Impact Assessment and Project Appraisal, 30*(1), 34-42. doi: 10.1080/14615517.2012.660356

Finucane, M., Slovic, P., Mertz, C., Flynn, J., & Satterfield, T. (2000). Gender, race, and perceived risk: The 'White Male' effect. *Health, Risk & Society, 2*, 159-172. doi:10.1080/713670162

Flynn, J., Slovic, P., & Mertz, C. (1994). Gender, race, and perception of environmental health risks. *Risk Analysis, 16*(6), 1101-1108. doi:10.1111/j.1539-6924.1994.tb00082.x

Gallina, M., & Williams, A. (2014). Perceptions of air quality and sense of place among women in northeast Hamilton, Ontario, Canada. *International Journal of Social Science Studies, 2*(3), 67-77. doi:10.11114/ijsss.v2i3.412

Gavrilescu, M., Demnerová, K., Aamand, J., Agathos, S., & Fava, F. (2015). Emerging pollutants in the environment: Present and future challenges in biomonitoring, ecological risks and bioremediation. *New Biotechnology, 32*(1), 147-156. doi:10.1016/j.nbt.2014.01.001

Grasmück, D., & Scholz, R. (2005). Risk perception of heavy metal soil contamination by high-exposed and low-exposed inhabitants: The role of knowledge and emotional concerns. *Risk Analysis, 25*(3), 611–622. doi:10.1111/j.1539-6924.2005.00628.x

Gray, S., Edwards, S., & Miranda, M. (2013). Race, socioeconomic status, and air pollution exposure in North Carolina. *Environmental Research, 126*, 152-158. doi:10.1016/j.envres.2013.06.005

Harclerode, M., Lal, P., Vedwan, M., Wolde, B., & Miller, M. (2016). Evaluation of the role of risk perception in stakeholder engagement to prevent lead exposure in an urban setting. *Journal of Environmental Management, 184*(1), 132-142. doi:10.1016/j.jenvman.2016.07.045

Harrington, D., & Elliott, S. (2015). Understanding emerging environmental health risks: A framework for responding to the unknown. *Canadian Geographer, 59*(3), 283-296. doi:10.1111/cag.12198

Hendryx, M., Conley, J., Fedorko, E., Luo, J., & Armistead, M. (2012). Permitted water pollution discharges and population cancer and non-cancer mortality: Toxicity weights and upstream discharge effects in U.S. rural-urban areas. *International Journal of Health Geographics, 11*(9), 1-15. doi:10.1186/1476-072X-11-9

Hidalgo, M. & Hernandez, B. (2001). Place attachment: Conceptual and empirical questions. *Journal of Environmental psychology, 21*(3), 273-281. doi: 10.1006/jevp.2001.0221

Howe, H. (1988). A comparison of actual and perceived residential proximity to toxic waste sites. *Archives of Environmental Health, 43*(6), 415-419. doi:10.1080/00039896.1988.9935860

Kahan, D., Braman, D., Gastil, J., Slovic, P., & Mertz, C. (2006). *Gender race and risk perception: The influence of cultural status anxiety* (No. 86). New Haven, CT: Yale Law School.

Kasperson, R. (2015). The social amplification of risk and low-level radiation. *Bulletin of the Atomic Scientists, 68*(3), 59-66. doi:10.1177/0096340212444871

Kasperson, R., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R… Ratick, S. (1988). The social amplification of risk: A conceptual framework. *Risk Analysis, 8*(2), 177–187. doi:10.1111/j.1539-6924.1988.tb01168.x

Keller, C., Bostrom, A., Kuttschreuter, M., Savadori, L., Spence, A., & White, M. (2011). Bringing appraisal theory to environmental risk perception: A review of conceptual approaches of the past 40 years and suggestions for future research. *Journal of Risk Research, 15*(3), 237-256. doi: 10.1080/13669877.2011.634523

Kershaw, S., Gower, S., Rinner, C., & Campbell, M. (2013). Identifying inequitable exposure to toxic air pollution in radicalized and low-income neighborhoods to support pollution prevention. *Geospatial Health, 7*(2), 265-278. doi:10.4081/gh.2013.85

Khafaie, M., Yajnik, C., Salvi, S., & Ojha, A. (2016). Critical review of air pollution health effects with special concern on respiratory health. *Journal of Air Pollution and Health, 1*(2), 123-136. Retrieved from http://japh.tums.ac.ir

