THE EFFECTS OF HURRICANE HARVEY ON HOUSTON'S GRAVIDAE

by

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Dedication

To Steve and Greg

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ABSTRACT

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This thesis studies the effects of Hurricane Harvey on Houston's gravidae (pregnant women). The study found that the gravidae's demography determined their vulnerability to the storm. Gravidae who were foreign-born, in low-income households, with no college education, with no private health insurance, who utilized a county hospital, and who had no access to medical services or a maternity hospital were most likely to be affected by Hurricane Harvey. U.S.-born, high-income household gravidae, those with private health insurance, and those who were private hospital users were more likely to suffer a financial loss of $5,000 or more. The U.S.-born, non-Latinx Black and Latinx gravidae who were fluent in English were more affected than Latinx gravidae who spoke Spanish only. The gravidae that reported anxiety for four weeks or more were U.S.-born, living in high-income households, and had a college degree.

Multivariate regression was performed for gravidae who were affected by the storm. The models show that during a public health crisis like Hurricane Harvey: 1)

Latinx gravidae will be least likely to have access to medical services, 2) non-Latinx Black and Latinx gravidae will be more likely to have financial difficulty, 3) those with income of less than $35,000 will be less likely to have access to maternity hospitals and will be less likely to suffer financial difficulty of more than $5,000, and 4) those utilizing county hospitals will be less likely to have access to medical services and maternity hospitals and will be less likely to experience the financial difficulty of more than $5,000 compared to those utilizing private hospitals.

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INTRODUCTION

Context of the Problem

Hurricanes are something we all wish to avoid but cannot prevent. The Houston metropolitan area is located on the Texas Gulf Coast and is subject to the Atlantic hurricane season from June through November each year. From 1900 to 2008, 44 hurricanes have made landfall in Texas (National Centers for Environmental Information-NCEI, 2020; National Oceanic and Atmospheric Administration-NOAA, 2020; Roth, 2010). Because of climate change, hurricanes are not only becoming more common, but their intensity and destruction is also increasing. On August 25, 2017, Hurricane Harvey, a category 4 hurricane, made landfall in Rockport, south of Houston. Although less than 100 people were killed, the storm caused havoc to eight Texas regions (Afiune, 2017; National Centers for Environmental Information-NCEI, 2020). The rainfall lasted seven days and produced up to 60 inches of rain (The Office of Texas Comptroller, 2018), which forced 30,000 people to evacuate from their homes. Additionally, 500,000 vehicles were damaged in the flood, 200,000 homes and businesses were damaged, and the Houston metropolis was paralyzed for almost a week (National Centers for Environmental Information-NCEI, 2020; The Office of Texas Comptroller, 2018).

During that time, it was difficult for people to obtain medical services from their usual medical facilities. Many dialysis centers operated by the University of Texas in Galveston had to close due to flooding. Hospitals in the Texas Medical Center were surrounded by water (Sunshine, 2018), and the HOPE clinics were open with skeleton staffing (Seda, 2017). The Texas Association of Community Health Centers were able to open the week after the storm passed (Simmons, 2017) and offered “whole” person medical services that included general medicine, dentistry, optometry, mental health, and

pharmacy services (Texas Association of Community Health Centers, 2020). However, obstetric specialty services were not available.

Societal Implication

Obstetrics is a medical field specializing in care for pregnant women. Since 2000, there have been more than 3,100 peer-reviewed research articles describing how natural disasters have a profound effect on health and healthcare. However, there are only 93 studies concerning obstetrics, two of which relate to Hurricane Harvey. Mendez-Figueroa et al. (2019) compared pregnancy outcomes before and after Hurricane Harvey while Olson et al. (2019) compared how stressors from three events, including Hurricane Harvey, affected pregnancies. Even though both studies conducted research on the gravidae population (*gravida* is defined as a pregnant woman) during Hurricane Harvey, neither addressed how different demographic populations were affected by the storm, at what level, and for which medical services.

This thesis examines how Hurricane Harvey affected Houstonian gravidae, who gave birth between October 28, 2017, to July 1, 2018. The thesis studies the relationships between the gravidae's demographics and the gravidae's health services experiences, their financial loss due to the storm, and their mental state resulting from their experience of the storm. This thesis includes 1) a review of the literature on how natural disasters affect different demographic populations and how demographics affect one's health; 2) the research methodology, outlining how data was analyzed; 3) the results; 4) the discussion; and 5) the conclusions of the study which further contextualize the results in the literature and theory. First, the following sections of this chapter review the literature.

Natural Disasters Affect Human Lives

Natural Disasters Affect Vulnerable Populations the Most

When Hurricane Harvey made landfall in southeast Texas in 2017, there was widespread flooding. Wealthy and low-income individuals alike found their homes underwater. A federally-funded flood insurance program sponsored by the Federal Emergency Management Agency (FEMA) covers up to $250,000 for property damage and $100,000 for personal damage after floods (Federal Emergency Management Agency, 2021; Texas Department of Insurance, 2021). The program is meant to alleviate the loss citizens face during catastrophic events. Depending on the property value and its location, the average premium for the policy is about $700 annually. That is a large sum of money that many low-income households cannot afford. According to the insurance industry, 80% of households flooded by Hurricane Harvey did not have flood insurance, and more than 80% of the properties in Houston flood zones had no flood insurance (Lozano & Hoyer, 2018). A high percentage of higher-income households were covered by their flood insurance premium, while lower-income households had to rely on government loans (Hersher & Benincasa, 2019; Lozano, 2018). Per government guidance, any house having damage less than $8,000 ($2,000 for renters) would not qualify for low-interest government loans. Many low-income households were left to fend for themselves. As a result, higher-income households fared better than lower-income households during the recovery phase. Three years after the storm, about 18% of the people who were forced to leave their homes because of Hurricane Harvey still lived in temporary housing (University of Houston-Hobby School of Public Affairs, 2020). Furthermore, 80% of those still living in temporary housing had family incomes less than half the city's median (Scherer & Morris, 2020).

When natural disasters occur, we often say, “we are in it together.” In reality, poorer countries, low-income communities, and poor people suffer the most (Diffenbaugh & Burke, 2019; Hersher & Benincasa, 2019; Milken Institute School of Public Health, 2018; Willison, Singer, Creary, & Greer, 2019). Studies have confirmed that racial minorities and low-income households endure more extensive flooding compared to Whites and people of higher socioeconomic status (Chakraborty, Collins, & Grineski, 2019; Collins, Grineski, Chakraborty, & Flores, 2019). Furthermore, after the flood water recedes, properties of the vulnerable populations (racial minorities and low-income households) have more petroleum contaminants than higher-income households because they lived in areas surrounded by superfund sites laden with industrial wastes (Bera et al., 2019; Horney et al., 2018; Karaye, Stone, Casillas, Newman, & Horney, 2019; Stone et al., 2019).

Natural Disasters Affect Health

In 2012, Hurricane Sandy took 117 lives; in 2017, Hurricane Maria caused 2,795 excess deaths in Puerto Rico, and in 2018 the wildfire in Paradise, California killed 85 people (Centers for Disease Control and Prevention, 2013; Milken Institute School of Public Health, 2018; Siegler, 2019). Besides casualties, natural disasters affect people’s physical and mental health. Studies showed that after floods, there are often surges of chronic and infectious diseases, including respiratory, skin, and gastrointestinal infections, especially in senior citizens and children (Sampson, Price, Kassem, Doan, & Hussein, 2018; Saulnier, Brolin Ribacke, & von Schreeb, 2017; Saulnier, Hanson, Ir, Molsted Alvesson, & von Schreeb, 2018). Researchers found low-income and minority adolescents who perceived stress from Hurricane Harvey had a reduction in their BMI after the storm compared to those who did not report being significantly impacted from the storm (Arlinghaus, Gorniak, Hernandez, & Johnston, 2020). Adults who encountered

multiple bad events were more likely to report depression and anxiety even five months after the storm (Bevilacqua et al., 2020). After the storm, people reporting substance abuse or behavior disorders increased 66% and 44%, respectively, compared to pre-storm levels (Phillippi et al., 2019).

Health Status Is a Function of One's Demographic

Studies have shown a person's health outcome is a function of one's socioeconomic status (Assari et al., 2019; Calo, Vernon, Lairson, & Linder, 2016; Vart et al., 2017), racial/ethnic identity (Bui et al., 2020; Gupta, 2020; Martinez et al., 2020), immigration status (Fleming, Villa-Torres, Taboada, Richards, & Barrington, 2017; Goodman, 2020; Velez, Palomo-Zerfas, Nunez-Alvarez, Ayala, & Finlayson, 2017), access to health insurance and medical services (Barker & Li, 2020; McClelland et al., 2017; Pulte, Jansen, & Brenner, 2017), and the person's gender and sex (Agenor, Krieger, Austin, Haneuse, & Gottlieb, 2014; Agénor, Pérez, Peitzmeier, Potter, & Borrero, 2018; Bruce et al., 2020; Gargano, Wehner, & Reeves, 2009).

