

**Associations between Sense of Community and Perceived Recovery from the Deepwater
Horizon Explosion**

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Mai Uchida

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Abstract

Natural disasters may bring devastating effects on the environment and humans. On April 20th, 2010, the Deepwater Horizon oil rig exploded, killing 11 people and spilling more than 4 million barrels of crude oil into the Gulf of Mexico. The spill caused extensive damage to marine and wildlife habitats, the fishing and tourism industries, and the Louisiana, Mississippi, Alabama, and Florida coastlines. Although people who lived in the area were deeply affected by the oil spill, most funded research have focused on the environmental issues, such as the effects of the spill on the marine ecology. However, within weeks after the explosion, the National Center for Disaster Preparedness initiated the Gulf Coast Population Impact Project (GCPI) to track the effects of the spill on the people who lived in the affected area. This thesis is a part of that project.

The data for the thesis take a survey format in which respondents were asked about the health effects from the spill. A limitation is that these self-reported diagnoses were not confirmed by medical professionals. However, the dataset includes some information that medical records cannot provide, including data about the respondents' location and sense of community. In this paper, potential association between people's sense of community and their effects on perceived recovery at the individual, household, and community levels are investigated. This research is significant because it may help to identify factors that promote resiliency through community building towards natural disasters in the future.

Introduction

Energy is one of the necessities in our modern lives; however, the ways it is produced are not necessarily sustainable neither safe. For instance, the US relies on its energy production on oil, and the extraction processes can sometimes be detrimental to the environment. In the past few decades, there were number of oil spill incidents happened which damaged the environment, and a greater number of creatures and their ecosystems. As a consequence, animals have been often the main focus of research studies regarding oil spills. However, the impacts from the oil spill on humans should not be ignored as they are also often greatly affected from the incidents.

On April 20th, 2010, the Deepwater Horizon explored in the Gulf of Mexico, which is located at about 40 miles off the coast from Louisiana. Former president Barack Obama issued the following the statement right after the oil spill incident: “Already, this oil spill is the worst environmental disaster America has ever faced. And unlike an earthquake or a hurricane, it’s not a single event that does its damage in a matter of minutes or days. The millions of gallons of oil that have spilled into the Gulf of Mexico are more like an epidemic, one that we will be fighting for months and even years” (GPO Oil Commission, 2011). As one can see from this remark, the impacts from the explosion and oil leak were massive and it is considered “one of the worst environmental disasters that the United States face in the history” (GPO Oil Commission, 2011), which brought long-term damages in the areas. This oil incidents left a number of scars in various environmental settings from marine life habitats to soil conditions (GPO Oil Commission, 2011).

The Deepwater Horizon is a “semi-submersive drilling rig” used to dig out crude oil from the bottom of the ocean (Transocean, 2010). This machinery was used by BP to extract oil, and the loss of the control to the Macondo is considered to be the cause of the explosion (GPO Oil

Commission, 2011). Due to the explosion, the platform and Macondo released about 4 million barrels of crude oil into the ocean, which negatively affected the environment and surrounding communities (EPA, 2018). The damaged Macondo took about three months to be capped and during that three months, oil kept leaking into the ocean. This explosion caused 11 deaths, which became “the largest oil spill in the history of marine oil drilling operations” (EPA, 2018). As a result of the explosion, BP paid 5.5 million-dollar penalty under the Clean Water Act and the natural resource damages are estimated to be 8.8 billion dollars (EPA, 2018). This oil spill incident affected not only the natural environment, but also the social environment, including local economic system and people’s lives there.

The three largest industries that sustained the local communities in the coastline of the affected areas from the oil spill were fishery, tourism, and energy production (GPO Oil Commission, 2011). The oil spill incidents immediately impacted the marine life and fishery in the area, because the site of the oil spill is a home for crabs, oysters, and various kinds of fish (GPO Oil Commission, 2011). The damage to the fishery industry directly impacted fishermen in the area. According to the national report, “88,522 square miles of the Gulf of Mexico were closed to fishing” at the most point (GPO Oil Commission, 2011). Not only the closure of the ocean, but also the safety concern towards local seafood consumption remained as a long term negative economic impact for the fishermen (GPO Oil Commission, 2011). Not only the fishermen but also people who were engaged in the tourist industry were also deeply affected from the oil spill as the soiled beaches experienced damages (GPO Oil Commission, 2011). As described, this oil spill incidents affected the main industries that generate local economy, which greatly impacted people’s lives in the affected areas.

The fishermen in the area who could no longer fish due to the sea closure sought for job opportunities and actually were concerned about the “out-of-state” contractors taking the oil-cleaning jobs (GPO Oil Commission, 2011). The local fishermen pushed BP and Unified Command to give them cleaning-related jobs; however, the health concerns for the exposure to crude oil were high for the Operational Safety and Health Administration (OSHA) (GPO Oil Commission, 2011). Surprisingly, the Center for the Disease Control could not imagine that this incident could bring negative impacts to a boarder population and did not “fully considered the role of health agencies” in response to the oil spill incidents (GPO Oil Commission, 2011). Despite a passive attitude of CDC, a number of human health impacts in addition to the devastating damages from the oil spill incident reported. As mentioned above, the explosion caused the death of 11 workers. 17 workers were injured by the destruction of the rig and many experienced traumas of losing their co-workers and/ or “the terror of explosions and fires” (GPO Oil Commission, 2011). Further, the areas affected from the oil spill overwrap with that of Hurricane Katrina happened in 2005 and were in the process of full-recovery, and this oil spill incident brought significant negative economic impacts to the communities (GPO Oil Commission, 2011). According to the survey taken after the oil spill incident, 60% of coastal residents of Louisiana lived in the same community/ region in their entire lives and 20% of them lived there more than 20 years (GPO Oil Commission, 2011). This suggests that people are very attached to their communities, which might have magnified the psychological stress on the economic impacts and sustainability of their area after the oil spill incident (GPO Oil Commission, 2011). Since their community is their only home and they are not willing to move to somewhere else, the damages they perceive in their community have a large potential to lead their lives to difficulties. The report says that “a Gallup survey of nearly 2,600 residents revealed

that medical diagnoses of depressive illness had increased by 25 percent since the rig explosion” though the actual effects from the oil spill incident on people’s mental health remain unknown (GPO Oil Commission, 2011). The oil spill incident not only affected people’s mental health but also physical health.

This research aims to investigate potential associations between people’s perceived recovery and sense of community while geographical elements of hospital accessibility is taking into account. The significance of this research is that it may help to identify factors in community building that might promote resiliency towards natural disasters in the future. Hence, this thesis aims to answer the question: How does sense of community affect perceived recovery after the oil spill incident?

Background

Since this research is a part of a larger project, which investigates effects from the oil spill incidents on people in the affected areas, it would be reasonable to demonstrate previous research findings. According to the research brief, which is published on August 3rd 2010, sociologists in Louisiana State University find that about 60% of Louisiana residents who live near the coastal line are worried about the oil spill incident (Abramson, 2010). This first phase of research is collaborated by Columbia University’s National Center for Disaster Preparedness, Children’s Health Fund, and the Marist Poll to investigate the effects of the oil spill incident from the “acute phase” transitioning to “chronic phase” through interviews (Abramson, 2010). There are 12,000 participants in this study, and they reside in the coastal line of Louisiana and Mississippi (Abramson, 2010). The main purpose of the study is to explore “the short- and potential long-term impact of the disaster on children” (Abramson, 2010). This study takes a

survey format and the interviews are conducted via telephone, and the participants are selected by a random digit dial (RDD) probability (Abramson, 2010). When constructing a sample frame, 75% of potential interviewees were made to reside within the areas 10 miles from the coastline. Prior to participating the study, the responders were asked if they live 10 miles from the coastline or in 30 minutes driving distance from the Gulf of Mexico. When they said no, those were excluded from the survey. After this sampling process, the researchers interviewed 1203 respondents, including 481 households from Louisiana and 722 households from Mississippi (Abramson, 2010).

Among 1203 respondents, 43.1% of households had children whose age was 18 years old or younger (Abramson, 2010). In this study, the researchers measured the exposure through the interview questions. They defined people as exposed when “they (a) had been involved in the oil cleanup, (b) had come in direct contact with the oil spill or cleanup activities, or (c) whose property had been lost or damaged as a result of the oil spill or the cleanup” (Abramson, 2010). Based on this definition of exposure, 42.6% interviewees are classified as exposed, and the researchers find that households with children are “1.4 times more likely to report oil spill exposure than” the households with no children (Abramson, 2010). Also, they found that elderlies are less likely to report exposure (Abramson et al, 2010). In addition to the exposure status, they measured several physical and psychological effects from the oil spill incidents.

Physical effects are defined as “respondents reporting respiratory symptoms or skin irritations that they or their children had experienced in the prior two weeks and which they believed to be related to the oil spill” (Abramson et al, 2010). Likewise, psychological effects were measured by parents’ answers on the following questions. A child was considered exposed if a parent answer that “their child had experienced any emotional or behavioral problems that

they didn't have prior to the oil spill, such as being sad or depressed, feeling nervous or afraid, having problems sleeping, or having problems getting along with other children" (Abramson et al, 2010). Their results show that more than 30% of children experienced some kind of either physical or psychological effects or both, according to their parents' report (Abramson et al, 2010). Among those who reported to have some kinds of effects from the oil spill incident, 7.4% of respondents answered that their children only experienced some psychological effects, and 11.8% of them answered that their children experienced both physical and psychological effects after the oil spill incident (Abramson et al, 2010). They find statistical significance between direct exposure and health effects comparing those who are exposed and not exposed for both adults and children (Abramson, 2010).

Further, the researchers found that the oil spill incident brought economic impacts on the residents. For instance, 20.6% of the participants reported a decrease in their household income due to the oil spill incident. It appears that people with lower income (household income < \$25,000 annually) tend to perceive the impact more severely as 24% of them reported a decrease in income compared to those with higher income (household income > \$75,000) while 14.2% of them reported a decrease income. Also, they find that household with children are more likely to report a financial impact of income decrease due to the oil spill incident (24.4%) compared to those without children (17.8%). The researchers point out the limitation of this study that it is very difficult to test if health effects and/ or a decrease in people's income have a direct association with the oil spill incidents. Another limitation is that since this is a survey-based data, people's exposure is not measured by specialists and the magnitude of the exposure remains unknown. Also, the health effects data are collected based on the interviewees' responses, not by a doctor's diagnosis which makes it harder to tease out an association of their research interest.

