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How Do Environmental Changes and Shared Cultural Experiences Impact the Health of Indigenous Peoples in South Louisiana?

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How Do Environmental Changes and Shared Cultural Experiences Impact the Health of
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by
Shanondora M. Billiot

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Washington University in St. Louis

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Dedicated to All My Relations of the air, water, and land.

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ABSTRACT OF THE DISSERTATION

How do Environmental Changes and Shared Cultural Experiences Impact Health of

Indigenous Peoples in South Louisiana?

by

Shanondora Billiot

Doctor of Philosophy in Social Work

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Professor Shanta Pandey, Chair

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Global environmental change is an ongoing and complex social problem that will continue to permeate all spheres of life on earth (Moran, 2010). Not all communities experience social and economic consequences of environmental change at the same level (Adger, 2006a; Cutter, Boruff, & Shirley, 2003; Gillespie, 2010; Nicholls et al., 2007; Vogel, Moser, Kasperson, & Dabelko, 2007). The variability of vulnerability, or potential for exposure or harm, stems from proximity to fragile ecosystems as well as social and economic differences across communities (Boruff, Emrich, & Cutter, 2005). Additionally, environmental changes are projected to have adverse impacts on marginalized populations through additional pressures on existing, struggling social systems. Indigenous coastal communities, given their attachment to and dependence on the land, are especially vulnerable to environmental changes (Ford, 2012). In addition, indigenous peoples worldwide have poorer health compared to their majority groups (Anderson et al., 2006; Castor et al., 2006; Gracey & King, 2009; King, Smith, & Gracey, 2009; Lama, 2012).

To date, there is limited academic literature on the impact of climate change on health outcomes, especially among indigenous peoples (Ford et al., 2014). Land is a viable resource to indigenous communities both culturally and for future generations. Therefore, it is imperative that we gain a better understanding of the impacts of environmental changes on indigenous communities through engaging with them in research.

This community-engaged study uses a concurrent mixed methods design that involves collecting quantitative and qualitative data simultaneously, analyzing both sets of data, and then merging those results with the purpose of comparing the results with each other (Creswell, 2015) using non-probability sampling strategies. A community advisory council was developed to guide culturally relevant research procedures.

Quantitative data was collected through an interviewer-administered survey (N=160) from United Houma Nation (UHN) members in Terrebonne Parish to test theoretical model to assess whether environmental changes relate to indigenous health outcomes after controlling for the moderating effects of indigenous-specific factors: connection to land, historical trauma, discrimination, social support, and ethnic identity. Qualitative data was collected through in-depth interviews (N=19) with a subset of survey participants on their shared cultural experiences of environmental changes to expand our understanding from the quantitative results. The aim of this study is to understand the health (physical, emotional, and mental) outcomes of environmental changes and shared cultural experiences among indigenous peoples in south Louisiana.

Three notable findings from this study will advance empirical knowledge of environmental change exposure among indigenous peoples: (1) The study builds on

previous qualitative knowledge that indigenous peoples exposed to environmental changes experience negative health consequences by quantifying their experience and showing direct relationships to health outcomes and indigenous-specific experiences. (2) There is an interconnected cyclical nature of the shared cultural experiences of exposure to environmental changes. These themes further refine the theoretical framework presented in this study. (3) Discrimination predicted poor mental health, reiterating the need to investigate contemporary trauma and makes a call to reclaim traditional knowledge and practices through developing community healing interventions.

The World Bank predicts that by 2050, environmental changes will be the global challenge (World-Bank, 2010). To social workers, this will mean that environmental changes will permeate every aspect of the client's social environment. The American Academy of Social Workers highlighted how the social work profession is well positioned to call attention to the negative effects of global environmental change with the Environmental Change Grand Challenge (Kemp & Palinkas, 2015). In fact, social workers are already involved in addressing environmental changes like natural and man-made disasters. For these reasons, I believe social work professionals will continue to carve out their role in addressing challenges of environmental change in what will be the global challenge of the century (Dominelli, 2012).

CHAPTER 1: INTRODUCTION

1.1   Statement of the Problem

Global environmental change is an ongoing and complex social problem that will continue to permeate all spheres of life on earth (Moran, 2010). Global environmental change is understood as the combined effect of changes on biodiversity, water, and ecosystems influenced by human activities that directly cause changes in the climate, or climate change (Moran, 2010; Paz, 2005). Exposure to the effects of global environmental change, such as coastal erosion, disasters, and oil spills, has adverse consequences on human health, food security, water supply, and physical infrastructure (Boruff, 2005; Nicholls et al., 2007; WHO, 2014).

Not all communities experience social and economic consequences of environmental change at the same level (Adger, 2006; Boruff, 2005; Cutter, Boruff, & Shirley, 2003; Gillespie, 2010; Nicholls et al., 2007; Vogel, Moser, Kasperson, & Dabelko, 2007). The variability of vulnerability, or potential for exposure or harm, stems from proximity to fragile ecosystems as well as social and economic differences across communities (Boruff, 2005). Additionally, environmental changes are projected to have adverse impacts on marginalized populations through additional pressures on struggling social systems. Indigenous coastal communities, given their attachment to and dependence on the land, are especially vulnerable to environmental changes (Ford, 2012).

Although indigenous peoples around the world contribute the least to changes in the environment, they are disproportionally affected by these changes due to at least three main reasons: (1) indigenous peoples' location to vulnerable ecosystems

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(exposure), (2) cultural and traditional lifestyles which are deeply reliant on natural resources for subsistence and practices (sensitivity), and (3) due to historical events, indigenous peoples as a group are disproportionately among the poorest of their societies and have the greatest health disparities (adaptive capacity) (Anderson et al., 2006; Anderson, Copeland, & Hayes, 2014; Castor et al., 2006; Gracey & King, 2009; King et al., 2009; Lama, 2012; McLean, 2010; Montenegro & Stephens, 2006; Smylie, Anderson, Ratima, Crengle, & Anderson, 2006; Stephens, Porter, Nettleton, & Willis, 2006). These changes are felt differently among indigenous peoples but consistently across the globe (Salick & Byg, 2007).

Indigenous peoples have long inhabited their lands, making their living from the natural resources of the area through fishing, hunting, and agricultural means (Colomeda, 1999). However, today Indigenous peoples worldwide have poorer health compared to their majority groups (Anderson et al., 2006; Castor et al., 2006; Gracey & King, 2009; King et al., 2009; Lama, 2012). For example, in Australia, mortality is five times greater for indigenous peoples than in the general population for ages 35 – 54; life expectancy is twenty years shorter for indigenous peoples (Anderson et al., 2006). In the United States, mortality for indigenous peoples compared to non-indigenous peoples is four times greater due to alcohol-related diseases and two times greater due to both diabetes and accidents (IHS, 2014). In Africa, consistent marginalization and denial of indigenous distinction have contributed to poorer health than their majority groups (Ohenjo et al., 2006).

The underlying causes of inequalities in health among Indigenous peoples are attributed to several reasons. First, historical events faced by indigenous peoples inform health inequalities today (Anderson et al., 2006; Gracey & King, 2009; King et al., 2009;

Stephens et al., 2006). For over two hundred years, indigenous peoples in diverse communities throughout Africa, Australia, North America, and South America have experienced loss of land through social and political processes of colonization. In many cases, this loss followed a similar pattern: armed European encroachment (Anderson, 2006; Berkhofer, 1978; Gracey & King, 2009; King et al., 2009; Wildcat, 2009) followed by European self-benefiting laws to "legally" take Indigenous Peoples' lands (Anderson, 2006; Berkhofer, 1978; Gracey & King, 2009; Wildcat, 2009) and man-made environmental manipulation such as the installation of dams and levees as well as mineral, oil and gas exploitation to accommodate urbanization (Dardar, 2008; Wildcat, 2009). Gracey and King (2009) assert that colonization of indigenous peoples removed their way of life, subjected them to live as outcasts of their societies and forced changes in lifestyle (through urbanization and removal efforts) that resulted in changes in their diets. Trauma from colonization, historical trauma, continues to contribute to the higher prevalence of infectious and non-communicable diseases associated with poverty, low education, housing conditions, and sedentary lifestyles (Gracey & King, 2009; Whitbeck, Hoyt, & Chen, 2004).

Second, displacement of indigenous peoples from their original environment disrupted access to clean water and fresh foods (Anderson et al., 2006; Gracey & King, 2009; King et al., 2009; Stephens et al., 2006). Removal from original lands disrupted, and in some cases, continues to disrupt, subsistence living and cultural interactions with the environment (Stephens et al., 2006). Currently, exploitation of indigenous lands for natural resources and waste landfills introduce exposure to hazardous and toxic chemicals (Gracey & King, 2009; Stephens et al., 2006). Moreover, global

environmental changes may further disconnect indigenous people from their relationship with the environment (Cunsolo Willox et al., 2012).

Third, health inequalities are attributed to the undervaluing of indigenous health practices (Montenegro & Stephens, 2006; Smylie et al., 2006). Majority populations impose foreign laws and social norms of healing ceremonies and medicinal practices on indigenous peoples. Indigenous peoples have holistic solutions to health that uses both traditional and allopathic medicine (Stephens et al., 2006). Holistic health is balancing physical, mental, emotional, and spiritual health in harmony with the community and environment (King, Smith, & Gracey, 2009). Balance is maintained through expressions of cultural identity like communicating in one's language and being connected to the environment. For example, non-indigenous medical practices are between the practitioner(s) and the individual. However, many indigenous peoples' notion of healing is a community process that involves returning balance through ceremonies, offerings, and traditional healers. In fact, research with indigenous peoples found social support to be inversely related to substance use (Oetzel, Duran, Jiang, & Lucero, 2007). King, Smith, and Gracey (2009) assert that imbalance among or disconnection from these spheres leads to illness or sickness.

This history of land loss and socio-political marginalization renders indigenous peoples vulnerable to the effects of environmental change as it threatens their livelihoods, and, therefore, their way of life. Global environmental change poses the latest threat for indigenous peoples' health and social and economic wellbeing (Wildcat, 2009). For instance, rising temperatures will mean widespread vector-borne illnesses (e.g. malaria), malnutrition, and diarrheal diseases (World-Bank, 2010). In the Intergovernmental Panel on Climate Change report, Portier et al. (2010) identified 11

categories of climate change impacts on human health: (1) asthma, (2) respiratory allergies and airway diseases, (3) cancer, (4) cardiovascular disease and stroke, (5) foodborne diseases and nutrition, (6) heat-related morbidity and mortality, (7) human developmental effects, (8) mental health and stress-related disorders, (9) neurological diseases and disorders, (10) vector borne and zoonotic diseases, (11) waterborne diseases, and weather-related morbidity and mortality (p. 7). Environmental change impacts on human health will be exacerbated among indigenous peoples due to existing health inequalities (Ford, 2012, Gracey & King, 2009).

To date, there is limited research literature on health impacts resulting from environmental change, especially among indigenous peoples in the United States (Ford, 2012). Studies with indigenous peoples in other countries report health outcomes such as water- and vector-borne diseases (Cunsolo Willox et al., 2012; Hofmeijer et al., 2013), malaria (Berrang-Ford et al., 2012; Doyle, Redsteer, & Eggers, 2013; Furgal & Seguin, 2006), stomach disorders (Berrang-Ford et al., 2012; Hofmeijer et al., 2013), malnutrition, respiratory diseases (Berrang-Ford et al., 2012) and cardiovascular diseases (Cunsolo Willox et al., 2012). Additionally, mental health outcomes such as negative feelings of place and maladaptive behaviors from environmental change increases family stress, enhanced drug and alcohol usage, and suicidal ideation (Cunsolo Willox et al., 2013).

Also, thus far, no study has been conducted to test if indigenous-specific factors (such as connection to land, historical trauma, discrimination, and social support) moderate the relationship between indigenous peoples' exposure to environmental change and their health outcomes. The aim of this study is to understand the relationship between environmental changes and indigenous health outcomes in

Louisiana after controlling for the moderating effects of indigenous-specific factors: historical trauma, discrimination, and social support.

Globally, about 22% of land surface is managed, used, or owned by the approximately 370 million indigenous peoples. This means approximately 6% of the world's population maintains about 80% of the world's biodiversity (McLean, 2010). Studying the effects of environmental changes on indigenous peoples is important not only for furthering indigenous scholarship, but for society at-large (McLean, 2010). Lessons learned from indigenous peoples can inform solutions applicable beyond those communities as well (McLean, 2010; Ford, 2012).

1.2   Purpose of Study

Coastal Louisiana experiences land loss at an average rate of 35 square miles per year (Tidewell, 2003). This is about the size of a football field every hour. In fact, since 1932 Louisiana has lost the land size equivalent to the state of Delaware. By 2050, it is expected that Louisiana will further lose land equivalent to the size of the combined Baltimore and Washington, DC metropolitan area. The land loss is attributed to environmental changes caused by dams, drilling, dredging and destruction (Galloway, Boesch, & Twilley, 2009; Lee & Blanchard, 2012; Moorehead & Brinson, 1995; Reed & Wilson, 2004; Templet & Meyer-Arendt, 1988). Indigenous coastal communities, given their attachment to and dependence on the land, are especially vulnerable to environmental changes (Ford, 2012). The most vulnerable parishes (counties) are where most indigenous peoples reside in Louisiana.

Within Louisiana, the United Houma Nation (UHN), with a population of approximately 17,000 people, resides in an area that is covered by about 90% water and

marshland. The tribe depends on the land and water for aquatic agriculture and livelihood. The permanent loss of land and aquatic agriculture will not only suspend their way of life, as the case with disasters, but will ultimately alter their place identity to the land and have impacts on wellbeing and mental health.

The aim of this study is to understand how environmental change exposure and indigenous-specific sensitivities impact the health (physical, emotional and mental) of indigenous peoples living in a physically vulnerable coastal area of the United States. Global environmental change, including disasters, climate change, and anthropogenic actions, affects human health (WHO, 2014). Additionally, environmental changes are projected to have adverse impacts on marginalized populations through additional pressures on struggling social welfare systems.

Historically, research on health outcomes among indigenous peoples has considered individual-level variables as explanations for health disparities (as innate vulnerabilities) and macro level factors that influence health outcomes (such as social and economic factors). Less is known, however, on environmental change factors that influence health outcomes. Historical trauma and racial discrimination has been considered in relation to substance abuse and negative health outcomes (Walters & Simoni, 2002). Connection to land has shown to have a relationship with negative feelings and perceived negative mental health outcomes (Cunsolo Willox et al., 2013). Additionally, social support and ethnic identity have been shown to have a relationship with health outcomes (Duran et al., 2004; Walters et al., 2010).

This study is unique because it is the first empirical research project in the United States exploring relationships between environmental changes, historical trauma and discrimination with health (physical and mental) outcomes. This study brings climate

change research previously conducted in Polar Regions to a nonpolar region with social

work research previously conducted with urban and U.S. reservation indigenous

peoples. Previous studies identify societal-level stressors that influence health outcomes,

however disruption to indigenous peoples' connection to land from environmental

changes has not been explored in the United States.

CHAPTER 2: LITERATURE REVIEW

Changes in the earth's environment are caused by human activities that in turn impact human physical and mental health (Moran, 2010; Ford, 2012). Anthropogenic causes are human population growth, material and resource consumption, energy and land use, and pollution (EPA, 2014; IPCC, 2014b; McLean, 2010; Moran, 2010; WHO, 2014). Global environmental changes impact the physical environment and human health (Moran, 2010). Scientific studies examining the impacts on environmental changes among indigenous peoples in the U.S. are limited. However, studies in other countries provide evidence of how indigenous peoples are disproportionately affected by the changes to their ecosystem because of existing social inequalities. The chapter will discuss theories used in the literature to understand environmental change impacts as well as review empirical studies with indigenous populations.

2.1 Environmental Changes

Global environmental change is defined as "changes in the physical and biogeochemical environment, either caused naturally or influenced by human activities such as deforestation, fossil fuel consumption, urbanization, land reclamation, agricultural intensification, freshwater extraction, fisheries over-exploitation and waste production" (GECAFS, 2014). The World Health Organization (WHO) adds to the definition by specifying these changes are large-scale impacts on human health (WHO, 2017). Global environmental change includes changes to long-term climatic cycles (climate change) as well as human activities that directly cause disturbances among ecosystems (Moran, 2010).

Global environmental change is understood as the combined effect of changes on biodiversity, water and ecosystems influenced by human activities to include changes in the climate, or climate change (Paz, 2005). For instance, the proposed Keystone pipeline, a 17,000-mile pipeline to run from Canada to Texas for large-scale tar sand oil extraction in North America, would not only disrupt water availability and changes in biodiversity but would also contribute to changes in the climate (NRDC, 2013). The pipeline will cross the largest water aquifer, the Ogallala Aquifer, remove plant and animal species essential to capturing dangerous greenhouse gases, and emit about 81% more greenhouse gases than oil extraction currently used (NRDC, 2013). The anthropogenic action of building the pipeline will substantially contribute to negative changes in the ecosystem along its path as well as to the climate.

Climate is "the average state of the lower atmosphere, and the associated characteristics of the underlying land or water, in a particular region, usually spanning at least several years" (WHO, 2014). Changes in the climate have occurred over millennia, yet scientists have shown that over the last century the global atmospheric composition has changed at a greater speed than in previous centuries (Gore, 2006; WHO, 2014). Differences between weather and climate are understood as the range of time measured. Weather is described as "the continuously changing condition of the atmosphere, usually considered on a time scale that extends from minutes to weeks" (WHO, 2014), whereas climate is described as "the average state of the lower atmosphere, and the associated characteristics of the underlying land or water, in a particular region, usually spanning at least several years" (WHO, 2014). Therefore, climate is the long-term average of weather patterns over time. In this study, I refer only to the climatic changes within the global environmental change field.

2.2   Physical and Mental Health of Indigenous Peoples

Per Horton (2006), "indigenous peoples are forced to confront many difficulties. Poor health is possibly the most intractable problem of all" (P. 1705). Absent global environmental change indigenous peoples worldwide have poorer health compared to their majority groups (Anderson et al., 2006; Castor et al., 2006; Gracey & King, 2009; King et al., 2009; Montenegro & Stephens, 2006; Smylie et al., 2006; Stephens et al., 2006). Studies in the Americans, Australia, and Africa highlight inequalities in health among indigenous peoples (Anderson et al., 2006; Castor et al., 2006; Ohenjo et al., 2006; Montenegro and Stephens, 2006).

In Africa, consistent marginalization and denial of indigenous distinction have contributed to poorer health than their majority groups (Ohenjo et al., 2006). The issues of most concern in African indigenous communities are water scarcity, agricultural practices, protecting human health from water and vector-borne illnesses, food security, land alienation, loss of biodiversity, and desertification (McLean, 2010). These strains are placing subsistence peoples (those who are nomadic, pastoral, hunters, and herders) at social and economic risks as well as changing cultural practices and roles among women and children as they migrate in search for labor-based income (McLean, 2010).

In a case study of Batwa Pygmies in Uganda, researchers found five climate-related outcomes such as malaria, dehydration, malnutrition, stomach disorders, and respiratory diseases (Berrang-Ford et al., 2012). Malaria was identified among all participants as stemming from greater density in mosquitoes due to warming temperatures (Berrang-Ford et al., 2012). Malnutrition was attributed to a decrease in subsistence crop yield that in turn contributed to consumption of lower nutritional

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foods because traditional foods were unavailable (Berrang-Ford et al., 2012). The warming temperatures placed strain on crops and homes because scarce filtered water led to lower crop yield and dehydration. Participants also reported higher rates of respiratory diseases due to the dry climate (Berrang-Ford et al., 2012). Researchers report on the adaptive capacity of Batwa as a function of the formal and informal institutions surrounding the health care system. However, the respondents reported relying on traditional knowledge systems of healing and the environment as mechanisms to adapt to the new reality of warming (Berrang-Ford et al., 2012). Similarly, in northern Kenya, pastoralist indigenous groups rely on religion as a mechanism for developing adaption to the changing environment (Watson & Hussein Kochore, 2012).

In a Chagaka Village, Malawi, researchers found participants perceived the warming temperatures and prolonged dry spells as contributing to the decrease in food production (Nkomwa et al., 2014). Participants believed the warming temperatures brought more pests which impacted crop yields (Nkomwa et al., 2014). Food security is most threatened in this region among indigenous peoples due to the dependence on subsistence agricultural practices (McLean, 2010). Many of the reported mitigation and adaptation strategies balance traditional knowledge with economic development opportunities; however, migration for employment continues to plague indigenous peoples in this region (McLean, 2010). Researchers found participants were changing the types and varieties of crops used that were more resistant to drought and pests (Nkomwa et al., 2014 Monjerezi, & Chipungu, 2014).

In South American, research with two indigenous communities in the Peruvian Amazon showed climate-related health risks of water and food insecurity (Hofmeijer et

al., 2013). Hofmeijer et al., (2013) found that limited access to treated water exposed participants to water-borne diseases such as cholera and leptospirosis (some bacteria in contaminated water), and observants reported higher rates of diarrheal diseases during flood season. In addition, warming temperatures have impacted crop yields where subsistence households were unable to obtain their needed stock of food supply (Hofmeijer et al., 2013). Adaptive capacity constraints identified were access to economic resources, institutional capacity, access to technology, and information deficit (Hofmeijer et al., 2013). Additionally, participants identified adaptation strategies like growing alternative (even if less preferred) crops which can tolerate the new weather patterns (Hofmeijer et al., 2013).

In the mountains of Bolivia, researchers used a household survey to identify climate-related threats to family well-being (Valdivia et al., 2010). They found very strong threats to family well-being through impacts of frost, floods and increase in pests (Valdivia et al., 2010). Researchers then used this information to work with community elders to develop early warning systems (Valdivia et al., 2010).

Studies in Canada and Alaska discuss changes in permafrost (Healey et al., 2011), snow and ice in terms of stability and duration (Cunsolo Willox et al., 2013; Doyle et al., 2013; Furgal & Seguin, 2006). In the Nunavik and Labrador communities in Canada, these changes were seen to have the potential to impact health through injury, accidents, psychosocial stress and heat (cold) related morbidity and mortality (Furgal & Sequin, 2006).

Indigenous peoples in these areas derive their cultural identity, subsistence and economic stability through their interaction with harsh Arctic conditions. For example, participants in Nunatsiavut report changes were negatively impacting their mental

health and well-being because they were losing their place-based solace (Cunsolo Willox et al., 2013). Increased family stress, intensifying existing mental health stressors, and increased potential for suicidal ideation were identified as climate-related health risks (Cunsolo Willox et al., 2013). Therefore, changes in place were believed to have resulted in health and mental health climate risks.

For some communities, access to water is dependent on the weather. In a small Alaskan community, Kivalina, many homes do not have running water and the public toilet, washeteria, and shower facilities gather water through shore ice. However, when the temperature is mild the shore ice is delayed (Brubaker, Berner, Chavan, & Warren, 2011). Research shows that homes with poor sanitation due to unavailability of water are more likely to have pneumonia and other respiratory diseases (Brubaker et al., 2011).

As the environment continues to change, many indigenous peoples are developing adaptation strategies that balance both traditional knowledge and scientific or technological advances, such as satellite tracking of reindeer (McLean, 2010). In the northwestern province of Nunavut, studies show adaptation strategies as originating from the participants. Healey et al. (2011) reports how participants used participatory research meetings as a call for environmental action at the individual level and to lessen the burden on environmental changes. In Nunavik, Martin et al. (2007) found that participants were changing their water drinking habits (i.e., their water source) and raising funds to purchase community filtering tanks to adapt to lack of available contaminant-free sources. In the James Bay region, participants are discussing how to change their hunting and subsistence harvest practices to gain access to traditional meats and berries (Tam, Gough, Edwards, & Tsuji, 2013). And in an Athabaskan village

in Alaska, participants developed a new seasonal calendar to reflect the current timing of subsistence practices due to changes in the environment (Wilson, 2014).

2.3   Indigenous-Specific Risk and Protective Factors That Affect Health

As discussed above, indigenous peoples experience horrific historic events and ongoing discrimination (Gracey & King, 2009; King et al., 2009; Wiechelt & Gryczynski, 2012). Many studies indicate that these stressors are associated with negative health outcomes and behaviors (Pearsall, 2009; Rollero & De Piccoli, 2010; Rynor, 2012; Watson & Hussein Kochore, 2012; Whitbeck et al., 2004). However, not all indigenous people experience historic events and ongoing discrimination as traumatic stressors, some may have greater protective factors known as cultural buffers (Walters & Simoni, 2002). Some cultural buffers are ethnic identity, social support, and practicing traditional activities like having a connection to land or the environment.

2.3.1 Historical trauma

Historical trauma is conceptualized as "the cumulative emotional and psychological wounding, over the lifespan and across generations, emanating from massive group trauma experiences." (Brave Heart, 2003, p. 7). Through consistent historic events, some theorize, that a disintegration of culture begins to occur and can lead to negative affective states with no means to buffer the negative that one (or a community) is left with self-destructive means to manage trauma–induced anxiety (Wiechelt & Gryczynski, 2012). Some critics of historical trauma raise three issues for empirical knowledge building: 1) it can be difficult to distinguish between micro-level versus macro-level impacts, 2) it is not clear how to track or measure the process of

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intergenerational transmission, and 3) how to examine past and present experiences (temporal shaping) (Wiechelt & Gryczynski, 2012).

2.3.2 Discrimination

Discrimination based on race is not a relic of previous eras, its ongoing and still prevalent in many communities today, especially against indigenous peoples. Previous studies found that nearly half of American Indian Alaska Natives (AIAN) adolescents living near reservations and college students experienced racial discrimination (Whitbeck, Hoyt, McMorris, Chen, & Stubben, 2001). Additionally, studies have found that discrimination can be associated with substance abuse, HIV risk behavior, PTSD, and chronic health outcomes (Davis, 2001; Dovidio et al., 2004; Johnson-Jennings, Belcourt, Town, Walls, & Walters, 2014; Walters & Simoni, 2002).

2.3.3 Social support

Research suggests that the presence of family and professional support reduced poor mental health, depression and prevents alcohol and drug abuse (Ang & Malhotra, 2016; Hanson & Jensen, 2015; Milner, Krnjacki, Butterworth, & LaMontagne, 2016; Oetzel et al., 2007). In addition, when indigenous people report social support they also report better perceptions of general health and adequate parenting skills (Momper & Jackson, 2007; Oetzel et al., 2007).

2.3.4 Ethnic identity

Research suggests that racial categorization and ethnic identification are different (Phinney & Ong, 2007). Ethnic identity was developed based on Erikson's identity formation psychological theories. Factors that influence ethnic identity experiences

among U.S. indigenous peoples are language, contextual differences in populations, and culture (Kvernmo & Heyerdahl, 2004; Schweigman, Soto, Wright, & Unger, 2011; Syed & Azmitia, 2008). Ethnic identity has been found to have relationships with wellness (Rayle & Myers, 2004), greater awareness and feeling upset by microaggression (Jones & Galliher, 2015), anxiety symptoms, depressive symptoms, externalizing behavior (Smokowski, Evans, Cotter, & Webber, 2014), eating disorder risk (Rhea & Thatcher, 2013), cultural practices (Donovan et al., 2015), and environmental concerns (Burn, Winter, Hori, & Silver, 2012).

2.3.5 Connection to land

Indigenous peoples' relationship with land is spiritual and cultural (Rosier, 2003). For some indigenous communities, a relationship with the environment is how culture is expressed and passed onto the next generation and becomes part of their indigenous identity (Colomeda, 1999; Wildcat, 2009). In a case study to understand indigenous peoples' relationship with the environment, researchers looked at place attachment to parks and protected areas of Nuu-chah-nulth (Nootkan) communities in British Columbia (McAvoy, McDonald, & Carlson, 2003). They found that participants (n=8) held "deep emotional, symbolic and spiritual meanings of places that used to be their traditional lands" (p. 100) and that these meanings have developed a strong sense of place. In a separate study with Labrador's Nunatsiavut population, Cunsolo Willox et al. (2012) found that all participants of the environmental distress survey (n=112) believed land to be important and most believed their identity was connected to the land (around 85%), where they found comfort and peace (about 95%) and a deep connection (about 95%) (Cunsolo Willox et al., 2012).

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Similarly, through semi-directed interviews in the James Bay Region (n=39), researchers found that participating in traditional activities meant interacting with the environment and these activities provided benefits to participants' mental and spiritual health (Tam et al., 2013). In other words, indigenous peoples developed the strongest meanings with emotions to the places where hunting, fishing and traditional gatherings occurred – so much so that they "identify so strongly with natural resources around them that if they cannot live on their own terms with the natural resources they historically used, then they cannot live fully" (McAvoy et al., 2003, p. 101). These indigenous communities expressed a strong relationship with their environment, or place, because they held cultural meanings through their traditional practices (Cunsolo Willox et al., 2012; McAvoy et al., 2003; Tam et al., 2013).