Kipen, H., & Fiedler, N. (2002). Environmental factors in medically unexplained symptoms and related syndromes: The evidence and the challenge. *Environmental Health Perspective, 110*(4), 597-599. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241211/

Lewicka, M. (2010). What makes neighborhood different from home and city? Effects of place scale on place attachment. *Journal of Environmental Psychology, 30*(1), 35-51. doi: 10.1016/j.jenvp.2009.05.004

Loewenstein, G., Weber, E., Hsee, C., & Welch, N. (2001). Risk as feeling. *Psychological Bulletin*, *27*(2), 267-286. doi:10.1037//0033-2909.127.2.267

Lu, Y., Song, S., Wang, R., Liu, Z., Meng, J., Sweetman, …Wang, T. (2015). Impacts of soil and water pollution on food safety and health risks in China. *Environment International, 77*, 5-15. doi:10.1016/j.envint.2014.12.010

Macias, T. (2015). Environmental risk perception among race and ethnic groups in the United States. *Ethnicities, 16*(1), 111-129. doi:10.1177/1468796815575382

Marcon, A., Nguyen, G., Braggion, M., Grassi, M., & Zanolin, M. (2015). A score for measuring health risk perception in environmental surveys. *Science of the Total Environment, 527*, 270-278. doi:10.1016/j.scitotenv.2015.04.110

Marshall, B. (2004). Gender, race, and risk perception: The "white male" effect in Cancer Alley, LA. *Sociological Spectrum, 24*(4), 453-478. doi:10.1080/02732170490459485

Marshall, B., Picou, J., Formichella, C., & Nicholls, K. (2006). Environmental risk perceptions and the white male effect: Pollution concerns among deep-south coastal residents. *Journal of Applied Sociology, 23*(2), 31-49. Retrieved from http://www.jstor.org/stable/43736133

Masuda, J., & Garvin, T. (2006). Place, culture, and the social amplification of risk. *Risk Analysis, 26*(2), 437-454. doi:10.1111/j.1539-6924.2006.00749.x

McComas, K. (2006). Defining moments in risk communication research: 1996–2005. *Journal of Health Communication, 11*(1), 75-91. doi: 10.1080/10810730500461091

McCright, A. (2010). The effects of gender on climate change knowledge and concern in the American public. *Population and Environment, 32*(1), 66-87. doi: 10.1007/s11111-010-0113-1

McCright, A., & Dunlap, R. (2013). Bringing ideology in: The conservative white male effect on worry about environmental problems in the USA. *Journal of Risk Research, 16*(2), 211-226. doi:10.1080/13669877.2012.726242

Mesch, S. & Manor, O. (1998). Social ties, environmental perception, and local attachment. *Environment and Behavior, 30*(4), 504-519. doi: 10.1177/001391659803000405

Moffatt, S., Bush, J., Dunn, C., Howel, D., & Prince, H. (1999). *Public awareness of air quality and respiratory health and the impact of health advice*. Newcastle: University of Newcastle.

Moffatt, S., Mulloli, T., Bhopal, R., Foy, C., & Phillimore, P. (2000). An exploration of awareness bias in two environmental epidemiology studies. *Epidemiology, 11*(2), 199-208. Retrieved from http://www.jstor.org/stable/3703743

Mohai, P. (1992). Men, women, and the environment: An examination of the gender gap in environmental concern and activism. *Society and Natural Resources, 5*(1), 1-9. doi: 10.1080/08941929209380772

Mohai, P., & Bryant, B. (1998). Is there a "race" effect on concern for environmental quality? *Public Opinion Quarterly, 62*(4), 475-505. Retrieved from http://www.jstor.org/stable/2749675

Mohai, P., & Saha, R. (2015). Which came first, people or pollution? A review of theory and evidence from longitudinal environmental justice studies. *Environmental Research Letters, 10*(12). doi: 1748-9326/10/12/125011

Olofsson, A., & Ohman, S. (2015). Vulnerability, values and heterogeneity: One step further to understand risk perception and behavior. *Journal of Risk Research, 18*(1), 2-20. doi:10.1080/13669877.2013.879485