The second series of this study is conducted and published as a report on January 2013. Based on the first study regarding the oil spill explained above, this second phase of study is designed (Redlener and Abramson, 2013). This study is funded by the Baron Rouge Area Foundation and conducted with a collaboration between Columbia University's National Center for the Disaster Preparedness to attain the three following goals. First, "to identify communities of children in the coastal areas of Louisiana, Mississippi, Alabama and Florida who were adversely impacted by the Deepwater Horizon oil spill" (Redlener and Abramson, 2013). Second, "to explore the prevalence of physical and mental health effects among these children" (Redlener and Abramson, 2013). Third, "to conduct a preliminary assessment of the health services available to these children and the potential for targeted interventions or health system enhancements" (Redlener and Abramson, 2013). This study is also a survey/ interview based, but the respondents and methods of data collection differ from the previous study. The data-collection and survey process began in April 2012, and it took about four and half months to complete the survey (Redlener and Abramson, 2013). In this study, they conducted 1473 "face-to-face household surveys in 15 communities in Louisiana, Mississippi, Alabama, and Florida (Redlender and Abramson, 2013). The geographical breakdown of the participants by states is as follows: 887 respondents in Louisiana, 177 respondents in Mississippi, 140 respondents in Alabama, and 233 respondents in Florida (Redlender and Abramson, 2013). The researchers estimated areas with higher impacts and lower impacts from the oil spill incidents using the data from the Gulf Coast Claims Facility (GCCF) and National Oceanic and Atmospheric Administration (NOAA), and the result is used to compared the residents in the highly-impacted areas and low impact areas (Redlender and Abramson, 2013).

The results show that more than 50% of respondents who live in the highly-impacted areas report that their children have various types of exposure regarding the oil spill incident ranging from physical exposure to economic factors (Redlender and Abramson, 2013). Among the parents who lived in the highly impacted areas, about 40% of them reported that their children experiencing some health effects after the oil spill incident (Redlender and Abramson, 2013). The breakdown of the health effects is as follows: 18.1% reported breathing problems, 14.8% reported skin problems, 16.0% reported vision problems, and 21.6% reported some “emotional or behavioral problems” after the oil spill incidents (Redlender and Abramson, 2013). Among the four states, 48.6% of parents in Alabama and 50.9% of parents in Mississippi reported a higher proportion of children’s health effects compared to the other two states (Redlender and Abramson, 2013). The participants who reported their children having a direct exposure to the oil spill or “dispersants” were three times more likely to report some kind of health effects (either physical or psychological or both) compared to those who did not have direct exposure when location, income, and the status of health insurance coverage are controlled (Redlender and Abramson, 2013). Also, the participants who reported some negative financial impacts since the oil spill incidents are 1.5 times more likely to report new health issues of their children compared to those who did not experience negative financial impacts after the oil spill incident (Redlender and Abramson, 2013). In this study, the researchers also point out the negative economic impacts on the household after the oil spill incidents, which seems to affect people’s stress level (Redlender and Abramson, 2013). Interestingly, they got an impression that people’s stress appears to be contagious that if one person in a household is sick, there is a tendency for the respondents to report more sick people and/ or people with health issues within a family, including extended family.

After the completion of household survey, the researchers decide to conduct community-level interviews. Four communities with high health effects turnouts were selected as the target communities, which includes two communities from Louisiana, one from Mississippi, and one from Alabama (Redlender and Abramson, 2013). In the four communities, the interviewees including “88 professionals, community leaders, and advocates, expressed their concerns regarding the lack of high quality pediatric health care in their community,” which might have an association with “clusters of unexplained physical symptoms...such as chronic headaches, nosebleeds and ear bleeding, early and heavy menstrual periods among young girls, and skin rashes” (Redlender and Abramson, 2013). Further, these four communities became incapable of providing economic “opportunities, social safety net programs, and sufficient network providers,” (Redlender and Abramsom, 2013) which may have an association with a higher percentage of respondents reporting their health effects.

Another longitudinal study is launched, after the second series of the study regarding the oil spill incidents. The project is “Understanding Resilience Attributes for Children, Youth and Communities in the Wake of the Deepwater Horizon Oil Spill (RCYC) Project, which is funded by the Gulf of Mexico Research Initiative (GoMRI). This study is planned to have 3 waves and all in a survey format to collect data. The wave one survey is conducted in 2014, the wave 2 is conducted in 2016, and the wave 3 is planned to be conducted in 2018. The purpose of this study is to “access and understand the socio-economic and health impacts pf the 2010 Deepwater Horizon Oil Spill, with an emphasis on children and families” and to “understand their recovery trajectory over time” (Beedasy et al, 2018). In the wave 1 survey, which is conducted in 2014, 655 people participated in this study. The area included are Lafourche county, Jefferson county, Orleans county, Plaquemines country, St. Tammany county, Terrebonne country, and Vermillion

Parishes counties in Louisiana (Beedasy et al, 2018). They chose the study area based on the zip code and the standardized oil impact score, which are composed of the data from BP compensation claims and NOAA oil monitoring data (Beedasy et al, 2018). In addition to the identification of highly impacted areas by zip code, they performed “multi-stage sampling” to select “zip codes, census blocks, and households with children” (Beedasy et al, 2018). In the wave 1 survey, 383 participants identified themselves as White, 191 of them as Black, 23 of them as Asian or Pacific Islander, 21 of them as Native American, 15 of them as Mixed and 22 of them as other. The gender breakdown of the data is that 260 males and 395 females in the wave 1 data. Regarding household income, 53 respondents answered that their household income is less than \$10,000 per year, 167 of them answered that their income is between \$10,001 and \$40,000 per year, 156 of them answered that their income is between \$40,001 and \$70,000 per year, and 119 of them answered that their income is more than \$70,000 per year (Beedasy et al, 2018). 160 participants did not give answer or answered “Don’t know” regarding the question of the income.

In the wave 1, the exposures are measured by several variables. They categorized exposure in two types. The one is direct exposure that one will be considered exposed when he or she had “direct contact with oil, tar, or dispersant” or was “directly exposed to forces of harm during event” (Beedasy et al, 2018). The other type is indirect exposure, and one will be considered exposed when he or she was “exposed to the affected person or community” (Beedasy et al, 2018). Some of the noteworthy results are: 38% of participants “reported smelling oil within the 6 months following the oil spill, 13% of children are reported “physically exposed to the oil spill,” 22% of parents are reported “physically exposed to the oil spill,” 36% of the participants reported “income loss as a result of the oil spill,” and 14% of the participants

reported “job loss as a result of the oil spill” (Beedasy et al, 2018). Regarding health effects, 60% of the participants reported “a child physical health issue since the oil spill,” and that of mental health is 31% (Beedasy et al, 2018).

In addition to the descriptive statistical analysis, the researchers conducted a logistic regression analysis and found that the children whose parents had a direct exposure have 2.87 times the odds of having physical health problem compared to the children whose parent did not have a direct exposure. When children reported to have a direct exposure, the odds of having physical health issue is 4.32 times higher than those who did not have a direct exposure. Also, the children whose parents reported to had some exposure to the smell have 4.89 times the odds of having physical health problems compared to those who did not have exposure to smell. The economic factor also appears to affect children’s health. For instance, children whose parents’ experienced job loss are 3.1 times more likely to experience physical health issues compared to those whose parents didn’t lose the job after the oil spill incident. Likewise, children in a household which experienced income loss are 3 times more likely to experience physical health problems compared to those in a household which did not experience any income loss. Psychological health effects on children also show similar results to the physical health effects.

The researchers run the same logistic analysis on the wave 2 data and the results are as follows. The children whose parents had a direct exposure have 1.24 times the odds of having physical health problem compared to the children whose parent did not have a direct exposure. When children reported to have a direct exposure, the odds of having physical health issue is times higher than those who did not have a direct exposure. The children whose parents reported to had some exposure to the smell have 2.63 times the odds of having physical health problems compared to those who did not have exposure to smell. In terms of the economic factors,

children whose parents' experienced job loss are 3.59 times more likely to experience physical health issues compared to those whose parents didn't lose the job after the oil spill incident. Similarly, children in a household which experienced income loss are 2.15 times more likely to experience physical health problems compared to those in a household which did not experience any income loss. The psychological issues show similar results; however, the magnitude of the odds is smaller than the that of physical health effects. It is worth pointing out that the effects from the exposures are all declined from the wave 1 analysis to the wave 2 analysis, but the effects from parents' job loss are slightly greater in the second wave than the first wave.

From the previous research that are conducted over years, it seems that the oil incident might have impacted people's both physical and psychological health status though the survey is not based on diagnosed medical data. In this thesis research project, the wave 2 dataset from RCYC is used to further investigate potential associations between the oil spill incident and people's health. Given the fact that a traditional statistical analysis has already been conducted and some limits are posed regarding the access to the exposure data from the wave 1 dataset, the outcome variable is determined as adult's perceived recovery. Also, since the wave 1 analysis did not take geospatial elements in the analysis, spatial analysis is conducted to assess how sense of community affects people's perceived recovery. The reason for choosing sense of community as one of the variables is that in the second series of this chain of research regarding the oil spill incident and its impacts on people, Redlender and Abramson point out that some communities appear to have more impacts from the oil spill incidents compared to others.

According to Paton and Johnston, community appears to be one of the factors that increases resilience (Paton and Johnston, 2001). They found from the observation that involvement to community activities may reduce community risk, which could work to increase

resiliency (Paton and Johnston, 2001). Involvement to community activities, according to them, does not require people to participate in activities for the sake of increasing community resiliency (Paton and Johnston, 2001). An important element of community activities is that those activities actually helps people to build sense of community (Paton and Johnston, 2001). In order to maintain a community resilient, they suggest that community empowerment through participation is an effective decision-making strategy (Paton and Johnston, 2001). They argue, “participation in identifying shared problems and developing and implementing solutions to [people in a community] facilitates the development of problem-focus coping, a sense of community, and commitment of action,” which are the key elements for community empowerment and higher resiliency (Paton and Johnston, 2001). Likewise, Norris et al also claim an important of having a sense of community in cultivating disaster resilience. According to them, “sense of community is an attitude of bonding...[which includes] mutual concerns and shared values (Norris et al, 2008). They think that “sense of community, place attachment, and citizen participation” are elements of social capital that are crucial for building disaster resiliency (Norris et al, 2008). In addition to the mentioned social capitals, the ability to work together to solve problems is also very important for increasing competency of a community under emergency situations (Norris et al, 2008). As described, sense of community appears to be one of the crucial factors that contribute to disaster resiliency. Hence, it will be interesting to explore how sense of community impacts people’s perceived recovery.

Further, Redlender and Abramson suggest that not having an access to health care might have accelerated the negative health effects on the participants of the survey in one of the highest impacted communities. According to Runkle et al, people who have health issues or in a disadvantaged socio-economic group tend to have considerably more limited access to health

care facilities, which does not only affect short-term but also long-term disaster recovery (Runkle et al, 2012). After a natural disaster, the demand for health care dramatically increases due to having considerably larger number of people who are injured from an incident, and disaster planning often only focus on the need during the “surge,” which is right after the incident happen (Davis et al 2010). In a short-term, the focus on surge plan is important as the areas affected tend to experience the shortage of doctors, medical tools, and other necessities. However, scholars argue that a long-term plan for securing an access to health care is crucial for affected communities (Runkle et al, 2012; Davis et al, 2010; Rudowitz et al, 2006). Natural disasters affect people’s health care access from two dimensions. The one is physical access to a hospital and/ or clinic due to closure or transportation disturbance cause by the incident which includes relocations. The other is the loss of an access to health insurance due to job loss (Rudowitz, 2006). Rudowitz et al also point out that the access to special care could be especially difficult due to the closure of healthcare facilities or relocations (Rudowitz, 2006). This finding that an access to a larger or more equipped healthcare facilities might be one of the driver for people’s recovery aligns with Abramson’s finding that some people in highly-impacted communities from the oil spill incident expressing their concerns of not having an adequate access to hospitals. From the literature, investigations on access to healthcare facilities is suggested that it might have some effects on people’s perceived recovery. To investigate the question that is raised by the previous study regarding access to health care, accessibility analysis is also conducted and included in the final regression model.