CHAPTER 3: THEORETICAL FRAMEWORKS

3.1   Environmental Change Theoretical Frameworks

Literature on theory and research describing global environmental change often mentions resilience, vulnerability, and adaptation when describing human-environment interactions. However, what is rarely mentioned in this body of work is how these frameworks might inform each other. Different disciplines using resilience, vulnerability, and adaptation in environmental change research invoke or infer different meanings, while using the same underlying notions (Birkmann, 2013b). Therefore, this section will review resilience, vulnerability, and adaptation definitions and concepts, as well as how they may relate to understanding environmental change within indigenous communities.

3.1.1 Resilience

Resilience is defined by the United Nations as the "ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" (UN/ISDR, 2007). Key concepts are drivers of change, adaptive capacity, and transformation. Drivers of change are the social, economic, institutional, infrastructure, community, and environmental factors which influence an individual or community's sensitivity to climate change exposure (Cutter, 2012). Adaptive capacity is the ability to progress (or grow) in the presence of external threats or changes and increases the system's capability to adapt (Adger, Brown, & Waters, 2011; Adger, Hughes, Folke, Carpenter, & Rockstrom, 2005;

Stucki, 2011). In some cases, returning to the previous pre-shock state may not be possible, transformation is the new state (Birkmann, 2013a). Transformation is understood as a mechanism for persistence in the presence of exposure to environmental stressors (Kirmayer, Dandeneau, Marshall, Phillips, & Williamson, 2011). Outside of environmental research, psychologists expanded resilience theory from a macro level to include individual level functioning in acute and chronic settings (Zakour & Gillespie, 2010). Social work uses a resilience framework to describe the strengths perspective of risk and protective factors as well as the empowerment approach (indigenous or structuralist approach) to use local knowledge for building and coping with adversities (Zakour & Gillespie, 2010). Both approaches are reflected in indigenous environmental change literature using resilience theory.

3.1.2 Vulnerability

Vulnerability is defined as, "the physical, economic, political or social susceptibility or predisposition of a community to damage in the case of a destabilizing phenomenon of natural or anthropogenic origin" (Cardona, 2006, p. 37). The variability of vulnerability stems from proximity to fragile ecosystems as well as the social and economic differences across communities (Boruff et al., 2005). The scientific community's understanding or conceptualization of vulnerability has changed over the last century from a hazards-only approach, to a human-centered focus, to the integration of human and environmental interactions (Birkmann, 2013a). The social work field focuses on the power differentials of an individual's, community's, or country's ability to address inequalities (Gillespie, 2010; Milner et al., 2016). Additionally, vulnerability has been subsequently integrated into public health, via

epidemiological work studying environmental impacts on human health (McMichael, 2001). Vulnerability is now commonly understood as a multidimensional concept that includes physical, social, economic, environmental and institutional factors that creates potential for exposure or harm (Birkmann, 2013a).

3.1.3 Adaptation

Adaptation is defined as "[t]he process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects" (IPCC, 2014a, p. 118). Adaptation is warranted when environmental changes have the potential to significantly harm society (Yohe & Tol, 2002). International frameworks as well as national, state, regional, and tribal policies guide adaptation strategies. To understand the range and limits of one's ability to adapt, system adaptive capacity is analyzed. Adaptive capacity is "the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments in both behavior and in resources and technologies" (Adger et al., 2007, p. 17.13.11). The level of adaptive capacity informs the resilience of a system exposed to changes in the environment.

Resilience related to vulnerability. The literature shows dual perspectives on how resilience is related to vulnerability. One perspective is that vulnerability comes from a loss of resilience and is a continuum from vulnerability to resilience (Dominelli, 2012; Holling, 1973). However, other researchers disagree and assert that placing vulnerability and resilience on a continuum ignores the nuanced complexity of both constructs (Miller et al., 2010). For example, one unit (at any level) could have

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vulnerabilities to environmental change yet have higher adaptive capacity and cultural buffers that enable successful adaptation or transformation, thus demonstrate resilience. Therefore, the relationship between resilience and vulnerability is still under debate and exploration among scientists (Miller et al., 2010).

Miller et al. (2010) explain that the lack of clarity between these concepts is because they developed on parallel tracks. Another reason for the separation is that vulnerability is empirically tested at the actor level and resilience has more exploration at the socio-ecological/systems level. Similarly, resilience and vulnerability differ on spatial and time scales of analysis (Miller et al., 2010). However, the latent constructs of adaptive capacity and drivers of change provide a complementary avenue for vulnerability and resilience. This gives scientists like Miller hope that further studies will work towards a convergence. One possible way to see this relationship is looking at resilience at an individual or community level. For example, impacts of environmental changes vary on levels of vulnerability among indigenous peoples. Their ability to adapt to change (resilience) while maintaining their basic structure or functions is dependent on their adaptive capacity and cultural buffers.

Relevance to Indigenous communities in the United States. A strict interpretation of vulnerability without considering resilience factors of cultural buffers and adaptive capacity would conclude that indigenous peoples' survival is significantly threatened by global environmental changes and must be void of resilience. However, Rotarangi and Russell (2009) argue that maintenance of indigenous identity and culture today is evidence of resilience among indigenous peoples. Practitioners and researchers are encouraged to promote indigenous communities' traditional environmental methods and tools when developing adaptation strategies. This allows for indigenous

communities to continue to build resilience and avoid further subjugation of "vulnerable" labels using pan-Indian research and practice approaches of the past (Rotarangi & Russell, 2009).

Adaptation related to resilience and vulnerability. Adaptation is the set of policy and programs designed to reduce vulnerability and increase adaptive capacity to global environmental changes. Adaptation is used as a framework in environmental change research in relation to vulnerability and resilience (Birkmann, 2011). Where environmental change is the perturbation disrupting the system, vulnerability is a source of negative feedback, and if successfully able to adapt to these disturbances, then the system demonstrates resilience at that time to that disturbance (Birkmann, 2011). Power dynamics of macro level social, political, and economic processes influence coping abilities through access to resources and shape individual and community adaptive capacity (Smit & Wandel, 2006). Wisner, Blaikie, Cannon, and Davis (2003) argue that these macro processes create conditions that enable or prohibit access to financial and informational opportunities necessary to successful adaptation. Thus, impact felt to environmental changes is dependent on conditions developed at the macro level (Wisner et al., 2003). In this sense, adaptive capacity is the level of vulnerability to environmental changes and adaptation activities focus on areas with low adaptive capacity (Smit & Wandel, 2006). Determinants of adaptive capacity (Johnston et al., 2011; Moser & Ekstrom, 2010; Smit & Wandel, 2006) include available technological options for adaptation; availability of financial resources; institutional design; human and social capital; access to risk-spreading tools, processes, and mechanisms; information availability and access; and awareness and understanding.

3.2   Dissertation Conceptual Framework

To understand how environmental changes impact indigenous peoples' health at the mezzo or micro level, I utilized concepts of vulnerability and resilience with the "indigenist stress-coping model" developed by Walters and Simoni (2002) and the climate change and mental health framework developed by Berry, Hogan, Owen, Rickwood, and Fragar (2011). Walters and Simoni (2002) posit cultural buffers of ethnic identity and social support at the individual level can moderate the relationship between stressors of indigenous life events, such as discrimination, historical trauma, and health outcomes. Berry, Hogan, Owen, Rickwood, and Fragar (2011) argue that environmental changes are within the local cultural, economic, social context and impact individual and community health. Figure 3.1 demonstrates how vulnerability, resilience and health outcomes are in the context of local culture, economic, social, developmental and environmental human and earth systems (Berry, Hogan, Owen, Rickwood, & Fragar, 2011). Vulnerability is the proximity to exposure of environmental changes and sensitivity is the range of impact of exposure (Frazier, Thompson, & Dezzani, 2014) determined by stressful events such as connection to land, historical trauma, discrimination, and traumatic life events (Walters & Simoni, 2002). Sensitivity can directly impact health outcomes or can be mediated or moderated through adaptive capacity (Frazier et al., 2014). Adaptive capacity can be assessed through level of human and social capital as well as information availability (Johnston et al., 2011; Moser & Ekstrom, 2010; Smit & Wandel, 2006). Similarly, exposure can directly impact maladaptation (poor health and increased substance use) or can be mediated or moderated through drivers of change (Frazier et al., 2014). Resilience is the presence or

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absence of adaptive capacity and drivers of change such as cultural buffers and
institutions and their influence on adaptation or transformation (Adger et al., 2011;
Frazier et al., 2014).
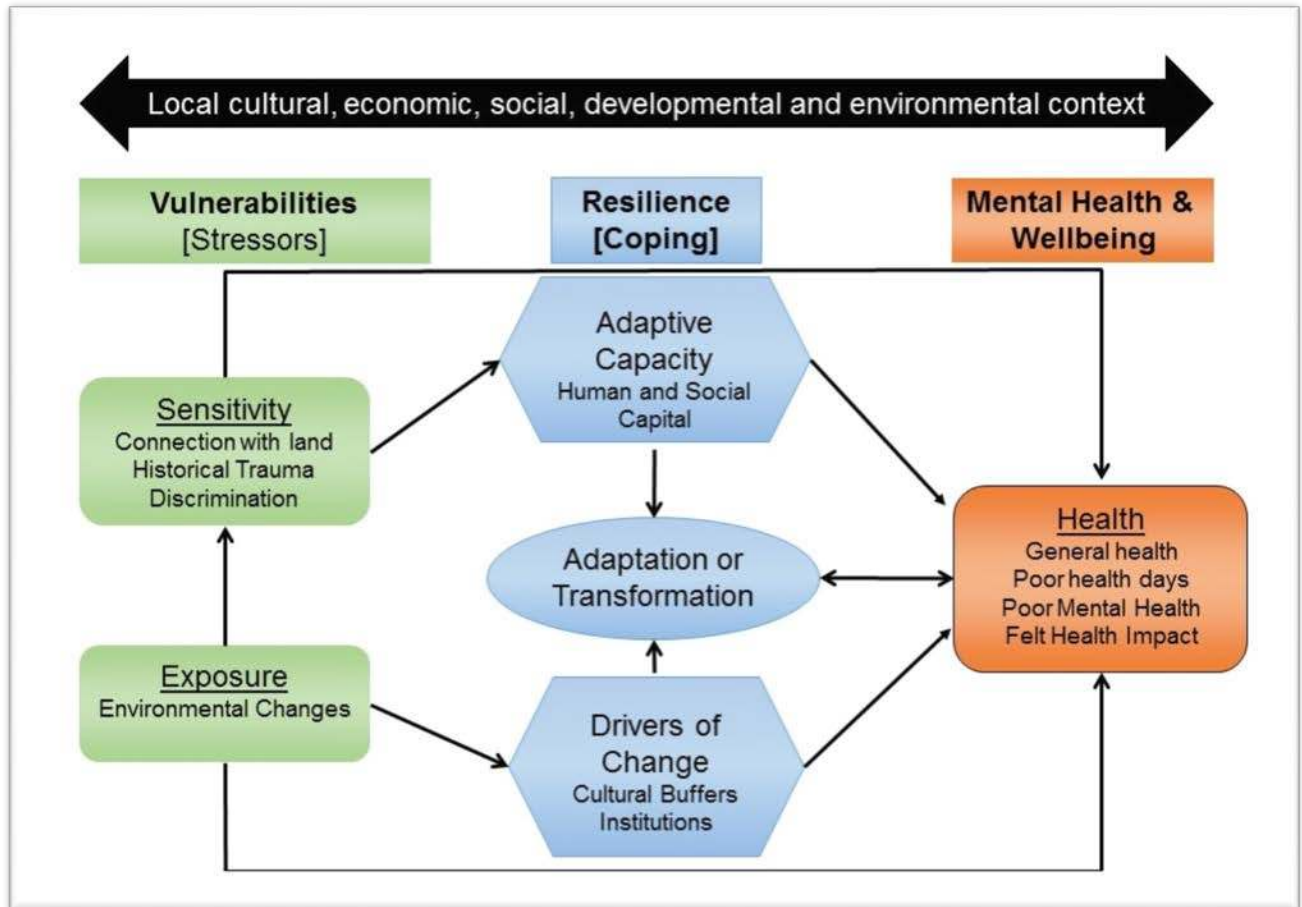
Figure 3.1: Indigenous Vulnerability, Resilience, and Health Outcome Theoretical Framework

The framework provides a big picture of the interaction between environmental
concepts, social work theories and public health frameworks to understand how
environmental change exposure and indigenous- specific factors impacts the health of
indigenous peoples. However, I will be studying only a portion of the framework.

3.3   Research Questions

This study utilizes some aspects of the conceptual framework to answer the following research questions:

1.   What is the prevalence and level of environmental change exposure and health conditions of indigenous populations of UHN sample participants?

2.   Is there a relationship between self-reported exposure to environmental change and health outcomes among indigenous peoples?

3.   Do indigenous-specific factors (such as connection to land, historical trauma, discrimination, social support, and ethnic identity) alter the relationship between self-reported exposure to environmental change and health outcomes among indigenous peoples? In other words, do indigenous specific cultural buffers moderate vulnerability to environmental changes and health outcomes?

4.   How do shared cultural experiences among UHN members influence perceptions of environmental changes?

5.   To what extent do the ethnographic interviews confirm the survey data results? Figure 3.2 outlines the specific hypotheses to be tested in this study.
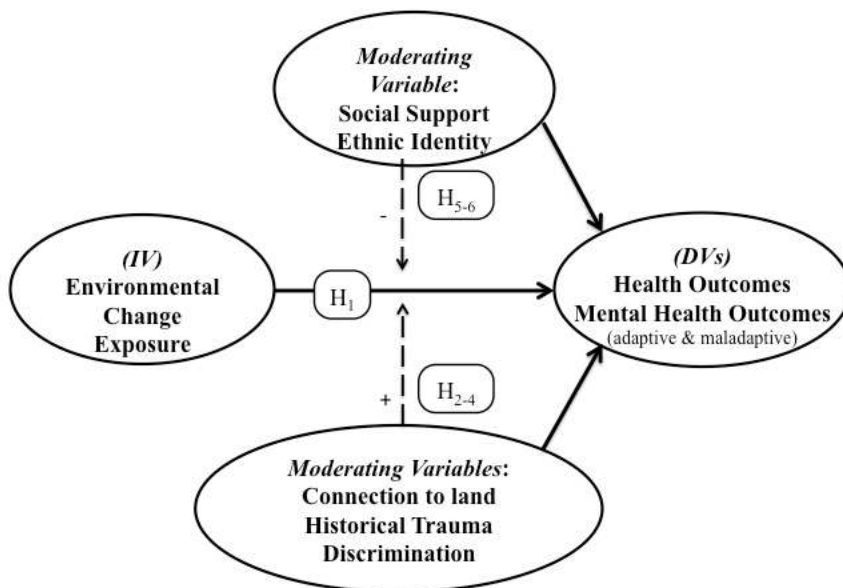
Figure 3.2: Proposed Dissertation Study Hypothesis

H1.   Exposure to disruptive environmental change adversely impacts health (physical and mental) outcomes.

H2.   Indigenous peoples with stronger connection to the land will experience better health outcomes (mental and physical) due to disruptive environmental change than indigenous peoples with weaker connection to land.

H3.   Indigenous peoples with lower perception of historical trauma will experience better health outcomes (mental and physical) due to disruptive environmental change than indigenous peoples with higher perception of historical trauma.

H4.   Indigenous peoples with more experience of discrimination will experience worse health outcomes (mental and physical) due to disruptive environmental change than indigenous peoples with less experience of discrimination.

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H5.   Indigenous peoples with more social support will experience less negative health outcomes (physical and mental) due to disruptive environmental change compared to indigenous peoples with less social support.

H6.   Indigenous peoples with greater ethnic identity will experience less negative health outcomes (physical and mental) due to disruptive environmental change compared to indigenous peoples with less ethnic identity.

CHAPTER 4: METHODOLOGY

4.1   Research Design

The aim of this study was to understand health (physical, emotional, and mental) outcomes of environmental changes among an indigenous community in south Louisiana. A concurrent mixed-methods design was used, involving simultaneous quantitative and qualitative data collection, analysis of both data sets, and merger of both results with the purpose of comparison (Creswell, 2015) using non-probability sampling strategies. Quantitative data was collected through an interviewer-administered survey (N=160) from United Houma Nation members in Terrebonne Parish to test my theoretical model to assess whether environmental changes relate to indigenous health outcomes after controlling for the moderating effects of indigenous-specific factors: historical trauma, discrimination, social support, and ethnic identity. Qualitative data was collected through interviews (N=19) regarding cultural experiences of environmental changes to develop a more complete understanding of how those changes may impact health outcomes from the quantitative results with a subset of survey participants (Creswell, 2015).

A mixed-methods design choice is more conducive to answering the dissertation research question than a single-approach design because it can render stronger inferences and draw on the complementary strengths of each approach (Teddlie & Tashakkori, 2003). The concurrent triangulation mixed-methods design is typically most utilized in social and behavioral research because it "uses two different methods in an attempt to confirm, cross-validate, or corroborate findings within a single study"

(Creswell, Plano Clark, Gutmann, & Hanson, 2003). The design utilizes the strengths of each method to offset the limitations of a single method (Creswell et al., 2003).

A mixed-methods approach depends on four criteria: implementation, priority, stage of integration, and theoretical perspective (Creswell et al., 2003). Implementation refers to the sequence of data collection, concurrent or sequential. A sequential data collection refers to one method collected followed by the second method (i.e., qualitative followed by quantitative or vice versa). A concurrent sequence is where both methods (quantitative and qualitative) are collected at the same time. *Priority* refers to the weight given to quantitative and qualitative research in the study's design. Priority can be unequal or equal weighting. Unequal weighting gives priority to quantitative over qualitative or vice versa. Equal weighting gives priority to both quantitative and qualitative aspects of the research. Research designs with equal weighting should be incorporated into all phases of the research process.

Another important decision in mixed-methods research design is the *stage of integration*, or the point at which one integrates the quantitative and qualitative data collection. Integration can occur at the data collection, data analysis, data interpretation, or some combination. The stage where integration takes place depends on the purpose of the research and the decisions of implementation and priority (Creswell et al., 2003). For example, a sequential design would not be able to integrate data at the data collection phase because one after the other. Finally, *theoretical perspective* refers to the lens that guides the quantitative and qualitative inquiry. Mixed-methods design may be implicit, indirectly based on a theoretical framework, or it may be explicit, firmly based on a theoretical framework.

As seen in figure 4.1 below, this dissertation research collected quantitative and qualitative data (within the same data collection phase) concurrently and the data was integrated at the data analysis stage of the project. Equal priority is provided to both quantitative and qualitative forms of inquiry. Data collection is implicitly based on the theoretical framework provided in Chapter Three.
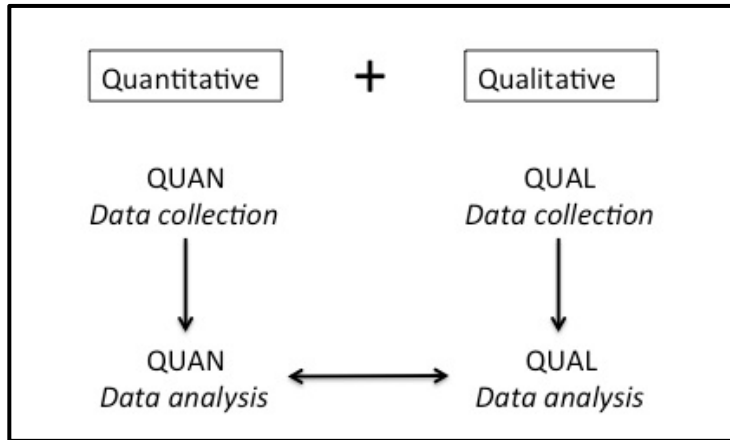
Figure 4.1: Concurrent Triangulation Mixed Methods Design (Creswell et al., 2003)

4.2   Sample Selection and Recruitment

This subsection will discuss the study setting, participant sample, and participant recruitment methods.

4.2.1 Study setting

The United Houma Nation (UHN) is a state-recognized tribe of approximately 17,000 tribal members residing within a six-parish (county) service area encompassing 4,570 square miles. At contact, UHN ancestors were located on the most fertile grounds in all the Louisiana Territory and were subsequently moved through colonial land laws of French, Spanish and then the US to our present-day location along the gulf coast. Settling on the bayous off the Mississippi, many Houma thrived on and built

relationships with the land and water. Tribal members continue to face threats of disasters, as in the 2005 duo of hurricanes Katrina and Rita, as well as anthropogenic disasters such as the BP oil spill in 2010, and remnants of institutional discrimination. For example, Jim Crow laws prohibited UHN members in Terrebonne Parish from attending public schools. UHN children attended missionary schools, termed "Indian" schools, up to the seventh grade until staged integration occurred from 1963-1968 (Ng-A-Fook, 2007). Those in seventh grade could attend public schools in 1963, followed by eighth grade in 1964 and so on until UHN members could graduate public high schools in 1968. Thus, the Tribe today is presented with the unique challenges of preserving and maintaining culture and their way of life when the land is disappearing, literally from underneath their feet.

4.2.2 Participant sample

A combination of sampling techniques was employed, which reflects the different levels of analysis generated by this study. The sampling frame consists of enrolled UHN members living in the Terrebonne Parish district. The study population consisted of a sample that participated in the survey and a sub-sample who participated in survey and in-depth interviews, both drawn from the same sampling frame. For the interviewer-administered survey, a combination of convenience and purposive techniques were used to reach the desired N (N= 160). Initial sampling techniques included convenience, snowball and purposive strategies such as criterion. These techniques are suggested for hidden and isolated populations (Padgett, 2008) and considered acceptable when obtaining a random sample is impractical (Miller & Salkind, 2002). Although there is more than one option to determine sample size, VanVoorhis and Morgan (2007) suggest

selecting sample sizes large enough to detect difference by the statistical procedure the study intents to conduct. The most comprehensive formula for selecting sample sizes when examining relationships is offered by Green (1991): $N > 50 + 8m$ (m is the number of independent variables). (4.1)

Therefore, a sample size of this magnitude should be sufficient to include a minimum of five variables in each linear model (Van Voorhis & Morgan, 2007).

Eligibility criteria for the interviewer-administered survey included: (1) enrolled member of United Houma Nation living in Terrebonne, (2) thirty years (30) of age or older, and (3) at least one member in their household depends on subsistence for income. Exclusion criteria included persons who are not enrolled members of UHN, younger than 30 years and do not depend on subsistence for income. This sampling frame excluded UHN members living outside the service area, UHN members living in the other five parishes, and any indigenous people living in Terrebonne Parish area but not UHN members.

The study initially proposed a 40 years of age limit. However, in consultation with the community advisory committee and the dissertation chair the age was lowered to 30 years of age. The primary reason was that many UHN members shared that there are fewer active fisherman as age increases. The age was lowered after the Washington University in St. Louis (WUSTL) institutional review board approved the amendment.

Participants in the survey who have a strong UHN ethnic identity and earn most of their income on subsistence activities were invited to participate in a follow-up in-depth qualitative interview (N=19). Inclusion criteria for the in-depth interviews were (1) participants who have completed the interviewer-administered survey (thus meeting

previous inclusion criteria, (2) have a strong UHN ethnic identity, and (3) earn most their income on subsistence activities.

A power analysis was not conducted. This decision was made for two reasons, (1) an a priori power analysis could not be conducted using the correlation between the independent and dependent variables because of the dearth of empirical evidence on prevalence of environmental change exposure and health outcomes and (2) time and financial resources preclude the student researcher from utilizing random sampling techniques. This study uses convenience-sampling techniques. The laws of the Theory of Normal Distribution do not apply in this study and the generalization is limited to the individuals interviewed.

4.2.3 Participant recruitment

Initial recruitment began with tribal leadership and the community advisory committee. I obtained a list of 45 names who were perceived to meet the study inclusion criteria. I attempted to contact these individuals via phone or email (if applicable). I asked each person with whom I had contact from the list for additional referrals who may also fit the inclusion criteria. Additionally, I was given names of potential candidates as people began taking the survey, their spouses, and from tribal council members. These snowball and criterion (a form of purposive) sampling techniques are suggested for hidden and isolated populations (Padgett, 2008).   With permission from the UHN tribe, referred tribal members were contacted via phone or email with an introduction to the study, informed consent information, and invitation to participate in the survey. Interview participants were recruited through several different ways: 1) flyers posted at the two UHN offices in Terrebonne Parish, marinas and local shopping

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centers; 2) referrals from UHN agencies in the area; and 3) participant referral. The researcher spent a great deal of time at the Isle de Jean Charles marina and other common gathering places to approach prospective participants.

Attempts were made to recruit equal proportion of male and female based on the census population distribution of gender. Previous research with Houma documents subsistence and culturally-based activities with the environment between male and females. For example, some women join their spouse in trawling or other fishery activities while others work in shrimp factories or as agriculture (cotton or cane) day laborers (Ng-A-Fook, 2007). Comparing experiences among and between genders helped the researcher get a more detailed understanding of exposure to environmental changes. Table 4.1 outlines targeted participation.

Table 4-1: Targeted Population by Parish and Gender

	Population U.S. census 2010, Terrebonne Parish	UHN living in Terrebonne Parish	UHN 40+ Terrebonne Population	Terrebonne's targeted sample population
Male	55,568	3803	1150	79
Female	56,292	3946	1185	81
TOTAL	111860	7749	2335	160

The contact phone number is a local number for the participants; no costs were required for the participants to make the phone call. Interviews were arranged via the participants' preferred method of contact (phone, email, text, mail), and were conducted in person. At the time of scheduling the interviewer-administered survey, I asked if the participant wished to conduct the interview in English or Houma French. No participant accepted my offer for a translator and all interviews were conducted in English. Informed consent was discussed with each participant during arrangements for the interview. Signatures were not necessary for the consent form; however, Washington

University requires that each participant complete a form to state they received a gift card. It was not culturally appropriate to ask for their social security number, and most participants did not want to include their address on the forms. Many gift card forms had only a date and my signature stating that they received the gift card.

4.3   Data Collection

This study began after securing the IRB approval from Washington University's Human Subjects Committee and UHN Community Advisory Committee (see Appendix A) in October 2015. The student researcher collected all data.

4.3.1 Data collection protocol

Interviews were held at location choice of participant. Choices included either the UHN office closest to the participant, a community center on their bayou, or UHN gathering location of their choice. Some participants preferred for me to interview them in their home. I also completed interviews while sitting on a wharf near a bayou. At the scheduled interview, I read the consent form approved by WUSTL IRB and UHN Community Advisory Committee that outlines the extent of their participation, the possible risks, safeguards to protect their confidentiality, alternatives to participation, and contact information for IRB staff at WUSTL. I read each section and asked if they had any questions. I did not receive any questions on the IRB. The interview began after I read the consent form.

At the start of the interview, the participants were reminded that they may feel free to skip any questions (no-response) or discontinue the survey or in-depth interview at any time without any repercussion. No surveys were discontinued. The interviewer-

administered survey lasted about one hour while the in-depth interview ranged from 30 minutes 2 hours depending on the participant.

4.3.2 Quantitative data collection

In this study, I utilized standardized instruments that have been previously used with indigenous populations. I gathered feedback and approval on the survey instrument and qualitative interview protocol from the community advisory committee to ensure these items were culturally appropriate and met content validity guidelines. The constructs assessed and the instruments used are presented in table 4.2. The measures assess socio-demographic characteristics of participants; environmental change exposure; sensitivity to environmental changes; cultural buffers; health issues (e.g., anxiety, depression); and aspects of alcohol and drug use patterns. Information collected from these measures provided a detailed picture of indigenous peoples' vulnerability to environmental change and health outcomes.