Even though this thesis only explores the effect of Hurricane Harvey on pregnant women, it cannot ignore that sex and gender play a subdued but significant role in healthcare when it intersects with race, ethnicity, immigration status, education, and wealth. According to the National Center for Health Statistics, women aged 18 to 64 had higher health insurance coverage rates and utilized more medical services than men (Clarke, Norris, & Schiller, 2017). In reality, when their illnesses were diagnosed, they were less likely to seek treatments as their median annual income was 82% of men's, and when they needed urgent medical care, they had to wait longer at the emergency department and were less likely to receive advanced testing and aggressive treatments as compared to men (Clarke et al., 2017; Gargano et al., 2009; The United States Census Bureau, 2019). Structurally, women are being punished for their unmarried status, as the

coverage rates for unmarried women are 5% to 15% lower than their married counterparts (Simpson & Cohen, 2017). Those who have non-binary gender identities also encounter obstacles that force them to forgo medical care (Agenor et al., 2014; Cicero, Reisner, Silva, Merwin, & Humphreys, 2019; Gonzales & Henning-Smith, 2017).

Racial/Ethnic Identity and Nativity Affected Health

Race – A Fairly New Concept Without Defined Definitions

Before Christopher Columbus landed in the New World in 1492, "in both European Christendom and Near Eastern Islam, the key issue in drawing distinctions among different kinds of human beings lay in sorting the believers and faithful from heathen" (Wolf, 1996:2606). People's skin color was recognized as a way to distinguish locals and outsiders but was not used as a tool to determine race. According to Hirschman, "racism is a modern idea that emerged in recent centuries as a result of three transformations that created sharp divides between Europeans and other peoples: 1) the enslavement of millions of Africans in plantation economies in the New World; 2) the spread of European colonial rule across the world, especially in Asia and Africa in the nineteenth century; and 3) the development of Social Darwinism - the pseudo-scientific theory of European superiority that became dominant in the nineteenth century" (Hirschman, 2004:392).

In the U.S. the definition of race has not remained constant over time. In fact, in under three years, the U.S. Supreme Court contradicted itself on different standards of race as evidenced by the decisions from the cases of Ozawa v. United States in 1922 and United States v. Bhagat Singh Thind in 1923 (The University of Texas at Austin - Department of History, 2019). Mr. Ozawa argued that he should be eligible for U.S. citizenship based on the Nationality Act of 1790, which granted citizenship to "free white persons" as his skin was whiter than any white person, and he was well acculturated into

American culture. He graduated from an American university, dressed in western clothes, spoke English at home, and attended church. The court denied his petition with the reason that "white" was synonymous with "Caucasian." A year later, the court also denied Mr. Thind's petition because he was not acculturated enough into American culture, even though Indians were categorized as Aryan or Caucasian during that time. Prior to 1970, a person's race on the U.S. Census was determined by the interviewers. Today, Americans are allowed to report their race based on the choices the government gives them.

Thus, the concept of race is a social construct, but it is often presented as though it is based in biology. Even though there are genetic variations between people, there is no evidence of genetic differences between races (Gravlee, 2009). The variations found in the global gene pool show no clear-cut distinctions regarding race (Li et al., 2008; Rosenberg, Palmer, Wise, Horton, & Corwin, 2002). Studies find wider genetic variations within racial groups than between racial groups, 85% vs. 5% respectively (Li et al., 2008; Relethford, 2002). Nevertheless, in the U.S., the idea of race has become extreme. It intertwines with ethnicities, nationalities, and legality creating a complicated racial stratum that leads to inequity in healthcare.

Implicit Racial Bias

Race has become an important criterion in many segments in the U.S., and it has had a pervasive long-lasting effect on people's minds and lives even after discrimination based on race was made illegal. Racial discrimination happens everywhere, even in medicine. Even though the explicit racial bias levels were low among healthcare providers (Blair et al., 2013; Dehon et al., 2017), implicit preference toward white patients did exist in every specialty, even in pediatric care, and the level of implicit bias was about the same as in the general population (Achuko, Walker, Campbell, Dawson, & Egede, 2016; Calvo & Hawkins, 2015; Dehon et al., 2017; FitzGerald & Hurst, 2017;

Johnson, Winger, et al., 2017). Sometimes the implicit bias was defined as poor communication quality toward patients of color; however, sometimes they were expressions of racial dominance during medical discourse (Hagiwara, Slatcher, Eggly, & Penner, 2017; Shen et al., 2018; Takeshita et al., 2020), and sometimes it affected physician's treatments toward patients of racial minorities, especially Black patients (Green et al., 2007; Hirsh, Hollingshead, Ashburn-Nardo, & Kroenke, 2015; Leitner, Hehman, Ayduk, & Mendoza-Denton, 2016; Sabin & Greenwald, 2012). The implicit pro-White/anti-Black bias did not stop at the provider-patient level but extended to faculty recruitment such that White physicians were hired over Black physicians (Johnson, Ellison, et al., 2017). During the COVID-19 pandemic, Black and Latinx communities had higher infection rates and death rates than the White community, even after adjustments for age, socioeconomic status, and health comorbidities (Dorman & Mishel, 2020; Ogedegbe et al., 2020; Thomas et al., 2020). Were those excessive deaths the results of America's fragmented healthcare system, low spending on public health, or the inequities created by structural racism?

Race Determines Accessibility Which Affects Health

According to the National Center for Health Statistics, 27% of Latinxs, 15% of Blacks, 8% of Asians, and 9% of Whites aged 18 to 64 had no health insurance; that accounted for up to 30.4 million people in the U.S. (Cohen, Terlizzi, & Martinez, 2018). In 2019, the number increased to 30% of Latinxs, 15% of Blacks, 8% Asians, and 11% Whites (Cohen, Cha, Martinez, & Terlizzi, 2019). Asians having higher enrollment in health insurance programs than other races is attributed to Asians' higher educational attainment. As structural racism becomes so pervasive, it constrains resources and opportunities. It limits the power of racial minority groups so that any gain from the groups' achievements, especially among Blacks, does not result in a significant gain in

health outcomes as compared to Whites (Assari, 2017; Assari, Mistry, & Bazargan, 2020; Assari & Moghani Lankarani, 2018; Assari et al., 2019).

As a group, Asians enjoy the label "model minority," but it is just a myth when looking at it closely (Budiman & Ruiz, 2021). Asians are not a monolithic group. They vary extensively with respect to ethnic groups, social-economic groups, and acculturation levels. Many of them are doing extremely well, but many are not; the average masks the true nature of this complexity. The Pew Research Center conducted a study that compared educational attainment, income, and poverty level of each Asian group to the U.S. national average (Budiman & Ruiz, 2021). While the Asian average is above the national average, there are large variations between each Asian country of origin. The report shows that 54% of people with Asian ancestry have at least a bachelor's degree, which is well above the 33% mark for all Americans. However, that 54% is an average that spans a range of 75% for Indians to 15% for Bhutanese. The U.S. median income is $61,800, which is lower than the Asians' median income of $86,000. But again, that number includes Indians (median income, $119,000) and Burmese (median income, $44,000). The U.S. poverty rate is at 13%, while for Indians, it is at 6%, which pulls down the Asian poverty rate to 10% and masks the Mongolians' rate of 25%. Seventy-five percent of Asian Americans have private insurance coverage. However, that rate spans from 79% for the Filipino to 62% for the Hmong (U.S. Department of Health & Human Services, 2019).

A survey from the National Center for Health Statistics shows a higher percentage of Latinxs and Blacks have limited access to healthcare compared to Whites (Clarke et al., 2017). A higher percentage of Latinxs and Blacks 1) cannot afford to see a doctor compare to Whites: 17% of Latinxs, 13% of Blacks, and 10% of Whites; 2) are less likely to receive influenza vaccinations: 33% Latinxs, 36% Blacks, and 46% Whites; and 3) are

less likely to report being in excellent or good health: 61% for Latinxs, 59% for Blacks, and 71% for Whites. Research has shown that Latinxs and Blacks have higher diagnoses of diabetes than Whites, but receive less blood glucose A1c tests, foot exams, eye exams, and cholesterol testing than do Whites (Canedo, Miller, Schlundt, Fadden, & Sanderson, 2018; Clarke et al., 2017). Blacks, Latinxs, and Native Americans have a higher risk of amputation due to their diabetic foot infections than Whites, 40%, 30%, and 50%, respectively (Tan et al., 2019). Even though the Latinxs are less likely to be smokers or drinkers than Whites, Latinxs have three times higher rates of kidney cancer than Whites (Batai et al., 2019). Blacks and Latinx women have worse breast cancer prognoses and outcomes than Whites, even though their incidence rates are lower (Guan et al., 2019; Gupta et al., 2018; Martinez et al., 2017).

Legality Affects Health

Structurally, the United States bars many immigrants from joining the healthcare system (United States Government, 2019). Under Title 8 of the U.S. Code 1613, legal immigrants must reside in the U.S. for at least five years to be eligible for federally subsidized healthcare. Code 1621b mandates that unauthorized immigrants can only be treated for emergency conditions or communicable diseases. Because of this law, Texas has stopped giving preventive medicine to unauthorized immigrants since 2001. Furthermore, U.S. Code 1621d has shifted the burden to the states to decide whether to give healthcare benefits to unauthorized immigrants. California, Illinois, Massachusetts, New York, Washington, and Washington D.C. took advantage of this federal law and provided healthcare to unauthorized immigrants in their jurisdictions; many states do not, including Texas. In 2010, the Affordable Care Act expanded the eligibility for Medicaid and provided subsidies to low-income people to buy private insurance. However, unauthorized immigrants are not eligible to join (United States Congress, 2010). The Act

does not specify undocumented immigrants to be asked their immigration status – providing a loophole for them to purchase the subsidized health insurance. However, they still cannot receive the tax break because the Internal Revenue Service (IRS) does ask the subscribers' legal residency in the tax code.