Methods

Datasets

Five datasets are used to conduct statistical and spatial analyses. Those are: the survey results from a research team at the National Center for Disaster Preparedness, which is funded by the Gulf of Mexico Research Initiative (GoMRI), 2016's demographic data from American Community Survey from Census, and health care facility data from Health Resources and Service Administration (HRSA), and the list of hospital locations from Louisiana Department of Health. The survey data is a follow-up survey results, which is taken in 2016, from the previous study conducted after the oil spill incident in 2014. The total number of participant is 484 people, and one subject is omitted from the preliminary analysis due to a privacy issue that he or she has a potential to be identified if included, which violates the IRB agreement. All the participants are located in the South part of Louisiana from the following counties: St. Tammany, Orleans, Jefferson, Lafourche, St. Bernard, and Plaquemines. The participants were asked 51 questions and compensated 10 dollars to participate in this study. The survey questions cover quite a wide range of topics from child health to community recovery from the oil spill. Although many of the questions on the survey ask about their current health status and health issues, all the answers are not based on doctor's diagnosis which is one of the limitations of this study.

For the sake of investigating the associations between participants' perceived recovery (*perceived recovery*), ten questions, some of which have sub-questions, are selected. The outcome of perceived recovery of individuals is measured by Question 8: "Compared with before and after the oil spill, would you say your health is better, about the same, or worse?" The answer choices are: "Better," "About the Same," or "Worse." To compare the perceived recovery at a different level, the households' perceived recovery is measured by Question 27: "How

would you rate your household recovery from the oil spill?” and the answer choices are “Completely recovered,” “Mostly recovered,” “Somewhat recovered,” “Not recovered at all,” “Was not affected by the oil spill,” and “Other.” To add layers to the individual and household level perceived recovery, Question 28: “How would you rate your community’s overall recovery from the oil spill? is used to measure that of the community level. The answer choices of Question 28 are the same as that of Question 27. In addition to the three-different level of perceived recovery, Question 7 regarding participants’ current health status is used to compare their health perspectives. Question 7 asks, “In general, how would you rate your health right now?” and the answer choices are “Excellent,” “Very good,” “Good,” “Fair,” and “Poor.”

In terms of variables that might have affected the participant’s level of perceived recovery, several questions are selected. In addition, to see if sense of community affects the participants’ perceived recovery, Question 23 that has 12 sub-questions were selected. The answer choices for all the sub-questions are “True,” or “False.” Question 23 asks the following: “Now I am going to read some things that people might say about their neighborhood. Please tell me if these are mostly true or mostly false about your neighborhood simply by saying ‘true’ or ‘false.’” The 12 sub-set questions are: (a) “I think my neighborhood is a good place to live for me;” (b) “People in this neighborhood do not share the same values;” (c) “My neighbors and I want the same things from the neighborhood;” (d) “I can recognize most of the people who live in my neighborhood;” (e) “ I feel at home in this neighborhood;” (f) “Very few of my neighbors know me;” (g) “I care about what my neighbors thinks of my actions;” (h) “I have no influence over what this neighborhood is like;” (i) “if there is a problem in the neighborhood people who live here can get it solved;” (j) “It is very important to me to live in this particular neighborhood;” (k) “People in this neighborhood generally don’t get along with each other;” (l)

“I expect to live in this neighborhood for a long time.” In addition to the sense of community questions, people’s reside years are included in the study, since the literature suggests that attachment to a place might be an element from building resiliency (Norris et al, 2008).

In consideration of closeness to one’s family affecting perceived recovery, Question 25, which contains 6 sub-questions, is used for the preliminary analysis. Question 25 asks, “Now I’d like to ask about your family’s relationships with relatives and friends. Please answer Yes or No to the following statements: ‘Currently, we have relatives or friends...’” and this leads to the sub-questions. The sub-questions are written as follows: (a) “We visit with regularly in their homes;” (b) “We borrow things from or exchange favors with;” (c) “Who would help us if we were in need;” (d) “We could stay with in an emergency;” (e) “Who could help a family member find a job if someone needed one;” (f) “Who could help us find new housing if we needed it.” In addition to Question 25 asking about the emotional closeness to their relatives and friends, Question 26 is used to measure the physical closeness (by distance) to their family and friends. Question 26 asks: “Thinking of the same relatives and friends, do most of these people live in your local community or do they live more than one hour away?” The answer choices are written as follows: “Most local,” “Most more than 1 hour away,” and “Pretty equally split.” The question regarding the sense of community and the family and friend’s ties are treated separately, since those might affect participant’s perceived recovery differently. In sum, ten questions are used from the survey to explore relationships among perceived recovery, sense of community, and family and friends’ ties. The outcomes are measured at three levels: individual’s, household’s and community’s perceived recovery. The question regarding closeness to family and friends are only used in preliminary analysis as the main focus of this research is to address potential

associations between perceived recovery and sense of community (results of the family-friends analysis are in the appendix).

In addition to those 13 variables described above, the questions regarding educational attainments and household income are used to compare the differences and/ or similarities. Question 42 is regarding educational attainments and asks, “What is the highest level of education you have completed?” The answer choices are (1) “Some grade school;” (2) “Some high school;” (3) “High school graduate (or GED);” (4) “Vocational or technical school beyond high school;” (5) “Community college (Associate’s Degree);” (6) “Some college, no degree;” (7) “College (Bachelor’s Degree);” (8) “College (Master’s Degree);” (9) “College (Ph.D., M.D, J.D. or similar);” and “Other.” Question 48 is a question about income, which asks, “Before taxes, in which income range was your total household income from all sources in 2015?” The answer choices are (1) “Under \$10,000,” (2) “Between \$10,000 and \$20,000,” (3) “Between \$30,000 and \$40,000,” (4) “Between \$40,000 and \$50,000,” (5) “Between \$50,000 and \$60,000,” (6) “Between \$60,000 and \$70,000,” and (7) “Above \$70,000.” In addition to those demographic data, participants’ age and sex are also used for the analysis.

In order to have a general idea about demographic information and insurance coverage in the area, the datasets from 2015’s American Community Survey are used. The datasets are all at Census Tracts level in six counties in the South of Louisiana: St. Tammy, Orleans, Jefferson, Lafourche, St. Bernard, and Plaquemines. ACS S1701 “Poverty Status in the Past 12 Months” is used to address the general poverty rate in the target area. ACS B27001 “Health Insurance Coverage by Sex and Age” is used to address if health care coverage affects people’s choice to going to see a health professional and/ or perceived recovery rate. ACS B27015 “Health Insurance Coverage Status and Type of Household Income in the Past 12 Months” is used to see

the difference in house hold income levels and health insurance coverage. The reason for using the Census data as a proxy of health insurance coverage of the participants is that the question about the reason for not going to see a health care provider contains a large number of missing data, making it difficult to estimate the effect of health insurance coverage on the outcome of interest.

Health Resources and Service Administration (HRSA) Data is used to locate health care service facilities in the target area. The data used from HRSA “Health Center Service Delivery Sites,” are clinics or places which provide health care service through “community-based and patient-directed organizations that serve populations with limited access to health care, including low-income populations, the uninsured, those with limited English proficiency, migratory and seasonal agricultural workers and their families, individuals and families experiencing homelessness, and those living in public housing”(HRSA, 2018). This data is targeted to show the health care access to people with socially disadvantaged people, which are more focused on primary care. Therefore, the data from Louisiana Department of Health, which is a list of hospitals in Louisiana are also used. The reason for adding this extra layer of data is to show the difference in the accessibility at different level of medical service provider.

Operationalization of Data

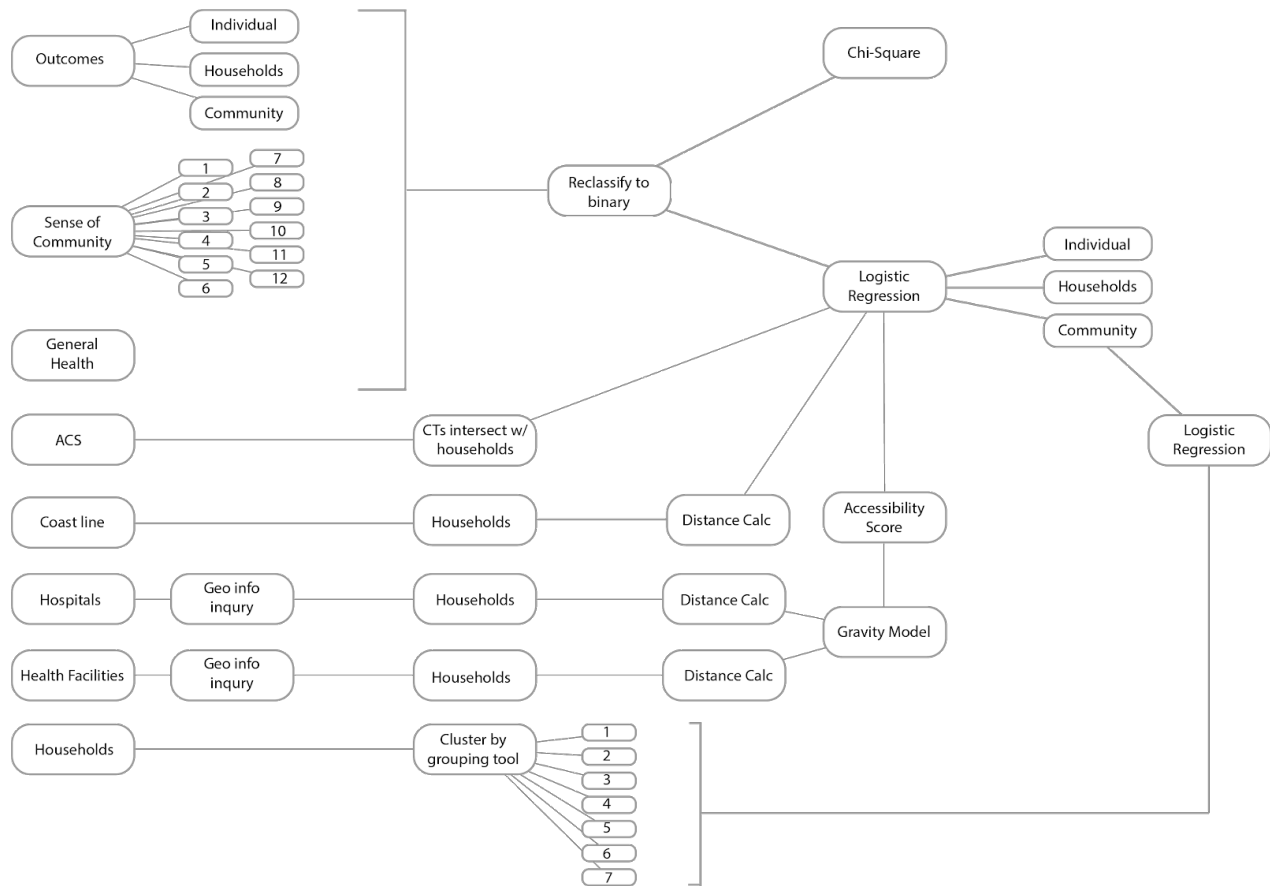


Fig1: Methodology Diagram

In order to conduct an analysis, a large volume of data re-classification was required. First, the outcomes of perceived recovery are re-classified into binary variables. For the individual perceived recovery question, there are 22 people answered their health status is better than before the oil spill incident, 119 people answered their health status is about the same as the time before the oil spill incident, 338 people answered their health status is worse than the time before the oil spill incident, three people answered they don't know, one person refused to answer and one other person is categorized as "Not Applicable" in the original data, before the re-classification process. To construct a simple and more interpretable model, the data are re-classified into "About the same + Better" and "Worse." The category of "About the same +

Better” is coded as 1 and “Worse” is coded as 0. The five participants who answered “Don’t Know,” “Refused,” and “Not Applicable” are all coded as “N/A.” After this reclassification, 141 people are classified as “About the same + Better” and the number of people who answered “Worse” stayed the same which is 338.