As of 2010, more than 60% of indigenous peoples living in Terrebonne Parish 65 years and older have less than a 9th grade education (Bureau, 2010). It is possible that some were not be able to read the questionnaire. To account for lower literacy level, interview-administer surveys were conducted face-to-face. I read each question aloud to each participant in their chosen meeting location to follow survey research method guidelines on working with populations having lower educational attainment (Fowler, 2009). In some instances, the participant asked to read the survey and in other instances the participant preferred to enter their answer on the keyboard. If they expressed these preferences prior to the start of the interview, I made sure to code the

survey based on those three scenarios. The interviewer-administered survey measures include the following constructs:

Environmental change exposure refers to the proximity of environmental changes (Yohe & Tol, 2002). Self-reports of experiences to environmental changes are good measures of exposure (Cunsolo Willox et al., 2012). One measure used with indigenous peoples is the environmental distress scale (EDS). Participants who lived in high environmental disturbance areas experienced greater exposure to loss of flora and fauna, pollutants, and other environmental changes (Higginbotham, Connor, Albrecht, Freeman, & Agho, 2007). In this study, environmental change exposure is measured by three sections of the environmental distress scale: (1) Frequency of 10 hazard events (e.g., foul smelling air, noise, heavy vehicle movement, pollution; rated never–very frequently); (2) Observation of nine hazards (e.g., heritage destruction, soil erosion, loss of native fisheries; never – very frequently); and (3) Threat to self/family of 18 hazards (none–very frequently). Psychometric analyses found the EDS subscales were highly intercorrelated (r = 0.36–0.83), and they demonstrated both strong internal consistency reliability (Cronbach's alpha = 0.79– 0.96) and test-retest reliability (ICC = 0.67–0.73). Greater total scores mean greater environmental change exposure.

Sensitivity refers to the "degree to which a system is affected by or responsive to climate stimuli" (IPCC, 2010, p. Glossary). Social and economic indicators are used in county or country level analysis. However, these indicators aggregated ignore variations among marginalized or non-majority populations (Birkmann, 2013a). As such, in this study I utilize indigenous specific indicators of risk factors such as historical trauma, discrimination and connection with land as well as protective factors of social support and ethnic identity.

Historical trauma. The 12-item Historical Loss Scale measures how often American Indians think about historical events and traumas related to the colonial experience on a Likert scale 1 (never) to 5 (daily). Greater scores indicate more frequency of thoughts related to historical trauma. Previous studies show the Historical Loss Scale to have a Cronbach's alpha coefficient of .92 (Whitbeck et al., 2004).

Discrimination. The Everyday Discrimination Scale is a 9-item scale that measures day-to-day discrimination 1 (never) to 7 (daily). Greater scores indicate a greater frequency in discriminations. It has a Cronbach's alpha of .77 (Sternthal, Slopen, & Williams, 2011).

Connection to land. In this study, connection to land is measured with a subscale of the EDS, Feelings about Living in the Coastal Louisiana Area (10-items) from (1) disagree very strongly to (7) agree very strongly (Higginbotham et al., 2007).

Cultural buffers. In this study, cultural buffers are measured by social support and ethnic identity utilizing the Social Support and Social Undermining scale and Ethnic Identity scale. The SSSU has two latent constructs for social support, emotional support (6-items) and instrumental social support (5-items) indicators (Oetzel et al., 2007). A confirmatory factor analysis supports four distinct latent constructs, X^2 (164) = 292.29, p<.001, IFI = .91, CFI = .91, RMR = .02 with Cronbach's alphas ranging from .72-.88.

The Multigroup Ethnic Identity Measure – Revised (MEIM-R) is a cross-cultural measure of ethnic identity (Yap et al., 2014). The MEIM-R has two latent constructs for exploration (3-items) and commitment (3-items) indicators (Phinney & Ong, 2007). The two-factor model has been suggested in several confirmatory factor analyses (Blozis & Villarreal, 2014; Ong, Fuller-Rowell, & Phinney, 2010; Phinney & Ong, 2007; Yap et al.,

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2014). Phinney & Ong (2007) found a correlated two-factor model fit of X^2 1.91, p <.001, AGFI = .96, CFI =.98, RMSEA =.04 with good reliability Cronbach's alpha of .81.

Health outcomes. This study considers the physical and mental health of participants in this study. Physical health outcomes are measured with two scales, one for self-reported health, the Health-Related Quality of Life (HRQOL), and the second to understand how participants believe their health is impacted by environmental changes. The HRQOL was developed by the Centers for Disease Control and Prevention (CDC, 2000). This study uses the Healthy Days Core Module (4 items) and the Activity Limitations Module (5 items). The EDS subscale measures the perceived impact of environmental change regarding physical symptoms, emotional and psychological symptoms, social and community dysfunction, and economic loss (21 Likert items, e.g., "I am worried about risks to human health from nearby environmental pollution"; "Environmental changes are decreasing the value of my home"; agree–disagree) (Higginbotham et al., 2007).

The diagnostic instrument, Mini-International Neuropsychiatric Interview (M.I.N.I.), measures mental health outcomes. Considered the "gold standard" by the National Institute for Mental Health, this short diagnostic interview is designed for studies assessing mental health (Lecrubier et al., 1997). The M.I.N.I is a short-structured clinical interview, taking about 15 minutes to complete, that provides diagnoses of psychiatric disorders per DSM-IV or ICD-10 diagnostic systems. It was designed for epidemiological studies and multicenter clinical trials and has been used in other projects conducted by indigenous researchers. This study uses the modules for major depression, general anxiety, and post-traumatic stress disorder.

Socio-demographic background information. The instrument also collects some basic demographic information, such as age, gender, first language, ethnicity, race, where they were raised (i.e. which bayou or parish), their current zip code, where they call home (i.e. which bayou or parish), household income, source(s) of income, participant and their parent's educational attainment, "Indian" school experience, relationship/marital status, number of children, number in the household, and veteran status (non-combat veteran, combat veteran, non-veteran), and cash flow assets.

Table 4-2: Interviewer-Administered Survey Measurements

Variable Type	Construct	Measures
Demographic and Educational Variables		
Independent Variables – Control	General demographic and background variables	Age, gender, first language, ethnicity, race, where they were raised (i.e. which bayou or parish), their current zip code, household income, participant's educational attainment, boarding school experience, relationship/marital status, and number in the household.
Environmental Change Exposure		
Independent Variables	Proximity to exposure	(1) Frequency of 10 hazard events (e.g., dust, noise, heavy vehicle movement, pollution; rated never–daily); (2) Observation of 9 hazards (e.g., heritage destruction, soil erosion, train vibration; yes—no); (3) Threat to self/family of 18 hazards (none–extreme) (Higginbotham, 2007)
Sensitivity		
Independent Variables	Historical trauma	The Historical Loss Scale (Whitbeck et al., 2004) Cronbach's alpha coefficient of .92.
Independent Variables	Discrimination	The Everyday Discrimination Scale is a 9-item scale that measures day-to-day discrimination 1 (never) to 7 (daily). Greater scores indicate a greater frequency in discriminations. It has a Cronbach's alpha of .77 (Sternthal, Slopen, & Williams, 2011).
Independent Variables	Connection with land	Environmental Distress Scale (EDS) Feelings of solastalgia module (loss of solace) (9 Likert items, e.g., ''I miss having the sense of peace and quiet I once enjoyed in this place;'' agree–disagree) (Higginbotham, 2007)
Cultural Buffers		
Independent Variables	Social support	Social Support and Social Undermining (Oetzel, Duran, Jiang & Lucero, 2007) emotional support (6-items), instrumental social support (5-items)
Independent Variables	Ethnic identity	Ethnic Identity measures importance of practicing and maintaining cultural traditions (Beals et al., 2005).
Health and Mental Health Outcomes		
Dependent Variables	Self-perceived level of health & functional status	Health-Related Quality of Life (HRQOL) developed by the Centers for Disease Control and Prevention (CDC, 2011). Healthy days core module (4 items) and Activity Limitations Module (5 items)
Dependent Variables	Perceived environment-related health outcomes	Environmental Distress Scale (EDS) Felt impact of environmental change regarding physical symptoms, emotional and psychological symptoms, social and community dysfunction, and economic loss (21 Likert items, e.g., ''I am worried about risks to human health from nearby environmental pollution'' (Higginbotham, 2007).
Dependent Variables	Mental health diagnoses	Mini-International Neuropsychiatric Interview (M.I.N.I.) (major depressive episodes, suicidality, PTSD, alcohol and drug dependence, generalized anxiety disorder sections) (Lecrubier et al., 1997)

4.3.3 Qualitative data collection

Participants from the interviewer-administered survey who reported a strong UHN ethnic identity and earned most their income on subsistence activities were invited to participate in a follow-up in-depth qualitative interview. Interviews were conducted by the student researcher and followed an interview guide (Appendix B) informed by guidelines by Carspecken (1996) for collecting critical ethnographic data. The purpose of this critical ethnographic data collection was to explore how shared cultural experiences influence perceptions of environmental change exposure with United Houma Nation members in Terrebonne Parish. Therefore, the qualitative interview guide contains broad questions to capture data that might be absent from the quantitative survey. Additionally, I collected data through participant and participant-observer observations utilizing thick and partial thick descriptions (Carspecken, 1996).

Critical ethnography method is designed to illuminate shared cultural experiences and challenge oppressive systems by calling to attention power and privilege. In research it has the ability to connect the individual or community with the political system by enhancing the "power of the people's ability to change the way in which they understand their problems as to better able to overcome them" (Van Wormer, 2011, p. 45). A critical ethnographic method adheres to indigenous research principles.

This study advances scholarship on indigenous frameworks for decolonizing research that seeks to prioritize the community's role in defining the problem, theorizing about their lives, connecting multiple generations, and acknowledging Indigenous ways of knowing (Smith, 2012; Walters et al., 2010). In preparation of this study I spent four years interacting with the community to elucidate their research

priority and methods preferred for data collection. I collected pre-dissertation data and worked with a community advisory committee in the development of the interviewer-administered survey to ensure cultural appropriateness and relevance. Member-checks were completed with tribal members and a formal presentation was made before the community to dissemination findings and receive feedback prior to publication. Dialectical data was collected in the form of interviews, observations with partial thick descriptions, field notes, and journal logs.

Carspecken (1996) recommends five stages of co-occurring data collection and analysis which includes: compiling the preliminary record, preliminary reconstructive analysis, dialogical data generation, describing systems relations, and system relations as explanations of findings. Each stage has standards for rigor. I followed guidelines for stages one through three as stages four and five are not typically recommended for dissertations (Carspecken, 1996).

Table 4-3: Study Application of Carspecken (1996) Stages of Critical Ethnography and Standards for Rigor

Stage	Data Collection	Standards for Rigor
One: Compiling the preliminary record	Monological field notes, observations, reflexivity, partial thick descriptions	- prolonged engagement - low inference vocabulary - flexible observation schedule - triangulation across recording devices
Two: Preliminary reconstructive analysis	Researcher interpretation	- same as stage one - used appropriate methodology - followed tribal protocols - worked with community advisory committee
Three: Dialogical data generation	Fieldwork: Survey ($N=160$) Interview ($N=19$) Reflections Journal logs Observations	- same as stage one - consistency checks - member checks - peer debriefing - interview repeated times

Reflexivity. I was constantly aware of the praxis of my situation. I was both an

insider and outsider. As a tribal member, I was given an opportunity to respectfully ask

permission to enter the community. I was an outsider because I have not lived

consistently in Louisiana, and especially not living a traditional lifestyle, for nearly 20

years. The dual role provided advantages, yet I had to be reflexive at any given point.

This was done through mindfulness in how I approached each situation, maintaining a

professional yet friendly demeanor allowed me to be outside of political situations. It

also held me at bay from developing closer friendships. I also journaled through note-

taking and audio recording on my phone. The journals were not intended for analysis,

rather for me to process the tension I felt to maintain an outside status. The journals

were also intended to help me process information as both an insider and outsider. The

following excerpt is an example of viewing a situation as an outsider and processing the

guilt I felt for not seeing the world as an insider:

> I am standing outside of the UHN building that houses the vocational
> rehabilitation services. It is in the city of Houma, about 20 miles from the
> furthest land point south and what used to be about 30 miles north of the Gulf of
> Mexico. Amidst Walmart and the other buildings surrounding the area I feel a
> disconnect because I feel like I am in Biloxi or Panama City, somewhere near a
> beach. For several minutes, I cannot figure out why. Yes, it is a warm day for
> December, probably in the 70s, yes I am wearing sun screen, yes I desperately
> want a beach vacation, but that is not it. I stand still, close my eyes and try to
> figure it out. Then I hear it. "Keow" "keow", the sound of seagulls. Wait! We don't
> get seagulls in Houma, at least we didn't when I was growing up. I thought they
> were only at the beach. Then, realization sets in. The bird that feeds on salt-water
> fish has a landing spot here in Houma…because the water in Houma is no longer
> fresh or brackish water…Houma is next, and soon. Tears well in my eyes because
> I only now make a connection that should have been obvious to me all along. I
> am, in this instant, seeing just out of touch I am with Houma. I also feel
> impending doom not only for those on the bayous but now for those who believe
> they are safe in their suburban homes within the city limits.

Principles for working with indigenous communities involve a cyclical and iterative process of relationship, responsibility, reciprocity, and redistribution (Walters et al., 2010). The empowering process promotes indigenous knowledge and co-learning which facilitates collaborative, equitable involvement of all partners in all phases of the research process (Walters et al., 2010). Walters et al (2010) argue that not only must researchers decolonize science, but they must call for the process of "indigenizing research" (p. 158) meaning to challenge power structures that delegitimize indigenous knowledge and sovereignty. Therefore, by understanding the shared cultural experiences of colonization, historical trauma, and discrimination among UHN members and how these experiences influence perceptions of environmental changes we can begin to understand the ways in which UHN members can develop adaptation strategies.

Dissemination. The first formal presentation of my preliminary results was made in the Dulac Community Center with tribal members. Participants were encouraged to ask any questions and provide input on this research project. Fulfilling my commitment to the tribal council, as stipulated in their letter of support for this dissertation research, I completed the presentation at least 2 weeks before my formal defense in January 2017. Following the town hall meeting, I incorporated comments and feedback into my dissertation prior to defending it to my academic committee. Additionally, a hard copy of the final dissertation will be provided to the tribe after it is approved by the academic committee.

4.4   Data Management Method

Questionnaires were collected and stored electronically in the Qualtrics system. The Qualtrics system allows researchers to build coding instructions into the survey. Therefore, as soon as each survey is initiated, the system begins coding and entering the data into a separate file. I could access the system at any time I had internet connection to download the data into one of several software formats (SPSS, SAS, STATA, Excel). While in the field I chose to download the data into Excel to visually inspect the data to ensure integrity. This option was convenient for field data collection because it eliminated the need to enter survey data into an electronic format and reduced errors in data coding. The Qualtrics system is password protected and only I have access to this file. To ensure I had constant access to the Qualtrics system, I also carried an internet hot-spot wherever I went. Because these areas are rural I also carried printed hard copies of the survey. On four separate occasions, I had to use the printed versions because the hotspot would not receive reception. As soon as they were completed I placed them in a locked box inside of my locked car until I could go to my dwelling to enter it into the Qualtrics system. The surveys were then kept in the locked box.

To protect confidentiality, participant names and contact information were entered a different file location than their survey responses. The participant names and contact information were kept to inform them about study dissemination dates.

4.5   Data Analysis Method

In this subsection, I present analysis methods for quantitative, qualitative, and mixed method data.

4.5.1 Quantitative data analyses

    To clean the data, I began by visually inspecting the characteristics of the sample. Univariate and bivariate analyses was performed on each coded variable, and scores from each scale were summed. Initial descriptive analyses include frequency distributions, measures of central tendency, and variation. Variables were examined to see if there is sufficient variability, the extent of missing data, and if any transformations need to be done.

    Missing data. I examined item non-response for large and non-random missing responses through univariate analysis of each of the variables utilized in this study. Overall, around 1% of data were missing for each variable apart from the dependent variable poor health days. Poor health days had missing responses from 8% (n=12) of all observations. Participants were given a choice to enter in the number of days, "don't know or not sure" or to refuse to answer the question. Responses that were "don't know and refuse" were set to missing. No participant chose to refuse to answer these questions. The missing values from this question are where participants chose "don't know" responses. Since participants were given a choice to refuse to answer, it is unlikely that there is a pattern due to sensitivity to answering these questions. Further inspection using the SAS command "Proc Print" of missing responses revealed there did not seem to be a pattern. Other variables with missing responses and the number missing are as follows: gender (1, .64% of all observations), relationship status (1, .64% of all observations), education (2, 1.3% of all observations), first language (2, 1.3% of all observations), boarding school (1, .64% of all observations), ethnic identity (1, .64% of all observations), and general health (1, .64% of all observations). No adjustments for missing data were done.

Regression diagnosis. Prior to running the regressions, I conducted regression diagnosis and tested if there were any influential data points, outliers, and collinearity issues. Multicollinearity occurs when more than two of the predictor variables are highly correlated, or in this case, when the interaction term is highly correlated with the predictor and moderator variables. This issue is common in moderated regression models. There were no issues of multicollinearity with the study variables.

Assessment of measures. Cronbach's alpha of each scale was assessed as a measure of internal consistency and the results are reported. Univariate, bivariate, and multiple regression models were run to test the association between historical trauma, discrimination, and connection with land variables and health outcomes as well as between social support and ethnic identity and health outcomes. Bivariate relationships between proposed constructs were examined via bivariate statistics (T-test, Chi-square test, correlation, and simple regressions). Also, multiple regressions and logistic regressions were employed to test for the proposed moderation effects of indigenous-specific factors that may contribute to health outcomes.

Table 4-4: Analysis Constructs

Construct (Dependent variables)	Construct (Independent variables)	Analysis
Health Outcomes • Perceived general health • Perceived healthy days • Perceived environment-related health impact • Mental Health diagnosis	*Environmental Exposure* • Proximity to Exposure *Sensitivity* • Historical Trauma • Discrimination • Connection with Land *Cultural Buffers* • Social Support • Ethnic Identity	• Bivariate and multivariate tests of association (correlation, chi-square) • Multiple regression

Specific analyses that I tested for each research aim are listed below:

Aim 1. *Determine the prevalence and level of environmental change exposure and health conditions of indigenous populations of UHN sample participants.*

A series of descriptive analysis were employed to examine demographic characteristics, ethnic identity, cultural connectedness, level of environmental change exposure, and health outcomes among the total sample of UHN participants.

A simple prevalence of environmental change exposure was calculated using the descriptive results. The main independent variables are Likert scale environmental change threat, frequency and observation of change.

Aim 2. *Investigate relationships between environmental change exposure and health outcomes.*

After calculating the means for the measures described in Aim 1, bivariate and correlational analysis were conducted to test for any significant relationships between health outcomes and participants' scores in environmental change exposure. This is also the test of my first hypothesis:

H$_1$ Exposure to disruptive environmental change adversely impacts health (physical and mental) outcomes.

Bivariate tests were conducted between each of the dependent variables and each of the independent variables (social support, ethnic identity, historical loss, discrimination, exposure to environmental changes) as well as demographics (gender, relationship status, low income, education, attended "Indian" school, first language, and age). This study has four dependent variables. Three of the dependent variables are dichotomous (general health, poor health days, and poor mental health) and a simple logistic regression is used to analyze relationship between the dependent variables and

continuous variables. To analyze relationships between the dichotomous dependent variables and categorical variables, chi-square tests are used.

The final dependent variable, felt health impact, is a continuous variable and correlations were used to analyze relationships with continuous variables. T-tests were used in the study to analyze relationships between the continuous dependent variable and categorical variables.

Aim 3. *Examine how cultural factors (i.e., historical trauma, discrimination, connection to land, social support and ethnic identity) act as moderating variables to buffer the effect of environmental change exposure and health outcomes.*

A moderating model is illustrated in the modified Indigenist-Stress Coping (original spelling) (Walters & Simoni, 2002) model below. Results from previous analyses guided the analyses used to test for moderation (interaction term) of connection to land, social support and ethnic identity on the relationship between environmental change exposure and health outcomes.

To test the hypothesized relationships—including interaction effects between environmental change exposure, demographics and other specified independent variables (indigenous-specific factors) and the dependent variables, a series of logistic regression models were constructed. These parsimonious models were run to account for the small sample size. In every model, no more than twelve predictor variables were used.

The multivariate results section is organized by regression of each dependent variable; poor health days, mental health (diagnosis), and felt health impact. For each dependent variable, the process is as follows:

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- Model one - the dependent variable is regressed on the demographic variables, indigenous -specific factors, and environmental change exposure;
- Model two - the dependent variable is regressed on the demographic variables that were significant in the first model, indigenous-specific factors, and exposure to environmental changes;
- Model three - an interaction term was added to model two (environmental change exposure and discrimination);
- Model four - an interaction term was added to model two (environmental change exposure and social support);
- Model five - an interaction term was added to model two (environmental change exposure and ethnic identity)
- Model six - an interaction term was added to model two (environmental change exposure and historical loss)

4.5.2 Qualitative data analysis

Interview transcriptions, observations, and field notes were uploaded into the qualitative analysis software, NVIVO 10, for data reconstruction of the development of categories and rich points by the student researcher. Data reduction techniques suggest transcribing the first interview in its entirety before conducting subsequent interviews (Charmaz, 2006; Schensul, Schensul, & LeCompte, 1999). There are three major stages to performing data analysis through coding: open coding, axial coding, and selective coding. *Open coding* reviews each line of the transcript and codes words or phrases. Oktay (2012) suggests coding everything, even the seemingly tangential, in case it becomes important to a developing theory later in the process. She also suggests to code words and phrases that evoke strong emotions, describe actions, reflects symbolic interaction concepts, and assumptions (Oktay, 2012). Initially, I developed a list of codes that correspond with the theoretical framework. Next, I reviewed the transcripts as they were uploaded into the software to develop a start-list of codes that were not

captured by the theory and were applied to additional transcripts. Following that, I grouped codes into flexible broader coding categories as key issues or concepts arose from the data. Therefore, analysis is a mixture of "coding down" from existing coding categories and "coding up" from themes that emerge inductively (Padgett, 2008). As new transcripts were coded, themes emerging from the data were explored via content (occurrence of specific themes or ideas in the narrative) and relational (relationships between themes in the narrative) analysis. As subsequent transcripts revealed new information, I added new codes and collapsed existing codes. Excess codes were tabled when the content was too thin to remain as an independent code for future analysis. I utilized *in-vivo coding*, when applicable, which is the process of coding using a participant's own words rather than professional jargon (Padgett, 2008). Saturation was met when no new themes or dimensions arose from new data (Oktay, 2012). Finally, I conducted *selective coding* by identifying core concepts, reaching theoretical saturation, and tying together a theory.

4.5.3 Mixed method data analysis

Integration of quantitative and qualitative methods occurred at the data analysis phase. Integration for concurrent designs, such as this one, occurs by merging the data in a side-by-side comparison where qualitative themes are compared with quantitative statistical results (Creswell, 2015). In instances where the themes did not directly compare with (or converge) quantitative constructs, I utilized a graphical technique that highlight points of divergence (Onwuegbuzie & Teddlie, 2003).

CHAPTER 5: RESULTS

"I know we must keep hope alive.
We must walk on despite the loss.
A people must stand strong.
Together, there is another river to cross."
~ T. Mayheart Dardar

In this chapter I present the findings of the study. First, quantitative results are presented. The quantitative results are organized by the type of analysis conducted: univariate, bivariate, multivariate. Next, I present findings from qualitative interviews by themes. Finally, mixed methods results are presented in side-by-side comparisons.

5.1   Quantitative Results

As a reminder, participants had to be at least 30 years of age, participate in subsistence activities in their lifetime, live in Terrebonne Parish, and be enrolled members of United Houma Nation. Participants represented portions of the parish where tribal members reside (Figure 5-1). The study did not have participants from zip codes located in the northwestern part of the parish.

Figure 5.1: Participants' Location within Study Area (ESRI, 2017).

5.1.1 Characteristics of sample population

Descriptive results from univariate analyses provide the characteristics of the overall

sample population (see Table 5-1).

Table 5-1: Univariate Results

Variables	Multivariate Role	N	All Participants (%)		
Categorical					
Gender	Control Variable	*156*			
Male		89	57.05		
Female		67	42.95		
Relationship Status	Control Variable	*156*			
Not in a Serious Relationship		28	17.95		
Serious Relationship		128	82.05		
First Language	Control Variable	*157*			
Houma French		95	61.29		
English or Both		60	38.71		
Education Level	Control Variable	*155*			
Less than High School		118	76.13		
High School or Greater		37	23.87		
Poverty level	Control Variable				
Not below poverty line		76	48.41		
Live below poverty line		81	51.59		
Attended "Indian" School	Control Variable	*156*			
No		95	60.9		
Yes		61	39.1		
Continuous Variables	**Multivariate Role**	*N*	*M*	*SD*	*Skew*	*Kurt*
Age	Control Variable	157	55.57	12.89	-0.04	-0.91
Total income	n/a	157	$30,277	$35,178	1.89	4.23
Ethnic Identity Index	Moderator Variable	156	24.76	3.57	-0.18	-0.19
Historical Loss Index	Moderator Variable	157	29.26	11.05	0.69	-0.25
Discrimination Index	Moderator Variable	157	19.83	12.18	1.38	1.50
Social Support Index	Moderator Variable	157	22.48	2.89	-1.6	3.14
Connection to Land Index	Moderator Variable	157	52	5.1	-1.43	1.3
Exposure to Environmental Changes Index	Independent Variable	157	87.28	28.14	-0.2	-0.33
Health Impact Index	Dependent Variable	157	35.76	7	-.44	.69

Gender and relationship status. Participants identified as male gender

(57%, n=89) more than female (43%, n=67). A majority (82%, n=128) of participants

were in a serious relationship (married, living as married, engaged or in a serious relationship) while the remaining 18% (n=28) of participants were either divorced, widowed, dating or in no relationship.

Income. Annual household income ranged from less than $2,000 to over $150,000. Most participants reported household annual income of $25,000 a year or less (59%). Therefore, income was reorganized to correspond with the weighted average poverty thresholds by size of the family for 2015[1] (ASPE, 2015). Utilizing household income reported and total household family size, a new variable was created: poverty line where no poverty equals "0" and poverty equals "1". The following table (5-2) describes how the variable was restructured. In this study, there were more participants who lived below the poverty line (52%, n=81) than those who did not live below the poverty line (48%, n=76).

Table 5-2: Process to restructure Income by Federal Poverty Level guidelines

ASPE FPL guidelines		Income reported	People per household
One person	$12,082	Less than or equal to $12,082	1
Two people	$15,391	Less than $15,391	2
Three people	$18,871	Less than $18,871	3
Four people	$24,257	Less than $24,257	4
Five people	$28,741	Less than $28,741	5
Six people	$32,542	Less than $32,542	6
Seven people	$36,998	Less than $36,998	7
Eight people	$41,029	Less than $41,029	8
Nine people or more	$49,177	Less than $49,177	9 or more

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[1] "the poverty guidelines updated periodically in the *Federal Register* by the U.S. Department of Health and Human Services under the authority of 42 U.S.C. 9902(2)."

Education, school, and language. An overwhelming majority (76%, n=118) reported having less than a high school education compared to those with a high school level degree or greater (24%, n=37). Some participants attended schools designated as "Indian Schools" (39%, n=61) while others did not (61%, n=95). Most participants spoke Houma French as their first language (61%, n=95) while the remaining participants spoke English or both as their first language (39%, n=60).

Age. The participants' average age was 56 with a range of 30 years to 82 years of age. Shapiro-Wilk test for normality was significant ($W=.98$, $p=.01$). Even though the conservative Shapiro-Wilk statistic indicates a non-normal distribution, overall, the age distribution approximates normal curve with the standard deviation of 12.89, skewness of -0.04, and kurtosis of -0.91. The skewness score, a measure of the asymmetry of the data distribution, is less than two times the standard error of skewness (.391) indicating that the data are symmetric and normally distributed. There are five participants who fall outside of two standard deviations. In this study's multiple regressions, age is used as a continuous control variable.

Ethnic identity. The revised-measure of ethnic identity (R-MEIM) is a summed index composite score consisting of 6 items ($\alpha = 88$) to measure ethnic identity (table 5-3). It has a theoretical range of 6-30 but the actual range was 15-30. The median and mode are the same (mean = 24.76, median and mode = 24) with a standard deviation of 3.57 and skewness of -0.18. The conservative Shapiro-Wilk statistic is significant ($W=.92$, $p<.0001$) and the skewness is twice the standard error of skewness, both of which indicate that the scale is not normally distributed. However, the standard deviation is less than half the mean, indicating that the scores are typically close to the mean. The composite scale was used as a continuous variable in the study analysis. A

high score in this scale means that the participant has a strong ethnic identity and a low

score means that the person has a lower level of ethnic identity.