Olofsson, A., & Rashid, S. (2011). The white (male) effect and risk perception: Can equality make a difference? *Risk Analysis, 31*(6), 1016-1032. doi:10.1111/j.1539-6924.2010.01566.x

Omanga, E., Ulmer, L., Berhane, L., & Gatari, M. (2014). Industrial air pollution in rural Kenya: Community awareness, risk perception and associations between risk variables. *BMC Public Health, 14*, 377. doi:10.1186/1471-2458-14-377

Pastor, M., Sadd, J., & Hipp, J. (2001). Which came first? Toxic facilities, minority move-in, and environmental justice. *Journal of Urban Affairs, 23*(1), 1-21. doi:10.1111/0735-2166.00072

Pellow, D. (2000). Environmental inequality formation: Toward a theory of environmental injustice. *American Behavioral Scientist, 43*(4), 581–601. doi:10.1177/0002764200043004004

Peters, R., Covello, V., & McCallum, D. (1996). The determinants of trust and credibility in environmental risk communication: An empirical study. *Risk Analysis, 17*(1), 43-54. doi:10.1111/j.1539-6924.1997.tb00842.x

Pidgeon, N. (1998). Risk assessment, risk values and the social science programme: Why we do risk perception research. *Reliability Engineering & System Safety, 59*(1), 5-15. doi:10.1016/S0951-8320(97)00114-2

Pidgeon, N., Kasperson, R. E., & Slovic, P. (2003). *The social amplification of risk*. Cambridge: Cambridge University Press.

Poortinga, W., Dunstan, F., & Fone, D. (2007). Perceptions of the neighborhood environment and self-rated health: A multilevel analysis of the Caerphilly health and social needs study. *BCM Public Health, 7*, 285. doi:10.1186/1471-2458-7-285

Ramirez-Andreotta, M., Brusseau, M., Artiola, J., Maier, R., & Gandolfi, A. (2014). Environmental research translation: Enhancing interactions with communities at

contaminated sites. *Science of the Total Environment, 497*, 651-664. doi:10.1016/j.scitotenv.2014.08.021

Raphael, B., Taylor, M., Stevens, G., Barr, M., Gorringe, M., & Agho, K. (2009). Factors associated with population risk perceptions of continuing drought in Australia. *Australian Journal of Rural Health, 17*, 330–337. doi:10.1111/j.1440-1584.2009.01108.x

Ristovski, Z., Miljevic, B., Surawski, L., Morawska, L., Fong, K., Goh, F., & Yang, I. (2012). Respiratory health effects of diesel particulate matter. *Respirology, 17*(2), 201-212. doi:10.1111/j.1440-1843.2011.02109.x

Satterfield, T., Mertz, C., & Slovic, P. (2004). Discrimination, vulnerability, and justice in the face of risk. *Risk Analysis, 24*(1), 115-129. doi:10.1111/j.0272-4332.2004.00416.x

Savage, I. (1993). Demographic influences on risk perceptions. *Risk Analysis, 13*(4), 413-420. doi: 10.1111/j.1539-6924.1993.tb00741.x

Schooten, M., Vanclay, F., & Slootweg, R. (2003). Conceptualizing social change processes and social impacts. In H. Becker (ed.) *The international handbook of social impact assessment* (pp. 74-91). Cheltenham, UK: Edward Elgar.

Schultz, W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology, 21*(4), 327-339. doi:10.1006/jevp.2001.0227

Sessa, A., Giuseppe, G., Marinelli, P., & Angelillo, I. (2009). Public concerns and behaviors towards solid waste management in Italy. *The European Journal of Public Health, 20*(6), 631-633. doi:10.1093/eurpub/ckp204

Shea, S., Kothari, D., Teresi, J., Kong, J., Eimicke, J., Lantigua, R.,…Weinstock, R. (2013). Social impact analysis of the effects of telemedicine intervention to improve diabetes outcomes in an ethnically diverse, medically underserved population: Findings from the IDEATel study. *American Journal of Public Health, 103*(10), 1888-1894. doi: 10.2105/AJPH.2012.300909

Shi, X., & He, F. (2012). The environmental pollution perception of residents in coal mining areas: A case study in Hancheng mine area, Shaanxi Province, China. *Environmental Management, 50*(4), 505-513. doi: 10.1007/s00267-012-9920-8