Studies show legality determines healthcare accessibility, which in turn affects a person's health status. The Kaiser Foundation showed that 45% of adult undocumented immigrants had no health insurance, compared to 23% of documented immigrants and 9% of naturalized citizens (Kaiser Foundation, 2020). Research showed that intense anti-immigrant rhetoric was associated with delayed prenatal care of Latinx-born gravidae, affected the mental wellness of American-born Latinx adolescents living in a mixed-status family, and led to increased preterm births (Chu et al., 2019; Eskenazi et al., 2019; Gemmill et al., 2019). In 2017, Adu-Boahene and colleagues found a lack of health insurance associated with the undocumented status of African immigrants (Adu-Boahene, Laws, & Dapaah-Afriyie, 2017). In 2015, a study in Cincinnati showed that Latinx immigrants had more barriers to healthcare and worse physical and mental health than American-born Latinxs, Whites, and African Americans (Jacquez, Vaughn, Pelley, & Topmiller, 2015). In 2014, a study in Denver reported that 41% of refugees in their study had no health insurance (Elwell, Junker, Sillau, & Aagaard, 2014). The lack of accessible health care in the immigrant population is nothing new, and its effects intersect with that of legality, race, and socioeconomic status.

The Immigrant Segmented Theory

One belief assumed by many Americans is that when immigrants arrive in the U.S., all they need to do is to learn a new language and then assimilate into American culture on a linear path of upward mobility (Rumbaut, 1997). That worked when everyone was White, Protestant and had European ancestors. It has not been so since

1965 when immigrants arrived in the U.S. with different cultures, languages, and religions. Even though they did not share memories, have common knowledge, or feel included, they did acculturate into the American culture. Their path in doing so was not linear but segmented. They integrated into American society according to their background and their reception in the host country. Some integrated rapidly into American culture and enjoyed upward mobility while keeping a tight relationship with their ethnic community. Others found a path of downward mobility and assimilated into the underclass. Others integrated directly into the White middle class (Portes & Zhou, 1993). Their children took their cultures and combined it with the stratification American society forced on them to make new paths of upward or downward mobility, or a mixture of both depending on the situation (Zhou, 1997).

Unlike other immigrant groups, Latinxs do not have an easy path to American prosperity. They have lower educational attainment than the American population and other immigrant groups from India, Nigeria, or the Philippines. The majority do not have governmental support in various programs, including the educational loans that can help their children gain upward mobility like those of the political refugees from Cuba or Southeast Asia. In the eye of many Americans, all Latinxs are "illegal" even though 80% of them are U.S. citizens (Pew Research Center, 2021).

The Collective Integration Theory

Acculturation and proficiency in the language of the host country go hand in hand. The more proficient in the language, the more people can acculturate to the new society and the better their lives will be. Studies have shown that proficiency in English leads to better access to healthcare, better quality care, and more satisfaction with the care (Ali & Watson, 2018; Garcia et al., 2020; Jang & Kim, 2019).

Paradoxically, studies show that immigrants such as Latinxs have better health, despite having lower socioeconomic status, more stressful lives as a higher percentage of them are unauthorized immigrants, and less access to healthcare compared to other ethnic minority groups. Studies have shown Latinx immigrant groups had lower infant mortality rates than U.S.-born Latinxs and U.S.-born Whites (Hummer, Powers, Pullum, Gossman, & Frisbie, 2007; Madan et al., 2006). Latinxs had lower cancer mortality rates than non-Latinx Blacks and Whites after adjusting for their lack of access to physicians and health insurance (Philips, Belasco, Markides, & Gong, 2013); and Latinx immigrants older than 65 had a lower mortality rate than U.S.-born Latinxs, Blacks, and Whites (Lariscy, Hummer, & Hayward, 2015).

Many social scientists explained the Latinx health paradox as a process of "self-selection," meaning only the most healthy are capable for emigration; and the "salmon-bias" effect or selective outmigration back to their homeland when they are old (Crimmins, Soldo, Kim, & Alley, 2005; Palloni & Arias, 2004). That might be the case, but empirical data show that social cohesion plays a big part in the immigrants' lives. Chinese and Korean immigrants who had limited English but lived in large ethnic enclaves such as Chinatown or Koreatown in California with many clinics providing in-language services had fewer problems accessing healthcare (Chawla, Breen, Liu, Lee, & Kagawa-Singer, 2015). The Somalian immigrants living in the ethnic enclave in Minnesota also had few problems accessing healthcare (Call et al., 2014). Both groups had one cultural characteristic in common: higher collective consciousness.

Immigrants who lack English competency or are of low socioeconomic status often conduct business and receive support from their compatriots. Their social network is their ethnic enclave where they have shared values and sets of rules based in their native cultures. According to Durkheim, those values and norms form the collective

consciousness that binds people together and guides them through social integration (Barou, 2014). Will the collective integration of the foreign-born in this study shield them from the potential detrimental health effects of Hurricane Harvey? Or will it only help some of them who take a different path toward assimilation and a different level of collective integration?

Socioeconomic Status Affects Health

The Relationship Between Education, Income, and Health

According to the U.S. Bureau of Labor Statistics, there is a positive correlation between educational attainment and income. In general, the higher a person's education, the greater her income (The United States Bureau of Labor Statistics, 2019). Studies have shown that educational attainment and health are interwoven because higher education exposes a person to more information, promotes healthier lifestyles, and fosters better health (Bodnar et al., 2017; Cuthbertson et al., 2018; Weitzman, 2017). More highly-educated people have more access to healthcare services (Tripathy et al., 2020; Zhang, Jarl, & Gerdtham, 2017) and longer lifespans than their lower-educated counterparts (Petrelli et al., 2019; Raghupathi & Raghupathi, 2020).

Higher Income Results in Better Healthcare Access

Since higher education correlates with economic rewards, it helps people empower other aspects of their lives; one of those aspects is their health. Health insurance is a gateway to good health, but the cost to be insured is a burden to many low-income people. Higher incomes give people better access to healthcare and innovative treatments. Seventy-four percentage of the uninsured people in the U.S. stated that they did not have health insurance because the coverage was unaffordable (Cha & Cohen, 2020). Using the Behavioral Risk Factor Surveillance System 2011 data of 159,000 self-reported hypertensive people, Fang and colleagues found that 32% of the people represented in

their data had no health insurance as their family's annual income was less than $25,000 (Fang, Yang, Ayala, & Loustalot, 2014). That finding was similar to the results published by the National Center for Health Statistics (NCHS) that showed poor people were less likely to have health insurance than "not-so-poor" people (Cohen et al., 2018; Martinez & Ward, 2016). In the NCHS 2013 survey, 40% of poor adults aged 18 to 64 had no health insurance compared to 12% of a similar group of "not-poor" adults; in 2015, 26% of poor vs. 8% of "not-poor"; and in 2018, 27% of poor vs. 8% of "not-poor." The numbers of the uninsured for both economic groups improved over the years, but the disparity between groups remained constant at about a 200% difference.

Higher Income Results in Better Health

A study from Rice University's Kinder Institute for Urban Research showed a relationship between health and wealth (Klineberg, Wu, & Barrera, 2014). They compared the Gini Index and the percentage of people in poor health of ten large urban regions in the U.S. The Gini Index measures income inequality with a scale from zero to one; a higher number on the scale represents a higher income disparity. The Gini Index scores for Philadelphia, Houston, and San Jose (0.497, 0.491, and 0.452 respectively) showed a strong positive correlation to the percentage of their citizens living in poor health (20%, 18%, 14%, respectively); the higher the income disparity, the higher the percentage of people living in poor health. Rana and colleagues showed similar results from their study that compiled data from the 30 countries in the Organization for Economic Co-operation and Development from 2004 to 2015 (Rana, Alam, & Gow, 2018). They showed that a country's income disparity had an inverse relationship with its health outcomes.

Two-Tier Health Services Affect Health

Inaccessibility to health insurance leads to inaccessibility to health services and results in poor management of diseases such as diabetes, poor preventive medicine such as low vaccination rates (Angier et al., 2020; Chasens et al., 2020; Ward, Clarke, Nugent, & Schiller, 2016), and delayed treatment and forgone medicine (Du & Xu, 2016; Shoemaker & White, 2016; Yabroff et al., 2020). All of these result in poor health prognoses and lower survival rates (Kwabeng et al., 2020; Rapado et al., 2020; Yabroff et al., 2020).

To improve access to healthcare and the health of its citizens, governments at the federal, state, and local levels create subsidized health insurance programs such as Medicaid, Children's Health Insurance Program (CHIP), or a program similar to the Gold Card issued by the Harris Health System in Houston for their low-income citizens. Research showed that people with Medicaid were less likely to visit the doctors' offices but more likely to visit the emergency centers (Cifaldi, Renaud, Ganguli, & Halpern, 2016; Fourquet et al., 2019; Taylor, Liu, & Howell, 2020). A study in Puerto Rico found that medical services provided by government insurance were three times less utilized compared to those provided by private insurance (Fourquet et al., 2019). In Mecklenburg County in North Carolina, women with Medicaid were eight times less likely to have well-woman visits, four times more likely to visit the emergency department before pregnancy occurred, 50% more likely to delay having first-trimester prenatal care, and 50% less likely to have postpartum checkups compared to privately insured women (Taylor et al., 2020). What were the reasons for underutilization of government sponsor health insurance? Other studies give some clues.