Likewise, the households’ perceived recovery is also re-classified into binary variables. For the question of perceived households’ recovery, 112 people answered that their households are completely recovered, 97 people answered that their households are mostly recovered, 72 people answered that their households are somewhat recovered, 158 people answered that their households were not affected by the oil spill, 32 people answered that their households are not recovered at all, nine people answered “Not Applicable,” and seven people answered “Other.” In order to make the outcome variables comparable with the individual’s perceived recovery, the data are grouped into “Completely recovered + Mostly recovered + Somewhat recovered + Was not affected by the oil spill,” which are considered “perceived recovery observed” and coded as 1, and the answer choice “Not recovered at all” is coded as 0. After re-classification, 439 people are classified as 1, which is the “Perceived Recovery-Observed” group and 32 people remained as “Not recovered at all.” 13 people who answered wither “Not Applicable” or “Other” are categorized as “N/A.” The community level perceived recovery has the same set of answer choices as the households’ and the breakdowns are as follows: 70 people think “Completely recovered,” 154 people think “Mostly recovered,” 153 people think “Somewhat recovered,” “45 people think “Was not affected by the oil spill, ” 26 people think “Not recovered at all,” 29 people answered “don’t know,” and seven people answered “Other.” Similar to the household’s perceived recovery, the data are re-classified as “Completely recovered + Mostly recovered + Somewhat recovered + Was not affected by the oil spill” and coded as 1 and “Not recovered at

all,” and coded as 0. After the re-classification, 422 participants are classified as the “Perceived Recovery-Observed” group, and 26 people remain to be categorized as “Not recovered at all.” The 29 people who answered “don’t know” and seven people who answered “Not Applicable,” which are 36 people in total, are re-classified and coded as “N/A.”

To compare how the participants, feel about their current health and their perceived recovery, the question about general recovery is also re-classified. 78 people answered their current health being “Excellent,” 136 people answered it as “Very good,” 144 people answered it as “Good,” 90 people answered it as “Fair,” 35 people answered it as “Poor,” and 1 person answered “Don’t know.” The data are re-classified as “Excellent + Very good + Good ” as “> Good” and “Fair/Worse.” After the re-classification 358 people are classified as “> Good” and 125 people are classified as “Fair/Poor.” This variable was not used for the main analysis, but to compare the differences between individual’s perceived recovery and their current health status.

Since some of the questions regarding sense of community were inverted, the answers of sub-question two: “People in my neighborhood do not share the same values,” sub-question six: “very few of my neighbors knows me,” sub-question 8: I have no influence over what this neighborhood is like,” sub-question nine: “If there is a problem in the neighborhood, people who live here can get it solved,” and sub-question 11: “People in this neighborhood generally don’t get along with each other” were flipped. As a result, all the positive answers towards a neighborhood are classified as “True” and coded as 1, and that of negative answers are classified “False” and coded as 0. Questions regarding the proximity to participants’ family and friends were also re-classified into binary variables. Under the proximity question, 367 people answered that their family and friends live most local, 72 people answered they live more than one hour away, 42 people answered “pretty equally split,” two people answered “Don’t know,” and one

person answered “Not Applicable.” The data are re-classified as “Most local + Pretty equal split” which is considered “Close” and “more than one hour away” which is considered “Far.” After re-classification, 409 people are classified as having their family (relatives) or friends in a close distance, and 72 people are classified as having their family and/ or friends in a far distance. Three people who answered either “don’t know” or “Not applicable” are both classified as “N/A.”

The main goal of this research is to investigate potential associations between sense of community and perceived recovery at three levels (individual, household, and community) while geographic components of access to healthcare facilities are taken into considerations. To construct a regression model, some preliminary statistical analysis and spatial analysis are conducted. After the data cleaning process and re-classification of variables, descriptive summary statistics are produced, and then Person’s Chi-Square tests were performed. Person’s Chi-Square test was selected, because most of the variables are re-classified into binary variables, and it is worth examining the relationship between the variables before constructing and running a regression model. The Chi-Squared tests were performed for each of the sense of community variables and perceived recovery and each of the family and friends’ ties variables and perceived recovery. All the statistical analyses are conducted using R and R studio. For the sake of construct a regression model, some of the geographical data need to be considered. First, since the oil spill was happened in the ocean, the proximity to water is calculated using the near tool in ArcGIS based on a hypothesis that the closer people are to the water, the more people might be affected by the oil spill incidence. In order to define a community and the neighborhood, network analysis was conducted. When the researchers asked about the sense of community questions, they defined a neighborhood by Zip Code; however, I

found that classification very unsatisfactory. The reason for not using Census Tracts is that those are boundaries not created to assess sense of neighborhoods, which have a large potential of misrepresenting actual neighborhoods. Hence, I decided to create a neighborhood based on the national average distanced from home to a grocery store. According to the research study conducted by United States Department of Agriculture (USDA), “the distance to the nearest supermarket or supercenter for the average U.S. household was 2.14 miles and that average household primarily shopped at a store 3.79 miles from home” (USDA, 2015). In this study, a neighborhood is defined as an area within a four-mile buffer.

In order to access potential relationships among the access to healthcare facilities, sense of community, and people’s perceived recovery, a logistic regression model was constructed. As a preparation for making a logistic regression model, the accessibility to health care facilities are calculated using Huff’s Gravity model. Huff’s Gravity model is a model that takes into account the distant decay function when mathematical computations are performed. This model is often used to estimate a potentially successful retail store location in the field of real estate and development. Although Two Step Area Floating Catchment Analysis is one of the most popular methods used in the field of Public Health to calculate hospital accessibility, the Huff’s Gravity model was selected for this analysis due to the data type. In many cases when calculating an accessibility to hospital and/ or health care facilities, researchers often do not have point data of specific households. Therefore, the Catchment model is useful, because it will estimate accessibility in a target area such as census tracts. Since the survey result data include participants’ housing locations by points, I have decided to calculate the accessibility from each hospital and health care facilities to each participants’ houses by using Huff’s Gravity model. The formula of Huff’s Gravity model is constructed as follows:

$$P_{ij} = \frac{W_i / D_{ij}^\alpha}{\sum_{i=1}^n \left(\frac{W_i}{D_{ij}^\alpha} \right)}$$

Where P_{ij} is the probability of a person j going to a hospital i , W_i is a measure of attractiveness of each hospital i , D_{ij} is the distance from a person j to hospital i , and α is “an exponent applied to distance so the probability of distant site is dampened” (Esri, 2018). According to the Esri website, the value of α ranges from 1.5 to 2. Hence, the value of 1.5 is used for the exponent in this study to keep the distant decay function moderate.

For the sake of calculating the Gravity model, the distance between each participants house and healthcare facilities are calculated. The definition of hospital used in this study is from Louisiana Department of Health. They define hospital as

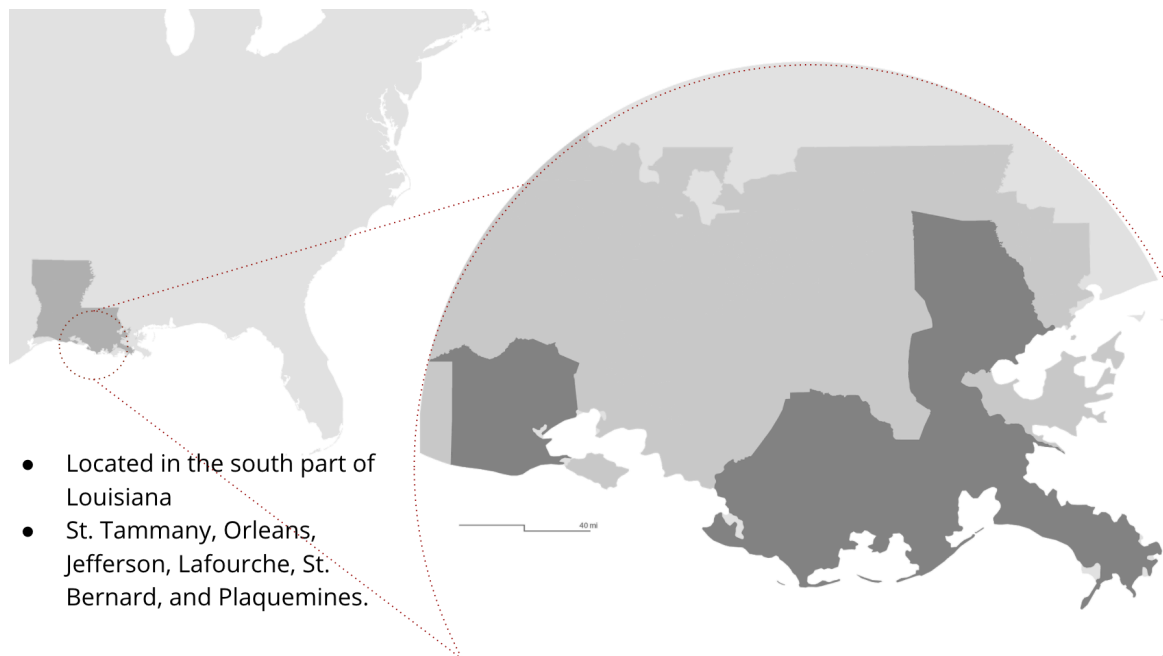
“any institution, place, building or agency, public or private, whether for profit or not, maintaining and operating facilities, 24 hours a day, 7 days a week, having 10 licensed beds or more, properly staffed and equipped for the diagnosis, treatment, and care of persons admitted for overnight stay or longer who are suffering from illness, injury, infirmity, or deformity or other physical or mental condition for which medical, surgical and/ or obstetrical service would be available and appropriate” (Louisiana Department of Health, 2018).

All the hospitals on the list that are included in this study satisfy the definition mentioned above. Since the list of hospitals did not provide latitude and longitude, those values are searched based on the address provided on the list. After the information regarding latitude and longitude are obtained, hospitals are mapped using ArcMap 10.5. Likewise, the data of healthcare facilities and/ or providers, excluding hospitals, are mapped based on their latitude and longitude.