Table 5-3: Ethnic Identity Mean by Items

Question/Item (*Item reversed for analysis) Please indicate how much you agree or disagree with the following statements: *Strongly agree (1), Agree (2), Neutral (3), Disagree (4), Strongly Disagree (5)*	Mean (*N*)
I have spent time trying to find out more about my ethnic group, such as its history, traditions, and customs*.	3.97 (156)
I have a strong sense of belonging to my own ethnic group*.	4.13 (156)
I understand well what Houma membership means to me*.	4.25 (156)
I have often done things that will help me understand my Houma background better*.	4.0 (156)
I have often talked to other people to learn more about Houma tribe*.	4.17 (156)
I feel a strong attachment towards my own ethnic group*.	4.25 (156)

Historical loss. The historical loss scale is a summed index composite score

consisting of 11 items (α = .88) measuring historical loss (table 5-4). It has a theoretical

range from 11-66 and an actual range of 11-57. The mean is 29.26 (SD = 11.05). The

skewness of .69 is more than twice the standard error of skewness. The Shapiro-Wilk

test for normality is significant (W =.94, p<.0001) and indicates that the composite

scale is not normally distributed. However, the standard deviation is less than half of the

mean indicating that the scores are typically close to the mean. Analysis used the

composite scale score as a continuous variable.

Table 5-4: Historical loss Mean by Items.

Question/Item American Indians have experienced many events, traumas and changes since encountering Europeans. Please indicate how often you think of these things. *Each item has the following choices Never (1), Yearly or special occasions (2), Monthly (3), Weekly (4), Daily (5), Several times a day (6)*	Mean (*N*)
The taking of our land.	2.8 (155)
Fewer and fewer people using our traditional language.	3.02 (155)
The separation of our family ties because of boarding schools or residential schools.	1.75 (155)

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The removal of families from the reservation due to government relocation.	1.83 (155)
Destruction of our culture and traditional spiritual ways.	2.83 (155)
Loss of respect for elders by our children and grandchildren.	3.75 (155)
Loss of respect by our children for traditional ways.	3.43 (155)
Distrust, resentment or fear toward whites.	2.18 (155)
Destruction or damage of traditional foods.	2.52 (155)
Taking of family members by Non-Native foster care or adoption placements.	1.9 (155)
The destruction of natural resources and beauty due to pollution, mining, and other industries.	3.33 (155)

Discrimination. The everyday discrimination scale is a summed index composite score consisting of 9 items (α = .89) measuring discrimination scale (table 5-5). The composite mean is 19.83 (SD = 12.18) and skewness is 1.38 which is more than twice the standard error of skewness. The Shapiro-Wilk for normality shows that it is not normally distributed (W =.83, p<.0001). The standard deviation is greater than half the mean; therefore, analysis using discrimination is done with a dichotomous variable. Each item within the scale was transformed into a dichotomous variable of never or rarely experiencing discrimination "0" and experienced discrimination at least once a month "1". Then an array was completed to develop a dichotomous discrimination variable. About 41% (n=64) did not or rarely experienced discrimination and 59% (n=93) experienced discrimination at least once a month or more.

Table 5-5: Discrimination Scale

Question/Item How often are you... *Each item has the following choices: Never (1), Less than once a month (2), Once a month (3), 2-3 times a month (4), Once a week (5), 2-3 times a week (6), Daily (7)*	**Mean (*N*)**
You are treated with less courtesy than other people are.	2.44 (151)
You are treated with less respect than other people are.	2.45 (151)
You receive poorer service than other people at restaurants/ or stores.	1.81 (151)
People act as if they think you are not smart.	2.49 (151)
People act as if they are afraid of you.	1.95 (151)

People act as if they think you are dishonest.	1.78 (151)
People act as if they are better than you are.	3.15 (151)
You are called names or insult.	1.93 (151)
You are threatened or harassed.	1.46 (151)

Social support. The social support subscale is a summed index composite score of 11 items (α = .82) measuring social support (table 5-6). The scale mean was 22.48 (SD = 2.89) and skewness is -1.6 which is more than twice the standard error of skewness. The theoretical range is from 11-28 with an actual range from 9-25 indicating that at least two items were not answered. The Shapiro-Wilk indicates the composite scale is not normally distributed (W=.82, p<.001). However, the standard deviation is less than half the mean indicating that the scores are typically close to the mean. Hence, the analysis uses the composite scale score.

Table 5-6: Social Support and Social Undermining Scale

Question/Item (*Item reversed for analysis) How much do your friends or relatives...*Each item has the following choices: Often (1), Sometimes (2), Never (3)*	**Mean** (*N*)
care about you? *	1.73 (147)
understand the way you feel about things? *	1.53 (147)
appreciate you? *	1.73 (147)
How much can you... *Each item has the following choices: Often (1), Sometimes (2), Never (3)*	
rely on your friends or relatives for help if you have a serious problem? *	2.64 (147)
talk to your friends or relatives about your worries? *	2.47 (147)
relax and be yourself around your friend or relatives? *	2.78 (147)
Among the people you know, is there SOMEONE...- *No (1), Yes (2)*	
you can go with to play cards, or go to bingo, a powwow, or a community meeting?	1.93 (147)
who would lend you money if you needed it in an emergency?	1.91 (147)
who would lend you a car or drive you somewhere else if you needed it?	1.95 (147)
you could call who would bail you out if you were arrested and put in jail?	1.95 (147)
you could count on to check in on you regularly?	1.98 (147)

Connection to land. The connection to land subscale is a summed index

composite score of 10 items (α = .87) measuring connection to land (table 5-7). The

theoretical range is 10-70 and the actual range is 32-56. The mean is 52.14 (5.1) and the

skewness is -1.43. The Shapiro-Wilk statistic indicates the composite scale is not

normally distributed (W=.77, p<.001). In fact, nearly all participants, 97% (n=152),

reported a connection to place by answering agree very strongly, agree strongly, or agree

and only 3% responded neither agreeing or disagreeing while no participants responded

in disagreement. This variable did not have sufficient variance thus, is not used in

bivariate and multivariable analysis.

Table 5-7: Connection to land Scale

Question/Item (*Item reversed for analysis) Below are statements about your feelings of living in Terrebonne Parish. Please indicate whether you agree or disagree with each statement from *Agree Very Strongly (7), Agree Strongly (6), Agree (5), Neither Agree or Disagree (4), Disagree (3), Disagree Strongly (2), Disagree very strongly (1).*	**Mean** (*N*)
I am proud of the heritage of this place.	6.74 (155)
I would continue to live in this place even if I were given the opportunity to leave.	6.15 (155)
My sense of who I am is linked to the environment where I live.	6.62 (155)
I get comfort or peace of mind from this place.	6.66 (155)
I feel I know every rock, nook and cranny around these parts.	6.51 (155)
I feel a deep connection to this place.	6.69 (155)
I would rather live somewhere different; this is not the place for me*.	6.48 (155)
I feel a sense of responsibility to the people of this place.	6.12 (155)
I feel I have a duty to maintain the land for future generations.	6.6 (155)
Because of the changes to this place, I would leave if I could*.	6.06 (155)

Environmental change exposure. Overall, participants were exposed to

environmental changes. Three subscales of the Environmental Distress Scale measure

environmental change exposure: frequency, observation, and threat; these culminate

into one variable termed "environmental change exposure". The scale is reliable (36

items; α = .80). The composite score is a summed index of all items measuring environmental change exposure. Each subscale is reported in more detail elsewhere (see Appendix C).

The mean for participant environmental change exposure is 85.28 (SD = 28.14) skewness of -0.2, and kurtosis of -0.33 with a theoretical range of 0 to 144 (as never = '0') and actual range of 5-144. SAS Extreme Observations chart shows one participant had a summed score of 5 indicating the person skipped many of the questions. The participant score pulled the mean and median from the center of the distribution. Therefore, mean and median were not relatively close to the mode (mean = 85.28, median = 87 and mode = 104). Overall, though, the summated scale distribution approximates a normal curve. The student's test was significant (t=38.86, p<.000) and the Shapiro-Wilk test for normality was not significant (W=.99, p=.39).

Participants' health. This section describes participants' overall health. General health and poor health days was quantified through the Health-Related Quality of Life (HRQOL) scale. Participants reported how they felt their health was impacted by environmental changes through items in a subscale of the environmental distress scale. Mental health was quantified through the Mini International Neuropsychiatric Interview (MINI). All items are self-reported responses.

Table 5-8: Health Variables

Variable		N	Participants (%)
Self-Reported General Health	DV	*156*	
Excellent - good		91	58.33
Fair - poor		65	41.67
Poor Health Days	DV	*145*	
No poor health days		59	40.69
Any poor health days in past 30		86	59.31
Screen for Depression	N/A	*157*	
No		113	71.97
Yes		44	28.03
Current Depression Diagnosis	N/A	*157*	
Did not meet criteria		131	83.44
Met criteria		26	16.56
Recurrent Depression Diagnosis	N/A	*157*	
Did not meet criteria		142	90.45
Met criteria		15	9.55
Screen for General Anxiety Disorder	N/A	*157*	
No		113	71.97
Yes		44	28.03
General Anxiety Disorder Diagnosis	N/A	*157*	
Did not meet criteria		133	84.71
Met criteria		24	15.29
Screen for PTSD	N/A	*157*	
No		118	75.16
Yes		39	24.84
Post Traumatic Disorder Diagnosis	N/A	*157*	
Did not meet criteria		150	95.54
Met criteria		7	4.46
Any Mental Health Screen	N/A	*157*	
No		82	52.23
Yes		75	47.77
Any Mental Health Diagnosis	DV	*157*	
No		124	78.98
Yes		33	21.02
All MH Screen	N/A	*157*	
No		142	90.45
Yes		15	9.55
Mental Health Diagnosis All	N/A	*157*	
No		156	99.36
Yes		1	.64

Variable		*N*	*M*	*SD*	*Skew*	*Kurt*
Health impacts	DV	157	35.76	7	-.44	0.69
Poor health days	DV	145	11.24	12.8	.58	-1.45

General health. Ten percent of the participants (n=16) reported their health to be excellent, 16% said their health was very good (n=25), 32% as good (n=50), 28% said fair (n=43), and 14% reported poor health (n=22). The CDC provides guidance to transform this item into a dichotomous variable where '0' is excellent, very good, good and '1' is fair or poor health. Approximately 58% (n=91) of participants said their health was good to excellent compared to about 42% (n=65) who said their health was fair to poor.

Poor health days. Participants reported they felt physical illness or injury an average of six days within the past 30 days (Table 5-9). Similarly, participants reported having emotional problems about 8 of the past 30 days (Table 5-9). The CDC recommends combining the two items on physical health and mental health into one summed variable to determine poor healthy days. The poor health days composite score had a mean of 11.24 (SD= 12.8) with skewness of .58. Although the skewness was less than twice the standard error of skewness, the distribution resembles a categorical variable with participants choosing 0, 15, or 30 with little variance in-between. Additionally, the Shapiro-Wilk test (*W*=.74, *p*<.0001) indicates the variable was also highly skewed. A log transformation did not improve the skewness of the physical or mental health variables. Therefore, "poor health days" was recoded into a dichotomous variable. More participants had poor health days (n=86, 59%) compared to participants who had no poor days (n=59, 41%) in the previous 30 days (Table 5-8).

Table 5-9: Healthy Days Core Module Mean by Items

Question/Item **Healthy Days Core Module Four Questions**	**Mean (*N*)**
Now thinking about your physical health, which includes illness and injury, for how many days in the past 30 days was your physical health not good?	6.36 (150)
Now thinking about your mental health, which includes stress and depression, and problems with emotions, for how many days in the past 30 days was your mental health not good?	7.55 (148)

Mental health. The Mini International Neuropsychiatric Interview (MINI) is an interview guide for screening and diagnosis of mental illness. This study uses the MINI guide to determine poor mental health as defined by the participants' eligibility to meet criteria for screening and diagnoses of general anxiety disorder, post-traumatic stress disorder or major depressive episode. Those who met screening for a mental illness were asked further questions to determine if they met criteria for diagnosis. Each sub-section below will report the percentages of participants who screened for each diagnosis and then percentages of those who met criteria for diagnosis. The dependent variable for mental health is a dichotomous variable described in the following subsection (also see Table 5-8).

<u>*Major Depressive Disorder*</u>. Screening for Major Depressive Disorder (MDD) had two questions. If a participant answered yes to either question they screened for MDD and were asked additional questions. If they did not answer yes, they were sent to the next module. Most participants did not screen for MDD (72%, n=113) while about 28% (n=44) participants did screen for MDD. MDD was the only module utilized in this study that had two categories of diagnosis, Major Current Depressive Disorder and Major Recurrent Depressive Disorder. About 17% (n=26) met the criteria for Major

Current Depressive Disorder compared to the 83% (n=131) who did not meet the criteria for diagnosis. About 10% (n=15) met the criteria for Major Recurrent Depressive Disorder compared to 90% (n=142) who did not meet the criteria for diagnosis.

Post-Traumatic Stress Disorder. Approximately 25% (n=39) of participants screened for post-traumatic stress disorder (PTSD) compared to about 75% (n=118) who did not screen for the condition and about 4% of participants (n=7) met the criteria for diagnosis.

General Anxiety Disorder. Approximately 28% (n=44) of participants screened for general anxiety disorder compared to 72% (n=113) who did not screen for the condition and 15% of participants (n=24) met the criteria for diagnosis.

Mental health condition screening. Just over half the participants did not meet screening criteria for a mental health condition (n=82, 52%) while 47% (n=75) did screen for at least one mental health condition and 10% (n=15) screened for all three conditions.

Mental health diagnosis. Most participants did not meet criteria for any mental health diagnosis (n=124, 79%) while about 21% (n=33) did meet criteria for at least one mental health diagnosis. One person (.64%) met criteria for each mental health diagnosis: major depressive disorder (current and recurrent), general anxiety disorder, and post-traumatic stress disorder. As the dependent variable for poor mental health, mental health diagnosis is dichotomous where "0" means the participant did not meet criteria for any mental health diagnosis and "1" means the participant met criteria for at least one mental health diagnosis.

Health impact subscale. The composite score is a summed index of all 7 items measuring felt health impact (table 5-10). The mean is 35.78 (SD=7) with a theoretical

range from 1-49 and an actual range from 8-49. The skewness is -.44 and the Shapiro-

Wilk test for normality ($W=.97$, $p=.00$) indicate a non-normal distribution. However,

the standard deviation is less than half of the mean, indicating that the scores are

typically close to the mean, thus analysis will use the scale composite score (5-8).

Table 5-10: Health Impact Subscale

Question/Item (*Items reverse coded) Below are statements about possible impacts of environmental changes in Terrebonne Parish. Please indicate whether you agree or disagree with each statement. Not applicable (7) Disagree very strongly (6) Disagree strongly (5) Disagree (4) Agree (3) Agree strongly (2) Agree very strongly (1)	Mean (*N*)
Claims about sickness being caused by environmental pollution are exaggerated.	4.05 (156)
People I know have become physically ill because of pollution in the local environment*.	4.96 (156)
There is a lot of cancer locally because of environmental pollution*.	5.42 (154)
I am worried about risks to human health from nearby environmental pollution*.	5.66 (155)
I am worried that environmental problems are causing birth defects in this area*.	5.17 (155)
I am concerned environmental problems will cause illness to myself or my family*.	5.61 (155)
There is a lot of asthma locally because of air pollution*.	5.30 (156)

5.1.2   Bivariate analysis

Bivariate tests were conducted between each of the dependent variables and each

of the independent variables (social support, ethnic identity, historical loss,

discrimination, exposure to environmental changes) as well as demographics (gender,

relationship status, low income, education, attended "Indian" school, first language, and

age). This study has four dependent variables. Three of the dependent variables are

dichotomous (general health, poor health days, and poor mental health) and a simple

logistic regression is used to analyze the relationship between the dependent variables

and continuous variables (see Table 5-11). To analyze relationships between the

dichotomous dependent variables and categorical variables, chi-square tests are used (see Table 5-12).

The final dependent variable, felt health impact, is a continuous variable and correlations are used to analyze relationships with continuous variables (see Table 5-13). T-tests are used in the study to analyze relationships between the continuous dependent variable and categorical independent/control variables (see Table 5-14).

This section is organized by bivariate analysis of health and each demographic variable, followed by health and indigenous -specific factors, next by health and exposure to environmental changes and finally by exposure to environmental changes and indigenous-specific factors.

Health and age. A simple logistic regression analysis was used to test if age significantly predicts general health (see Table 5-11). The overall model was statistically significant (Wald χ^2 (1) = 8.63, *p*=.00). Age significantly predicted general health (β = -.04, p=.00). For each year increase in age participants were 4% less likely to have poorer general health (OR 1.04, CI 1.01-1.07).

A simple logistic regression analysis was used to test if age significantly predicts poor mental health (see Table 5-11). The overall model was statistically significant (Wald χ^2 (1) = 4.6 *p*=.03). Age significantly predicted poor mental health (β = -.03, p=.03). For each year increase in age, participants' odds of meeting criteria for a mental health diagnosis drops by about 3% (OR .97, CI .94-.997). Age was not significantly associated with poor health days, poor mental health (see Table 5-11) nor was age significantly associated with health impact (see Table 5-13).

Health and gender. Poor mental health was significantly associated with gender X^2(1, 156) = 7.31, *p*=.01 (see Table 5-12). More females (64%, n=21) than males

(36%, n=12) had poor mental health. Gender was not significantly associated with general health or poor health days (see Table 5-12). Gender is not associated with felt health impact (see Table 5-14).

Health and first language. First language was significantly associated with general health $X^2(1, 154) = 8.98$, $p=.00$ (table 5-12). Among those who had fair or poor general health, 75% (n=48) spoke Houma French as their first language compared to 25% (n=16) who spoke English or both as their first language.

Independent t-test indicated a statistically significant relationship between felt health impact and first language $t (153) = 2.36$; $p =.02$. The mean felt health impact score for Houma French as first language is 36.84 (SD = 6.73) and for English or both as first language is 34.15 (SD= 7.18) (see Table 5-14). First language is not significantly associated with poor health days and poor mental health (see Table 5-12).

Health and "Indian school". General health is significantly associated with attendance at an Indian school $X^2(1, 155) = 13.04$, $p=.00$ (table 5-12). Among those who had fair or poor general health, 44% (n=28) did not attend an Indian school compared to 56% (n=36) who did attend an Indian school. Attending an Indian school is not significantly associated with poor health days, poor mental health (see Table 5-12) and health impact (see Table 5-14).

Health and education. Education was not significantly associated with general health, poor health days, poor mental health (see Table 5-12) and felt health impact (see Table 5-14).

Health and relationship status. Relationship status was not significantly with general health, poor health days, poor mental health (table 5-12) and felt health impact (see Table 5-14).

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Health and poverty line. General health was significantly associated with living below the poverty line $X^2(1,156)$ 6.02, p=.01. (see Table 5-12). Among participants who reported poor general health, 37% (n=24) were living at or above the poverty line compared to those who were living below the poverty line 63% (n=41). Poverty was not significantly associated with poor health days or poor mental health (see Table 5-12) nor felt health impact (see Table 5-14).

Health and discrimination. Discrimination is significantly associated with poor health days $X^2(1,145)$ 9.29, $p<.00$ (see Table 5-12). Among participants who had poor health days, 71% (n=61) did experience discrimination compared to those who did not experience discrimination 29% (n=25). Discrimination was significantly associated with poor mental health $X^2(1,157)$ 11.35, $p<.00$. Among participants who met criteria for a mental health diagnosis, 15% (n=5) did not experience discrimination compared to 84% (n=28) who experienced discrimination. Independent t-test indicated a statistically significant relationship between felt health impact and discrimination t (155) = -4.43; p <.0001. The mean felt health impact score for no discrimination is 32.94 (SD=6.31) and for experiencing discrimination is 37.7 (SD=6.82) (see Table 5-14). General health was not associated with discrimination (see Table 5-12).

Health and ethnic identity. Ethnic identity did not significantly predict general health, poor health days, poor mental health (see Table 5-11) or felt health impact (See Table 5-13).

Health and historical loss. A simple logistic regression analysis was used to test if historical loss significantly predicts poor mental health. The overall model was statistically significant (Wald χ^2 =5.01, $p<.03$). It was found that historical loss significantly predicted poor mental health (β = .04, p=.03). For each increase of

historical loss scale, participants were 4% more likely to meet the criteria for a mental health diagnosis (OR= 1.04, CI =1.01-1.08) (see Table 5-11).

Felt health impact was significantly associated with historical loss, r=.29, p<.0001 (see Table 5-13). Historical loss was not associated with general health, or poor health days (see Table 5-11).

Health and social support. A simple logistic regression analysis was used to test if social support significantly predicts general health. The overall model was statistically significant (Wald χ^2 =5.49, *p*=.02). It was found that social support significantly predicted general health (β = -.14, *p*=.02). For each unit increase in social support scale, participants' odds of having poorer general health drops by about 13% (OR .87, C.I. = .77-.98) (See Table 5-11). Social support is not significantly associated with poor health days, poor mental health (see Table 5-11) and felt health impact (see Table 5-13).

Health and proximity to exposure. There is a relationship between exposure to environmental changes and health outcomes among participants. Specifically, there is a relationship between exposure to environmental changes and poor health days, poor mental health, and feeling health impact. A relationship between exposure to environmental changes and general health was not found at the bivariate level.

A simple logistic regression analysis was used to test if environmental change exposure significantly predicts poor health days (see Table 5-11). The overall model was statistically significant (Wald χ^2 =5.09, *p*<.02). It was found that exposure to environmental changes significantly predicted poor health days (β = .01, *p*=.02). For

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each unit increase in environmental change exposure scale, participants were 1% more likely to have poor mental health (OR 1.01, CI= 1.0-1.03).

Simple logistic regression analysis was used to test if environmental change exposure significantly predicts poor mental health (Wald χ^2 =6.1, p=.01) (see Table 5-11). It was found that exposure to environmental changes significantly predicted meeting criteria for a mental health diagnosis (β = .02, p=.01). For each unit increase in environmental change exposure scale, participants were 2% more likely to meet criteria for a mental health diagnosis (OR 1.02, CI= 1.0-1.03).

Bivariate analysis shows a relationship between felt health impact and exposure to environmental changes (r=.52, p<.0001) (table 5- 13). Environmental change exposure scale was not significantly associated with general health (see Table 5-11).

Proximity to exposure and indigenous-specific factors. There was a positive correlation between environmental change exposure and historical loss, r = .51, p <.001, with moderate to strong R^2 = .26 (see Table 5-13). Independent t-test indicated a statistically significant relationship between exposure to environmental changes and discrimination t (155) = -3.38; p <.001 (see Table 5-14). The remaining indigenous-specific factors of social support and ethnic identity were not significantly associated with environmental change exposure (see Table 5-13).

Table 5-11: Table 10: Simple Logistic Regression Predicting Different Health Variables by Independent or Control Variables

Parameters	*General Health*				*Poor Health Days*				*MH Diagnosis*			
	b	*SE*	*Wald*	*OR (95%)*	*b*	*SE*	*Wald*	*OR (95%)*	*b*	*SE*	*Wald*	*OR (95%)*
Age	.04	.01	8.63	1.04 (1.01-1.07)	.01	.01	.26	1.01 (.98-1.03)	-.03	.02	4.6	.97 (.94-1)
	Wald χ^2 (1) = 8.63, p=.00, Max-rescaled R^2=.08				Wald χ^2 (1) = .26, p=.61, Max-rescaled R^2=.00				Wald χ^2 (1) = 4.6, p=.03, Max-rescaled R^2=.05			
Exposure	.01	.01	1.95	1.01 (.99-1.02)	.01	.01	5.09	1.01 (1-1.03)	.02	.01	6.1	1.02 (1-1.03)
	Wald χ^2 (1) = 1.95, p=.16, Max-rescaled R^2=.02				Wald χ^2 (1) = 5.09, p=.02, Max-rescaled R^2=.05				Wald χ^2 (1) = 6.1, p=.01, Max-rescaled R^2=.06			
Ethnic Identity	-.00	.05	.00	1 (.91-1.1)	.01	.05	.02	1.01 (.92-1.11)	.08	.06	1.85	1.08 (.97-1.21)
	Wald χ^2 (1) = .00, p=.96, Max-rescaled R^2=.00				Wald χ^2 (1) = .02, p=.89, Max-rescaled R^2=.00				Wald χ^2 (1) = 1.85, p=.17, Max-rescaled R^2=.02			
Social Support	-.14	.06	5.49	.87 (.77-.98)	-.1	.07	2.49	.9 (.79-1.03)	-.12	.06	3.65	.89 (.79-1)
	Wald χ^2 (1) = 5.49, p=.02, Max-rescaled R^2=.06				Wald χ^2 (1) = 2.49, p=.11, Max-rescaled R^2=.25				Wald χ^2 (1) = 3.65, p=.06, Max-rescaled R^2=.03			
Historical Loss	.02	.01	1.69	1.02 (.99-1.05)	.02	.02	1.57	1.02 (.99-1.05)	.04	.02	5.01	1.04 (1.01-1.08)
	Wald χ^2 (1) = 1.69, p=.19, Max-rescaled R^2=.01				Wald χ^2 (1) = 1.57, p=.21, Max-rescaled R^2=.01				Wald χ^2 (1) = 5.01, p=.01, Max-rescaled R^2=.06			

Table 5-12: Results Chi-Square Analysis

	General Health		Poor Health Days		Mental Health Diagnosis	
	Good Health	Poor Health	None	Poor Days	None	Diagnosis
Gender						
Male	56(62%)	33(51%)	37(64%)	47(55%)	77(63%)	12(36%)
Female	34(38%)	32(49%)	21(36%)	39(45%)	46(37%)	21(64%)
	X^2(1,155) 2.02, p=.15		X^2(1,144) 1.19, p=.28		X^2(1,156) 7.31, p=.01	
First language						
English	46(51%)	48(75%)	35(60%)	54(63%)	77(63%)	18(55%)
Houma French	44(49%)	16(25%)	23(40%)	32(37%)	45(37%)	15(45%)
	X^2(1,154) 8.98, p<.00		X^2(1,144) .08, p=.77		X^2(1,155) .8, p=.37	
Indian School						
Did not attend	66(73%)	28(44%)	39(67%)	47(55%)	73(59%)	22(67%)
Attended	25(27%)	36(56%)	19(33%)	39(45%)	50(41%)	11(33%)
	X^2(1,155)13.04, p<.00		X^2(1,144)2.28, p=.13		X^2(1,156) .59, p=.44	
Education						
<high school	64(72%)	53(82%)	46(81%)	66(77%)	97(79%)	21(66%)
>high school	25(28%)	12(18%)	11(19%)	20(23%)	26(21%)	11(34%)
	X^2(1,154) 1.91, p=.17		X^2(1,143) .32, p=.57		X^2(1,155) 2.45, p=.12	
Relationship						
Not in Serious	15(17%)	12(18%)	13(22%)	9(10%)	21(17%)	7(21%)
In Serious	75(83%)	53(82%)	45(78%)	77(90%)	102(83%)	26(79%)
	X^2(1,155).09, p=.77		X^2(1,144) 3.82, p=.05		X^2(1,156) 3.03, p=.58	
Poverty line						
No poverty	52(57%)	24(37%)	30(51%)	41(48%)	65(52%)	11(33%)
Below poverty line	39(43%)	41(63%)	29(49%)	45(52%)	59(48%)	22(67%)
	X^2(1,156) 6.2, p=.01		X^2(1,145) .14, p=.7		X^2(1,157) 3.8, p=.05	
Discrimination						
No	39(43%)	25(38%)	32(54%)	25(29%)	59(48%)	5(15%)
Yes	52(57%)	40(62%)	27(46%)	61(71%)	65(52%)	28(85%)
	X^2(1,156) .30, p<.58		X^2(1,145) 9.29, p<.00		X^2(1,157) 11.35, p<.00	

Table 5-13: Pearson Correlation Results with Health Impact, Environmental Changes, Age, and Indigenous-Specific Factors

Variable	1	2	3	4	5	6
1. Health Impact	--					
2. Environmental Changes	.52***	--				
3. Age	.08	-.11	--			
4. Historical loss	.29***	.51***	-.15	--		
5. Ethnic identity	.15	.15	.02	.28***	--	
6. Social support	-.14	-.1	-.17*	.07	-.02	--
M	35.76	87.28	55.57	29.26	24.76	22.48
SD	7	28.24	12.89	11.05	3.57	2.89

*p < .05. **p < .01. ***p < .001

Table 5-14: Results T-Tests Health Impact and Categorical Independent Variables

Variable	M(SD)	t(df)	p
Gender and health impact		.12 (154)	.91
Male	35.78 (6.42)		
Female	35.64 (7.77)		
First Language and health impact		2.36 (153)	.02
Houma French	36.84 (6.73)		
English	34.15 (7.18)		
Indian School and health impact		.05 (154)	.96
Did not attend	35.80 (7.37)		
Attended	35.74 (6.51)		
Education and health impact		-1.9 (153)	.06
<High School	35.20 (7.2)		
High School or greater	37.70 (6.21)		
Relationship status and health impact		-1.01 (154)	.31
Not in serious relationship	34.5 (7.84)		
In serious relationship	35.98 (6.81)		
Poverty line		.26 (155)	.8
No poverty	35.90 (7)		
Below poverty line	35.62 (7.04)		
Discrimination and health impact		-4.43 (155)	<.0001
No discrimination	32.94 (6.31)		
Experienced discrimination	37.70 (6.82)		
Discrimination and Exposure		-3.38 (155)	<.001
No discrimination	77.94		
Experienced discrimination	93.71		

5.1.3 Multivariate analyses

As a reminder, the hypothesis is that environmental change exposure has a direct relationship on the health outcome and subsequent hypotheses state that the indigenous-specific factors moderate the relationship between environmental change exposure and the health outcome.
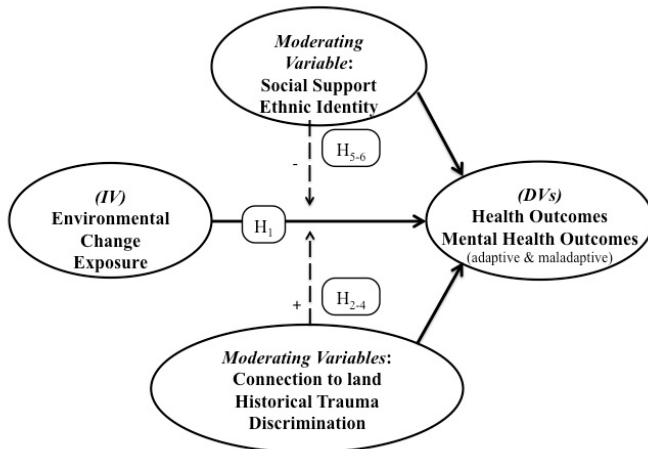
Figure 5.2: Dissertation Study Hypotheses

To test the hypothesized relationships—including interaction effects between environmental change exposure, demographics and other specified independent variables (indigenous-specific factors) and the dependent variables, a series of logistic regression models were constructed. In the last step, parsimonious models were run to account for the small sample size. In every model, no more than twelve predictor variables were used.