One problem is accessibility. Governments in different states have different reimbursement rates on preventive medicine for Medicaid and Medicare, and the

reimbursements are slow and often underpaid (Granade, McCord, Bhatti, & Lindley, 2020; Jaqua et al., 2020). That leads to many private doctors' offices and hospitals not wanting to treat patients with Medicaid/Medicare, which leaves people utilizing those resources with limited choices for providers and hospitals. Because of that, their treatments were delayed (Adamson, Zhou, Baggett, Thomas, & Meyer, 2017; Ahmad, Susko, Lindquist, & Anwar, 2019; Cifaldi et al., 2016; Tsui et al., 2019), their prognoses were worse (Churilla et al., 2016; Jain et al., 2019; Rapado et al., 2020), and their outcomes were less successful (Ahmad et al., 2019; Chan et al., 2016; Taylor et al., 2020).

The second problem is stigmatization. Stigmatization prevented or delayed people from visiting doctors and seeking medical services (Alcalá, Ng, Gayen, & Ortega, 2020; Allen, Call, Beebe, McAlpine, & Johnson, 2017; Baer et al., 2019). Furthermore, when they sought help, they perceived that their providers ignored their health complaints and gave them less autonomy on medical decisions than people with private insurance (Arpey, Gaglioti, & Rosenbaum, 2017; Declercq, Sakala, & Belanoff, 2020). To make the matter worse, public healthcare facilities with resources for indigent care are disappearing. The remaining indigent-care providers are forced to rush patients in and out in order to see more patients so that the government does not shut down their clinics.

Martinez-Hume and colleagues' study is worth mentioning. They conducted a semi-structured interview with low-income Medicaid recipients recruited from food banks and farmers markets through a snowball sampling method (Martinez-Hume et al., 2017). The study showed that recipients often perceive stigmas, poor quality care, and indifferent treatment when interacting with healthcare workers and providers. The sample size for the study was relatively small (n = 31), but the authors explored another important issue in healthcare: how stigmatization affects public insurance recipients'

perception of their care, affects medical decisions, and how much patients want to avoid the healthcare system.

Intersectionality Theory

Studies have shown that race, ethnicity, nativity, socioeconomic status, and health insurance type determines a person's access to healthcare. As the United States population becomes more diverse, different laws and policies are introduced to society to support its social, ideological, and bureaucratic system. Over time, the hierarchal social structures become so stratified and widely practiced that people still practice them even when they are outlawed (i.e., racial discrimination). Where hierarchal social structures intersect, they can reinforce each other, creating a web of inequalities from home to workplace, housing to education, and food to healthcare. How they do so is the focus of Intersectionality Theory.

The term "intersectionality" was first introduced by Kimberlé Crenshaw, an activist and legal scholar. It is defined as "the relationships among multiple dimensions and modalities of social relations and subject formations" (McCall, 2005:1771) and as "the interaction between gender, race, and other categories of difference in individual lives, social practices, institutional arrangements, and cultural ideologies and the outcomes of these interactions in terms of power" (Davis, 2008:68). In other words, Intersectionality Theory is the study of an individual's multiple identities. It is the relationship between social categories through which a discriminating ideology exerts control over the life of the individual. Intersectionality Theory postulates that 1) people can face multiple oppressions; 2) they can be the oppressed and the oppressor at the same time; and 3) even though all oppressions intersect at the same point, each of them plays a different role at different levels in society creating an ultimate impact on a person (Collins, 1993). For example, the experiences of a wealthy, educated African immigrant

and a low-income, low educated White American-born would be affected by the differences that race, wealth, education, immigration status, and nativity play in their lives.

Agenor and colleagues' study is worth mentioning. They studied the rates of Black, White, and Latinx women obtaining Pap tests (Agenor et al., 2014). Opposed to the majority of the studies, they did not utilize White as the comparison group. Instead, they considered specific disparities such as access to healthcare, education level, employment, economic status, and the stigma patients faced, such as gender preference, marital status, and living situation. They found that women with no sexual partner or female sexual partners had fewer Pap tests than women with male sexual partners among Black and White women, but no difference for Latinx women in the case with female sexual partners and only a marginal difference in the case with no sexual partner. The reason there was no difference with Latinx women was that they had lower accessibility to healthcare; it did not make a difference what sexual partners the women had. By using the framework of Intersectionality Theory, their findings gave social scientists a better understanding of the complexity of healthcare accessibility in the U.S.

CHAPTER II:

STUDY'S PURPOSE AND METHODOLOGY

Purpose of the Study

Race/ethnicity, English fluency, nationality, educational attainment, income, and health insurance type affect people's ability to receive medical services. Past natural disasters disrupted infrastructure services such as transportation that in turn affected the daily lives of racial minorities and their health more than other demographic groups (Dargin & Mostafavi, 2020; Flores, Collins, Grineski, & Chakraborty, 2020). Studies have shown that these vulnerable populations already have limited access to healthcare. Natural disasters such as storms or pandemics exacerbate the problem even more (Assari, 2017; Cha & Cohen, 2020; Cuthbertson et al., 2018; Kaiser Foundation, 2020). Hurricane Harvey destroyed between 250 thousand to half a million vehicles and more than 178,400 homes (The Office of Texas Comptroller, 2018). Losing vehicles and homes are a significant loss as they are often the most expensive purchased items for individuals, especially for the foreign-born, racial minorities, and lower socioeconomic classes (The United States Bureau of Labor Statistics, 2019; The United States Census Bureau, 2019). Studies have shown the relationship between health and mental health, mental distress, and perceived wealth lost (Scholten, Velten, & Margraf, 2018; Thompson, Wagemakers, & van Ophem, 2020).

This thesis aims to examine Houston's gravidae who were affected by Hurricane Harvey with respect to access to maternity hospitals and medical services, suffering financial losses, and their mental health. This thesis explores the relationship between the gravidae's demographics and the severity of Hurricane Harvey's effects on them. It explores the effects between nativity groups, racial-ethnic groups, and the Spanish fluency levels of Latinxs; between socioeconomic class and between health insurance

type; and by hospital setting. These measures will better the understanding of assimilation and social structure in the United States.

Methodology

Research Design

This thesis studies the effects of Hurricane Harvey on Houston's gravidae by examining the relationship to nativity, race and ethnicity, educational attainment, income, insurance type, and hospital type. It is the first of its kind to study the relationship between natural disasters, the gravidae population, and healthcare accessibility. The study aims to investigate how severely the storm affected the gravidae's access to medical services and maternity hospitals, their suffering of financial difficulties, and their mental health based on their demographics.

Demographic characteristics such as a person's nativity, race and ethnicity, Spanish fluency, marital status, educational attainment, family income, insurance type, and hospital of delivery are independent variables that contribute to their individual risk of living in a flood zone and the promptness of rescue efforts. Those factors will influence the dependent variables of this study: access to medical services and maternity hospitals, suffering financial loss, and mental health. How these variables are captured into data will be described in detail below.

Sampling Method

This thesis is a cross-sectional study conducted under the University of Houston Clear Lake's Institutional Review Board (IRB) human protocol to utilize Baylor College of Medicine's de-identified database, called PeriBank (H-26364). PeriBank is an ongoing perinatal database and specimen repository that was established in 2010 by Baylor College of Medicine (BCM) to collect health data of gravidae delivering their babies at Texas Children's Hospital-Pavilion for Women (a non-profit private teaching hospital for

BCM) and Ben Taub General Hospital (a county teaching hospital for BCM). Gravidae are also asked to give consent for the collection of cord blood, placenta tissue and maternal blood for storage for future research use. On October 28, 2017 (approximately a month after Hurricane Harvey hit Houston), an amendment survey was added to the PeriBank protocol asking gravidae about their experiences during Hurricane Harvey. The amendment was concluded on July 1, 2018. This thesis utilizes the data from the amendment and gravidae's demographic data that is associated with the birth of their babies from October 28, 2017 to July 1, 2018.

Measure Construction

This research assessed five variables: the demography dimensions of the study, who were affected by the storm, healthcare accessibility, financial hardship, and mental health status of those who were affected by the storm. The extent each demographic was affected by the storm, the gravidae's ability to access medical services and maternity hospitals, whether the gravidae reported experiencing the household financial difficulty of more than $5,000, and the extent the gravidae reported experiencing anxiety in the four weeks during or after Harvey were measured across the demographic dimensions of age, marital status, race, ethnicity, nativity, English proficiency, educational attainment, household income, health insurance type, and hospital type.