Shusterman, D. (1992). Critical review: The health significance of environmental odor pollution. *Archives of Environmental Health, 47*(1), 76-87. doi:10.1080/00039896.1992.9935948

Slimak, M., & Dietz, T. (2006). Personal values, beliefs, and ecological risk perception. *Risk Analysis, 26*(6), 1689-1705. doi:10.1111/j.1539-6924.2006.00832.x

Spurgen, A., Gompertz, D., & Harrington, J. (1996). Modifiers of non-specific symptoms in occupational and environmental syndromes. *Occupational and Environmental Medicine, 53*(6), 361-366. doi:10.1136/oem.53.6.361

Stenlund, T., Lidén, E., Andersson, K., Garvill, J., & Nordin, S. (2009). Annoyance and health symptoms and their influencing factors: A population-based air pollution intervention study. *Public Health*, *123*(4), 339-345. doi:10.1016/j.puhe.2008.12.021

Taylor, D. (2000). The rise of the environmental justice paradigm. *American Behavioral Scientist, 43*(4), 508-580. doi:10.1177/0002764200043004003

Tindall, D., Davies, S., & Mauboules, C. (2003). Activism and conservation behavior in and environmental movement: The contradictory effects of gender. *Society and Natural Resources, 16*(10), 909-932. doi: 10.1080/716100620

Toma, L., & Mathijs, E. (2007). Environmental risk perception, environmental concern and propensity to participate in organic farming programmes. *Journal of Environmental Management, 83*(2), 145-157. doi:10.1016/j.jenvman.2006.02.004

Torriti, J. (2011), The unsustainable rationality of impact assessment. *European Journal of Law and Economics, 31*(3), 307-320. doi: 10.1007/s10657-010-9202-yFs

Tversky, A., & Kahneman, D. (1983). Extensional versus intuitive reasoning: The conjunction fallacy in probability judgment. *Psychological Review, 90*(4), 293-315. doi: 10.1037/0033-295X.90.4.293

van Thriel, C., Kiesswetter, E., Schaper, M., Juran, S., Blaszkewicz, M., & Kleinbeck, S. (2008). Odor annoyance of environmental chemicals: Sensory and cognitive influences. *Journal of Toxicology and Environmental Health, Part A, 71*(11), 776-785. doi:10.1080/15287390801985596

Vanclay, F. (1999). Social impact assessment. In J. Petts (ed), *Handbook of environmental impact assessment Vol. 1* (pp. 301-326). Oxford, UK: Blackwell Science.

Vanclay, F. (2003). International Principles for social impacts assessment. *Impact assessment and Project Appraisal, 21*(1), 5-12. doi: 10.3152/147154603781766491

Vanclay, F. (2006). Principles for social impact assessment: A critical comparison between the international and US documents. *Environmental Impact Assessment Review, 26*(1), 3-14. doi: 10.1016/j.eiar.2005.05.002

Vaske, J. & Kobrin, K. (2001). Place attachment and environmentally responsible behavior. *Journal of Environmental Psychology, 32*(4), 16-21. doi: 10.1080/00958960109598658

Venables, D., Pidgeon, N., Parkhill, K., Henwood, K., & Simmons, P. (2012). Living with nuclear power: Sense of place, proximity, and risk perceptions in local host communities. *Journal of Environmental Psychology, 32*(4), 371-383. doi:10.1016/j.jenvp.2012.06.003

Wang, P., Lassoie, J., Dong, S., & Morreale, S. (2013). A framework for social impact analysis of large dams: A case study of cascading dams on the Upper-Mekong River, China. *Journal of Environmental Management, 117*, 131-140. doi: 10.1016/j.jenvman.2012.12.045

Weiner, M., MacKinnon, T., & Greenberg, M. (2013). Exploring the gender gap and the impact of residential location on environmental risk tolerance. *Journal of Environmental Psychology*, *36*, 190-201. doi:10.1016/j.jenvp.2013.07.012

Weinstein, N. (1987). Unrealistic optimism about susceptibility to health problems: Conclusions from a community-wide sample. *Journal of Behavioral Medicine, 10*(5), 481-500. doi: 10.1007/BF00846146

White, B., & Hall, E. (2015). Perceptions of environmental health risks among residents in the "Toxic Doughnut": Opportunities for risk screening and community mobilization. *BCM Public Health, 15*, 1-9. doi:10.1186/s12889-015-2563-y