As for the dependent variable, general health, a bivariate relationship was not found between environmental change exposure. Therefore, multivariable analysis is not conducted with the dependent variable general health.

This section is organized by regression of each of the three remaining dependent variables; poor health days, mental health (diagnosis), and felt health impact. For each dependent variable, the process is as follows:

- Model one - the dependent variable is regressed on the demographic variables, indigenous-specific factors, and environmental change exposure;
- Model two - the dependent variable is regressed on the demographic variables that were significant in the first model, indigenous-specific factors, and exposure to environmental changes;
- Model three - an interaction term was added to model two (environmental change exposure and discrimination);
- Model four - an interaction term was added to model two (environmental change exposure and social support);
- Model five - an interaction term was added to model two (environmental change exposure and ethnic identity)
- Model six - an interaction term was added to model two (environmental change exposure and historical loss)

Predicting poor health days. As indicated above, six multiple logistic regressions were utilized to understand the predictors of poor health days at the multivariate level where "0" corresponds to no poor health days in past 30 days and "1" corresponds to having poor health days in past 30 days (tables 5-15 & 5-16).

Model one. A multiple logistic regression was used controlling for demographics (age, gender, first language, "Indian" school attendance, education, relationship, low income) to test the extent to which observed variation in poor health days was driven by the variation in indigenous-specific factors and environmental change exposure. The overall model is not significant (Wald $\chi2$ (12) = 15.83, *p*=.2). However, one variable is significantly associated with poor health days. Those in a serious relationship are over 3 times as likely as those not in a serious relationship to have poor health days (OR = 3.43, CI=1.15 – 10.24) controlling for other factors in the model.

Model two. After removing demographic variables that did not have a statistical significance in Model one, poor health days was regressed on relationship status, indigenous-specific factors and exposure to environmental changes. The overall model was significant (Wald $\chi2$ (6) = 15.42, *p*=.02). The Hosmer and Lemeshow goodness of fit test is not significant (X^2 (8) =8.31, *p*=.4) indicating the model is a good fit. The c-statistic =.70 indicates a moderate level of correct classification of the cases (table 14). Controlling for demographics, indigenous-specific factors, and exposure, those who experience discrimination are 3 times as likely as those who do not experience discrimination of having poor health days (OR = 3.07, CI=1.36 – 6.9).

Model three. Building on Model two, an interaction term was added to the model to test if the relationship between exposure and poor health days is moderated by discrimination. The overall model was significant (Wald $\chi2$ (7) = 16.01, *p*=.03). The Hosmer and Lemeshow goodness of fit test is not significant (X^2 (8) =8.56, *p*=.38) indicating the model is a good fit. Theoretically, the value of concordance index (c statistic) ranges from 0.5 to 1, where 0.5 suggests that the model randomly predicts the response and 1 indicates that the model perfectly discriminates the response. The c-statistic =.71 indicates a moderate level of correct classification of the response (table 14). *The interaction term was not significant.*

Model four. An interaction term was added to Model two to test if the relationship between exposure and poor health days is moderated by ethnic identity. The overall model was significant (Wald $\chi2$ (7) = 15.65, *p*=.03). The Hosmer and Lemeshow goodness of fit test is not significant (X^2 (8) =6.95, *p*=.54) indicating the model is a good fit. The c-statistic =.69 indicates a moderate level of correct classification of the responses (table 15). Controlling for demographics, indigenous-

specific factors, and exposure, those who experience discrimination are 3 times as likely as those who do not experience discrimination to have poor health days (OR = 3.12, CI= 1.38-7.05). *The interaction term was not significant.*

Model five. An interaction term was added to Model two to test if the relationship between exposure and poor health days is moderated by historical loss. The overall model was significant (Wald χ2 (7) = 16.32, *p*=.02). The Hosmer and Lemeshow goodness of fit test is not significant (X^2 (8) =6.68, *p*=.57) indicating the model is a good fit. The c-statistic =.70 indicates a moderate level of correct classification of the response (table 15). Controlling for demographics, indigenous-specific factors, and exposure, those who experience discrimination are 3 times as likely as those who do not experience discrimination to have poor health days (OR = 3.17, CI=1.4-7.16). *The interaction term was not significant.*

Model six. An interaction term was added to Model two to test if the relationship between exposure and poor health days is moderated by social support. The overall model was significant (Wald χ2 (7) = 15.77, *p*=.03). The Hosmer and Lemeshow goodness of fit test is not significant (X^2 (8) =8, *p*=.43) indicating the model is a good fit. The c-statistic =.71 indicates a moderate level of correct classification of the response (table 15). Controlling for demographics, indigenous-specific factors, and exposure, those who experience discrimination are 3.08 times as likely as those who do not experience discrimination to have poor health days (OR = 3.08, CI= 1.37-6.95). *The interaction term was not significant.*

Table 5-15: Results Logistic Models Predicting Poor Health Days

Parameters	Model 1				Model 2				Model 3			
	b	SE	Wald	OR (95%)	b	SE	Wald	OR (95%)	b	SE	Wald	OR (95%)
Demographics												
Age	-0.02	0.03	.41	.98 (.94-1.03)	-	-	-	-	-	-	-	--
Gender	0.58	0.41	2.06	1.79 (.81-3.97)	-	-	-	-	-	-	-	--
First language	0.17	0.48	.13	1.19 (.47-3.03)	-	-	-	-	-	-	-	--
"Indian" school	0.91	0.57	2.55	2.49 (.81-7.64)	-	-	-	-	-	-	-	--
Education	0.23	0.54	.18	1.26 (.44-3.59)	-	-	-	-	-	-	-	--
Relationship status	1.23	0.56	4.88	3.43 (1.15-10.24)	0.93	0.51	3.32	2.53 (.93-6.86)	.88	.51	2.98	2.41 (.89-6.57)
Poverty line	-0.00	0.4	0.00	1(.46-2.17)	-	-	-	-				--
Indigenous Factors												
Discrimination	0.86	0.44	3.81	2.36 (.997-5.61)	1.12	0.41	7.33	3.07 (1.36-6.91)	.04	1.23	.00	1.04 (.09-11.62)
Ethnic identity	-0.02	0.06	0.13	0.98 (.87-1.1)	-0.03	0.06	0.21	.98 (.88-1.09)	-.03	.06	.34	.97 (.87-1.08)
Historical loss	0.00	0.03	0.00	1 (.96-1.05)	-0.01	0.02	0.14	.99 (.95-1.03)	-.00	.02	.2	.99 (.95-1.03)
Social support	-0.1	0.08	1.6	0.91 (.78-1.06)	-0.09	0.07	1.40	.92 (.8-1.06)	-.09	.07	1.42	.92 (.79-1.06)
IV												
Exposure to environment	0.01	0.01	0.58	1.01 (.99-1.02)	0.01	0.01	1.01	1.01 (.99-1.02)	.00	.00	.03	1 (.98-1.02)
Interaction												
Discrimination *exposure	-	-	-	--	-	-	-	--	.01	.01	.86	1.01 (.99-1.04)
^R^2 = Max-rescaled R^2	Wald χ^2 (12) =15.83, p=.2 ^R^2=.18; c =.72; Hosmer & Lemeshow χ^2 GFI =11.96(8), p=.15				Wald χ^2 (6) = 15.42, p=.02 ^R^2 = .16; c = .70; Hosmer & Lemeshow χ^2 GFI = 8.31 (8), p=.4				Wald χ^2 (7) = 16.01, p=.03; ^R^2 = .16; c = .71; Hosmer & Lemeshow χ^2 GFI =8.56 (8), p=.38			

Table 5-l6: Results Logistic Models Predicting Poor Health Days, Continued

Parameters	Model 4				Model 5				Model 6			
	b	SE	Wald	OR (95%)	b	SE	Wald	OR (95%)	b	SE	Wald	OR (95%)
Demographics												
Relationship status	.91	.51	3.19	2.5 (.92-6.81)	.93	.51	3.3	2.53 (.93-6.87)	.92	.51	3.22	2.5 (.92-6.83)
Indigenous Factors												
Discrimination	1.14	.42	7.5	3.12 (1.38-7.05)	1.15	.42	7.67	3.17 (1.4-7.16)	1.13	.42	7.36	3.08 (1.37-6.95)
Ethnic identity	.1	.2	.24	1.1 (.75-1.61)	-.03	.06	.22	.97 (.87- 1.09)	-.03	.06	.23	.97 (.87-1.09)
Historical loss	-.01	.02	.12	.99 (.95-1.03)	-.07	.06	1.43	.94 (.84-1.04)	-.01	.02	.17	.99 (.95-1.03)
Social support	-.08	.07	1.3	.92 (.8-1.06)	-.09	.07	1.53	.91 (.79-1.05)	-.25	.25	.92	.78 (.48-1.29)
IV												
Exposure to environment	.04	.05	.63	1.04 (.94-1.15)	-.00	.02	.34	.99 (.96-1.02)	-.03	.06	.28	.97 (.85-1.1)
Interaction												
Ethnic identity *exposure	-.00	.00	.42	1 (.995-1)	-	-	-	-	-	-	-	--
Historical loss * exposure	-	-	-	-	.00	.00	1.23	1 (1-1.0)	-	-	-	--
Social support * environment	-	-	-	-	-	-	-	-	.00	.00	.43	1.00 (.996-1.01)
	Wald χ² (7) = 15.65, p=.03 Max-rescaled R² = .16; c = .69; Hosmer & Lemeshow χ² GFI =6.95(8), p=.54				Wald χ2 (7) = 16.32, p=.02 Max-rescaled R2 = .17; c = .70; Hosmer & Lemeshow χ2 GFI =6.68(8), p=.57				Wald χ² (7) = 15.77, p=.03 Max-rescaled R² = .16; c = .71; Hosmer & Lemeshow χ² GFI = 8 (8), p=.43			

Predicting Mental Health Diagnosis. Logistic regressions were run to predict poor mental health at the multivariable level as indicated by meeting diagnosis criteria for at least one mental health condition (yes) or not meeting diagnosis criteria for a mental health condition (no) (Tables 5-17 & 5-18).

Model one. A logistic regression was used controlling for demographics (age, gender, first language, "Indian" school attendance, education, relationship, low income) to test the extent to which observed variation in poor mental health is predicted by the variation in indigenous-specific factors and environmental change exposure. The overall model is significant (Wald $\chi2$ (12) = 24.44, *p*=.02). The Hosmer and Lemeshow goodness of fit test is not significant (X^2 (8) =9.55, *p*=.3) indicating the model is a good fit. The c-statistic =.82 indicates a good level of correct classification of the response (table 16). Controlling for other factors, for each year increase in age, participants' odds of meeting criteria for a mental health diagnosis decreases by 8% (OR = .92, CI = .86-.99). Controlling for other demographic characteristics, indigenous-specific factors, and exposure, females are 3.96 times as likely as males of meeting criteria for a mental health diagnosis (OR = 3.96, CI=1.43 – 10.95). Controlling for demographic characteristics, indigenous-specific factors, and exposure, those who experience discrimination are 5.47 times as likely as those who do not experience discrimination of meeting criteria for a mental health diagnosis (OR = 5.47, CI = 1.50 - 20). Controlling for demographics, indigenous-specific factors, and exposure, for each unit increase in social support scale, participants' odds of meeting criteria for a mental health diagnosis decreases by 14% (OR = .86, CI = 0.74 - 0.99).

Model two. After removing demographic variables that did not have a statistical significance in Model one, poor mental health was regressed on relationship status,

indigenous- specific factors and exposure to environmental changes. The overall model is significant (Wald $\chi2$ (7) = 22.15, *p*=.00). The Hosmer and Lemeshow goodness of fit test is not significant (X^2 (8) 12.82, *p*=.12) indicating the model is a good fit. The c-statistic =.79 indicates a good level of correct classification of the model (table 16). Controlling for other factors in the model, for each year increase in age, participants' odds of meeting criteria for a mental health diagnosis decreases by 05% (OR = .95, CI = .92-.99). Controlling for other factors in the model, females are 4.25 times as likely as males of meeting criteria for mental health diagnosis (OR = 4.25, CI=1.65 – 10.96). Controlling for demographics, indigenous-specific factors, and exposure, those who experience discrimination are 4.6 times as likely as those who do not experience discrimination of meeting criteria for a mental health diagnosis (OR = 4.6, CI = 1.40 – 15.09). Controlling for demographics, indigenous-specific factors, and exposure, for each unit increase in social support scale, participants' odds of meeting criteria for a mental health diagnosis decreases by 15% (OR = .85, CI = 0.74 - 0.99).

 Model three. Building on Model two, an interaction term was added to the model to test if the relationship between exposure and poor mental health is moderated by discrimination. The overall model is significant (Wald $\chi2$ (8) = 24.08, *p*=.00). The Hosmer and Lemeshow goodness of fit test is not significant (X^2 (8) 8.66, *p*=.37) indicating the model is a good fit. The c-statistic =.80 indicates a good level of correct classification of the response (table 16). Controlling for other factors in the model, for each year increase in age, participants' odds of meeting criteria for a mental health diagnosis decreases by 05% (OR = .95, CI = .91-.98). Controlling for other factors in the model, females are 4.34 times as likely as males of meeting criteria for a mental health diagnosis (OR = 4.34, CI=1.66 – 11.33). Controlling for demographics, indigenous-

specific factors, and exposure, for each unit increase in social support scale, participants'

odds of meeting criteria for a mental health diagnosis decreases by 16% (OR = .84, CI =

0.72 - 0.98). *The interaction term was not significant.*

      Model four. An interaction term was added to Model two to test if the

relationship between exposure and poor mental health is moderated by ethnic identity.

The overall model is significant (Wald $\chi 2$ (8) = 23.25, *p*=.00). The Hosmer and

Lemeshow goodness of fit test is not significant (X^2 (8) 6.95, *p*=.54) indicating the

model is a good fit. The c-statistic =.81 indicates a good level of correct classification of

the response. Controlling for other factors in the model, for each year increase in age,

participants' odds of meeting criteria for a mental health diagnosis decreases by 05%

(OR = .95, CI = .91-.98). Controlling for other factors in the model, females are 4.09

times as likely as males of meeting criteria for a mental health diagnosis (OR = 4.09,

CI=1.58 – 10.62). Controlling for demographics, indigenous-specific factors, and

exposure, those who experience discrimination are 5.34 times as likely as those who do

not experience discrimination of meeting criteria for a mental health diagnosis (OR =

5.34, CI = 1.56 – 18.92). Controlling for demographics, indigenous-specific factors, and

exposure, for each unit increase in the ethnic identity scale score, participants' odds of

meeting criteria for a mental health diagnosis increases by 85% (OR = 1.85, CI = 1.03 –

3.33). Controlling for demographics, indigenous-specific factors, and exposure, for each

unit increase in social support scale, participants' odds of meeting criteria for a mental

health diagnosis decreases by 14% (OR = .86, CI = 0.72 - 0.98). Controlling for

demographics, indigenous-specific factors, and exposure, for each unit increase in

exposure to environmental exposure scale, participants' odds of meeting criteria for a

mental health diagnosis increases by 17% (OR = 1.17, CI = 1.01-1.35). *The interaction term was not significant.*

Model five. An interaction term was added to Model two to test if the relationship between exposure and poor mental health is moderated by historical loss. The overall model is significant (Wald χ2 (8) = 23.24 *p*=.00). The Hosmer and Lemeshow goodness of fit test is not significant (X^2 (8) =12.33, *p*=.14) indicating the model is a good fit. The c-statistic =.80 indicates a moderate level of correct classification of the model (table 17). Controlling for other factors in the model, for each year increase in age, participants' odds of meeting criteria for a mental health diagnosis decreases by 05% (OR = .95, CI = .91-.98). Controlling for other factors in the model, females are 3.97 times as likely as males of meeting criteria for a mental health diagnosis (OR = 3.97, CI=1.52 – 10.38). Controlling for demographics, indigenous-specific factors, and exposure, those who experience discrimination are 5.03 times as likely as those who do not experience discrimination of meeting criteria for a mental health diagnosis (OR = 5.03, CI = 1.5 – 16.87). Controlling for demographics, indigenous-specific factors, and exposure, for each unit increase in social support scale, participants' odds of meeting criteria for a mental health diagnosis decreases by 15% (OR = .85, CI = .73 - 0.98). *The interaction term was not significant.*

Model six. An interaction term was added to Model two to test if the relationship between exposure and poor mental health is moderated by social support. The overall model is significant (Wald χ2 (8) = 22.14, *p*=.00). The Hosmer and Lemeshow goodness of fit test is significant (X^2 (8) =17.61, *p*=.02) indicating the model is not a good fit. The c-statistic =.79 indicates a moderate level of correct classification of the response (table 17). Controlling for other factors in the model, for each year increase in age, participants'

odds of meeting criteria for a mental health diagnosis decreases by 05% (OR = .95, CI = .91-.99). Controlling for other factors in the model, females are 4.27 times as likely as males of meeting criteria for a mental health diagnosis (OR = 4.27, CI=1.65 – 11.03). Controlling for demographics, indigenous-specific factors, and exposure, those who experience discrimination are 4.67 times as likely as those who do not experience discrimination of meeting criteria for a mental health diagnosis (OR = 4.67, CI = 1.42 – 15.59). *The interaction term was not significant.*

Table 5-17: Results Logistic Models Predicting Mental Health Diagnosis

Parameters	Model 1				Model 2				Model 3			
	b	*SE*	*Wald*	*OR (95%)*	*b*	*SE*	*Wald*	*OR (95%)*	*b*	*SE*	*Wald*	*OR (95%)*
Demographics												
Age	-.08	.04	5.73	.92 (.86- .99)	-.05	.02	7.06	.95 (.92-.99)	-.05	.02	7.61	.95 (.91-.98)
Gender	1.37	.52	7	3.96 (1.43-10.95)	1.45	.48	8.96	4.25 (1.65-10.96)	1.46	.49	9	4.34 (1.66-11.33)
First language	.08	.6	.02	1.09 (.34-3.52)	-	-	-	--	-	-	-	--
"Indian" school	.87	.74	1.37	2.38 (.56-10.18)	-	-	-	--	-	-	-	--
Education	-.4	.64	.39	.67 (.19-2.34)	-	-	-	--	-	-	-	--
Relationship status	-.02	.64	.00	.98 (.28-3.41)	-	-	-	--	-	-	-	--
Poverty line	.87	.5	3	2.39 (.89-6.43)	-	-	-	--	-	-	-	--
Indigenous Factors												
Discrimination	1.7	.66	6.59	5.47 (1.5-20)	1.53	.61	6.32	4.6 (1.4-15.09)	-.99	1.73	.32	.37 (.01-11.11)
Ethnic identity	.06	.07	.67	1.06 (.92-1.22)	.06	.07	.74	1.06 .93-1.20)	.05	.07	.56	1.05 .92-1.20)
Historical loss	.00	.03	.00	1.00 (.95-1.06)	-.00	.02	.00	1.00 (.95-1.05)	-.00	.03	.00	1.00 (.95-1.05)
Social support	-.16	.08	4.14	.86 (.74-.99)	-.16	.07	4.57	.85 (.74-.99)	-.17	.08	5.10	.84 (.72-.98)
IV												
Exposure to environment	.01	.01	.92	1.01 (.99-1.03)	.00	.01	.89	1.01 (.99-1.03)	.00	.02	.48	.99 (.99-1.07)
Interaction												
Discrimination *exposure	-	-	-	--	-	-	-	--	.03	.02	2.20	1.03 (.99-1.07)
	Wald χ² (12) = 24.44, *p*=.02 Max-rescaled R² = .35; *c* = .82; Hosmer & Lemeshow χ² GFI =9.55, *p*=.3				Wald χ² (7) = 22.15, *p*=.00 Max-rescaled R² = .30; *c* = .79; Hosmer & Lemeshow χ² GFI = 12.82 (8), *p*=.12				Wald χ² (8) = 24.08, *p*=.00 Max-rescaled R² = .32; *c* = .80; Hosmer & Lemeshow χ² GFI = 8.66 (8), *p*=.37			

Table 5-18: Results Logistic Models Predicting Mental Health Diagnosis, Continued

Parameters	Model 4				Model 5				Model 6			
	b	*SE*	*Wald*	*OR (95%)*	*b*	*SE*	*Wald*	*OR (95%)*	*b*	*SE*	*Wald*	*OR (95%)*
Demographics												
Age	-.06	.02	8.18	.95 (.91-.98)	-.05	.02	7.65	.95 (.91-.98)	-.05	.02	7.08	.95 (.91-.99)
Gender	1.41	.49	8.39	4.09 (1.58-10.62)	1.38	.02	7.92	3.97 (1.52-10.38)	1.45	.48	9	4.27 (1.65-11.03)
Indigenous Factors												
Discrimination	1.69	.64	7.07	5.34 (1.56-18.92)	1.38	.49	6.83	5.03 (1.5-16.87)	1.55	.61	6.39	4.7 (1.4-15.59)
Ethnic identity	.62	.3	4.23	1.85 (1.03-3.33)	.06	.07	.82	1.06 (.93-1.21)	.06	.07	.78	1.06 (.93-1.21)
Historical loss	-.00	.03	.02	1.00 (.95-1.05)	-.08	.07	1.16	.92 (.8-1.07)	.00	.02	.00	1.00 (.95-1.05)
Social support	-.15	.08	4.07	.86 (.74-.996)	-.17	.08	4.77	.85 (.73-.98)	-.07	.28	.05	.94 (.54-1.63)
IV												
Exposure to environment	.15	.08	4.09	1.17 (1.01-1.35)	-.01	.02	4.08	.99 (.94-1.03)	.03	.07	.23	1.03 (.91-1.18)
Interaction												
Ethnic identity *exposure	-.01	.00	3.71	.99 (.99-1.00)	-	-	-	--	-	-	-	--
Historical loss * exposure	-	-	-	--	.00	.00	1.32	1.00 (.999-1.00)	-	-	-	--
Social support * environment	-	-	-	--	-	-	-	--	-.00	.00	.12	1.00 (.999-1.00)

Wald χ^2 (8) = 23.25, *p*=.00
Max-rescaled R^2 = .33; *c* = .81;
Hosmer & Lemeshow χ^2 GFI =6.95(8), *p*=.54

Wald χ^2 (8) = 23.24, *p*=.00
Max-rescaled R^2 = .31; *c* = .80;
Hosmer & Lemeshow χ^2 GFI = 12.33 (8), p=.14

Wald χ^2 (8) = 22.14, *p*=.00
Max-rescaled R^2 = .19; *c* = .79;
Hosmer & Lemeshow χ^2 GFI = 17.61 (8), *p*=.02

Predicting Felt Health Impact. Multiple linear regressions were run to understand the predictors of the felt health impact summed composite scale score (see Tables 5-19 & 5-20).

Model one. A multiple regression was used controlling for demographics (age, gender, first language, "Indian" school attendance, education, relationship, low income) to test the extent to which observed variation in felt health impact was driven by the variation in indigenous-specific factors and environmental change exposure. The overall model is significant ($F(12,136) = 7.12$, $p < .0001$). The model accounted for about 33% of the variance in felt health impact (Adj. $R^2 = .33$).

When controlling for all other variables in the model environmental change exposure is statistically significantly related to the outcome variable, felt health impact. Results suggest that as the environmental change exposure score increases by one unit, participants' felt health impact scale score increases by .13 points ($b = .13$, $t = 6.10$, $p < .0001$), controlling for other variables in the model.

Also, the relationship between discrimination and felt health impact is positive and statistically significant when controlling for all other variables in the model. As discrimination index score increases by one unit, participants' felt health impact goes up by 2.9 points ($b = 2.9$, $t = 2.65$, $p < .01$), controlling for other factors in the model. The other factors in the model were not significant; age, gender, language, "Indian" school, education, serious relationship, poverty, ethnic identity, historical loss, and social support.

Model two. After removing demographic variables that did not have a statistical significance in Model one, felt health impact was regressed on indigenous- specific factors and exposure to environmental changes. The overall model is significant (F

(5,150) =14.29, $p < .0001$). The model accounted for about 30% of the variance in felt health impact (Adj. $R^2 = .30$).

When controlling for all other variables in the model environmental change exposure is statistically significantly related to felt health impact. Results suggest that as environmental change exposure scale score increases by one unit, participants' felt health impact scale score goes up by .12 points ($b = .12$, $t = 5.95$, $p < .0001$), controlling for other variables in the model.

The relationship between discrimination and felt health impact is statistically significant when controlling for all other variables in the model. As discrimination index score increases by one unit, participants' felt health impact scale score goes up by 2.89 points ($b = 2.89$, $t = 2.7$, $p < .01$).

Model three. An interaction term was added to Model two to test if the relationship between exposure and felt health impact is moderated by discrimination. The overall model is significant (F (6,149) =11.83, $p < .0001$). The model accounted for about 30% of the variance in felt health impact (Adj. $R^2 = .30$). When controlling for all other variables in the model environmental change exposure is statistically significantly related to felt health impact. Results suggest that as the environmental change exposure scale score increases by one unit participants' felt health impact scale score increases by .12 points ($b = .12$, $t = 4.41$, $p < .0001$), controlling for other variables in the model. *The interaction term was not significant*, indicating that discrimination did not moderate the relationship between exposure and felt health impact.

Model four. An interaction term was added to Model two to test if the relationship between exposure and felt health impact is moderated by ethnic identity.

The overall model is significant ($F(6,149) = 12.71$, $p < .0001$). The model accounted for about 31% of the variance in felt health impact (Adj. $R^2 = .31$).

When controlling for all other variables in the model, environmental change exposure is statistically significantly related to felt health impact. Results suggest that as environmental change exposure scale score increases by one unit participants' felt health impact scale score goes up by .35 points ($b = .35$, $t = 2.79$, $p = .01$), controlling for other variables in the model.

Also, the relationship between discrimination and felt health impact is statistically significant when controlling for all other variables in the model. As discrimination index score increases by one unit, the participants' felt health impact scale score goes up by 3.01 points ($b = 3.01$, $t = 2.83$, $p < .01$), controlling for other variables in the model. *The interaction term was not significant*, indicating that ethnic identity did not moderate the relationship between exposure and felt health impact.

Model five. An interaction term was added to Model two to test if the relationship between exposure and felt health impact is moderated by historical loss. The overall model is significant ($F(6,149) = 12.06$, $p < .0001$). The model accounted for about 33% of the variance in felt health impact (Adj. $R^2 = .33$).

The relationship between discrimination and felt health impact is statistically significant when controlling for all other variables in the model. As discrimination index score increases by one unit, participants' felt health impact scale score goes up by 2.97 points ($b = 2.97$, $t = 2.76$, $p < .01$), controlling for other variables in the model. *The interaction term was not significant*, indicating that historical loss did not moderate the relationship between exposure and felt health impact.