Attributes were coded numerically. All questions with dichromatic answers were coded 1 for "Yes" and 0 for "No." For nativity, U.S.-born was coded as 1, foreign-born was 0. Race and ethnicity were combined into a new group called "RaceEthnicity." A small number of participants were in Non-Latinx Asian, Native American, and Pacific Islanders. They were combined into one group called "Non-Latinx Other". The coding for RaceEthnicity was as follows: 1 for "Non-Latinx Other", 2 for "Non-Latinx Black", 3 for "Latinx" regardless of race, and 4 for "Non-Latinx White." For language, "Only

Spanish or more Spanish" was coded 1, "Both languages equally" for 2, "Only English or more English" for 3. In the PeriBank protocol, six questions were asked about a respondent's level of Spanish/English proficiency. The answers were almost identical. Data analysis was based on the subject "primary language spoken at home." For education, less than high school, high school/GED, and some colleges were combined into one group called "No college" and coded 0. Bachelor's degree, master's degree, and doctoral/professional degree were combined into one group called "College" and coded 1. For household income, "$34,999 and below" was coded for 1 and "$35,000 and above" for 2. Sometimes, income $34,999 and below was referred to as "income below $35,000." For health insurance, out-of-pocket and all types of public insurances were combined into one group called "Insurance Other" and coded 0 while private health insurance was coded 1. For hospital, Ben Taub General Hospital was called "County Hospital" and coded 0 while Texas Children's Hospital was called "Private Hospital" and coded 1.

After attributes were coded, the data were exported to SPSS (IBM SPSS Statistics Grad Pack, Student Version 26.0). The measurement levels for all variables were nominal except for "household income," which was ordinal; "age" and "household size" were interval ratio. Maternal ages were calculated from the gravidae's birthdate to her infant's birthdate.

Data Analysis

The data were first extracted from PeriBank then saved in Excel files, N = 5,194. There were 4,951 singletons and 243 multiple births. Only singletons were included in the analysis. From here on, this group is called the "whole population." Five hundred eleven (n = 511) gravidae answered "yes" to the question asking if they were affected by the storm. This group is called the "affected group." There was no analysis for non-

Latinx Other in the affected group as its number is six (n = 6). Any change in this group will be significant but carries no meaningful results. Four questions focused on the affected group: 1) if they had access to medical services and 2) access to maternity hospitals, 3) if they had a financial difficulty of more than $5,000 due to the storm, and 4) if they experienced anxiety in the four weeks during or after the storm.

SPSS was utilized for all data analysis. For descriptive statistics, the percentage from bivariate correlations and Pearson Chi-Square 2-sided asymptotic significance were reported. Odds ratios Exp(B), standard errors (S.E.), and significant level were reported for multivariate logistic regression models. Microsoft Excel was utilized for generating tables and graphs. SPSS coding is in Appendix A. Gravidae's demographics' questionnaire is in Appendix B. Harvey's questionnaire is in Appendix C.

CHAPTER III:

RESULTS

Demographic Data of the Study

Table 3.1.a shows the demographic data of the study. Some study participants did not share their information; therefore, total participants in each category do not add up to the total sample size of 4,951. The data revealed that 10.3% of the gravidae were affected by Hurricane Harvey. The study's percentages of foreign-born and U.S.-born were comparable (44.5% for foreign-born vs. 55.5% for U.S.-born). About half of the participants were Latinx (49.4%), of those 56% spoke only or mostly Spanish. Of the study participants, 56.2% had no college degree, 48.8% had a family income of $34,999 and below, 59.1% had governmental health insurance, paid out-of-pocket or a combination of both, and 34.5% utilized county hospital for delivering their babies.

Table 3.1.a

The Study Demographics

	N	%			N	%
Sample Size	4,951	100		No College Degree	2,257	56.2
Affected Population	511	10.3		College Degrees	2,152	43.8
Foreign-Born	2,187	44.5		$34,999 and below	2,141	48.8
US-Born	2,726	55.5		$35,000 and above	2,243	51.2
Non-Latinx Other	334	6.7		Government & Self-paid	2,916	59.1
Non-Latinx Black	809	16.3		Private Insurance	2,018	40.9
Latinx	2,447	49.4		County Hospital	1,704	34.5
Non-Latinx White	1,359	27.5		Private Hospital	3,240	65.5
Only/More Spanish	1,356	56.0		Not Married	908	18.4
Both Language Equally	753	31.1		Married	4,012	81.6
Only/More English	313	12.9				

Demographic Data of Affected Group

The gravidae's mean ages and their family size were calculated from the whole population. Figure 3.1.a shows gravidae affected by Hurricane Harvey were younger than the non-affected group. The affected group had an average age of 28.49 years compared to 30.05 years for the non-affected group, $p < 0.001$. Figure 3.1.b shows gravidae with larger household sizes were more affected by Hurricane Harvey. The affected group had a household size of 3.80 on average, compared to the non-affected group's average of 3.51, $p < 0.001$.

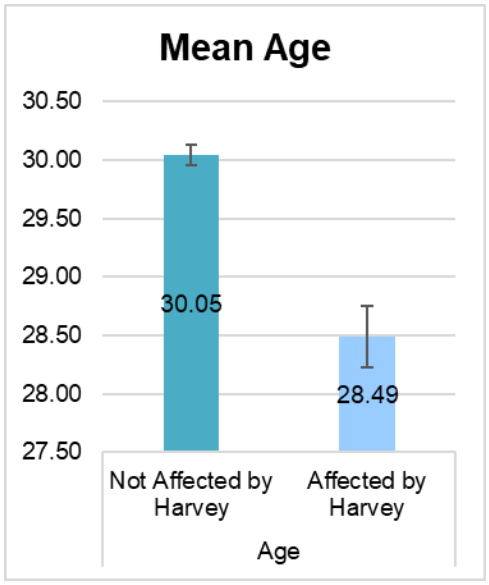

Figure 3.1.a
Hurricane Harvey Affects – Age

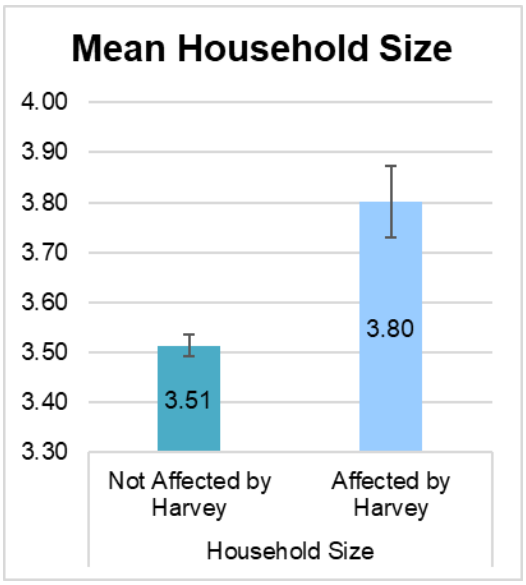

Figure 3.1.b
Hurricane Harvey Affects – Household Size

Figure 3.1.c shows a higher percentage of unmarried gravidae were affected by the storm than were married ones; 14.2% were unmarried gravidae compared to 9.5% of married, $p < 0.001$. Figure 3.1.d shows more U.S.-born gravidae were affected than foreign-born; 12.7% for U.S.-born compared to 7.4% foreign-born, $p < 0.001$.

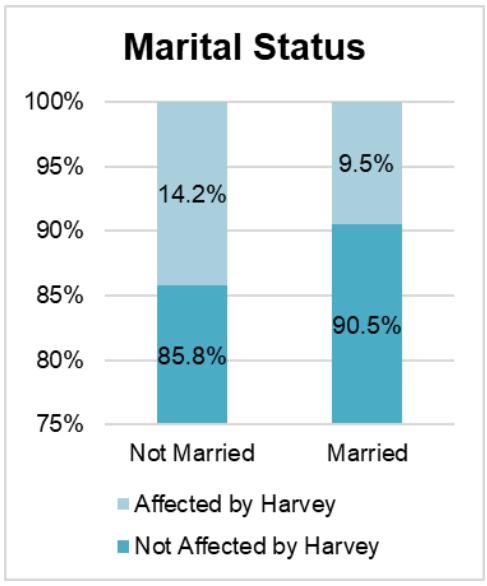

Figure 3.1.c
Marital Status of Affected and non-Affected

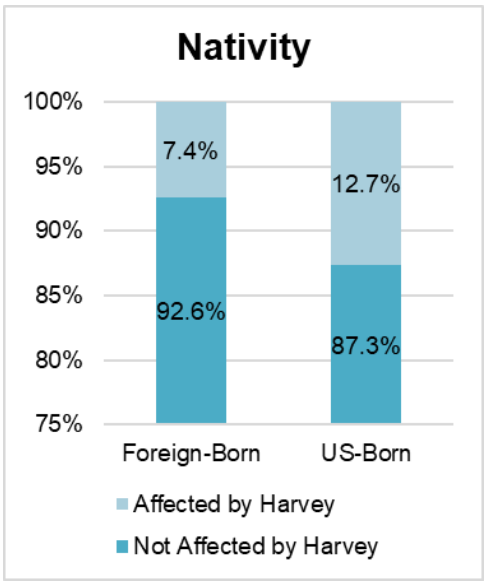

Figure 3.1.d
Nativity of Affected and non-Affected

Further looking into the affected foreign-born group shows 4.9% are non-Latinx Others, 10.5% are non-Latinx Blacks, 80.2% are Latinxs, and 4.3% are non-Latinx Whites. For the affected U.S.-born, the number are 1.4%, 34.2%, 33.6% and 30.7%, respectively, $p < 0.001$. Overall, racial minorities are affected the most. Table 3.1.b shows the race and ethnicity of the affected group in the study.