Regarding the target and health care location selections, health care facilities and hospitals that

are opened after January 1st 2012 are excluded as some of the survey are taken in the end of 2012. The reason for excluding healthcare facilities that are opened after January 1st 2012 is that it is difficult to determine when exactly the participants gained an access to that facility and to eliminate a possibility of including the facilities that weren't open at the time the survey was taken.

In terms of participant's housing location data, 5 data points are omitted due to them being easily identifiable. This operation resulted to limit the study area to only Louisiana.



Map1: Study Site

The total household numbers included in this study is 479. For the sake of providing participants locations in a broader sense without disclosing their actual housing locations, the grouping tool in ArcMap is used. Based on the longitude and latitude, 7 clusters are created and all most of the participants locations falls within 4 miles buffer from each other's houses. The neighborhood clusters are also used for hospital and healthcare facilities selections. All the healthcare facilities and hospitals that are included in the analysis are located within 60 miles from the centroid of

each neighborhoods. This based line was chosen, because 60 miles are an approximately one hour driving distance, which is often considered the farthest point of accessibility (Guagliardo et al, 2004). The centroid of each neighborhood was calculated after the polygonal area of the cluster was calculated using Convex Hull as spatial criteria within the minimum bounding tool in ArcGIS. In order to include houses that are located farther from the centroid and their health care accessibility, additional 30 miles buffers from 4 houses that are located in the north point of the neighborhood are created. The healthcare facilities that are within the 30 miles buffers are also included in the analysis. Based on the selection criterion, 129 hospitals and 166 healthcare facilities are chosen. However, due to one healthcare facility lacking information on the hours of operation per week, the final model included the total of 165 healthcare facilities. In addition, the survey data did not include information of health care coverage as described before. Therefore, the census tracts that intersects with the houses' edges are selected to have approximation of health insurance coverage of participants.

The operation of calculating accessibility based on the Huff's Gravity model is performed using ArcMap, Excel, and R. First, the distance between each houses and hospitals are calculated using the near tool. Since there are 165 healthcare facilities, 129 hospitals, and 479 houses in the target area, an automation model was created to calculate the distances from each hospital and healthcare facilities to each house. To calculate accessibility using the Huff's Gravity model, the calculation of attractiveness of each health providers is necessary. In most of the studies that calculate the accessibility of hospitals usually uses the number of doctors divided by the population in a target area. However, the hospital and healthcare facility data in this study do not have information on the numbers of doctors in each facility. Therefore, the numbers of operation hours per week divided by the population of the census tracts that are within 30 miles buffer

from the centroids of each neighborhood was used to calculate the attractiveness. I acknowledge that the hours of operation per week for all the hospitals are the same, which is 160 hours per week, based on the selection criteria of hospitals. However, this calculation was performed to distinguish the difference between smaller healthcare facilities and hospitals in terms of their attractiveness. Hence, for this purpose of distinguishing between larger and smaller health care providers, the possible distortion and/or inaccuracy caused by this operation is not considered significant. A reason that this distinction between larger hospitals and smaller healthcare facilities are created is that the previous study points out the lack of access to larger and more equipped hospitals may have an association with people's health status. Therefore, making this distinction would address potential issues of not having great access to larger hospitals. The benefit of accessing the difference in accessibility using Huff's Gravity model is to take the difference in distance consideration of accessibility. This means that if a person has an access to both smaller scale healthcare facility in a very close location from the home and larger hospital farther away from the home, the accessibility to the both facilities will be weighted based on the distance decay function. As a result, accessibility of small but close hospitals and large but farther hospitals will be similar due to their differences in distance and attractiveness.

After accessibility from each healthcare facilities to each participant's home is calculated, the accessibility score was normalized due to putting all the different accessibility scores for each participant in a regression model is not feasible. The average of total healthcare accessibility and each participant average total accessibility score were calculated as a preparation of normalization of the accessibility score. The final normalized accessibility score was calculated by subtracting the average total healthcare accessibility score from all the participants from each participant average healthcare accessibility score. Further, separated normalized accessibility

scores for hospital access and healthcare facility access were also calculated to see if there is any difference between the two.

A logistic regression model was constructed to investigate potential associations among the sense of community and people's perceived recovery, while taking the geographical element of hospital accessibility is accounted. As explained more thoroughly in the previous section, the outcome has three level, and those are reclassified into binary variables. The outcome of perceived individual recovery is reclassified in 1: "Better" and "About the same" and 0: "Worse." The outcomes of perceived household recovery and community recovery are reclassified as 1: "Completely recovered," "Mostly recovered," "Somewhat recovered," "was not affected by the oil spill," and 0: "Not recovered at all." The outcome of general health is also reclassified into binary variables as follows: 1 as "Excellent," "Very Good," "Good," and "Fair" and 0 as "Poor." Due to an issue of multicollinearity, when all the sense of community questions are put into a single model, it is anticipated to distort the results. Therefore, I have tested one of each sense of community question while remaining other variables constant, meaning I have created 12 models that each model only includes one sense of community question to see if the variable yields a statistical significance. As a comparison, the total score of sense of community, which is the result of addition of all the 12 sense of community variables are included. In the final model, sense of community question 9, educational attainment (Bachelor's degree or higher, or not), income that are categorized in low (<\$20,000 annual household income) and high (> \$60,000), age, the average percentage of uninsured populations in a neighborhood cluster, years of residence, access to hospitals, and distance to the ocean was included. The reference group for the education attainment category is lower than holding a bachelor degree that includes community college, high school graduate, some college without a degree, so grade school, some

high school, and vocational or technical school beyond high school. The reference group for the income category is people's annual household income between \$20,000 to \$50,000. I acknowledge that \$20,000 annual income for a household is a very low bound threshold; however, this value is selected based on the Medicaid eligibility that Louisiana States set for a household for two people (Louisiana Department of Health, 2018). The reason for setting the Medicaid eligibility for income grouping criteria is to tease out the differences between people who are low income but insured by Medicaid and people who are low income but their income not being low enough to get Medicaid benefits, assuming those have a higher chance of being uninsured. Some of the elements: educational attainment, the average percentage of uninsured population, years of residence, hospital accessibility, and distance to the ocean are not found to be statistically significant; however, those are either clinically important factors or model improvement factors which are retained in the model.

In addition to a logistic regression model that is used to test the outcome of individual adult's perceived recovery, adult participants current general health status, the outcome of household perceived recovery and community perceived recovery are assessed. The sense of community questions are tested in the same way as the adult perceived recovery model. Regarding the outcome of community recovery, there are two versions of the models created: the one is community's perceived recovery model for all the participants, and the other is that of for the seven neighborhoods. To assess community recovery based on the neighborhood groups, the data are split into the seven clusters (neighborhoods) based on their longitude and latitude. For each neighborhood, 12 models which include one sense of community question for each are constructed. For the purpose of keeping consistency among the three models upon the association evaluation, all the variables included are the same throughout the three models. In

sum, the variables that are included in all the three models are: education attainment (lower than bachelor degree as a reference group), income (medium income group as a reference group), age (continuous variable), percentage of adults (>18 years old) who are uninsured, the years of residence, normalized accessibility scores to all healthcare facilities in a target area, and the distance to the ocean. The variables “normalized accessibility scores” and “the distance to the ocean” are considered variables that account for geographical differences in the model. As a comparison, the models with total sense of community score (maximum value =12) for each of the three outcomes are also created.

Results

Preliminary Statistical Analysis

First of all, it would be helpful to start discussing the results with descriptive statistical results. In terms of the basic demographic data, the median age of participants is 44 years old. There are 285 females, 188 males, and 11 participants answered “Not Applicable” to this question. 154 respondents graduated from high school, 90 of them went to a college but did not obtain a degree, 62 of them went to a high school but did not obtain a diploma, 59 of them went to college and obtained a bachelor’s degree, 35 of them went to some grade school, and 28 of them went to vocational or technical school beyond high school and 56 of them answered “Other.” The median resident year is 11 years and that of mean is 28.52 years. This result suggests that some of the residents live in their area for a long time and some others are more or less new to the area. About the income distribution, of 128 participants make \$70,000 as household per year, 44 of them make \$50, 000 to \$60,000 as household per year, 43 of them make \$10,000 to \$20,000 as household a year, 43 of them make \$20, 000 to \$30,000 as

household per year, 42 of them make \$30,000 to \$40,000 as a household per year, 41 of them make less than \$10,000 as a household per year, and 143 of them answered “Other.” These are the results of descriptive statistics for the entire participants disregarding the location. The location based descriptive statistical results will be shown after addressing the results of the total participants.

While running statistical analysis, I noticed a somewhat strange breakdown of answer between the perceived individual recovery and their current health status. As shown below in the table 1, 180 people who answered their health being worse than the time before the oil spill incidents think their health being good or better. This result might suggest that the lack of magnitude in assessing how “worse” their health have gotten over the two years given more than the majority of people answered their health is good.

	Worse (perc_recov)	About the same/ Better (perc_recov)
Fair/ Worse (genhealth)	38	83
> Good (genhealth)	180	42

Table1: Comparison of Perceived Recovery and General Health

In terms of the sense of community, the numbers are distributed as the table 2 below.

	1 (or Positive Attitude Towards the neighborhood)	0 (or Negative Attitude Towards the neighborhood)	N/A
1. I think my neighborhood is a good place for me to live	445 (91%)	30 (6%)	9
2. People in my neighborhood do NOT share the same values	285* (59%)	141 (29%)	58
3. My neighbors and I want the same thing from the neighborhood	392 (81%)	55 (11%)	37
4. I can recognize most of the people who live in my neighborhood	411 (85%)	65 (13%)	8
5. I feel at home in this neighborhood	449 (93%)	29 (6%)	6
6. Very few of my neighbors knows me	345* (71%)	130 (27%)	9

7. I care about what my neighbors thinks of my actions	306 (63%)	168 (35%)	10
8. I have no influence over what this neighborhood is like	288 (60%)	170 (35%)	26
9. if there is a problem in the neighborhood people who live here can get it solved	407 (84%)	51 (11%)	26
10.it is very important for me to live in this particular neighborhood	321 (66%)	155 (32%)	8
11.People in this neighborhood generally don't get along with each other	418 (86%)	50 (10%)	16
12. I expect to live in this neighborhood for a long time	360 (74%)	99 (20%)	25

Table2: Descriptive Statistics of SOC

As shown on the table 2, the majority of the people have a positive idea towards their community. The overall average percentage of the participants who answered positively regarding their neighborhood under the 12 sub-categories is 76%. When combined the score of the 12 variables, it is distributed as the histogram below.

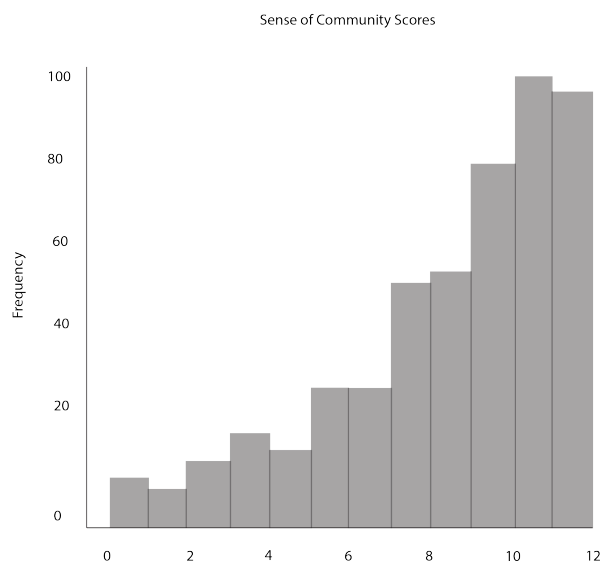


Fig2: Frequency Distribution of SOC

The median value of the total sense of community score is 10.