Model six. An interaction term was added to Model two to test if the relationship between exposure and felt health impact is moderated by social support. The overall model is significant (F (6,149) =11.85, p<.0001). The model accounted for about 30% of the variance of felt health impact (Adj. R^2=.30).

The relationship between discrimination and felt health impact is statistically significant when controlling for all other variables in the model. As discrimination index score increases by one unit, participants' felt health impact scale score goes up by 2.89 points (b=2.89, t=2.69, p=.01), controlling for other variables in the model. *The interaction term was not significant*, indicating that social support did not moderate the relationship between exposure and felt health impact.

Table 5-19: Results Multiple Linear Regression Predicting Felt Health Impact

Parameters	Model 1			Model 2			Model 3		
	b	*SE*	*β*	*b*	*SE*	*β*	*b*	*SE*	*β*
Demographics									
Age	0.07	0.06	1.10						
Female	-0.96	1.01	-0.96						
First language	-1.10	1.21	-0.91						
"Indian" school	-0.60	1.40	-0.43						
Education	1.55	1.30	1.20						
Relationship	0.53	1.32	0.40						
Poverty line	-0.74	1.01	-0.73						
Indigenous Factors									
Discrimination	2.90	1.09	2.65**	2.89	1.07	2.70**	3.06	3.15	0.97**
Ethnic identity	0.00	0.15	0.00	0.05	0.14	0.39	0.05	0.14	0.39
Historical loss	-0.02	0.06	-0.42	-0.02	0.05	-0.29	-0.02	0.05	-0.29
Social support	-0.12	0.17	-0.71	-0.15	0.17	-0.92	-0.15	0.17	-0.91
Independent Variable									
Exposure	0.13	0.02	6.10***	0.12	0.02	5.95***	0.12	0.03	4.41***
interaction									
Exposure * Discrimination	-	-	-	-	-	-	0.00	0.04	-0.06
	F (12,136) = 7.12			*F* (5,150) = 14.29			*F* (6,149) = 11.83		
	Adj. R^2 = .33***			Adj. R^2 = .30***			Adj. R2 = .30***		

*p < .05. **p < .01. ***p < .001

Table 5-20: Results Multiple Regression Predicting Felt Health Impact, Continued

Parameters	Model 4			Model 5			Model 6		
	b	*SE*	*β*	*b*	*SE*	*β*	*b*	*SE*	*β*
Indigenous Factors									
Discrimination	3.01	1.06	2.83**	2.97	1.07	2.76**	2.89	1.07	2.69**
Ethnic identity	0.94	0.49	1.92	0.05	0.14	0.38	0.05	0.14	0.38
Historical loss	-0.01	0.05	-0.26	-0.15	0.15	-1.00	-0.02	0.05	-0.31
Social support	-0.14	0.17	-0.82	-0.16	0.17	-0.97	-0.32	0.61	-0.53
Independent Variable									
Exposure	0.35	0.13	2.79**	0.08	0.04	1.79	0.07	0.15	0.49
interaction									
Exposure * Ethnic Identity	-0.01	0.01	-1.89	-	-	-	-	-	-
Exposure * Historical loss	-	-	-	0.00	0.00	0.96	-	-	-
Exposure * Social support	-	-	-	-	-	-	0.00	0.01	0.29
	$F (6,149) = 12.71$ Adj. $R^2 = .31$***			$F (6,149) = 12.06$ Adj. $R^2 = .30$***			$F (6,149) = 11.85$ Adj. $R^2 = .30$***		

*p < .05. **p < .01. ***p < .001

Summary of Quantitative Results. In this section I summarize the quantitative results by each research question.

1. *What are the prevalence levels of environmental change exposure and health conditions of indigenous peoples of UHN sample participants?*

To answer this question, I turn to the univariate results reported at the beginning of this chapter. The results show that participants observed, experienced, and felt threatened by changes in the environment. The mean for participant environmental change exposure is 85.28 (SD = 28.14).

Univariate analysis (table 12) shows that more people had poor health days 59% (n=86) than no poor health days (n=59, 40%). Approximately 58% (n=91) of participants said their health was good to excellent compared to about 42% (n=65) who said their health was fair to poor. Fewer people did not meet criteria for any mental health diagnosis 79% (n=124) while about 21% (n=33) did meet criteria for at least one mental health diagnosis. There was a high level of belief among participants that their health was impacted by environmental changes, mean is 35.78 (SD=7).

2. *Is there a relationship between self-reported exposure to environmental changes and health outcomes among indigenous peoples?*

To answer this research question, I examine the bi-variate results. There is a relationship between exposure to environmental changes and health outcomes. Specifically, there is a relationship between exposure to environmental changes and poor health days, meeting criteria for a mental health diagnosis, and feeling health impact. A relationship between exposure to environmental changes and general health was not found at the bivariate level.

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It was found that exposure to environmental changes significantly predicted poor health days (β = .01, p=.02). For each unit increase of exposure to environmental change, participants were 1% more likely to have poor mental health (OR 1.01, CI= 1.0-1.03).

It was found that exposure to environmental changes significantly predicted meeting criteria for mental health diagnosis (β = .02, p=.01). For each unit increase of exposure to environmental change, participants were 2% more likely to meet criteria for mental health diagnosis (OR 1.02, CI= 1.0-1.03).

Bivariate analysis shows a relationship between felt health impact and exposure to environmental changes (r=.52, p<.0001) (table 12).

3. *Do indigenous-specific cultural buffers (such as connection to land, historical loss, discrimination, social support, and ethnic identity) moderate vulnerability to environmental changes and health outcomes among indigenous peoples?*

Multivariate results were utilized to answer research question three. Results of this research question are broken out by health outcomes.

H3a. *Indigenous-specific buffers (such as connection to land, historical loss, discrimination, social support, and ethnic identity) moderate vulnerability to environmental changes and <u>general health</u> among indigenous peoples.*

Hypothesis 3a was not supported by the data. Multivariate logistic regressions were not conducted with general health dependent variable because there was not a statistically significant relationship between general health and environmental change exposure at the bivariate level.

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H3b. *Indigenous-specific buffers (such as connection to land, historical loss,*

discrimination, social support, and ethnic identity) moderate

vulnerability to environmental changes and <u>poor health days</u> among

indigenous peoples.

This hypothesis was not supported by the data. Multivariate logistic regressions show that controlling for demographics, indigenous-specific buffers did not moderate the relationship between environmental changes and poor health days. However, indigenous-specific factor of discrimination did have a direct effect on poor health days. In this study, discrimination was simply an independent variable and not a moderator.

Controlling for demographics, indigenous-specific factors, and exposure, those who experience discrimination are 3 times as likely as those who do not experience discrimination of having poor health days (OR = 3.07, CI=1.36 – 6.9).

H3c. *Indigenous-specific buffers (such as connection to land, historical loss,*

discrimination, social support, and ethnic identity) moderate

vulnerability to environmental changes and <u>poor mental health</u> (met

diagnosis criteria) among indigenous peoples.

This hypothesis was not supported by the data. A series of logistic of regressions were run to predict mental health at the multivariable level. First to control for demographics (age, gender, first language, "Indian" school attendance, education, relationship, low income) to test the extent to which observed variation in meeting criteria for a mental health diagnosis was driven by the variation in indigenous-specific factors and environmental change exposure. Second to eliminate demographic variables that did not have statistical significance in model one. The final models were to test

interaction effects. Even though there were no interaction effects, discrimination, social

support, and exposure to environmental changes did predict poor mental health.

Controlling for other factors in the model, for each year increase in age,

participants' odds of meeting criteria for a mental health diagnosis decreases by 05%

(OR = .95, CI = .91-.98). Controlling for other factors in the model, females are 4.09

times as likely as males of meeting criteria for a mental health diagnosis (OR = 4.09,

CI=1.58 – 10.62). Controlling for demographics, indigenous-specific factors, and

exposure, those who experience discrimination are 5.34 times as likely as those who do

not experience discrimination of meeting criteria for a mental health diagnosis (OR =

5.34, CI = 1.56 – 18.92). Controlling for demographics, indigenous-specific factors, and

exposure, for each unit increase in social support scale, participants' odds of meeting

criteria for a mental health diagnosis decreases by 14% (OR = .86, CI = 0.72 - 0.98).

Controlling for demographics, indigenous-specific factors, and exposure, for each unit

increase in exposure to environmental exposure scale, participants' odds of meeting

criteria for a mental health diagnosis increases by 17% (OR = 1.17, CI = 1.01-1.35).

> *H3d.   Indigenous-specific buffers (such as connection to land, historical loss,*
>
> *discrimination, social support, and ethnic identity) moderate*
>
> *vulnerability to environmental changes and felt health impact among*
>
> *indigenous peoples.*

This hypothesis was not supported by the data. Multiple linear regressions show

that controlling for demographics, indigenous-specific buffers did not moderate the

relationship between felt health impact and environmental changes. However, the

indigenous-specific factor of discrimination did predict felt health impact of

environmental changes. In addition, exposure to environmental change did predict felt health impact.

When controlling for all other variables in the model environmental change exposure is statistically significantly related to felt health impact. Results suggest that as environmental change exposure scale score increases by one unit participants' felt health impact scale score goes up by .35 points ($b=.35$, $t=2.79$, $p=.01$), controlling for other variables in the model.

Also, the relationship between discrimination and felt health impact is statistically significant when controlling for all other variables in the model. As discrimination index score increases by one unit, the participants' felt health impact scale score goes up by 3.01 points ($b=3.01$, $t=2.83$, $p<.01$), controlling for other variables in the model.

5.2   Qualitative Results

In this section, I present results from qualitative interviews to illuminate shared cultural experiences of exposure to environmental changes among members of United Houma Nation. During these conversations, we spoke about how their livelihoods put them in contact with the land, how the land has transitioned over time, ways that these changes impacted them and their families, how their families have adapted to these changes, and their opinions on long-term effects for the tribe and their families. This chapter highlights the common or shared experiences among the participants. Common among all participants is the shared memory of structural racism in Terrebonne Parish that remained until the late 1960's by denying UHN children access to an education. Termed discrimination, this theme is presented first to emphasize the institutional

barriers participants have faced. And yet, they persisted. Next, I present shared

experiences of living off the land, observations of environmental changes, and

commonly expressed beliefs on the causes of those changes. The final section presents

the theme of interconnectedness of participants shared experiences.

5.2.1 Discrimination

An elder man described what it was like to grow up in Terrebonne Parish. "We

were not allowed in restaurants" (observation notes). Signs on all the restaurants and

bars in Houma said "NO INDIANS ALLOWED". What made matters worse, he said, was

that the discrimination led Indians to fight each other in bars. People from different

bayous or families would fight people from other bayous. He said, "it was like they let

the whites tell them they were not good so they fought each other" (observation notes).

Also during segregation, UHN members were not allowed to go to public school.

Schools designated as "Indian schools" were built by Baptist and Methodist missionaries

in remote locations along the bayou. One elder who grew up on the Island recounts his

experience, "My daddy had all told us while we were young, that we was going to have to

learn the water, because we was unable to get an education" (participant 4). Then he

went on to say,

> I went to the Indian school, but I didn't learn much. I learned my ABC, and I
> learned how. . . Most of all my reading I have to say I learned on my own. . . If I'd
> had an education, I can promise you I'd be Chief right now, but because you have
> to have a GED, you can't become Chief [without it]. (participant 4)

In 1968 (fourteen years after desegregation), UHN members could graduate from

public schools. However, some people still feel unwanted in certain white

neighborhoods,

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The people didn't want no Indians going through there. . . Trust me. I know them. Like a friend of mine that's a native, his wife had to ask permission for him to live over there before she took him in. It's still, how many people say, 'Racism's here, yeah.' Racism is still here. (participant 6)

In discussing the reason a road from their Island was built over water rather than over the natural ridge, he said, "and the whites over there, they didn't want the Indians running through their backyard" (participant 6). Participants also felt they were not welcome in white institutions. "And being that he was an Indian guy, he couldn't borrow no money at the bank. That was a no-no." (participant 15). But now, they say it's different because they can go to school, eat at restaurants, sit anywhere in the theater, and borrow money from the bank.

5.2.2 Connection to land

Older participants recall traditional ways of living off the land and rarely consuming material goods.

> You didn't need much in my time. All you bought in my time was sugar, coffee, rice and flour. That was four things you bought. Everything else you lived off the land. That's how it was. Everything else was grown right there on the land. Whenever you'd buy flour and sugar, flour and rice, they would come in a beautiful bag. Then the mammas would either make you a shirt or a pants with it. (participant 4)

Participants grew up living off the land and in turn learned how to care for their physical environment. A married couple share that their entire livelihood is from the land,

> Participant 8: We use the land a lot.
> Participant 7: Yeah because we shrimp, we oyster, crab, trap.
> Participant 8: Trap. We live off the land.
> Participant 7: We live off the land.
> PI: Your vegetables and everything?
> Participant 7: Vegetables, yes. . . Pouldeau, ducks, all kind of stuff. . . We use the land, we live off of it. We do all our shrimping, everything that we doing is, like we plant our okras, sometimes our potatoes, squash, we have fig, we have cucumbers, we have orange.

Participant 8: You want succeed you go to follow the new moon. . . . The moon work the people, she didn't got no trouble with the people.

Parents taught their children ways passed onto them to care for the land so they could reap the benefits of the land.

> You wouldn't want to throw that [the trash], or it - we eat the crab and the brother fish, crab, and the last thing you want to do is pollute the water. You want to keep that water as clean as possible. You know, we eat the crab and we eat the fish from out of that water. So the last thing you want to do is go and pollute that water and everything in that. (participant 15)

Living off the land was a family effort that followed seasons. From spring to early fall, they harvested water animals such as fish, shrimp, crab, oysters. Then trapping season was from November 1 through March 1. During this time the children were taken out of school. The whole family would travel (by boat) to a mostly swampy area, deep within the marsh and live in a camp. The camps had palmetto roofs. Or they would live in the boat.

> When we trap, the kids, we took them out of school, and we went trapping, and then when we would come home, we'd come back home in March or- February. February, latter part of February, the first few days of March, and then they would go back to school. When [Name] was 6 when she started school, well the other ones were old enough to watch her, keep her, and I started going with him, and I never, I always did go with him, you know. (participants 7 & 8)

When asked how he felt about the area, one participant said, "I'm always gonna have a connection here. This is where I was born. This is where I was raised" (participant 6). This sentiment was shared among all participants.

5.2.3 Observing changes in the environment

This section describes shared experiences of observing changes in the environment.

Repeated disasters. Juan, Lilly, Andrew, Katrina, Rita, Ike, Gustav...They have been exposed to many hurricanes, but it wasn't until the early 1990s that people

started experiencing consistent, repeated damage to their homes, "'cause I been through all the storms since 1965. . . It was Andrew put 12 inches of water in the house" (participant 14). Another participant said, "(w)e used to have some big trees on that side and some on that side but with the storm coming and all, they all fell over on the roof over there. One fell on the porch on that side."

Participants recount their whereabouts for each hurricane, the emotional turmoil of making evacuation decisions, and how much water they got in their homes. One married participant who harvests with her husband described one of her experiences,

> We was only home two weeks from Katrina. We evacuated for Katrina, but Katrina didn't really hurt us in the yard. We was only home two weeks for Katrina that we had to evacuate for Rita. Then Rita's the one that brought a lot of water in this yard.
>
> Then, in between [Ike] and Gustav, we evacuated to Little Rock, Arkansas for Gustav. We was over there, it was costing too high 'cause I had all my kids and I was paying their room. I said, "We're going to go to Texas." I said, "I'm going to rent a beach house.", 'cause we have friends over there in Texas that it wasn't going to cost me as high. I could get one beach house and pay one thing.
>
> But Ike was brewing too. We was in Texas and watching the news. My daughter says, "Mom, when we going to leave?", 'cause she was worried about the. . .I said, [Name], I don't know where Ike is going yet. When I'm a little for sure where Ike is going", I says. . . 'Cause I didn't know if I should start . . .Which ways to start. . . Yeah, that was about maybe the scariest, 'cause I didn't know which way I was going to go from Texas, if I was going to come towards Louisiana, or go further north. (participant 2)

Older people heard stories from their elders about hurricanes of the past. One story is about a hurricane in 1885 that wiped out a plantation turned resort-mansion on Grand Isle. (The hurricane occurred in 1893.) The story was to highlight that as long as their parents and their parents' parents have been there, there have been hurricanes. However, the participants' perception was that the "big ones" only came around once a decade or generation. Now, they believe, not only are the larger hurricanes much more

frequent, but that there are no longer natural defenses to protect them and the participants perceive that manmade defenses like levees are ill-equipped (observation notes). The repeated hurricanes caused permanent damage to their lands, "nature was still the same, until the hurricanes came and changed the whole landscape" (participant 14). Now, they say damage comes from heavy rainfall or lesser grade storms, "The only time you had water on the land was for hurricane. But now, if you get a tropical depression, tropical storm, and you get high water" (participant 15).

Chronic land loss. The loss of land is salient along the bayous of Terrebonne Parish. The trees appear to be in hibernation with no leaves, even in the summer. The loss was frequently discussed by participants, described in different ways. A female participant said, "(s)hoot, we don't have no more land. It's like the land would separate like the bays and the lakes and all. Now it's all one" (participant 3).

One semi-retired man said, "they used to have land on both sides. Now it's all open. It all washed away. And it's getting worse every year. Every hurricane it washes them away, you know" (participant 12). Going forward, another married couple said "every year is less and less, and it's not going to get any better, because the more loss of land we have, the more damage is being done" (participants 7 & 8).

Participants advise that the land is eroding so fast that they need GPS system and radar to recognize where they are located at any time, "a lot of people go down there, they don't know where they are at and they get lost" (participant 3). Participants who are away from the coast for a few months or a season have trouble recognizing certain places. It is in these instances that confirms for them how fast it is eroding and what they are losing.

The water has changed. The area has changed. Oh, lord a lot of the coast, the coastline and especially where we would go shrimping at has changed tremendous because it all ate up. Some places we would go was just a little small lake. Now you go, it's a big wide open lake. (participant 10)

Climate change. Participants believe that warmer temperatures have led to changes in migration patterns of birds and seafood. Participants noticed that duck and pouldeau (American coot) have been arriving later in the past few years than they did in past decades. However, when they do arrive, participants have a small window to harvest them because of the hunting season laws set by the Louisiana Department of Wildlife and Fisheries. About the avian migration and the law, one participant said, "the duck season was always far too early for us down here. They should wait until the first good freeze to open up the first good part of duck season. Here it should go up into February" (participant 5).

Pollution of bayous or canals. Participants also notice changes in the environment through pollution of the bayous or canals, "because I was living in this house for (Hurricane) Juan, and Juan brought in some waters. . . And then after two, three days . . . the water turns black. It's like a polluted water" (participant 14). When the water becomes black and fish "pop up" it means there is little oxygen in the water and the fish have died. In the past they only noticed it for hurricanes, but now it happens after a storm or flooding to the north,

They got so much pollution in there the fish die in the bayou sometime. This year for sure I think. Yeah, after we had that hard water and a lot of the water they didn't pump it out right away, and it stayed, oh Lord, it stunk. Water got black, black. Black, black and the fish were popping up. (participants 7 & 8)

5.2.4 Causes of changes in the environment

This section presents the participants shared beliefs on the causes of changes to the environment.

Oil field dredging and navigation canals. The oil field industry arrived in Louisiana around 1928 and many participants believe the industry practices began the dramatic shift in loss of land, "oil companies started drilling - opened canals and then didn't fill them, left them open. That started the erosion. First noticed it when they built the canal - Houma Navigation canal (around the late 1970s)." (survey comment, participant unknown). Another participant said, "it's saltwater intrusion you know and that's coming from the oilfield digging bayous and not concerned about what it would do to the land you know" (participant 1).

After decades of exposure to salt water, the once small canals are much larger. One participant describes, "when the first oil company started digging [the] canal - and then today, what was a canal back then, that's a bayou now. It's a navigation bayou now" (participant 15). One participant goes on to say that in the past oil companies could dig wherever they wanted, "this island was five miles wide and seven miles long before the oil field came in here" (participant 6). But that today, they say, the companies would not be able to dig canals like they did in the past. When asked if he believed the oil company would fix it he said,

> No. Not really, because saltwater is washed away the land. It just took away the natural way of bayous. The hurricanes came in. When, I think the oil fields, whenever they dug it. They hadn't let wooden dams or shell dams that they were supposed to maintain. They never maintain it. Now everything's just a big lake. Most of your seafood is going to follow its original migrating pattern like it always did. Now, it just has more of a bigger area to go into. (participant 6)

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Dams. Cutting off fresh water supply through building dams has contributed to land loss in southern Louisiana. One participant described the harmful impact dams have on the marsh,

> They got locks and they got dams that are keeping all the water from coming into the marsh. And that's what I said a while ago, that you've got too much salt water coming in the marsh. That's why it's killing all the trees and your grasses and everything. If you had more fresh water coming in. . . . In other words, [if] you had a lot of fresh water coming in that would make you keep your grass grow and trees all. (participant 15)

Boat traffic. The increase of boat traffic and the speed they travel provides constant waves washing up on the banks. A participant who lives further down the bayou notices the boat traffic increase and said, "(w)hat makes it wider, believe it or not, is these smaller boats that are going real fast and making wakes. . . I notice a difference you know because there's one place where the bulkhead is kind of rotting away" (participant 1). The waves in the past were fewer, smaller, and had a great deal less salt. The constant exposure to saltwater erodes the soil along the banks and slowly washes away the land.

5.2.5 Interconnectedness of place and living creatures

Key findings show the cyclical nature between sociocultural events, physical environmental changes, and impacts (figure 5.2). Anthropogenic activities cause changes in the environment. The changes lead to a loss of medicines and harvest which leads to impacts on health and livelihoods which leads to loss of cultural knowledge being passed and reiterated between and among generations which leads to loss of knowledge on protecting land and leads to developing anthropogenic activities that cause changes in the environment.
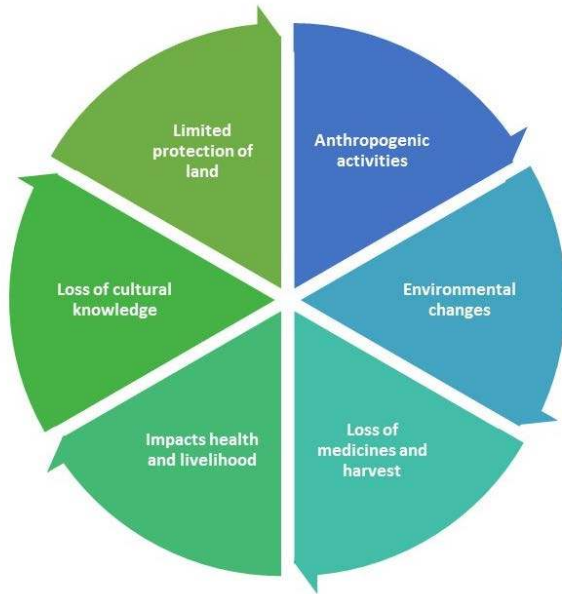
Figure 5.3: Interconnectedness of Place and Human Activities

Loss of medicines and harvest. Several people shared that they did not go to doctors when they were growing up. Instead, if they had health problems, the traiteur (treaters), would use traditional medicines of herbs, plant roots, trees, solvents and prayer to heal them.

> Well, yes, a long time ago. Like down here, we didn't go to the doctor every time that we had something. [If the kids] had a bad cough or asthma. We would call [the traiteur] and she would come. She had some big staff or something like that, and she had her rosary with her to say a prayer. I would believe in that. Then I had my grandpa; if you cut yourself and you was bleeding anywhere, he'd come and treat you. He'd make a cross on your forehead, and he'd say a prayer. That bleeding would stop. We didn't go to the doctor or anything like that. Oh, yes. I believe in those days, but that's gone. (participant 15)

When asked why they don't use traiteurs anymore the consensus was that there were few, if any, practicing traiteurs. Participants who do know of some of the prayers and ways of the traiteurs travel to northern Louisiana to find many of the plants and trees because they no longer grow in the area (observation notes).

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Participants also experience a loss of harvest. Participants who fish for shrimp note the volume of their harvest and the size of the shrimp they catch. Here a participant discusses the size of the shrimp,

> Yeah, shrimp would mostly leave from east to west. They still does pretty much the same but shrimp don't stay as long inside like they used to. Because with brown shrimp we used to troll brown shrimp for 40/50, 36/40 before they leave. Now we're lucky if we get to 60/70. (participant 9)

The number represents the amount of shrimp per pound. The lower the number, less shrimp per pound, and the bigger the shrimp is in size. For example, "60/70" size means that approximately 60 to 70 shrimp equal one pound. Then he goes on to share that not only is the size of the shrimp changing but the quantity of the population is changing as well.

> Brown shrimp, no. We don't get big shrimp no more. Like I said, for one time we used to inside 40/50, 36/40 brown shrimp. We don't get that big no more. The biggest we might have is 60/70 of browns you know? They don't get big because the water, I don't know if the water's changing and it's not as much brown as we used to have. I remember one night you'd go make 30 to 40 boxes a night. Now you're lucky if you catch 10 to 15 boxes a night. (participant 9)

Health of environment impacts health and livelihood of the people.
The decrease in shrimp size and population, in turn impacts the price per pound of shrimp they receive. Other participants describe the size of the population of shrimp, "before it used to have more shrimp than now" (participant 3). Crab fishermen shared similar concerns on the health of the crabs. "That's why crabs are getting less and less. They're not throwing back the small ones so they can grow and produce more crabs".

Another reason some participants believe their livelihood is impacted is through globalization of seafood harvesting,

> Ain't got no price now. Them shrimp there used to be like $8, $7 a pound. Now we got a hard time to get $2, that's a big difference. . . . The factories say it's

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because of the globalization, because of buying from foreign shrimp, that's why their setting the prices so low.

The health of the Louisiana coast limits the amount of seafood it can produce.

The reduced amount of production cannot meet demand for seafood and factories

supplement their sales with imported products (observation notes). Describing the long-

term effects of environmental changes on their way of life, participants did not seem

hopeful that future generations could live the way they lived because the land has

changed so much in their lifetime, "I don't think they'll never get it back to just what it

was 20 years ago. . . . There's no way. We've lost a life that'll already never be restored"

(participant 5). A common phrase was "they're doing too little, too late".

In response to the question, do you think your health and the health of your

family has been impacted because of all these changes, participants had mixed reactions

from describing ability to have fresh food and vegetables to beliefs that the changes are

causing health problems.

> No, not everything, no. But the land is not like it was before, because I was born across the bayou and I can tell you that for a fact my grandma raise their own garden, like green beans, potatoes. We had sweet potatoes, we had corn, and we had good potatoes. That was the last you all year until next grow. You see, they wouldn't go to the store and buy that. And uh, and that's how it was. We didn't have no freezer, you see. That was all put in jars. Where they had flowers and stuff planted in the front, now every time during the summer time, in the summer time when the water get high, it got water then. At that time, it was high and dry. The only time you had water on the land was for hurricane. But now, if you get a tropical depression, tropical storm, and you get high water. (participant 15)

The loss of land has meant the loss of access to fresh food and water for many.

Participants used to grow their own food. "My grandpa, we grew okra, corn, squash,

cucumber, potato, snap beans, peas. . . Everything was all for our own consumption"

(participant 6). However, the increase in salt content of the soil decreases its ability to

grow medicines, healthy foods. Instead of planting in their yard, either they buy it at a

store or plant further from the gulf (up the bayou) where the soil is better. One younger

participant said,

> It's like I said, its different season for different things because we used to plant
> okra and stuff like that down the bayou. Now the ground is I guess more saltier
> water. That don't grow down there. We've got to plant it up here further north.
> (participant 9)

An elder participant said,

> And today, where we used to do that, they cut canal and... and everything. That's
> mostly salt water today. Just like where we live right now, you see, where we live
> right now, you can make your garden in the back, you can plant your green beans
> or whatever you wanted to plant and it will grow [in the past]. But now you've got
> too much salt in the soil. It will not grow. And if it grow, it will not produce any
> vegetable at all. It would get pretty and leaves, but you won't have no tomatoes,
> no cucumbers, no nothing. (participant 15)

Growing up, participants had access to fresh fish as a source of nutrients like protein,

vitamin D and omega-3 fatty acids. Now, participants say they are limited in their ability

to catch seasonal fresh water fish, "(w)e ain't had none . . . not like we would have had if

the fish would be biting like we used to had in October, November" (participant 5). They

believe this, in turn, impacts their health.