Table 3.1.b

Composition of the Affected Foreign-Born and U.S.-Born in the Study

	Non-Latinx Other	Non-Latinx Black	Latinx	Non-Latinx White	Total (%)
Foreign-Born (%)	4.9	10.5	80.2	4.3	100
U.S.-Born (%)	1.4	34.2	33.6	30.7	100

Of the foreign-born Latinxs, 81.5% speak only or mostly Spanish, 16.2% speak Spanish and English equally, and 2.3% speak only or mostly English. For the U.S.-born Latinxs, the data show language proficiency at 7.3%, 53.2%, and 39.4%, respectively, $p < 0.001$. Overall, U.S.-born Latinxs who were fluent in English were affected the most. Table 3.1.c shows English proficiency of the Latinxs.

Table 3.1.c

English Proficiency of the Affected Latinx

	Only/More Spanish	Spanish/English Equally	Only/More English	Total (%)
Foreign-Born (%)	81.5	16.2	2.3	100
U.S.-Born (%)	7.3	53.2	39.4	100

Figure 3.1.e supports the result showing in table 3.1.b. that minorities are more affected than non-Latinx Whites. It shows that more non-Latinx Blacks were affected by Hurricane Harvey than other racial-ethnic groups; 16.7% non-Latinx Blacks compared to 10.2% of Latinxs, 8.3% non-Latinx Whites, and 3.9% non-Latinx Others, $p < 0.001$.

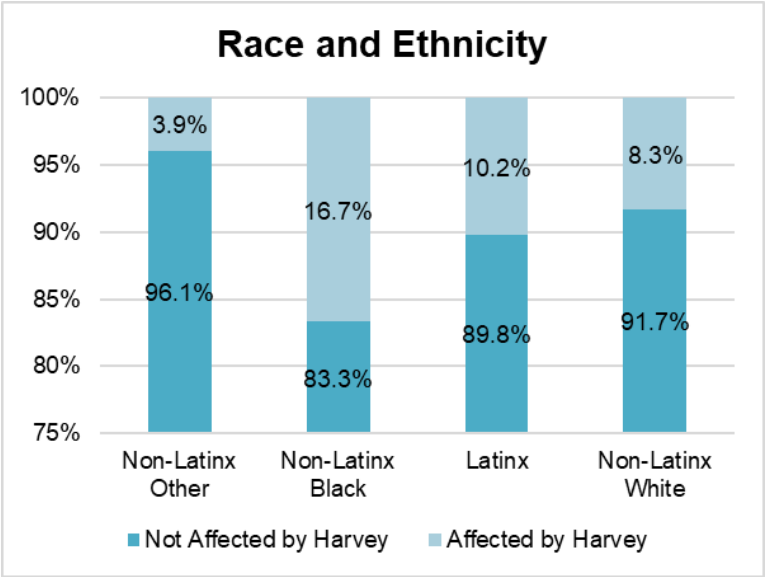

Figure 3.1.e
Hurricane Harvey Affects – Race and Ethnicity

Figure 3.1.f shows gravidae without a college degree were more likely to be affected than those with a college degree; 12.5% of gravidae with no college degree compared to 7.6% with a college degree, $p < 0.001$. Figure 3.1.g shows more gravidae with lower family incomes were affected by Hurricane Harvey than those with higher incomes; 13.0% of income $34,999 and below were affected compared to 8.0% with income $35,000 and above, $p < 0.001$.

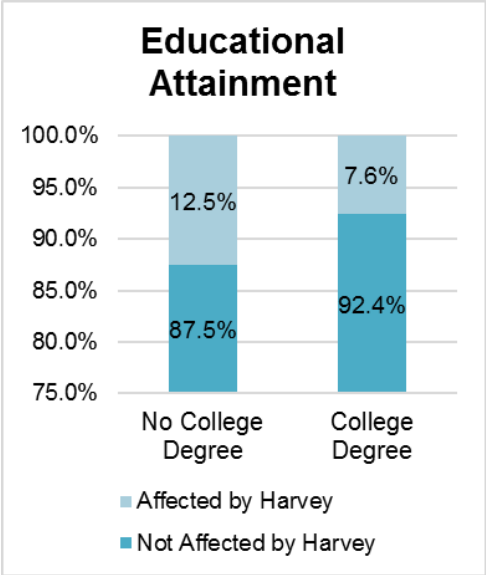

Figure 3.1.f
Hurricane Harvey Affects – Educational Attainment

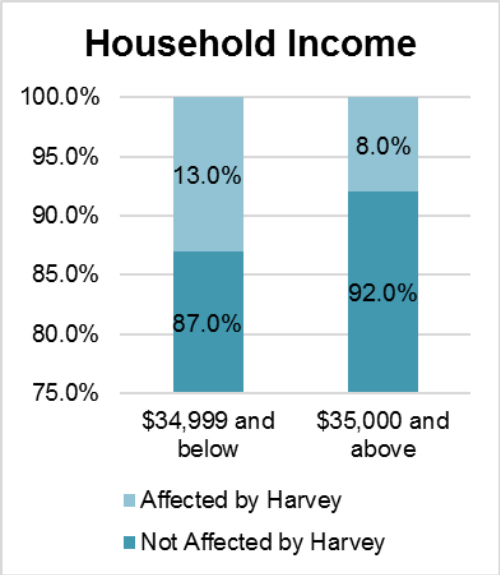

Figure 3.1.g
Hurricane Harvey Affects – Household Income

The Severity of the Affected Group

The results above are the overview of the study on the "whole population." In order to determine the severity of the "affected group," we rely on the responses from the following four questions: what was their level of 1) access to medical services, 2) access to maternity hospitals, 3) financial difficulty of more than $5,000, and 4) anxiety in the following four weeks?

Access to Medical Services

Descriptive Statistics

Data show gravidae with low access to medical services were foreign-born, Latinx – especially those with less English proficiency, household income of less than $35,000, those having public insurance, and those using the county hospital. Figure 3.2.a shows a higher percentage of foreign-born gravidae had no access to medical services during Hurricane Harvey compared to U.S.-born (69.4% vs. 35.9%), $p < 0.001$.

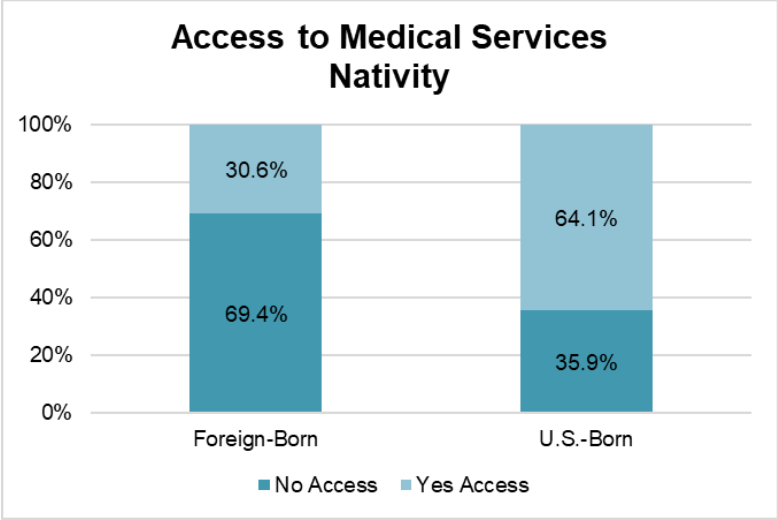

Figure 3.2.a
Access to Medical Services – Nativity

The results indicate higher percentages of Latinxs had no access to medical services than other racial-ethnic groups (Figure 3.2.b); 56.6% for Latinxs, 39.4% for non-Latinx Blacks, and 28.9% for non-Latinx Whites with $p < 0.001$.

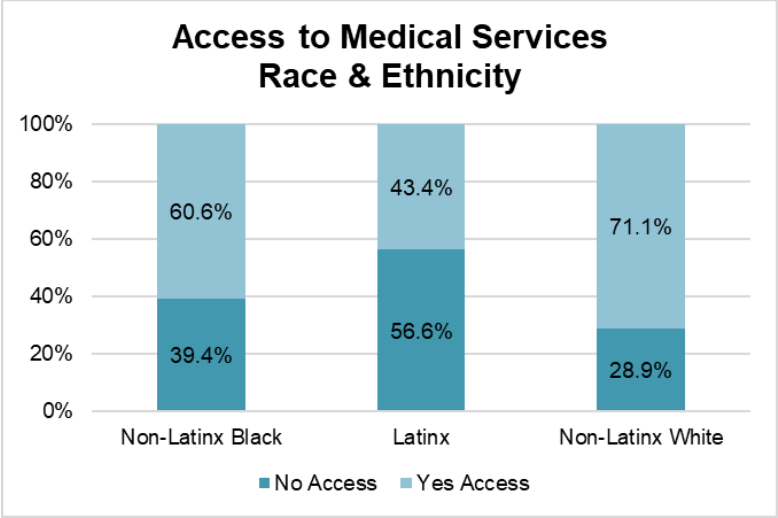

Figure 3.2.b
Access to Medical Service – Race & Ethnicity

Further investigations into the Latinx group shows that the higher English proficiency the person has, the better their access to medical services (Figure 3.2.c); 71.4% for people who speak only or mostly English compared to 48.5% of those who are bilingual, and 27.5% of those who speak only or mostly Spanish, $p < 0.001$.