After conducting the descriptive analysis, the sense of community variables is compared with individual's perceived health status. Person's Chi-Squared test was conducted for all the

pairs of perceived individual recovery and sub-question of sense of community (see the appendix for all the results). The majority of the results found to be not statistically significant. However, three sub-questions turned out to be statistically significant. The first variable is the question that asks, “I think my neighborhood is a good place for me to live,” and its test statistics is 4.021 with 1 degree of freedom, and the p-value is 0.04. This result suggests that the residents’ positive attribute towards their neighborhood might have an association with the level of individual’s perceived recovery. Another variable that is found to be statistically significant is the question that asks, “if there is a problem in the neighborhood people who live here can get it solved.” The test statistic is 11.286 with 1 degree of freedom, and the p-value is 00007. The result suggests that people’s attitude of thinking that a problem can be solved with help from their neighbor has an association with perceived recovery. The last statistically significant variable is the question that asks if people in the neighborhood get along with each other. The test statistic is 5.557 with 1 degree of freedom, and the p-value is 0.002. This result suggests that there is an association between people’s perceived recovery and the idea of getting along together with their neighbors. These results are interesting, because those suggest that sense of security appear to play a role in how people perceive their recovery from the oil spill incident.

Spatially Weighted Analysis

Due to a reason for some participants being identifiable (some of the participants live in a place less than five people in a cluster), 479 samples are included in the spatially weighted analysis. Five participants from Mississippi were omitted although the logistic regression model itself has a low possibility for make them be identified. The result of perceived recovery of individuals among adults yields four statistically significant variables: low income, high income,

and the questions one and nine of the sense of community. The individual model one that assesses adult individual's perceived recovery and its relation to the sense of community question one: "I think my neighborhood is a good place for me to live" results that people who are classified as low income have 1.95 times the odds of answering their health being better or about the same compared with the time prior to the oil spill incident ($p=0.0$, $CI[1.13, 3.36]$), compared to people who have medium income while all else remains constant. In the same model, participants with higher income have about 36.7% lower chance of answering their health being better or about the same compared to the time prior to the oil spill incident ($p=0.03$, $CI[0.37, 0.93]$), compared to those who are classified as medium income while holding all else constant. The participants, who answered "yes" to the sense of community question one, are 32.6% less likely to answer their health status is better or about the same than the time before the oil spill incident ($p=0.04$, $CI[0.24, 0.98]$), compared to those who are classified as medium income group, while holding all else remains constant.

In the individual level model two that includes the sense of community question nine: "if there is a problem in the neighborhood, people who live here can get it solved," two of the income variables (low and high) in addition of the sense of community question produced statistically significant results. For those who are classified in a low-income group, the odd of them perceiving their health being better is 1.87 times the odds of those who are in the medium income group, while holding all else constant ($p=0.02$, $CI[1.08, 3.22]$). Regarding their higher income counterpart, those who are classified as higher income are 36.3% less likely to answer their health being better than before the oil spill incident compared to those who are classified as medium income group, while all else is constant ($p=0.02$, $CI[0.36, 0.92]$). Also, those who think that "if there is a problem in the neighborhood, people who live here can get it solved" have

34.1% less likely to answer that their health status got better or stays the same compared to those who are in a medium income group while the model retains the same variables ($p=0.02$, CI[0.36, 0.89]). These results are interesting, because one would assume that people with higher income would have a better perceived recovery than those who are medium or low income; however, the results show that participants with low income have higher odds of having better perceived recovery. In addition, the sense of community question one and nine that evaluate a community positively actually negatively affect participants perceived recovery at an individual level, which is also surprising. This might be because of people with higher income have a higher expectation on their health status, or their previous health status being better than those with lower or medium income. However, further investigations will be needed to figure out what factors actually creates these unexpected outcomes.

In terms of the outcome of adult individual's current general health outcome, the sense of community question one turned out to be the only variables among sense of community questions that produced a statistically significant result. In the model of the sense of community question 1, income variables (low/ high) are found to be statistically significant. The participants who are classified as low income have 1.87 times the odds of considering their health being fair or better compared to those who are in the medium income group, while holding else constant ($p=0.02$). For those who are classified as a higher income group, they have 36.3% less likely to think their health being fair or better compared to those who are in the medium income group ($p=0.02$), while holding else constant. Regarding the sense of community, those who answered yes to the sense of community question nine are 34.1% less likely to answer their health status is fair or better compared to those who answered no to the sense of community question 9 ($p=0.0154$), while holding all else constant. These results are somewhat consistent with the results

from perceived recovery models at the individual level. The results show that what usually thought to affect positively to people's health status actually do the opposite.

Now moving a scope one level up to discuss the results of household recovery. The three models of the sense of community: the sense of community question one, five, and nine produced statistical significant results. In the household level model with the sense of community question one, participants with high income have 4.1 times the odds of thinking that their household are somewhat recovered, mostly recovered, or completely recovered compared to those who are in the medium income group ($p=0.001$, CI [1.78, 10.68]). Also, the participants who answered yes to the sense of community question one ("I think my neighborhood is a good place to live") have 2.90 times the odds of thinking their households being somewhat recovered or better while all the variables remain constant ($p=0.01$, CI [1.23, 6.81]). In the sense of community question five ("I feel at home in this neighborhood"), the participants who are classified as higher income have 3.67 times the odds of answering that their households are recovered from the oil spill compared to those who are classified as medium income while holding else constant ($p=0.003$, CI[1.59, 9.56]). The participants who answered yes to the sense of community question five have 4.67 times the odds of answering their household being somewhat recovered or better from the oil spill incident compared to those who do not feel at home in their neighborhood, while holding else constant ($p=0.0004$, CI[1.94, 10.78]). In the model with the question of sense of community nine, "if there is a problem in the neighborhood people who live here can get it solved," the participants who answered yes to this question have 2.28 times the odds of answering their household being recovered from the oil spill compared to those who answered no to this question, while all the control variables remain constant ($p=0.03$, CI[1.07, 4.67]). The results from the household level models that attempt to assess associations

between sense of community and perceived household recovery do not carry surprises like the previous models that tried to assess individual level perceived recovery. Also, this result of sense of community question nine supports Paton and Johnston's argument that the development of problem-focused plans is important for resiliency building (Paton and Johnston, 2001). The important factors, besides income, for higher perceived household recovery is the feeling of comfort in their neighborhood (sense of community question one and five) and the feeling of support from their neighborhood (sense of community question nine), which are interesting findings from the analysis at the household level.

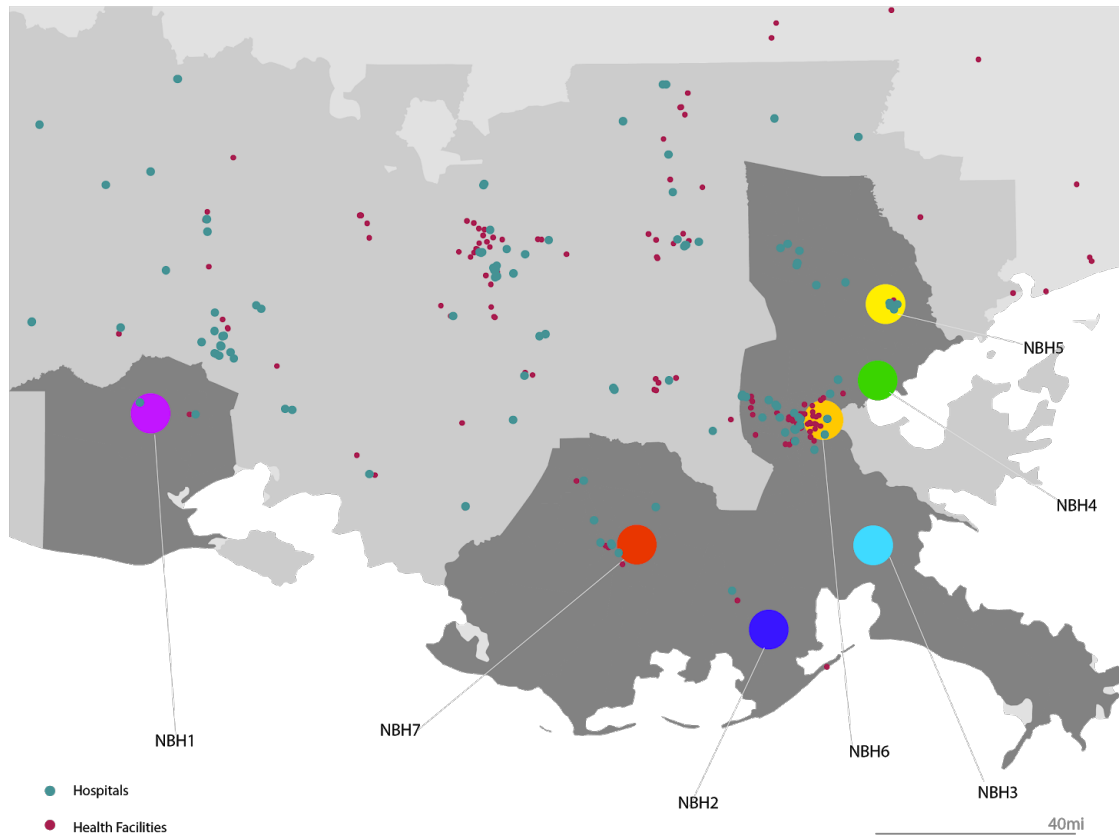
Once again, moving the scope of this research up to a community level. The 12 models that assess sense of community variables are constructed with all the same variables used for the individual and household level models. Interestingly, all the community level models yield statistically significant results for sense of community variables. Throughout all the 12 models, the high-income variable constantly resulted statistical significance. Overall, the participants who are classified as a higher income group have about 2.2 times the odds of considering their communities being recovered compared to their medium income counterparts, while holding else constant ($P < 0.05$). Further, majority of the models show that as one year in their resident year increases, it decreases the chance of the participants seeing their community being recovered from the oil spill by about 9% while holding all else constant ($P < 0.05$). Regarding the sense of community, the participants who answered yes to the sense of community question one ("I think my neighborhood is a good place to live") have 3.03 times the odds of perceiving their community being recovered compared to those who answered no to the same question, while holding else constant ($p = 0.005$, CI[1.37, 6.46]). The sense of community question two: "people in my neighborhood do share the same values (the original question was "people in my