> Maybe cancer too because you hear a lot about the younger, you see we had two
> daughters had cancer. . . I guess that too has a lot to do with the environment,
> because, I'm 68, and he's 70, and when we were growing up, you never hear
> about a lot of cancer. (participants 7 & 8)

Another person attributed the cancer mortality to the British Petroleum (BP) oil spill,

"We worked for BP cleaning up and all. . . Since the oil spill there's a lot of people that

died of cancer down here" (participant 12). The same participant expressed how the oil

spill contributed to the health of the seafood as well, "before the oil spill, they was

catching a lot more crab. And there were more oysters, too, and shrimp" (participant

12).

Participants wonder if changes in the environment, to include disasters, coastal erosion, and pollution, are causing other health conditions like sinus problems or allergies, "(y)ou think about everybody that's dying down here, so it makes you wonder if our soils are not contaminated or if our air is not contaminated or something and it's slowly killing everybody down here." (participant 2). Another participant said, "(y)eah, most probably sinus" (participant 7). While others are more cautious to believe that there are health impacts,

> Well I . . . I'm hoping that you know we can see more results on some of the tests that they've been doing and all this. And I'm just hoping that nothing comes of it. . . . I don't want to let go of it. And I don't ever want to hear that we can't eat you know because we do eat a lot of fish here you know. And because of the cholesterol level, my wife doesn't want to eat a whole bunch of shrimp you know. She's a lot more about regulating what we take in you know. (participant 1)

Expressing sadness of coastal erosion and connecting the health of land with overall wellbeing, one participant said, "[coastal erosion is)] it's the cancer of the land".

Loss of cultural knowledge. Traditions need to be continually reinforced and practiced to maintain relevance to the culture. Older participants who lived a more traditional lifestyle recall when they got their first boat there was a ceremony to mark the occasion.

> It was like a birthday party. They didn't have no such thing as ribbons, but they would find different material colors to put on your boat to present it to you. They would make a seafood dinner, it was very special, a nice ceremony. (participant 4)

However, for younger participants that was not the case. When asked if there was a ceremony or if his first boat was gifted, he stated,

> I worked for another man on a boat. I made money and I got my own boat after I had my money. . . Oh no, no. I had to work for it. I had to work for everything I got. I worked before I got my first boat. (participant 9)

In this study, I found there were three broad categories of UHN fishermen, (1) those who harvest seafood for subsistence only (typically had a wage-earning job and fished on weekends or time off), (2) those who harvest seafood for subsistence and commercial retail (primarily those who earned other income or social security), and (3) those whose main priority is commercial fishing and of course kept some for subsistence. Each type must pay the same fees and licenses. In addition, those who fish for oyster must pay a leasing fee to private companies to harvest on private waters. Oystermen could harvest in open waters without leasing the water, but only during certain open season months and not year around as those with leases. There are also fees for crabbing that is in the form of tags for the traps.

The move to commercial fishing is a demonstration of modern times or accepting western ideology. However, it is practical in that now people have financial responsibilities that did not exist for previous generations. Therefore, fishermen had to conform to western standards to develop their practice into small businesses as a commercial fisherman.

From cast nets, to trawling, to skimming, shrimpers change their harvesting methods to keep up with the changes in the environment to meet demand. "Oh the land changed a whole lot. Because where we used to do the cast-net, today you got more salt water intrusion in that - you ain't going to be able to do what we was doing then" (participant 15). The cast-net process was explained by an older participant who harvested this way with his grandfather.

> We'd leave home around 2:00 in the morning. It'd take us two hours to go where we were going to go. Then my grandpa would bait the line [with shrimp dust]. He would have maybe like 100 or 200 poles in the lake, you see? And then, uh, we'd bait it and come daylight, 6:30, 7:00, they started the cast-net. You throw your cast-net right on top of where you throw your bait, you see? And, uh, then we'd

catch some shrimp. And at that time the shrimp my grandpa was catching, we'd get paid by the tub, that was a 100 pound tub. And we was catching five, six, seven, sometimes ten tubs a day. With the cast-net you'd have to back about 10:30 or 11:00 because we didn't carry no ice. And you had to be back to unload your shrimp. And that was done during the summertime, you see? . . . You didn't want it to be too hot. We had to cover the shrimp with sacks, burlap sacks and moss. Cover them up so they wouldn't spoil. (participant 15)

As demand for shrimp rose, the trawling method became popular among UHN members. Trawling is a method that requires a much larger boat that is rigged with boards and nets that drop to the bottom of the water. Trawling is a controversial method because it disrupts the ecosystem by dragging the sea bottom and pulling up everything in its wake.

Figure 5.4: Shrimp boats, Dulac, Louisiana March, 2016. Photo Credit: Shanondora Billiot

Approximately 20 years ago a newer and more sustainable method was introduced, skimming. These boats do not have dragging nets. Instead the nets are along the side of the boat and skim the top of the water. The skimming method also allows fishermen to utilize indigenous knowledge of working by the tides and moon phases. This method is both less invasive to the ecosystem and can yield a larger harvest.

Therefore, there is tension between those who harvest through trawling and those who harvest through skimming.

Another source of concern for environmentalists is the use of the salt barrel. Traditional ways are to sort (piquer) the shrimp by sizes and throw back any bycatch that will not be sold or consumed. In addition to high demand for seafood, there are many laws on what kinds of fish can be kept and brought into the dock. Therefore, some participants adopted a sorting process to where they dump the full nets into a large container that has water mixed with salt purchased from the store. The shrimp will sink to the bottom and the bycatch will die and float to the top. When I asked if the fish would otherwise be eaten by other fish, one participant replied,

> Probably so, I don't know. I've never thought about it. I know you kill a bunch of fish, but it's them little trash fish, they call it, where I don't think . . . Never thought about killing a bunch of fish. Got me thinking there. (participant 2)

I got the impression that naming the bycatch as "trash fish" removed the responsibility to ensure ecosystem sustainability and that in many instances participants were not aware of the potential harm of this practice.

In addition to the methods, fishermen are forced to be more reliant on technology to navigate the waters. With many of the land markers disappearing they must use a combination of computer systems equipped with GPS and radar technology.

> Yeah we got a GPS. Before that it was just knowledge, you know. You knew your little land marks. You knew little points and this and that. You knew how to get around but then since it ate up you just have to know of knowledge before the GPS's came out. Now we have a GPS but on the GPS it's still marking the land. In other words, the GPS say you got land right there but you go over there, they don't have no more land. Really, you can't go [just] according to the GPS neither. (participant 10)

Without these tools, even the most experienced fisherman can get turned around.

The UHN fishermen have had to adopt western practices of harvesting and operate not only as an individual harvesting for subsistence but a commercial fisher to make a living. The transition from traditional methods to western practices also meant that some adopted techniques were not sustainable practices. Therefore, adopting the western techniques interrupted the reiteration of traditions and passing on knowledge, such as caring for the land.

Surviving as a commercial fisherman requires many more skills today than in the past. In many pockets of Terrebonne Parish among predominately white and wealthy residents, there is still a low perception of fishing as an occupation. Wealthy residents believe that because shrimping is labor intensive it does not require much skill or intelligence, and does not produce wealth. However, I found tremendous intelligence and skill among every participant in the study. There is a set of skills in knowing how to navigate the water and working with the ever-changing seasons and laws guiding the practice that are unique to UHN members and commercial fishermen. In addition, commercial fishermen today require management and leadership skills to successfully run a small business. I spent weeks trying (unsuccessfully) to understand all the laws associated with the fishing industry and migration patterns to conduct interviews with them. I was in constant awe of their ability to continue to persevere with the constant changes (observation notes).

Loss of ability to protect the environment. Trapping was a major source of revenue for many Houma families. Not only did trapping for nutria reduce the population that causes extensive damage to the wetlands, the nutria pelts were also sold to the fur trade industry. In the 1980s nutria were considered protected animals and the

fur trade industry declined, "well, that [trapping laws] started changing about the 1980's. That's about the time it started change for the worst for us" (participant 15).

However, Louisiana state officials noticed an increase in the damage to the marsh from a lack of nutria population control and implemented a coast-wide nutria control program. The program offers $5 per nutria tail delivered to the department of wildlife and fisheries (observation notes).

In addition, trappers had a practice to preserve the marsh for the following year, an elder participant discusses how it protected the land from natural and manmade disruptions.

> Just about every storm that they had that came, you had a big change. Big change. Any time you're going to have a powerful storm that's going to come, it's going to take some marsh with it. If you don't have the marsh, you don't have much to protect the land. When they had trappers that trapped the land, they would burn the land every year. Every year they would burn the marsh. Right when trapping season closed, they would burn the marsh, and the marsh would stay hard. It would keep the marsh hard. Then a new growth would come, and that would keep the land. Yeah, that would keep the land. (participant 4)

During the survey a participant shared that when the oil field started building pipe tunnels under the marsh, sometimes there would be these swirls that drain like in the bathtub. "But when we used to burn, "the swirls couldn't chew the burned marsh" because it was strong." With the decline in trapping and laws against open burns, the land is no longer preserved in this way. (participant 4)Thus, leaving the marsh more vulnerable to salt water intrusion now than before the laws were enacted.

Indigenous practices included things like burning the marsh annually in different locations to strengthen it. UHN practices also include maintaining interactions with the environment as essential to reinforcing cultural knowledge. Older participants who earned above median income still interacted with the land and water in some way.

Because of their experience working on the waters from a young age (earliest reported running his own boat at age 10) they were sought to run tug boats along the Mississippi River. They knew the water and more importantly knew how to navigate waters in calm and treacherous conditions. In addition to have a wage-earning career, they would still take to the waters on their days off. They had shrimp, crab, or oyster boats. In many instances their spouses and children would also run the fish boats in their absence. When those interactions are interrupted, they lose the ability to care for the land.

5.2.6 Qualitative summary

The shared experiences of UHN members in this study were discrimination, observing environmental changes, causes, and interconnectedness of place and human activities. This shared knowledge informs how UHN member experience exposure to environmental changes.

5.3   Mixed Methods Results

This section will present mixed methods results. To date, there is limited research on how to best present and analyze convergent mixed methods studies. However, in a systematic review of mixed method studies, Guetterman, Fetters, and Creswell (2015) found the most useful and utilized format to present a convergent mixed methods study is the use of a side-by-side joint display table. The results are presented in table 5-21. It is organized by quantitative results organized by hypotheses. It is important to note that hypothesis three is a statement that can only be answered with a quantitative statistical test, one of moderating relationships. Therefore, indigenous specific factors are compared with participants' beliefs on health impacts from environmental changes.

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Relationships between indigenous-specific factors, environmental changes and health are also covered in the second side-by-side comparison displayed as a figure.

In this study the qualitative results converge and diverge from quantitative results. The themes found illuminate shared cultural experiences of exposure to environmental changes by expanded the limited knowledge gathered from the survey. In the table are the following mixed methods results:

- Mixed methods analysis converges on findings of the prevalence of environmental change exposure. Qualitative interviews further revealed commonly held beliefs of environmental changes, threats to environment and health, and causes of environmental changes not present in the survey (see Table 5-21).

- Participants did not discuss their individual health in detail, therefore the mixed methods result for the level of health conditions among participants is divergent (see Table 5-21).

- Some participants did report health conditions of cancer, sinus, and allergies (see Table 5-21).

- Qualitative and quantitative results converge to show relationships between environmental changes and health (see Table 5-21).

Quantitative survey did not collect data on harvest loss of livelihood impacts. Qualitative data reveals participants' loss of harvest. Mixed methods result is divergent on the interconnectedness between human activities, environmental changes, harvest and medicines, livelihood and health, loss of culture, and caring for the land (Figure 5-5).

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Table 5-21: Mixed Methods Side-by-Side Joint Display of Results

	Quantitative Survey Results	**Qualitative Interview Results**	**Mixed Method Result**
By quantitative results			
Prevalence of environmental change exposure	The mean for participant environmental change exposure is 85.28 (SD = 28.14) skewness of -0.2, and kurtosis of -0.33 with a theoretical range of 0 to 144 (as never = '0') and actual range of 5-144.	Environmental changes were observed through repeated disasters, chronic land loss, climate change, and pollution.	Qualitative results converged with quantitative analysis. Further, interviews revealed commonly held beliefs of environmental changes, threats to environment and health, and causes of environmental changes not present in the survey.
Level of health condition	• Approximately 58% (n=91) of participants said their health was good to excellent compared to about 42% (n=65) who said their health was fair to poor. • More participants had poor health days (n=86, 59%) compared to participants who had no poor days (n=59, 41%) in the previous 30 days. • Most participants did not meet criteria for any mental health diagnosis (n=124, 79%) while about 21% (n=33) did meet criteria for at least one mental health diagnosis.	In qualitative interviews participants reported recently recovering from cancer, sinus or allergy problems, or work injuries. However, the number of days they were ill was not reported in this interview. Some participants reported health conditions of cancer, sinus, and allergies.	Qualitative and quantitative analysis show divergent results primarily because participants did not discuss their individual health.

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	• There was a high level of belief among participants that their health was impacted by environmental changes, mean is 35.78 (SD=7) with a theoretical range from 1-49 and an actual range from 8-49.		
Relationship between environmental changes and health	There is a relationship between exposure to environmental changes and health outcomes. Specifically, there is a relationship between exposure to environmental changes and poor health days, screening for mental health condition, meeting criteria for a mental health diagnosis, and feeling health impact. A relationship between exposure to environmental changes and general health was not found at the bivariate level. • It was found that exposure to environmental changes significantly predicted poor health days (β = .01, *p*=.02). For each increase of exposure to environmental change, participants were 1% more likely to have poor mental health (OR 1.01, CI= 1.0-1.03). • It was found that exposure to environmental changes significantly predicted meeting criteria for mental health diagnosis	The loss of land has meant loss of access to fresh vegetables that must now be purchased or grown with soil fertilizer. Additionally, environmental changes have interrupted access to fresh fish and water fowl commonly consumed. Participants believe the pollution may be causing cancer, allergies, and sinus problems.	Qualitative and quantitative results converge to show relationships between environmental changes and health.

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	(β = .02, p=.01). For each increase of exposure to environmental change, participants were 2% more likely to meet criteria for mental health diagnosis (OR 1.02, CI= 1.0-1.03). • Bivariate analysis shows a relationship between felt health impact and exposure to environmental changes (r=.52, p<.0001) (table 12).		
Relationship between Indigenous specific factors, environmental changes and health	No interaction effects were found to moderate the relationship between environmental changes and health outcomes. However, controlling for other variables in the model, the following indigenous specific factors were found to predict health outcomes: discrimination, social support, and ethnic identity.	-------------	--------------
General health	Multivariate level tests were not conducted with the general health outcome variable because there was not a statistically significant relationship found at the bivariate level.		Divergent results.
Poor health days	Controlling for other variables in the model both discrimination and social support had statistically significant relationship with poor health days. When interaction terms were added the relationship between	Older participants discussed how they used their support system in the past to have access to a traiteur when they were growing up.	

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	discrimination and poor health days disappeared. However, when interaction terms were added to the model the relationship between social support and poor health days remained.		
Poor mental health	Controlling for other variables in the model discrimination had statistically significant relationship with poor mental health. When interaction terms were added the relationship between discrimination and poor mental health remained.	Expressing sadness of coastal erosion and connecting the health of land with overall wellbeing, one participant said, "[*Coastal erosion*] *it's the cancer of the land*".	Divergent results. Quantitative results revealed more information on mental health than did the qualitative results.
Health impact	Controlling for other variables in the model both discrimination and social support had statistically significant relationship with health impact. When interaction terms were added the relationship between social support and health impact disappeared. However, when interaction terms were added to the model the relationship between discrimination and health impact remained.	Participants also did not discuss health in terms of discrimination and historical loss. many participants discussed health through fondly remembering traditional healing methods of a traiteur that has become part of their identity as Houma and requires a social support system. Several people shared that they did not go to doctors when they were growing up. Instead, if they had health problems, the traiteur (treaters), would use traditional medicines of herbs, plant roots, trees, solvents and prayer to heal	Partial convergent results. Both qualitative and quantitative results show relationships between indigenous-specific factors, environmental changes and felt health impacts. The qualitative results reveal the interconnected nature that adds to the understanding of the theoretical model.

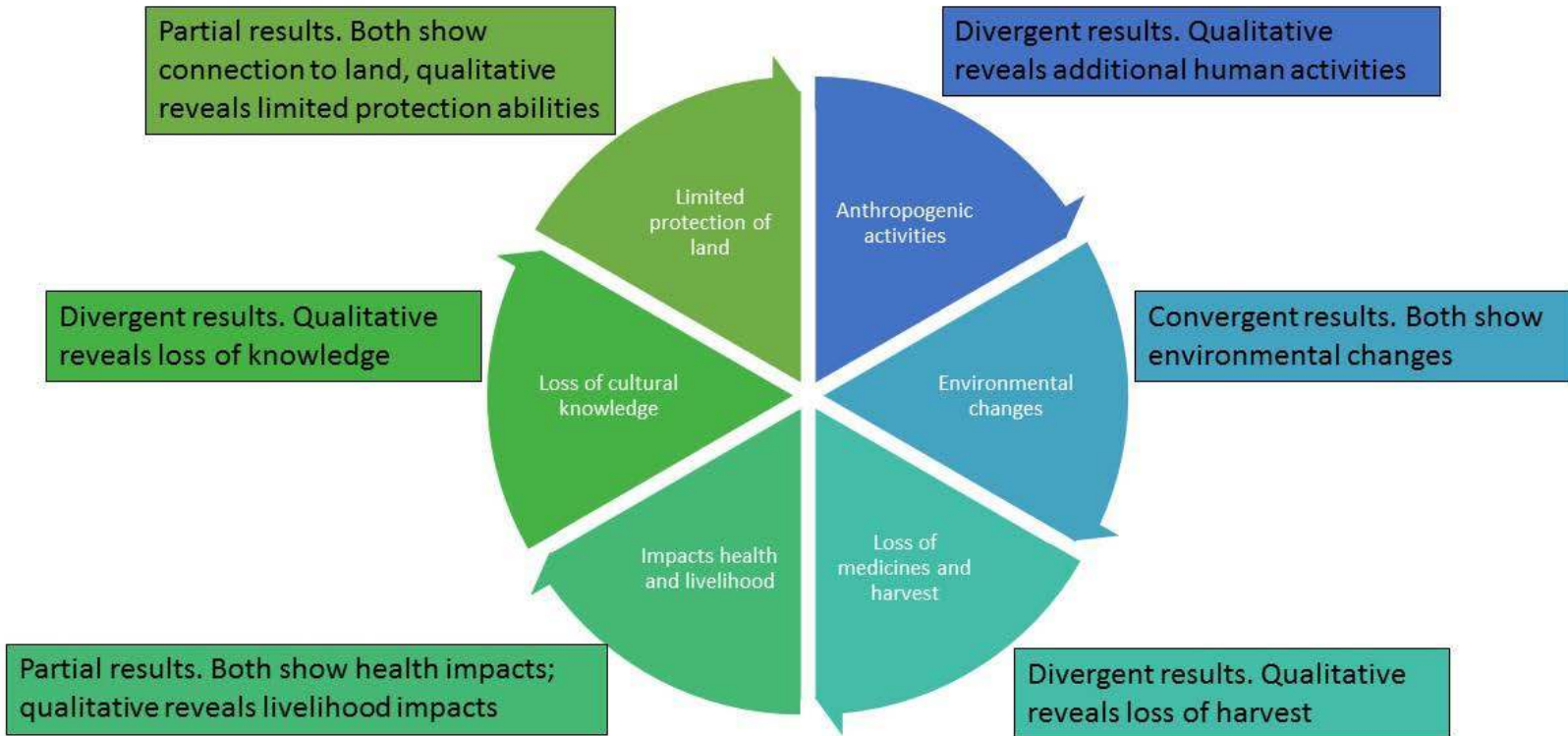|		them. Losing the ability to find medicines and losing traiteurs, they believe, has impacted their health.	

Figure 5.5: Mixed Methods Results Side-by-Side Comparison of Qualitative and Quantitative Data

CHAPTER 6: DISCUSSION

"But how do you replace paradise?
How do you make a memory real?
How can your children see a place
That they can no longer touch or feel?"
~ T. Mayheart Dardar

6.1 Introduction

The purpose of this study was to understand how environmental change exposure and indigenous-specific sensitivities impact the holistic health of indigenous peoples living in a physically vulnerable coastal area of the United States. Three notable findings from this study will advance empirical knowledge of environmental change exposure among indigenous peoples: (1) The study builds on previous qualitative knowledge that indigenous peoples exposed to environmental changes experience negative health consequences by quantifying their experience and showing direct relationships to health outcomes and indigenous-specific experiences. (2) There is an interconnected cyclical nature of the shared cultural experiences of exposure to environmental changes. These themes further refine the theoretical framework presented in this study. (3) Discrimination predicted poor mental health, reiterating the need to investigate contemporary trauma and makes a call to reclaim traditional knowledge and practices through developing community healing interventions.

I begin with a discussion of the prevalence of environmental change exposure in comparison to previous literature on indigenous peoples and environmental changes. Next I discuss the remaining notable findings. The chapter closes with presenting the limitations of the study.

6.2   Building on Previous Research

In this study both qualitative and quantitative findings demonstrate that participants have a deep connection to land and they observe environmental changes. Findings are consistent with previous research. Indigenous peoples have observed and reported on changes in the climate through warming temperatures (Berrang-Ford et al., 2012), water availability (Berrang-Ford et al., 2012; Brubaker et al., 2011), biodiversity loss (Furgal & Seguin, 2006), uncharacteristic weather patterns (Furgal & Seguin, 2006), melting and thinning of snow, ice, and permafrost (Brubaker et al., 2011; Ford et al., 2014; Tam et al., 2013) as well as increased pollution (Snodgrass, 2013).

Nearly all participants, 97% (n=152), reported a connection to place by answering agree very strongly, agree strongly, or agree and only 3% responded neither agreeing or disagreeing while no participants responded in disagreement. Unfortunately, this precluded bivariate and multivariable analysis, due to insufficient variance, to explore relationships with health outcomes. However, qualitative data supports existing literature that describes how participants develop their connection to place through following the natural climatic seasons for subsistence activities that included the whole family. Survey questions reveal that *plac*e was defined as where they called "home" rather than where they lived.

Survey results indicate that the participant sample has a wide range of exposure to environmental changes (mean= 85.28, SD = 28.14). The qualitative data expands our understanding by providing details to shared experiences of observing environmental changes through disasters, chronic land loss, climate change, and pollution in a coastal area of the United States. These details can be used to culturally modify the environmental distress scale in future studies.

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6.2.1 Relationship between environmental changes and health

Previous research with indigenous peoples in other countries report health outcomes such as water- and vector-borne diseases (Cunsolo Willox et al., 2012; Hofmeijer et al., 2013) malaria (Berrang-Ford et al., 2012; Doyle et al., 2013; Furgal & Seguin, 2006) stomach disorders (Berrang-Ford et al., 2012; Hofmeijer et al., 2013), malnutrition, respiratory diseases (Berrang-Ford et al., 2012) and cardiovascular diseases (Cunsolo Willox et al., 2012). Additionally, mental health outcomes such as of negative feelings of place and maladaptive behaviors from environmental change increases family stress, enhanced drug and alcohol usage, and suicidal ideation (Cunsolo Willox et al., 2013).

A relationship was found between exposure to environmental changes and health outcomes. Specifically, there is a relationship between exposure to environmental changes and poor health days, meeting criteria for a mental health diagnosis, and feeling health impacts. For each increase of exposure to environmental change, participants were 2% more likely to meet criteria for mental health diagnosis (OR 1.02, CI= 1.0-1.03). Bivariate analysis shows a relationship between felt health impact and exposure to environmental changes ($r=.52, p<.0001$). This finding contributes to literature by quantifying a relationship between environmental change exposure and health outcomes. Qualitative results reveal that participants believe the environmental changes and pollution may be causing cancer, allergies, and sinus problems. These results also elaborate on how they feel their health is impacted by environmental changes, thus converging the results.

Qualitative results also expand knowledge of changing of health behaviors among participants. The loss of land has meant loss of access to fresh water and vegetables that

must now be purchased or grown with soil fertilizer. Additionally, environmental changes have interrupted access to fresh fish and water fowl commonly consumed. These findings suggest that exposure to environmental changes have interrupted their consumption of healthy foods and clean water. These findings are consistent with previous literature from studies conducted with indigenous peoples (Berrang-Ford et al., 2012; Doyle et al., 2013; Furgal & Seguin, 2006; Mitchell, 2016). Future studies should consider adding health behaviors to the felt health impact scale.

6.2.2 Relationship between environmental changes and indigenous-specific factors

This study did not find an interaction effect between indigenous-specific factors and environmental changes when predicting health outcomes. However, this study contributes to literature by showing a statistically significant relationship between exposure to environmental changes and discrimination (t (155) = -3.38; p <.001) and with historical loss (r = .51, p <.001, R^2 = .26). Many older participants had only the land to survive when they were shut out of many institutions. As an elder participant male said, "(m)y daddy had all told us while we were young, that we was going to have to learn the water, because we was unable to get an education" (participant 4). I will continue the discussion on indigenous-specific factors and environmental changes in further in the chapter in the refining theoretical model section.

6.2.3 Age as a protective factor

In this study, age had a negative statistically significant relationship with poor mental health. Controlling for other factors, for each year increase in age, participants' odds of meeting criteria for a mental health diagnosis decreases by 8% (OR = .92, CI =

.86-.99). This could be due to one or more factors. Older participants may be more likely to report better mental health given their experience and longevity. In the context of environmental changes, they have a longer time frame in which they may have come to accept that changes are normal. However, it could also be that older participants have a greater stigma of mental illness. This would fit with existing literature that has found stigma among older adults when discussing mental illness or negative feelings (Préville et al., 2015). Further research is needed to understand if age is a protective factor for mental health among this population.

6.2.4 Gender has a differential impact on mental health

Women were more likely to meet criteria for a mental health diagnosis. This finding is consistent with previous literature that shows gender disparities in depression, anxiety and posttraumatic stress disorder (Kessler, 1994; WHO, n.d.). Women are more likely to be diagnosed with depression especially after "disruptive, negative life events that cannot be controlled or evaded are most strongly related to the onset of depressive symptoms" (WHO, n.d.). Possible reasons found in literature are differences in gender roles, income disparity, and violence (WHO, n.d.). It would seem unlikely that the gender differential impact on mental health found in this study is due to subversive gender roles given that UHN is a matriarchal and matrilineal culture and there is no evidence of interpersonal violence among women in this study. However, U.S. Indigenous women experience intimate partner violence at higher rates than other races (Wahab & Olson, 2004).

There is an income disparity in this study which could be a possible reason why study findings indicate that more females meet the criteria for a mental health diagnosis.

Further research is needed to explore the gender differential impact on mental health with this population.

6.2.5 Serious relationship status is a risk factor of health

Those in a serious relationship are over 3 times as likely as those not in a serious relationship to have poor health days (OR = 3.43, CI=1.15 – 10.24) controlling for other factors in the model. Previous literature widely reports that marital status is related to health with conventional wisdom that married people have better health (Fuller, 2010). Many studies over the past decade have tried to parse out the qualities of the marital relationship that serve as a protective factor for health. Recent studies have found mixed results regarding relationship status and health (Fuller, 2010). For example, one study found that marital status is a risk factor for men as they are more likely than non-married men to be overweight or obese (Berge, Bauer, MacLehose, Eisenberg, & Neumark-Sztainer, 2014). Another study found that marital couples who commute (or live apart) have poorer health than marital couples who live together (Fuller, 2010). Many of the participants experience long separations through the nature of the oil-field industry work schedule (typically 3 weeks away and one week home) and Gulf shrimping (where the shrimper is away for work 7-10 days). Another possible explanation for this finding in this study is that most participants were married or in a serious relationship (82%) and could unduly influence the results.