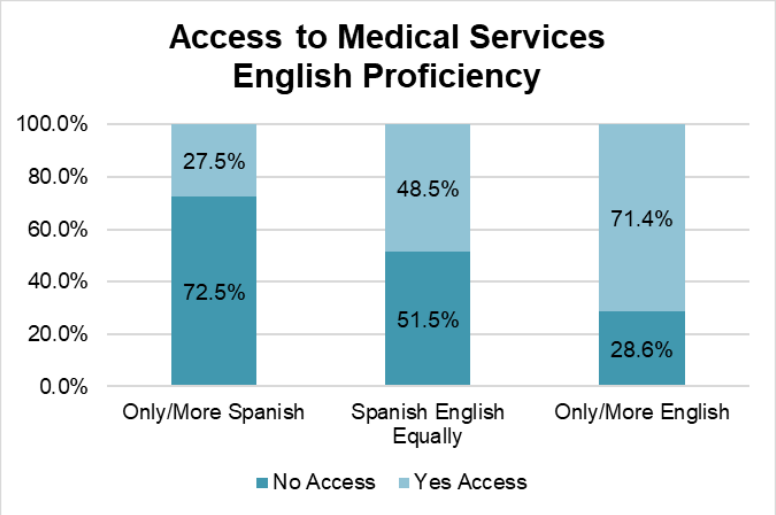

Figure 3.2.c
Access to Medical Services – Latinx English Proficiency

Data show gravidae with higher incomes had more access to medical services than those with lower incomes; 66.9% for income of $35,000 and above compared to 46.4% for income of $34,999 and below, $p < 0.05$ (Figure 3.2.d).

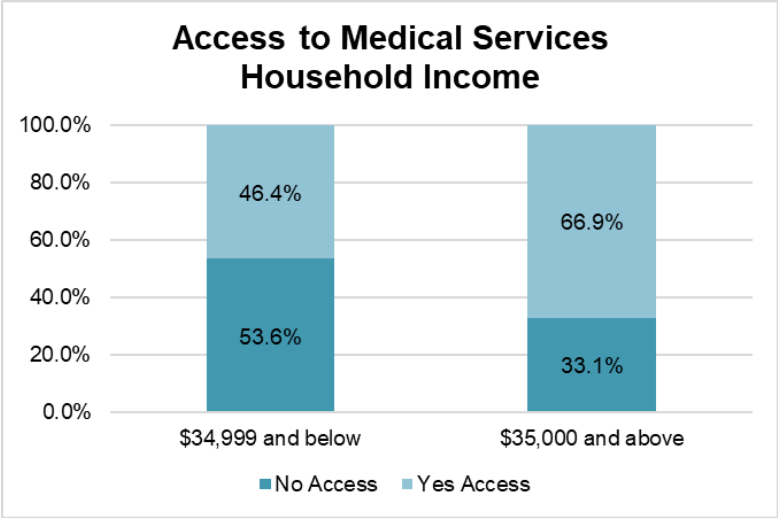

Figure 3.2.d
Access to Medical Services – Household Income

Figure 3.2.e shows higher percentages of gravidae with "insurance other" (government insurances and out-of-pocket paying) have no access to medical services compared to those with private insurance; 49.7% for "insurance other" compared to 37% for private insurance, $p < 0.05$.

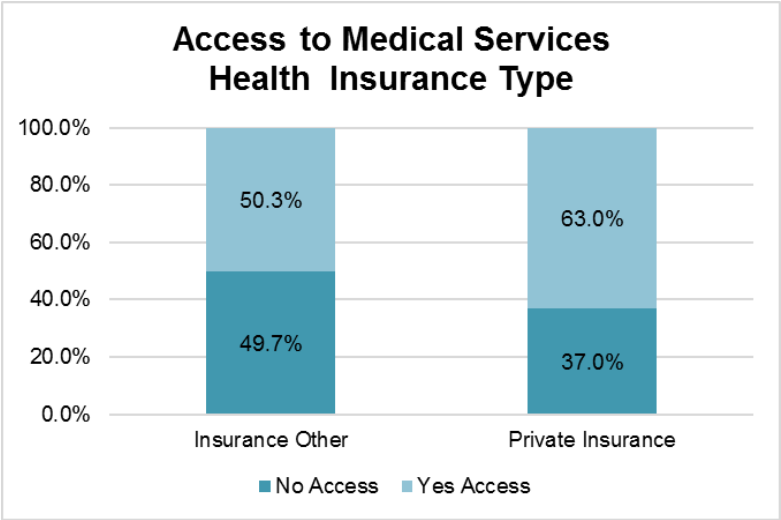

Figure 3.2.e
Access to Medical Services – Health Insurance Type

Data show a higher percentage of gravidae who utilized the county hospital had no access to medical services than gravidae who utilized private hospitals (Figure 3.2.f), 81% vs. 33.5%, respectively, with $p < 0.001$.

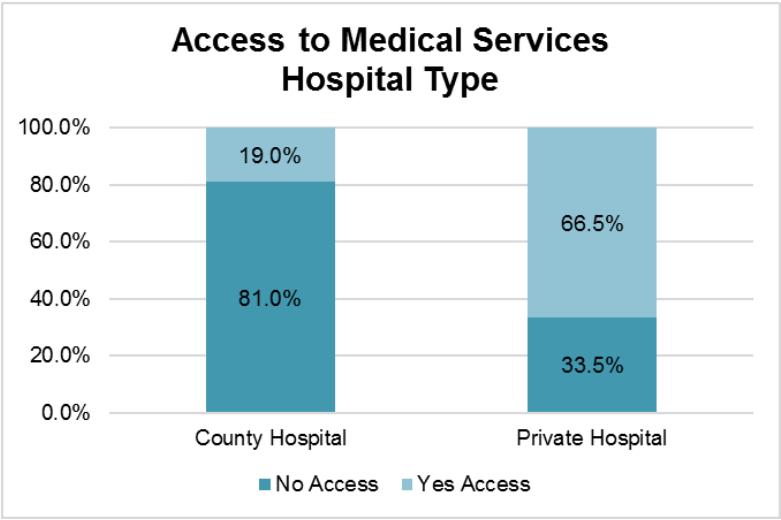

Figure 3.2.f
Access to Medical Services – Hospital Type

Multivariate Analysis – Access to Medical Services

Multivariate Logistic Regression was employed to make an inferential prediction about if a similar situation should happen again who would be best and least able to access medical services. The Logistic Regression was done using three multivariate models. Table 3.2 shows the odds ratios for each model for access to medical services regressed with respect to nativity, race and ethnicity, social economic status, health insurance type, and hospital type. The first model indicates relationships between nativity and race and ethnicity with respect to access to medical services. Foreign-born and Latinxs are less likely to have access to medical services than U.S.-born and non-Latinx Whites. In Model 2, the relationship still holds for foreign-born after adding social-economic status. The model also shows that gravidae with household incomes of less than $35,000 are less likely to access medical services. Health insurance type and hospital type are added to Model 3. It shows Latinxs and gravidae who utilize county hospitals are less likely to have access to medical services. Table 3.2 below shows the relationships.

Table 3.2

Logistic Regression – Access to Medical Services

	Model 1	**Model 2**	**Model 3**
	Odds Ratios (SE)	Odds Ratios (SE)	Odds Ratios (SE)
[a] Foreign-Born	0.33*** (0.26)	0.42** (0.28)	0.93 (0.34)
[b] Race & Ethnicity			
Non-Latinx Black	0.6 (0.32)	0.93 (0.37)	0.73 (0.40)
Latinx	0.50* (0.31)	0.62 (0.35)	0.51^ (0.37)
[c] No College Degree		1.06 (0.30)	0.84 (0.33)
[d] Income < $35,000		0.54* (0.31)	0.61 (0.37)
[e] Insurance Other			1.88 (0.41)
[f] County Hospital			0.17*** (0.37)
Nagelkerke R^2	0.14	0.14	0.23

[a] U.S.-Born as reference
[b] Non-Latinx White as reference
[c] College degree as reference
[d] Income >$35,000 as reference
[e] Private insurance as reference
[f] Private Hospital as reference

^*p*<.10 **p*<.05 ***p*<.01 ****p*<.001
SE: Standard Error

Access to Maternity Hospitals

Descriptive Statistics

Data show gravidae with lower access to maternity hospitals are foreign-born, especially those who speak only or mostly Spanish, have no college degree, have household incomes of $34,999 and below, pay out-of-pocket or use public health insurance, and utilize the county hospital. The same demographics also have low access to medical services.

The results (Figure 3.3.a) show that 76.6% of foreign-born gravidae had no access to maternity hospitals during Hurricane Harvey compared to 47.5% of U.S.-born, $p < 0.001$.