Whittaker, M., Segura, G., & Bowler, S. (2005). Racial/Ethnic group attitudes toward environmental protection in California: Is "environmentalism" still a white phenomenon? *Political Research Quarterly, 58*(3), 435-447. doi: 10.1177/106591290505800306

World Health Organization. (2015). *WHO releases country estimates on air pollution exposure and health impact.* (2016, September 27). World Health Organization Media Centre. Retrieved from http://www.who.int/mediacentre/news/releases/2016/air-pollution-estimates/en/

Xiao, C. & McCright, A. (2012). Explaining gender differences in concern about environmental problems in the United States. *Society and Natural Resources, 25*(11), 1067-1084. doi: 10.1080/08941920.2011.651191

Zhang, L., Yuan, Z., Maddok, J.,… Lu, Y. (2014). Air quality and environmental protection concerns among residents in Nanchang, China. *Air Quality, Atmosphere & Health, 7*(4), 441-448. doi: 10.1007/s11869-014-0255-x

Table 1. Research Variables

Dependent Variable	
Perception of Environmental Risk (PoR)	PoR was created by analyzing the responses to the following question: *"Please tell us how much you agree or disagree with each of these statements?"* The responses to the following statement were used: "Air pollution is dangerous to me and my family's health." The responses of "strongly disagree, slightly disagree, neither, slightly agree, and strongly agree" were then coded as follows: 0 = Strongly disagree 1 = Slightly disagree 2 = Neither 3 = Slightly agree 4 = Strongly agree PoR was created by analyzing the responses to the following question: *"How dangerous do you think that the following items are to you and your family's health?"* Possible responses include: 0 = Not at all dangerous 1 = Not dangerous 2 = Somewhat dangerous 3 = Dangerous 4 = Very dangerous The responses to the following three items were used: "Air pollution by cars" "Air pollution by industry" "Pollution of rivers, lakes, and streams" The responses to these two survey questions were combined to create an additive PoR scale. The additive scores could range from 0-16.
Independent Variables *Sociodemographic Characteristics*	
Gender	A dummy variable was created representing gender: 0 = Male

	1 = Female
Race	A dummy variable was created representing race: 0 = White/Caucasian 1 = All others
Age	Age was recoded into a continuous variable, from the year of birth given by respondents, and represents the age of the respondent at the time they took the survey.
Education	The education variable was created using the question: *"How much schooling have you completed?"* Possible responses were as follows: Less than 9th grade; Some high school, but no diploma, High school graduate or GED; Some college, business or technical school; Associate's degree; Bachelor's degree; Graduate degree (MS, MD, JD, PhD). These responses were recoded as: 0 = Some high school, high school graduate or GED 1 = Some college or associates degree 2 = Bachelor's degree or higher
Location Variables	
Polluted Scale	The question "*Are any of the following places within walking distance of your home?"* had a list of two choices: Industrial areas or factories, and Major roadways. Respondent were asked to check "yes" or "no" next to each category. Responses were recoded into dummy variables as follows: 0 = No 1 = Yes The question "*Can you see any of the following places from your home?*" had a list of two choices: Industrial areas or factories, and Major roadways. Respondent were asked to check "yes" or "no" next to each category. Responses were recoded into dummy variables as follows: 0 = No 1 = Yes The responses for these two survey items were then combined into an additive scale ranging from 0-4, and used as a continuous variable.
Length of Time in Residence	The question "*Approximately how long have you lived at your current address?*" was an open-end question.

	Length of time living at residence was recoded throughout, using years and fraction of year (i.e. 1.5). It was left as a continuous variable.
Health Variables	
Self-rated Health	Respondents were asked "*In general would you say your health is,*" Possible responses and their codes are as follows: 0 = Poor 1 = Fair 2 = Good 3 = Very good 4 = Excellent
Personal Diagnosed Health	Respondents were asked to "*Please check the box next to the condition(s) that you have been diagnosed with, or taken medication for, over the past year*." The following conditions were used for this variable: (1) lung disease; (2) heart attack or other heart trouble; (3) hypertension or high blood pressure; (4) cancer or a malignant tumor. The responses were combined to create an additive scale to represent the conditions that respondents reported experiencing, ranging from 0 to 4 based on the number of conditions. This score was then dichotomized as follows: 0 = No conditions 1 = 1-4 conditions
Family Diagnosed Health	Respondents were asked to indicate "*The condition(s) that anyone in your household has been diagnosed with, or taken medication for, over the past year."* The following conditions were used for this variable: (1) lung disease; (2) heart attack or other heart trouble; (3) hypertension or high blood pressure; (4) cancer or a malignant tumor. The responses were combined to create an additive scale to represent the conditions that respondents reported experiencing, ranging from 0 to 4 based on the number of conditions. This score was then dichotomized as follows: 0 = No conditions 1 = 1-4 conditions