neighborhood do not share the same value” and for the mathematical consistency purpose, the answers were re-coded), those who answered yes to this question two have 3 times the odds of answering their communities being recovered compared to those who answered no to the same question while holding else constant ($p=0.0002$, CI[1.70, 5.44]). The model three assesses the question three of the sense of community: “my neighbors and I want the same thing from the neighborhood,” and the result shows that the participants who answered yes to this question have 2.33 times the odds of answering their community being recovered compared to those who answered no to this question while holding all else constant ($p=0.007$, CI[1.24, 4.27]). In the model 4, the sense of community question four was assessed: “I can recognize most of the people who live in my neighborhood,” and those who answered yes to this question have 2.07 times the odds of answering their community being recovered from the oil spill compared to those who answered no to this question, while all the variables remain in the model ($p=0.04$, CI[1.01, 4.06]). In the model 5, the question: “I feel at home in this neighborhood” as assessed, and those who answered yes to this question have 4.02 times the of odds of answering their neighborhood being recovered from the oil spill compared to those who answered no to this question, while holding all else constant ($p=0.0006$, CI[1.79, 8.79]). In the model 6, the participants who answered “not very few of my neighbors knows me (the original question was ‘very few of my neighbors knows me’ and the answers were re-coded) have 2.05 times the odds of perceiving their community being recovered compared to those who answered no to this question, while all the variables stay in the model ($p=0.01$, CI[1.56, 3.60]). In the model 7, the participants who “care about what [their] neighbors think of [their] actions” have 1.84 times the odds of seeing their community being recovered from the oil spill incident, while holding all else constant ($p=0.04$, CI[1.04, 3.24]). The model 8 assesses the question “I have influence over what

this neighborhood is like (the original question is ‘I have no influence over what this neighborhood is like,’ and answers were re-coded), and those who answered yes to this question have 2.02 times the odds of seeing their neighborhood being recovered compared from those who said no to this question, while holding else constant ($p=0.01$, CI[1.16, 3.58]). Those who answered yes to the question “if there is a problem in my neighborhood, people who live here can get it solved” in the model 9 have 2.93 times the odds of perceiving community recovery compared to those who answered no to this question while the model remains the same ($p=0.0008$, CI[1.54, 5.48]). The model 10 assesses the question “it is very important for me to live in this particular neighborhood” and those who answered yes to this question have 2 times the odds of seeing their community being recovered compared to those who answered no to this question while holding else constant ($p=0.02$, CI[1.13, 3.54]). In the model 11, the participants who think that “people in this neighborhood generally get along with each other” (the original question was ‘people in this neighborhood generally do not get along with each other’ and re-coded) have 2.95 times the odds of seeing their community being recovered while holding all else constant ($p=0.001$, CI[1.52, 5.58]). Finally, in the model 12, the participants who “expect to live in this neighborhood for a long time” have 2.9 times the odds of answering their community being recovered from the oil spill incident compared to those who do not expect to stay in the same neighborhood for a long time while holding all else constant ($p=0.0003$, CI[1.17, 5.20]).

Based on the models and results regarding perceived community recovery, the sense of community turns out to matter the most in the community level among the three levels of perceived recovery. However, the question came up after this analysis, which is the participants’ level and/ or feelings of sense of community could potentially vary depending on which neighborhoods they live in. Therefore, further analysis of the 12 models that assesses community

recovery was conducted. In this analysis the participants are divided into seven neighborhood groups depending on their longitude and latitude of housing locations as it is described in the method section.



Map2: Location of Seven Neighborhood Groups

The brief descriptive number profile of each neighborhood groups is shown in the tables below:

	Participants (n)	Median age	Median reside years	Median% uninsured (Census Tract Level)
group 1	24	42	10	14.55
group 2	37	47	16	18.80
group 3	46	48	13	22.20
group 4	15	46	14	5
group 5	153	44	11	11.30

group 6	56	40	8.50	27.45
group 7	148	43	13.50	18.60

*Total median reside years: 11 years

*Total median uninsured%: 17.6%

Table3: Neighborhood based Descriptive Statistics

	Income Low	Income med	Income high	>BA/BS	< BA/BS
group1	5	4	15	0	24
group2	9	5	10	0	37
group3	11	23	10	0	46
group4	1	4	10	0	15
group5	10	30	98	4	149
group 6	26	13	10	0	56
group7	22	42	52	1	147

*Total Number of BA/BS holders: 5

Table4: Neighborhood based Descriptive Statistics 2

Among group-based models created, group 1, group5, group 6, and group 7 yield some statistically significant results. The model 1 of group 1 which assesses the question: “I think my neighborhood is a good place for me to live” yield $4.530e+15$ beta coefficient ($P < 2e-16$). With this large number of coefficient, the several diagnoses were run to check issues; however, no significant mistakes in the model was found so far. This model produced similar types of an extremely large number of beta coefficient for the sense of community question three, four, five, and nine. Regarding group 5, the variables that resulted in statistical significance are the question of the sense of community two and six. Those who answered yes to the sense of community question two have 6.57 times the odds of perceiving their community’s recovery compared to those who said no to this question, while holding else constant ($p=0.01$, CI[1.72, 3.29]).

Respectively, those who answered yes to the question six have 4.84 times the odds of seeing their community recovery compared to those who answered no to this question assuming all variables stay the same in the model ($p=0.02$, CI[1.35, 2.04]). In the group 6, the sense of community question 9 and 12 produced statistically significant results, and the interpretations are as follows: people who answered yes to the question 9 have 8 times the odds of perceiving community recovery compared to those who answered no while holding all else constant ($p=0.04$, CI[1.32, 7.86]). Likewise, those who said yes to question 12 have 1.47 times the odds of seeing their community being recovered compared to those who said no to this question assuming the model stays constant ($p=0.0243$, CI[2.02, 3.22]). The model 7 resulted the question 5 and 12 of the sense of community to be statistically significant. Those who answered yes to the question 5 have 9.79 times the odds of perceiving positive community recovery compared to those who answered no to this question while holding all else constant ($p=0.004$, CI[2.14, 5.12]). For those who answered yes to the question 12 of the sense of community, they have 4.73 times the odds of perceiving community recovery compared to those who answered no to this question assuming the model stays the same ($p=0.002$, CI[1.34, 1.72]). This divergence of the results suggests that the sense of community and their perceived recovery might better not be assessed at a larger scale and/ or in an aggregated manner but rather it should be assessed at a community scale as comparative studies.

Conclusion

This research study points out that people's perceived recovery varies by the scales and levels of perceived recovery. As shown, the sense of community and income seem to affect negatively on people's perceived recovery at the individual level while those variables affect

positively for both household and community level recoveries. Also, the magnitude of association between the sense of community and perceived recovery appears to become greater as the scale of perceived recovery becomes larger. For instance, the sense of community seems to have a stronger association between perceived household recovery compared to individuals' perceived recovery. Similarly, it appears to have a stronger association between community level recovery compared to perceived household recovery. Further, among the sense of community questions the questions one ("I think my neighborhood is a good place for me to live"), five ("I feel at home in this neighborhood"), nine ("if there is a problem in the neighborhood people who live here can get it solved") seem to have a higher association with perceived recovery at the both household and community level recovery. The question one and five can be categorized as conformity towards one's neighborhood, and question nine can be considered perceived strength of a community. For the sake of building a strong resilience for upcoming disasters from a planning perspective, putting an effort in a creation of sense of community, especially regarding conformity and perceived strength would be important factors to make people and place stronger.

Discussion

Although the analyses yield some interesting results that are statistically significant, this research project has several limitations. One of the major limitations is that perceived recovery at all the three levels is measured by the survey, which do not include an objective measure. For the future studies, it will be interesting to include more objective measures, such as percentage of people who moved from the emergency shelter or number of houses remains unfixed, to have a more holistic understanding of recovery. Further, the previous damages or exposures to crude oil, petroleum or other harmful substances are not included, which makes it harder to assess more

objective recovery rate since exposure status and the magnitude and levels of exposure are not assessed. Another limitation is that a neighborhood and community is not well-defined in this study. In the survey, a neighborhood is considered an area within one's zip code. However, zip code is not a sufficient measure of one's neighborhood, because the zip codes are created to maximize the efficiency of mail delivery service which disregards the concept of actual neighborhood where people live in. Therefore, for the future survey, it would be helpful to ask participants draw a boundary of their neighborhood when assessing sense of community related questions.

Regarding the assessment of causality, it is impossible to establish causality and directionality from this study due to many variables not being able to be controlled to establish a proper causal relationship between the sense of community and perceived recovery. If one wants to assess a causality, the best way is to conduct an experiment; however, it is fairly unfeasible since ethical issues are expected to be a large concern. In terms of geospatial elements in the model, the healthcare accessibility was calculated based on the hours of operation per week, which by definition gives the same value of attractiveness to all the hospitals. Therefore, in order to measure more accurate accessibility to healthcare facilities, it would be better to calculate the attractiveness score by the number of doctors in each facility as it is often used in many hospital accessibility studies. Also, all the hospital accessibilities are calculated by the unit of feet, which might not be the best measure to use for longer distance, since people usually drive in the study area. Although the rationale for using the feet as a measurement unit is to create consistency in units throughout all the geographical variable, assuming that a geographically weighted logistic model would be performed. However, since the traditional logistic regression was performed due to the limited knowledge in geospatial statistics, which gives a reason to change the unit of

measurement to miles from feet in order to make interpretation simpler and more intuitive for future studies.

Furthermore, it would give an opportunity for a more rigorous analysis if there were information about the participants' healthcare coverage before and after the oil spill incident to assess healthcare access. For future study, it might be interesting to run a similar analysis with demographic data from Census to increase generalizability of this study.

Appendix

General Health vs Perceived Recovery (Individual Level)

	Poor	Fair	Good	Very Good	Excellent
Worse	3	35	105	120	75
About the Same	31	47	33	7	0
Better	0	5	6	8	3

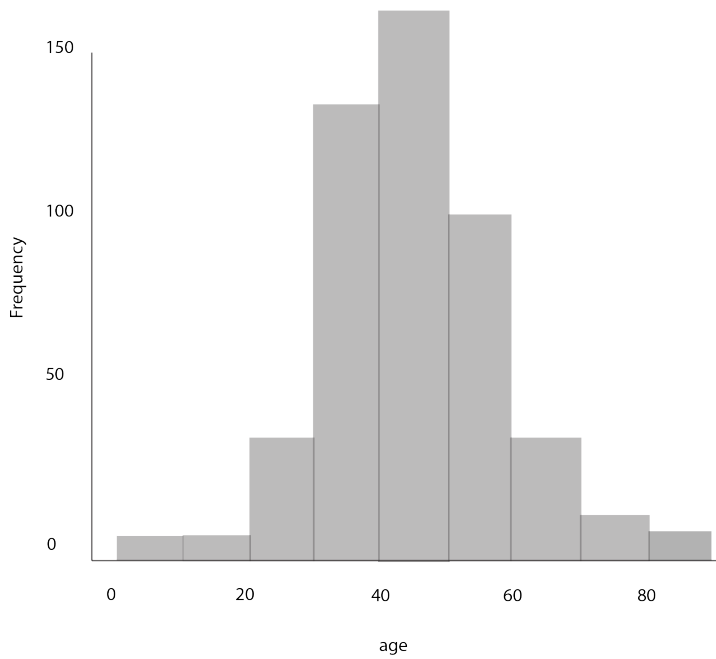
	Worse (perc_recov)	About the same/ Better (perc_recov)
Fair/ Worse (genhealth)	38	83
> Good (genhealth)	180	42

Employment

What is your current employment status?