6.3   Refining Theoretical Framework

Findings from this study partially support the theoretical model. Bivariate results support the theoretical model to show that environmental exposure has a direct relationship with health outcomes. Results converge to reinforce the relationship

between discrimination and social support on the health of participants. Interaction effects between environmental change exposure and indigenous-specific sensitivities (vulnerability) did not predict health outcomes as the model theorized. This result conforms to previous studies that find moderation effects difficult to prove (Schultz, 2016), especially when one or more variable is continuous (McClelland & Judd, 1993). The lack of interaction effects in this study could also be due to a couple of factors.
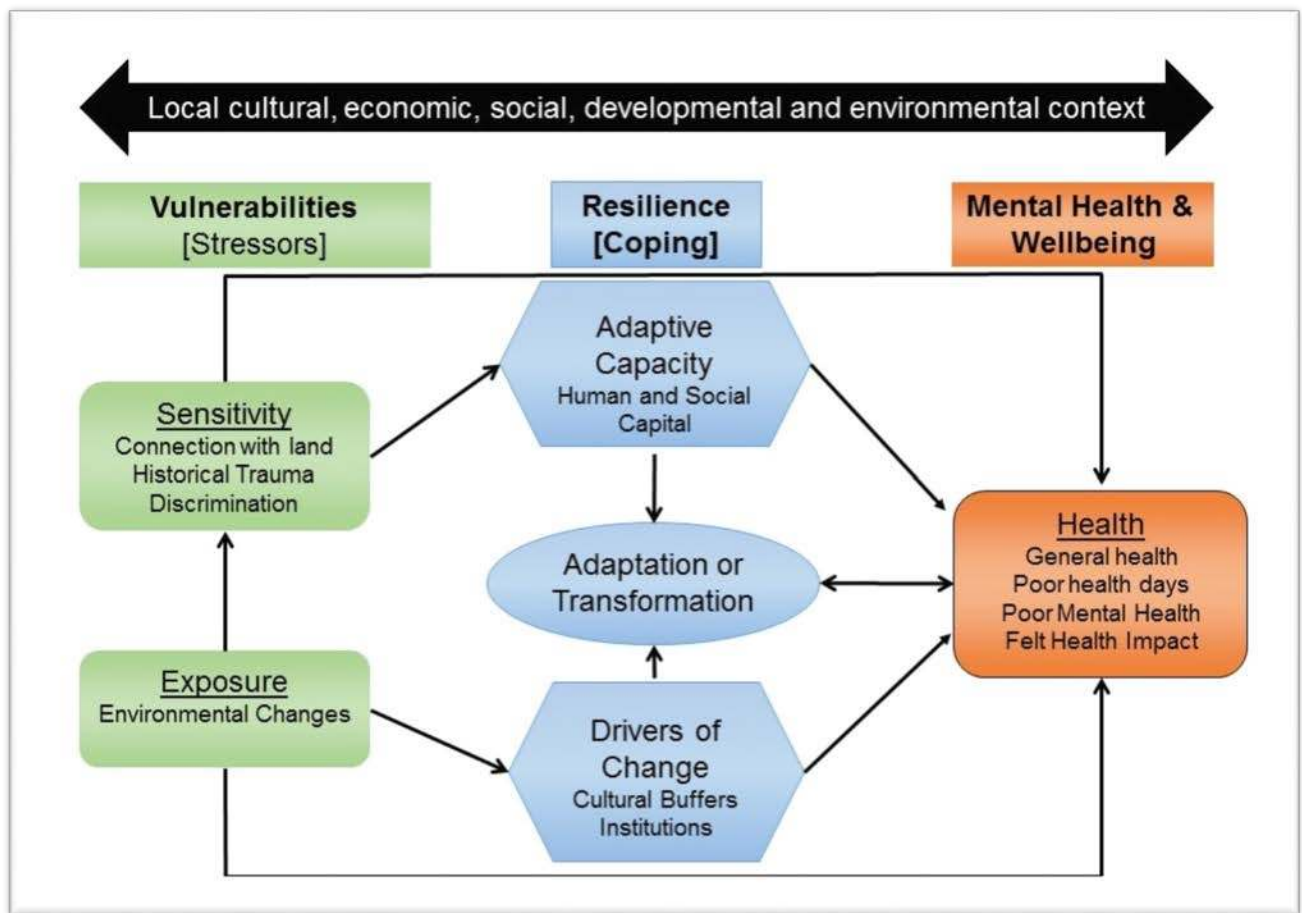

Figure 6.1: Indigenous Vulnerability, Resilience, and Health Outcome Theoretical Framework

In this study, discrimination and historical trauma were conceived as stressors in the Indigenist-Stress Coping Model (Walters and Simoni, 2002). The variability of vulnerability stems from proximity to fragile ecosystems as well as the social and

economic differences across communities (Boruff et al., 2005). I hypothesized that discrimination and historical trauma are stressors to indigenous health as documented in literature (Walters and Simoni, 2002). I add to the hypothesis by conceptualizing sensitivity to be measured by discrimination and historical trauma as a proxy to account for social and economic differences in exposure to environmental changes with indigenous peoples. While there are direct relationships between historical trauma and discrimination with environmental changes, in this study they did not interact to predict health outcomes. Therefore, results indicate that both discrimination and historical loss are stressors, or risk factors as conceptualized by Walters and Simoni (2002) rather than as moderators. This study shows that environmental changes could be incorporated into the "Indigenist" stress-coping model as a stressor for indigenous populations.

In addition, social support and ethnic identity were hypothesized as cultural buffers where people with more social support and greater ethnic identity will experience less negative health outcomes. Neither social support nor ethnic identity had interaction effects with environmental changes on health outcomes. In this study, social support did serve as a cultural buffer when predicting poor mental health. Social support included friends and family support. Controlling for other variables in the model, for each unit increase in social support scale, participants' odds of meeting criteria for a mental health diagnosis decreases by 14% (OR = .86, CI = 0.72 - 0.98). In qualitative interviews, elders were also mentioned as part of their social support system which was not captured in the social support survey measure.

Ethnic identity did not serve as a cultural buffer when predicting health. In fact, ethnic identity appeared as a stressor when predicting poor mental health. Controlling

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for other factors in the model, for each unit increase in the ethnic identity scale score, participants' odds of meeting criteria for a mental health diagnosis increases by 85% (OR = 1.85, CI = 1.03 − 3.33). Recent research shows similar results when using the Multigroup Ethnic Identity Measure-Revised (MEIM-R) to measure ethnic identity and health outcomes (Schultz, 2016). Schultz (2016) suggested perhaps this could be that ethnic identity is performing as a proxy for historical or contemporary traumas that are tied to one's identity as an indigenous person. Further research is needed to differentiate identity from feelings about one's identity when attempting to discern health outcomes.

The qualitative data shows a cyclical interconnected nature of shared cultural experiences of environmental changes and its impacts. This highlights the concern of quantifying indigenous knowledge without the iterative process of also utilizing qualitative data or other indigenous methods (Burnette & Billiot, 2015). Where quantitative results do not show statistically significant interactions among environmental change exposure and indigenous-specific factors when predicting health outcomes, the qualitative data does show how the concepts are interconnected through their shared lived experiences. The results indicate that anthropogenic activities cause changes in the environment. The changes lead to a loss of medicines and harvest, which leads to impacts on health and livelihoods, which leads to loss of cultural knowledge being passed and reiterated between and among generations, which leads to loss of knowledge on protecting land and leads to developing anthropogenic activities that cause changes in the environment.

6.4   Addressing Contemporary Trauma

Results indicate that connection to land among study participants is clearly profound. In fact, nearly all participants, 97% (n=152), reported a connection to place by answering "agree very strongly, agree strongly, or agree" and only 3% responded "neither agreeing or disagreeing", while no participants responded in disagreement. One participant described how he felt about interacting with the land, "That was my life. That was in my blood" (participant 15).

Indigenous peoples' relationship with land is spiritual, cultural, and place-specific (Pierotti & Wildcat, 2000; Rosier, 2003; Schultz, Walters, Beltran, Stroud, & Johnson-Jennings, 2016; Settee, 2008). Interruption of Indigenous Peoples' ability to interact with land is called the fourth removal for U.S. Indigenous Peoples (Wildcat, 2009). It occurs when natural resources are exploited, the ecosystem dies, the land is repurposed for unsustainable practices, and the relationship with the land is lost (Wildcat, 2009). Removing connection to land can result in a form of contemporary trauma (Evans-Campbell, 2008) through removing traditional ways of coping like spiritual-land based healing, which can reduce cultural buffers from modern stressors or traumas (Brave Heart, Chase, Elkins, & Altschul, 2011).

Another form of contemporary trauma is discrimination (Evans-Campbell, 2008). Participants persisted despite institutional barriers to education and economic resources. However, while many of those structural barriers have disappeared, discrimination is in their collective memory. In the survey, discrimination had a significant relationship with poor mental health and felt health impacts. While 79% (n=124) of the participants did not meet criteria for a mental health diagnosis, 21% (n=33) did. This fits with the U.S. national average of mental illness among American

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Indian/ Alaska Native adults of 21% (SAMHSA, 2016). Untreated mental illness can be due to lack of access to treatment, given the limited number of providers in the rural area, or access through insurance or financial means. In fact, 34% of participants stated they did not have insurance of any kind (figure 6.2).
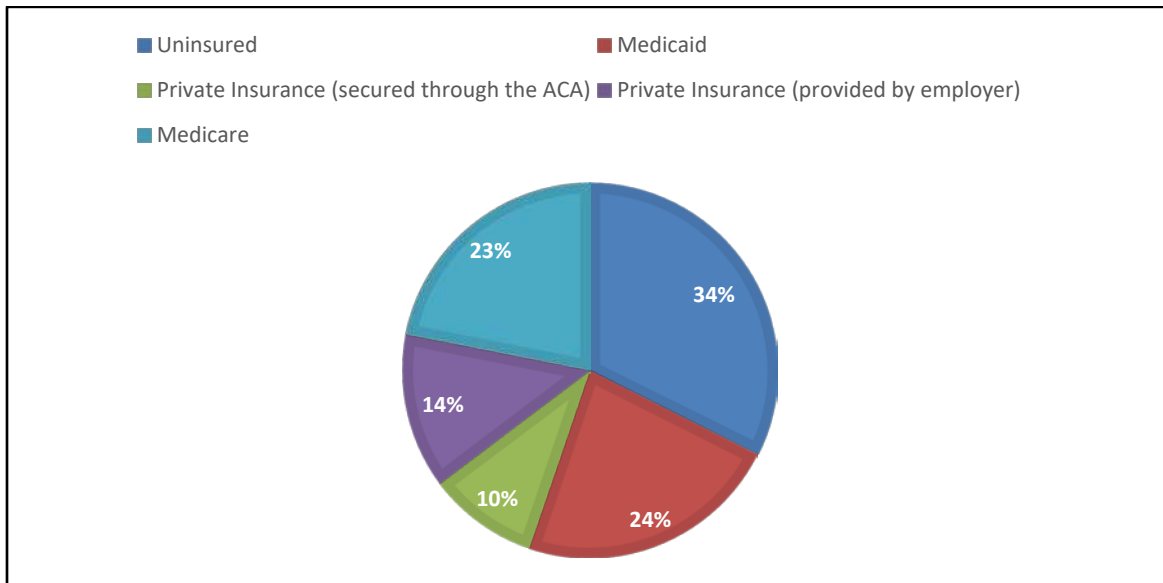

Figure 6.2: Participants' Medical Insurance Status

The high prevalence of poor mental health among participants suggest a need for culturally-informed evidence based intervention to heal contemporary trauma and address holistic health among UHN members. Meta-analysis of the efficacy of treatments for PTSD revealed that the most effective treatments were cognitive processing therapy, prolonged exposure therapy, and eye movement desensitization and reprocessing (EMDR) (Cusack et al., 2016). A systems approach to addressing trauma is trauma-informed care in primary health care and school settings (SAMHSA, 2014). Interventions aimed to address poor mental health with UHN should include considerations of access to care, cultural adaptations of effective treatments, and systems approaches.

6.5   Limitations

The results from the interviewer-administered survey and the qualitiative interviews will only be generalizable to United Houma Nation population included in the study. However, results could inform future climate change and health outcomes research, particularly within the United States and among indigenous peoples. In addition, the sample size (n=157) may have limited the ability to find significant interaction effects between indigneous-specific factors and environmental changes when predicting health outcomes.

CHAPTER 7: IMPLICATIONS AND CONCLUSION

7.1 Implications for Future Research

7.1.1 Mental health

A grave social impact of environmental change is the mental health of survivors, given that about 17 % of the U.S. population will experience a disaster in their lifetimes (Kessler et al., 1995) and approximately 25% of the U.S. population will be affected by coastal erosion by 2030 (Boruff, 2005). Land is a viable resource to indigenous communities both culturally and for future generations. Therefore, it is imperative that we engage indigenous communities in research related to impacts on health services to understand any long-term effects of mental health when exposed to chronic global environmental changes such as coastal erosion and land loss.

7.1.2 Refining collecting health data

While most participants rated their health from good to excellent (58%, n=91) we see that participants had more days of poor health (59%, n=86) than those who did not have poor health days (41%, n=59). In addition, about 21% of the participants met criteria for a mental health diagnosis and there was a high level of belief among participants that their health was impacted by environmental changes (mean=35.78, SD = 7). However, participants did not elaborate on their health conditions during the qualitative interviews. This could mean that it is not culturally appropriate to discuss health problems and additional measures must be taken to develop a more culturally appropriate interview protocol. Also, several participants completed the qualitative interviews with their spouse. It was stated in their IRB consent form that they could

have someone with them because my community advisory committee and I believed that would be most culturally appropriate. However, it may have also limited some of the health information that would have been shared if everyone were interviewed separately. In both instances, future studies should weigh cultural appropriateness with scientific rigor.

7.2   Implications for Practice

Participants noticed changes in their environment through land loss and migration patterns and believed these changes were impacting their livelihood. One example where this may be the case is with a reduction of brown shrimp for shrimp harvesters. Three measurements are key to stock yield and level of growth for brown shrimp: temperature, salinity and tidal height. Prior to the 2015 brown shrimp season, NOAA (2015) predicted there would be about 24.8 million pounds of brown shrimp catch for the 2015-2016 season (the year this data was collected). This volume prediction was lower than the 53-year historical average of 30.8 million pounds off the coast of Louisiana. The decrease was attributed to the record high rainfall (NOAA, 2015). Therefore, the year that this data was collected NOAA predicted to be a low catch season for brown shrimp. In addition, (Smith et al., 2017) found that fertilizer and other chemicals introduced into the Mississippi River through its tributary system impacts the relative price of shrimp through the process of coastal hypoxia effects on the size of shrimp within the population. Fertilizer and other chemical runoffs flow into the Mississippi River system during times of high rainfall the hypoxia increases in the Gulf (Smith et al., 2017). During the 2015 shrimping season fertilizer entering the Gulf impacted the growth size of shrimp which ultimately impacted fishermen livelihoods.

The observations made by the participants were accurate, even without the advantage of scientific data to support their assumptions, the size of the shrimp and the size of the population were different in this year. This highlights the importance of accepting and utilizing traditional ecological knowledge (TEK) to improve the quality of research and expanding resource management (Huntington, 2000). If the knowledge provided by NOAA were shared with UHN members, harvesters could make informed harvesting decisions. Likewise, if NOAA scientists consulted with UHN members then their prediction models could have greater forecast precision. A possible solution could be to include NOAA scientists in the development of a formal mutual consultation effort.

These findings further shed light on the need for social workers to be trained in environmental justice issues for both macro and individual level practice. At the macro level the findings highlight the interconnectedness of anthropogenic activities, the health of the environment and people, livelihoods, and culture. In the finding just described, environmental justice practitioners could work to develop interventions to address non-sustainable practices.

At the community level, social workers can be part of the call to action, to develop and implement educational and sustainable living interventions (adaptations) and guidelines. Mezzo-level social workers can concentrate their efforts among those in rural versus urban geographic locations (Green, Niall, & Morrison, 2012) as these social vulnerabilities only enhance impacts to environmental changes. Here, social workers can conduct vulnerability assessments and develop disaster preventative plans with clients. As evidenced by the work presented in this paper, mental and physical health needs abound. Therefore, building workforce capacity to handle the influx of need, developing mental health strategies to adapt to environmental changes, and creating

resources for food and water-stricken communities are all areas in which social work practitioners can be involved.

At a national level, the micro-level practice field also offers many opportunities for social workers to engage in addressing global environmental change. Clinical social workers can develop trauma and crisis interventions that build on attachment theory that is used in early childhood and adolescence and as a guideline for working with indigenous clients who experience loss or disruption to their environment. Medical social workers can follow examples from Australia, New Zealand, Canada and Peru to develop culturally appropriate health services that integrate western practices with indigenous medical practices (Stephens et al., 2006). Additionally, there is a need for social workers to develop a culturally relevant notion of "environment" similar to that of aboriginal Inuit—where personhood is understood as identity that includes one's relationship with the land and environment (Kirmayer et al., 2011).

7.3   Summary

Exposure to global environmental changes will pervade into life on earth (Moran, 2010). Thus, humans will experience social, economic, and health impacts (Boruff et al., 2005; Nicholls et al., 2007; WHO, 2014). For instance, rising temperatures will mean widespread vector-borne illnesses (i.e., malaria), malnutrition, and diarrheal diseases (World-Bank, 2010). Additional research suggests increases in non-communicable diseases (i.e. cancer, cardiovascular disease, mental health and stress-related disorders) as potential impacts on human health (Portier et al., 2010).

How humans experience consequences of environmental change depend on proximity to exposure as well as social and economic differences across communities

(Adger, 2006b; Boruff et al., 2005; Cutter et al., 2003; Gillespie, 2010; Nicholls et al., 2007; Vogel et al., 2007). Marginalized populations, such as indigenous coastal communities, are especially vulnerable to additional pressures on their struggling social systems. Environmental change impacts on human health will be exacerbated among indigenous peoples due to existing health inequalities (Ford, 2012; Gracey & King, 2009).

Empirical evidence on health impacts of environmental changes among indigenous peoples is limited. Drawing on principles steeped in community-engaged and indigenous research, this dissertation study utilized a mixed method cross-sectional design to understand how environmental change exposure and shared cultural experiences impact the health of an indigenous community, United Houma Nation. A mixed-methods design choice was more conducive to answering the study research questions than a single-approach design because it rendered stronger inferences and drew on the complementary strengths of each approach (Teddlie & Tashakkori, 2003). The mixed methods results partially support the theoretical framework by illuminating shared cultural experiences of discrimination and social support through the qualitative interviews and expanded our knowledge of statistically significant relationships between environmental change exposure and health outcomes.

7.4   Conclusion

In March of 2015, I attended a water ceremony with tribal members. National activists were going around the country and gathering water from tribal communities who have been in prolonged battles to protect their water sources. They chose one UHN community of Grand Bois because of the ongoing battle with nearby oil companies

polluting the air and water of the small community. One of the lead UHN advocates in the community has been a key community advisor to me since entering the community as a researcher. On our first meeting, she said to me, "My job is not exactly environmentalist, it's to protect the land. You know protector of the land, that's because I'm Native American, that's what we are supposed to do. That's in our spirit. In our soul. It's to protect the land. It's always been that way. And that's why I am happy doing what I do because I believe in the old way. I believe in living off the land as much as you can". At the ceremony, I asked her if she still felt the same way and she said, "even more so now. Now we are all called on to protect our lands" (observation notes).

This dissertation is the building block for a research career that seeks to understand global environmental change impacts and to protect the health of land and all living creatures. Future research projects will build on this experience and the study's findings. Furthermore, future research will better position social workers to develop environmental justice and indigenous community healing interventions and adaptations to environmental changes as impacts become more salient.

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APPENDIX A. UHN LETTER OF DISSERTATION RESEARCH SUPPORT

UNITED HOUMA NATION

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Thomas Dardar, Jr., Principal Chief

Adam Crappel
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Lora Ann Chaisson
Vice Principal Chief
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Charlton "Chuck" Duthu
Parliamentarian
District 5

Maryal Mewherter
District 6

Lawrence "Pete" Billiot
District 7

August "Cocoa" Creppel
District 8

Ernie Brunet, Jr.
District 9

VACANT
District 10

Lucretia McDonald
Secretary
District 11

November 11, 2014

Shanondora Billiot (United Houma Nation), MSW
Kathryn M. Buder Pre Doctoral Fellow
Council on Social Work Education, Minority Fellow
George Warren Brown School of Social Work,
Washington University in St Louis

Dear Ms. Shanondora Billiot:

The United Houma Nation is pleased to support your dissertation work to understand the physical and mental health impacts of coastal erosion among indigenous people. United Houma Nation is a state recognized tribe in Louisiana with approximately 17,000 tribal citizens residing within a six-parish (county) service area, which encompasses 4,750 square miles. We have a strong interest in participating in this research because we lose about 34 square miles of land each year and with the loss of land we also lose many of our traditional practices. Understanding how we can combat this loss will not only protect our lands, culture, and people but could also inform many other indigenous communities around the world.

Our organization fully supports this effort and will provide you names of potential participants to serve as your tribal Community Advisory Board (CAB). When available, we allow you to conduct your focus group sessions in our office(s). Once you have prepared your survey, our office will send it to tribal members according to your sample specifications. In return, we ask that you provide periodic updates of your progress to both the CAB as well as the tribal council.

We look forward to working with you, as we believe this partnership will produce positive results for United Houma Nation and Native communities across the country.

Sincerely,

Thomas Dardar Jr

Thomas Dardar, Jr.
Principal Chief

WWW.UNITEDHOUMANATION.ORG

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APPENDIX B. INTERVIEW PROTOCOL

Project: How Do Environmental Changes and Shared Cultural Experiences Impact the Health of Indigenous Peoples in South Louisiana?
Reintroduce myself
Read consent form, ask if participant has any questions and ask for a signature
Discussion Items below:

Thank you for consenting to participate in this study. I would like to record the interview so my understanding can be as accurate as possible. You may request that the audio recorder be turned off at any point of the interview.
During our last session you completed a survey that asked about your observations and feelings about environmental changes in your community. You were also asked about questions related to your perceptions about your health. Today I would like to further explore some of those topics.

- How does your livelihood put you in contact with the land (natural resources)?
- How has the land (water, etc) transitioned over time?
- In what ways has these changes impacted you personally? *Probe: Did any of these changes impact how you think or any of your daily activities? Any changes in your own health behavior, attitudes, sense of self, perception of the world, community, material use, income generating activities, passing on culture?*
- How have you or your family adapted to this change? *Were there any changes in your livelihood or recreation activities?*
- What do you see as the long-term effects for you and UHN of this experience?
- Is there anything that can be done to protect the land that is left?
- Have you noticed changes in the temperature?
- Anything else you wish to add…..

Thank you for participating in this interview.
Provide the gift card form, ensure it is completed properly
Present the gift card
Provide a copy of the consent form to the participant

APPENDIX C. ENVIRONMENTAL SUBSCALE ANALYSIS

Each of the subscales are described below for reference only. Analysis uses the composite score that is summed average of the proximity to environmental exposure scale.

Observation subscale. The Observation subscale is a sum of the Likert score from each of the observation variables. Each participant gets an observation subscale score ranging from 0-40. Summed score mean for participant observation of environmental changes is 28.11 (N=157) with a range of 1 to 40. The mean and median were not relatively close to the mode (mean = 28.11 median = 29 and mode = 26). SAS Extreme Observations chart shows one participant had a summed score of 1 but several (at least five) participants had a score of 40 which pulled the mean and median from the center of the distribution. Overall, though, the observation subscale distribution approximates a normal curve with the standard deviation of 6.73, skewness of -0.46, and kurtosis of 0.51. The student's test was significant (t=52.34, p<.001) and the Shapiro-Wilk test for normality was significant (W=.97, p=.002). The Normality Plot shows approximately several summed scores who fall outside of two standard deviations of linearity.

Table A-1: Observation Subscale Mean by Question

Question/Item *Each item has the following choices Never (0), Rarely (1), Occasionally (2), Frequently (3), Very Frequently (4)*	Mean (N)
How often have you ever PERSONALLY observed or experienced the following environmental issues in Terrebonne Parish?	
Rebuilding of coastal land incorrectly.	2.52 (156)
Destruction of historic buildings, villages, cemeteries or sacred sites.	2.15 (156)
Changes to the natural waterways (dams, drilling, dredging, altering waterways).	3.1 (157)
Pollution from waste disposal sites and management (industrial or household waste).	2.32 (157)
Sinking of land.	3.46 (156)

Loss of native vegetation and animals due to environmental changes (e.g., land clearing, industrial activity, housing).	3.33 (157)
Coastal or soil erosion.	3.57 (156)
Damage to houses and/or business buildings from land changes.	3.31 (157)
Noise, pollution and vibration from shocks, wakes, or air traffic (helicopters or air planes).	1.62 (156)
Loss of native fisheries due to environmental changes (e.g. oil spills, coastal erosion, sea level rise, hurricanes)	2.82 (156)

Frequency subscale*.* The frequency subscale is a sum of the Likert score from each of the frequency variables. Each participant gets a frequency subscale score ranging from 0-32. Summed score mean for frequency experiencing environmental changes is 15.7 (*N*=157) with a range of 0 to 32. The mean, median, and mode are relatively close (mean = 15.7 median = 15 and mode = 16). The box plot is comparatively tall suggesting a wide range of experiences among participants and it has slightly longer whiskers extending upwards to show greater proportion of higher than lower summed scores. Overall, though, the frequency subscale distribution approximates a normal curve with the standard deviation of 8.25, skewness of -0.33, and kurtosis of 0.7. The student's test was significant (*t*=23.84, *p*<.001) and the Shapiro-Wilk test for normality was significant (*W*=.96, *p*=.000). The Normality Plot shows several summed scores who fall outside of two standard deviations of linearity with a slight S curve.

Table A-2: Frequency Subscale Mean by Question

Question/Item *Each item has the following choices Never (0), Rarely (1), Occasionally (2), Frequently (3), Very Frequently (4)*	**Mean (*N*)**
Frequency. Below are environmental issues that you may have experienced in Terrebonne Parish. Please indicate how often, if at all, you have experienced the following issues from never to very frequently.	
Visual air pollution (haze, smog, smoke).	1.43 (157)
Foul smelling air from tarpits or other big companies.	1.57 (157)

Noise from heavy vehicle movement or other big company activities.	1.9 (156)
Vibration or shaking from heavy vehicle movements.	1.75 (156)
Pollution of land (e.g., chemicals, pesticides, heavy metals).	1.77 (157)
Pollution of bayous or canals (e.g., salinity, chemicals, effluent, oil, or trash).	2.68 (157)
Pollution of drinking water (dams, water tanks).	2.38 (157)
Contamination of piped water (water mains).	2.26 (155)

Threat subscales. Participants answered threat subscale questions through a skip pattern built into Qualtrics. If participants answered they observed or experienced an environmental issue (1-4) they were then asked how threatening it was to them or their family but were not asked these questions if they selected "never" (0). This led to a lower *N* for each of the threat subscales than for the other environmental subscales.

Threatening – observation subscale. Summed score mean for threatening – observation subscale is 27.01 (SD=9.6, *n*=155), skewness = -1.04, a kurtosis of 0.68 with a range of 0 to 40. The mean, median, and mode are relatively close (mean = 27.01 median = 29 and mode = 28).

Table A-3: Threat Subscale Mean by Question

Question/Item Threatening. Below are statements that can contribute to environmental changes in Terrebonne Parish. Please indicate the degree to which you believe that these activities are threatening to you and your family from no threat to extremely threatening. Each item has the following choices Never (0), Rarely (1), Occasionally (2), Frequently (3), Very Frequently (4)	Mean (N)
Rebuilding of coastal land incorrectly.	2.91 (127)
Destruction of historic buildings, villages, cemeteries or sacred sites.	2.82 (123)
Changes to the natural waterways (dams, drilling, dredging, altering waterways).	3.1 (141)
Pollution from waste disposal sites and management (industrial or household waste).	2.9 (126)
Sinking of land.	3.57 (146)
Loss of native vegetation and animals due to environmental changes (e.g., land clearing, industrial activity, housing).	3.29 (145)
Coastal or soil erosion.	3.59 (147)
Damage to houses and/or business buildings from land changes.	3.34 (148)

Noise, pollution and vibration from shocks, wakes, or air traffic (helicopters or air planes).	2.21 (105)
Loss of native fisheries due to environmental changes (e.g. oil spills, coastal erosion, sea level rise, hurricanes)	3.47 (139)

Threatening-frequency subscale. Summed score mean for threatening –

frequency subscale is 15.39 (SD= 9.6, *n*=157), skewness = .12 kurtosis of -1.09 with a

range of 0 to 32. The mean and median are distant from the mode (mean = 15.39

median = 15 and mode = 32).

Table A-4: Threatening Frequency Mean by Items

Question/Item *Frequency threating. Please indicate the degree to which you believe that these activities are threatening to you and your family from no threat to extremely threatening. Each item has the following choices Never (0), Rarely (1), Occasionally (2), Frequently (3), Very Frequently (4)*	Mean (*N*)
Visual air pollution (haze, smog, smoke).	2.32 (114)
Foul smelling air from tarpits or other big companies.	2.3 (112)
Noise from heavy vehicle movement or other big company activities.	2.04 (122)
Vibration or shaking from heavy vehicle movements.	2.2 (113)
Pollution of land (e.g., chemicals, pesticides, heavy metals).	2.78 (115)
Pollution of bayous or canals (e.g., salinity, chemicals, effluent, oil, or trash).	2.98 (144)
Pollution of drinking water (dams, water tanks).	3.12 (130)
Contamination of piped water (water mains).	3.03 (132)