Table 2. Descriptive Statistics

	Frequency (Percent)	Mean (std.)	Valid Percent
Perception of Risk (Scale) Dependent Measure (n=674)		11.53 (2.836)	
Sociodemographic Variables			
Gender (n=696)			
Male	300 (41.5%)		43.1%
Female	396 (54.8%)		56.9%
Race (n=702)			
White/Caucasian	564 (78.0%)		80.3%
Minorities	138 (19.1%)		19.7%
Education (n=689)			
High school degree or less	153 (21.2%)		22.2%
Some college, or associates degree	230 (31.8%)		33.4%
Bachelors degree or higher	306 (42.3%)		44.4%
Age (in years) (n=666)		55.14 (17.287)	
Location Variables			
Polluted Scale (n=652)		1.66 (1.110)	
Length of Residence (in years) (n=701)		16.73 (15.557)	
Health variables			
Self-rated Health (n=692)		2.47 (.887)	
Diagnosed Conditions, Self (n=723)			

No conditions	448 (62.1%)	62.0%
1-4 conditions	275 (38.1%)	38.0%
Diagnosed Conditions, Family (n=721)		
No conditions	498 (68.8%)	69.1%
1-4 conditions	223 (30.8%)	30.9%

Table 3. Pearson correlations between variables

	1	2	3	4	5	6	7	8	9	10	11	12
(1) Perception of Environmental Risk Scale, 0-16	1											
(2) Gender (female)	.118**	1										
(3) Race (minority)	.159**	.030	1									
(4) Age in years	.027	.017	-.035	1								
(5) Education: Less than HS or HS degree	.008	.013	.094*	.241**	1							
(6) Education: Some college or associates degree	-.054	.009	.038	.005	-.378**	1						
(7) Education: Bachelor's degree or higher	.045	-.020	-.115**	-.203**	-.478**	-.633**	1					
(8) Polluted Scale	.027	.046	.000	.029	-.008	.009	-.002	1				
(9) Length of Residence	.042	.002	.030	.050	.048	-.042	-.001	.065	1			
(10) Family Health Dummy: Having condition(s)	.051	.040	-.042	.317**	.106**	.099**	-.183**	.005	.011	1		
(11) Self-Health Dummy: Having condition(s)	.034	-.003	.045	.484**	.151**	.100**	-.221**	.058	.032	.391**	1	
(12) Self-Rated Health	-.057	-.007	-.169**	-.208**	-.263**	-.089*	.303**	-.011	-.051	-.194**	-.327**	1

* p < .05, ** p < .01.

Table 4. Unstandardized regression coefficients of perceived environmental risk on sociodemographic, location and health variables (N=577)

	Model 1	**Model 2**	**Model 3**
Variables	Coefficient (std. error)	Coefficient (std. error)	Coefficient (std. error)
Constant	10.395 (.525)	10.236 (.557)	10.371 (.677)
Female	.619** (.230)	.615** (.230)	.607** (.231)
Minority	1.167*** (.325)	1.204*** (.299)	1.204*** (.306)
Age	.006 (.007)	.005 (.007)	.003 (.008)
Education (ref=high school or less)			
Some college	-.028 (.325)	-.024 (.325)	-.035 (.328)
Bachelors or higher	.402 (.321)	.405 (.321)	.452 (.332)
Polluted scale		.042 (.104)	.043 (.104)
Length of residence		.007 (.007)	.007 (.007)
Self-rated health			-.040 (.147)
Family's health conditions			.283 (.271)
Personal health conditions			.002 (.291)
R^2	.043	.045	.051
Adjusted R^2	.035	.033	.030
** p<.01 *** p<.001			