- 1: Full-time, that is 35 or more hours per week
 - 249
- 2: Part-time, that is 20-35 hours per week
 - 30
- 3: Occasional, that is less than 20 hours per week
 - 6
- 4: Self-employed
 - 34
- 5: Retired
 - 30
- 6: Student
 - 2
- 7: Housemaker
 - 55
- 8: On disability
 - 37
- 9: Unemployed
 - 32
- 10: Other (specify)
 - 7
- 888: Don't know
 - 1
- 999: N/A
 - 1

Age Distribution



Sense of Community

#PercRecovery: "adulthealthcompare_c", 'soc1_c"

- I think my neighborhood is a good place for me to live

	Soc 1 NO	Soc1 Yes
Worse	16	318
Better/About the same	14	122

- Pearson's Chi-squared test with Yates' continuity correction
 - X-squared = 4.0214, df = 1, p-value = 0.04493

#PercRecovery: "adulthealthcompare_c", 'soc2_c"

- People in my neighborhood do NOT share the same values
 - 1 means that they think their neighborhood share the same values

	Soc 2 0	Soc2 1
Worse	96	201
Better/About the same	44	81

- Pearson's Chi-squared test with Yates' continuity correction
 - X-squared = 0.21146, df = 1, p-value = 0.6456

#PercRecovery: "adulthealthcompare_c", 'soc3_c"

- My neighbors and I want the same thing from the neighborhood

	Soc 3 NO	Soc3 Yes
Worse	34	276
Better/About the same	20	113

- Pearson's Chi-squared test with Yates' continuity correction

- X-squared = 1.0851, df = 1, p-value = 0.2976

#PercRecovery: "adulthealthcompare_c", 'soc4_c"

- I can recognize most of the people who live in my neighborhood

	Soc 4 NO	Soc4 Yes
Worse	47	286
Better/About the same	17	121

- Pearson's Chi-squared test with Yates' continuity correction
 - X-squared = 0.13674, df = 1, p-value = 0.7115

#PercRecovery: "adulthealthcompare_c", 'soc5_c"

- I feel at home in this neighborhood

	Soc 5 NO	Soc5 Yes
Worse	17	318
Better/About the same	12	126

- Pearson's Chi-squared test with Yates' continuity correction
 - X-squared = 1.642, df = 1, p-value = 0.2001

#PercRecovery: "adulthealthcompare_c", 'soc6_c"

- very few of my neighbors knows me
 - 1 means that lots of neighbors knows them

	Soc 6 0	Soc6 1
Worse	93	239
Better/About the same	36	102

- Pearson's Chi-squared test with Yates' continuity correction
 - X-squared = 0.097621, df = 1, p-value = 0.7547

#PercRecovery: "adulthealthcompare_c", 'soc7_c"

- I care about what my neighbors thinks of my actions

	Soc 7 NO	Soc7 Yes
Worse	116	217
Better/About the same	49	87

- Pearson's Chi-squared test with Yates' continuity correction
 - X-squared = 0.019395, df = 1, p-value = 0.8892

#PercRecovery: "adulthealthcompare_c", 'soc8_c"

- I have no influence over what this neighborhood is like
 - 1: I have influence over...

	Soc 8 0	Soc8 1
Worse	122	200
Better/About the same	47	84

- Pearson's Chi-squared test with Yates' continuity correction
 - X-squared = 0.086427, df = 1, p-value = 0.7688

#PercRecovery: "adulthealthcompare_c", 'soc9_c"

- if there is a problem in the neighborhood people who live here can get it solved

	Soc 9 NO	Soc9 Yes
Worse	24	296
Better/About the same	25	108

- Pearson's Chi-squared test with Yates' continuity correction
 - X-squared = 11.286, df = 1, p-value = 0.000781

#PercRecovery: "adulthealthcompare_c", 'soc10_c"

- it is very important for me to live in this particular neighborhood

	Soc10 NO	Soc10 Yes
Worse	110	225
Better/About the same	41	95

- Pearson's Chi-squared test with Yates' continuity correction
 - X-squared = 0.20948, df = 1, p-value = 0.6472

#PercRecovery: "adulthealthcompare_c", 'soc11_c"

- People in this neighborhood generally don't get along with each other
 - Ture(1) means that people think they get along with each other

	Soc11 0	Soc11 1
Worse	27	300
Better/About the same	22	114

- Pearson's Chi-squared test with Yates' continuity correction
 - X-squared = 5.5568, df = 1, p-value = 0.01841

#PercRecovery: "adulthealthcompare_c", 'soc12_c"

- I expect to live in this neighborhood for a long time

	Soc12 NO	Soc12 Yes
Worse	64	257
Better/About the same	34	100

- Pearson's Chi-squared test with Yates' continuity correction
 - X-squared = 1.3467, df = 1, p-value = 0.2459

#genhealth: "genhealth_c", "soc1_c"

	Soc 1 NO	Soc1 Yes
Fair/Worse	11	111
> Good	15	203

- X-squared = 0.24804, df = 1, p-value = 0.6185

#genhealth: "genhealth_c," "soc2_c"

	Soc 2 NO	Soc2 Yes
Fair/Worse	38	71
> Good	63	130

- X-squared = 0.070612, df = 1, p-value = 0.7904

#genhealth: "genhealth_c," "soc3_c"

	Soc 3 NO	Soc3 Yes
Fair/Worse	17	100
> Good	27	176

- X-squared = 0.019331, df = 1, p-value = 0.8894

#genhealth: "genhealth_c," "soc4_c"

	Soc 4 NO	Soc4 Yes
Fair/Worse	11	113
> Good	33	186

- X-squared = 2.1934, df = 1, p-value = 0.1386

#genhealth: "genhealth_c," "soc5_c"

	Soc 5 NO	Soc5 Yes
Fair/Worse	11	112
> Good	12	208

- X-squared = 1.0277, df = 1, p-value = 0.3107

#genhealth: "genhealth_c," "soc6_c"

	Soc 6 NO	Soc6 Yes
Fair/Worse	29	95
> Good	68	148

- X-squared = 2.1499, df = 1, p-value = 0.1426

#genhealth: "genhealth_c," "soc7_c"

	Soc 7 NO	Soc7 Yes
Fair/Worse	46	74
> Good	77	143

- X-squared = 0.24324, df = 1, p-value = 0.6219

#genhealth: "genhealth_c," "soc8_c"

	Soc 8NO	Soc8 Yes
Fair/Worse	44	71
> Good	78	135

- X-squared = 0.03018, df = 1, p-value = 0.8621

#genhealth: "genhealth_c," "soc9_c"

	Soc 9NO	Soc9 Yes
Fair/Worse	17	102
> Good	24	186

- X-squared = 0.33666, df = 1, p-value = 0.5618

#genhealth: "genhealth_c," "soc10_c"

	Soc 10 NO	Soc10 Yes
Fair/Worse	33	89
> Good	76	143

- X-squared = 1.7734, df = 1, p-value = 0.183

#genhealth: "genhealth_c," "soc11_c"

	Soc 11 NO	Soc11 Yes
Fair/Worse	18	102
> Good	24	190

- X-squared = 0.68724, df = 1, p-value = 0.4071

#genhealth: "genhealth_c," "soc12_c"

	Soc 12 NO	Soc12 Yes
Fair/Worse	23	98
> Good	45	164

- X-squared = 0.16387, df = 1, p-value = 0.6856

Closeness to a family

- **1: Yes, No: 0**
- [visitreg1]: Do you currently have relatives or friends you visit with regularly in their homes?
 - 1: 431
 - 0: 52
 - Refused: 1
- [visitreg2]: Do you currently have relatives or friends you borrow things from or exchange favors with?
 - 1: 357
 - 0: 126
 - Refused: 1
- [visitreg3]: Do you currently have relatives or friends who would help you if were in need?
 - 1: 463
 - 0: 19

- Dont know: 2
- [visitreg4]: Do you currently have relatives or friends you could stay with in an emergency?
 - 1: 470
 - 0: 13
 - Dont know: 1
- [visitreg5]: Do you currently have relatives or friends who could help a family member find a job if someone needed one?
 - 1: 415
 - 0: 56
 - Don't know: 11
 - N/A: 11
- [visitreg6]: Do you currently have relatives or friends who could help you find new housing if you needed it?
 - 1: 405
 - 0: 67
 - Dont know: 11
 - Refused: 1
- [howfarlive]: Thinking of these same relatives and friends, do most of these people live in your local community or do they live more than an hour away?
 - Most local: 367
 - > 1 hour away: 72
 - Pretty equal split: 42
 - Don't know: 2
 - N/A: 1

#PercRecovery_fam: "adulthealthcompare_c", 'visitreg1_c"

- Do you currently have relatives or friends you visit with regularly in their homes?

	Visitreg1_c NO	Visitreg1_c Yes
Worse	31	306
Better/About the same	21	120

- X-squared = 2.7638, df = 1, p-value = 0.09642

#PercRecovery_fam: "adulthealthcompare_c", 'visitreg2_c"

- Do you currently have relatives or friends you borrow things from or exchange favors with?

	Visitreg2_c NO	Visitreg2_c Yes
Worse	82	255
Better/About the same	44	97

- X-squared = 2.0782, df = 1, p-value = 0.1494

#PercRecovery_fam: "adulthealthcompare_c", 'visitreg3_c"

- Do you currently have relatives or friends who would help you if were in need?

	Visitreg3_c NO	Visitreg3_c Yes
Worse	9	328
Better/About the same	5	136

- X-squared = 2.8814, df = 1, p-value = 0.08961

#PercRecovery_fam: "adulthealthcompare_c", 'visitreg4_c"

- Do you currently have relatives or friends you could stay with in an emergency?

	Visitreg4_c NO	Visitreg4_c Yes
Worse	8	329
Better/About the same	5	136

- X-squared = 0.16828, df = 1, p-value = 0.6816 (Chi-squared approximation may be incorrect)

#PercRecovery_fam: "adulthealthcompare_c", 'visitreg5_c"

- Do you currently have relatives or friends who could help a family member find a job if someone needed one?

	Visitreg5_c NO	Visitreg5_c Yes
Worse	34	295
Better/About the same	20	117

- X-squared = 1.3257, df = 1, p-value = 0.2496

#PercRecovery_fam: "adulthealthcompare_c", 'visitreg6_c"

- Do you currently have relatives or friends who could help you find new housing if you needed it?

	Visitreg6_c NO	Visitreg6_c Yes
Worse	40	291
Better/About the same	23	113

- X-squared = 1.5332, df = 1, p-value = 0.2156

Household Recovery

- Completely recovered: 112
- Mostly recovered: 97
- Somewhat recovered: 72
- Not recovered at all: 32
- Was not affected by the oil spill: 158
- Refused: 1
- Don't know: 5
- N/A: 6
- Other (Specify): 1

Community Recovery

- Completely recovered: 70
- Mostly recovered: 154
- Somewhat recovered: 153
- Not recovered at all: 26
- Was not affected by the oil spill: 45
- Refused: 2
- Don't know: 29
- N/A: 6

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