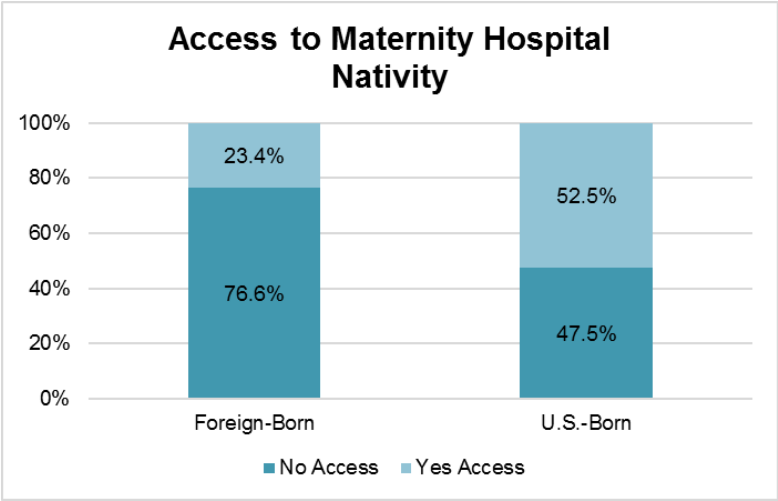

Figure 3.3.a
Access to Maternity Hospital – Nativity

Figure 3.3.b shows, 68% of Latinxs had no access to a maternity hospital compared to 48.5% of non-Latinx Blacks, and 41% of non-Latinx Whites, $p < 0.001$.

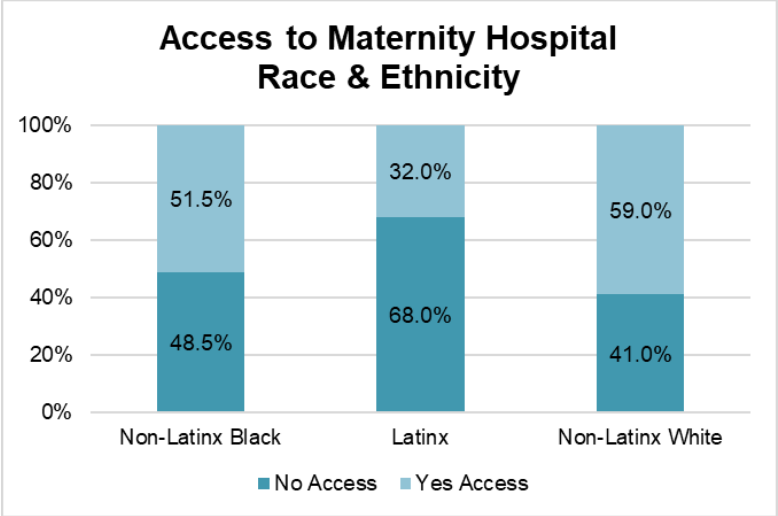

Figure 3.3.b
Access to Maternity Hospital – Race and Ethnicity

Looking further into the Latinx group shows a correlation between English proficiency and access to maternity hospitals. The higher the gravidae's proficiency in English, the more they had access to the maternity hospitals; 19.8% of the gravidae who

speak only or mostly Spanish compared to 35.9% of bilingual gravidae, and 51.4% of those who speak only or mostly English, $p < 0.01$ (Figure 3.3.c).

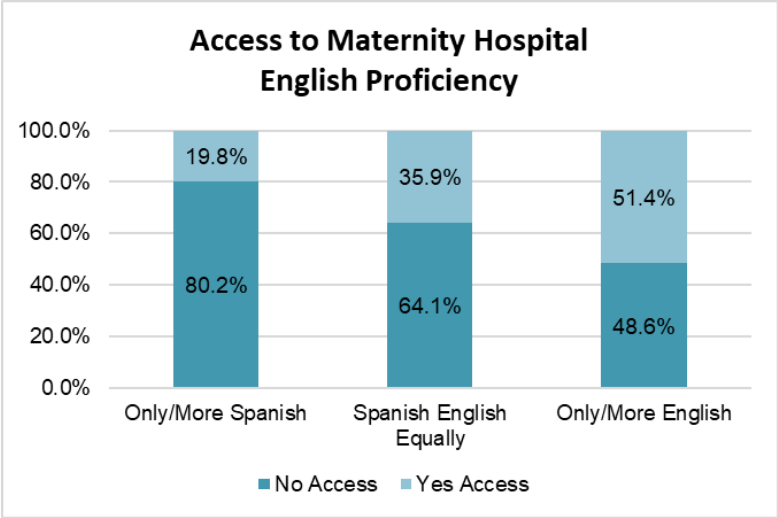

Figure 3.3.c
Access to Maternity Hospital – English Proficiency

Gravidae without college degrees had less access to maternity hospitals than those with college degrees, 38.5% vs. 52.9%, with $p < 0.01$ (Figure 3.3.d).

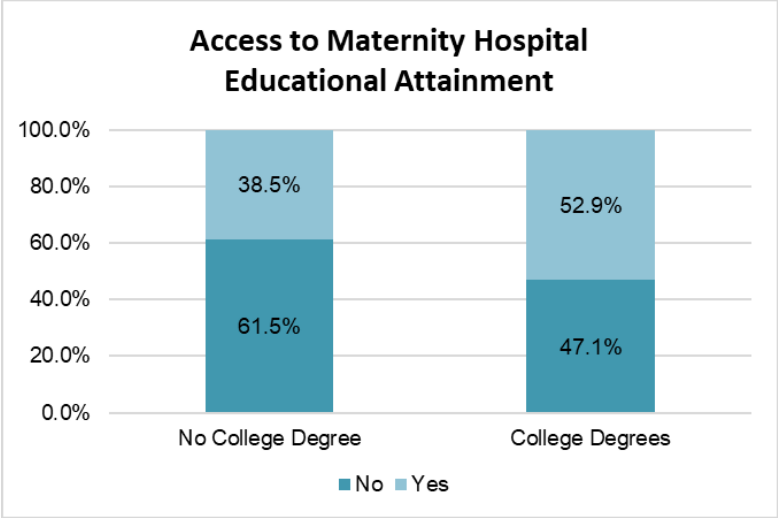

Figure 3.3.d
Access to Maternity Hospital – Educational Attainment

Figure 3.3.e shows gravidae with lower family incomes had lower access to maternity hospitals than gravidae with higher family income, 33.8% vs. 57.6%, $p < 0.01$.

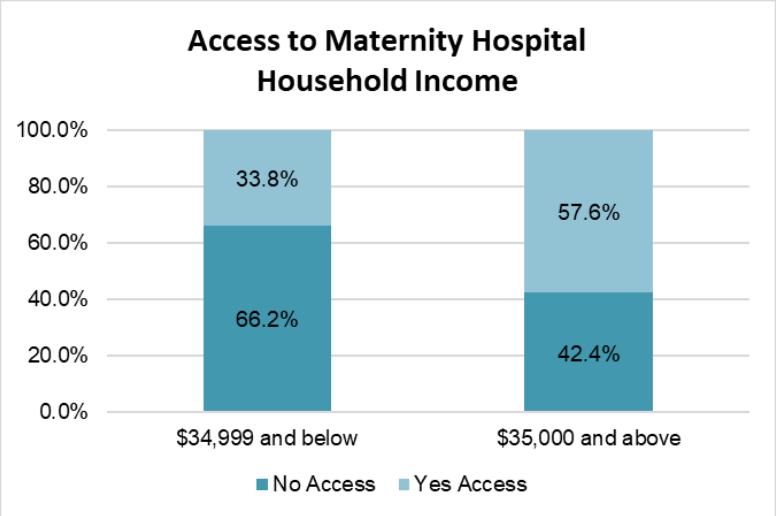

Figure 3.3.e
Access to Maternity Hospital – Household Income

Figure 3.3.f shows that gravidae who had public health insurance and/or paid out-of-pockets were less able to access to maternity hospitals than private insurance users, 38.9% vs. 55.1%, with $p < 0.01$.

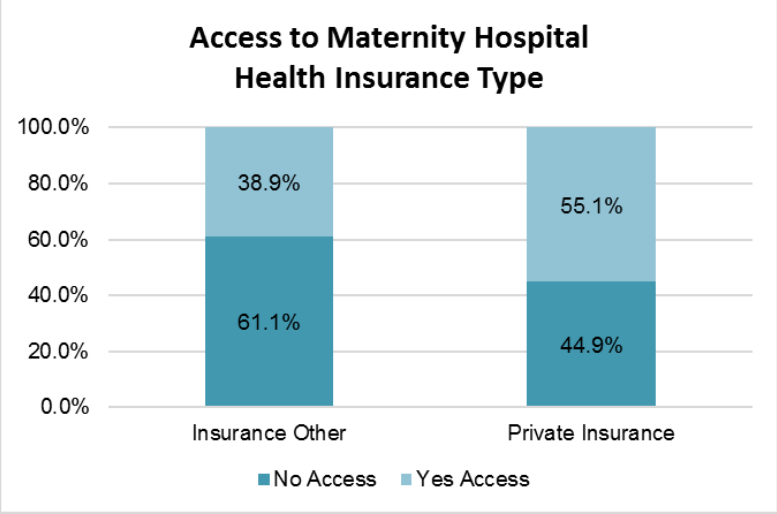

Figure 3.3.f
Access to Maternity Hospital – Health Insurance Type

Figure 3.3.g shows gravidae who utilized the county hospital had lower access to a maternity hospital than those who utilized a private hospital, 11.4% vs. 54.8%, with $p < 0.001$.

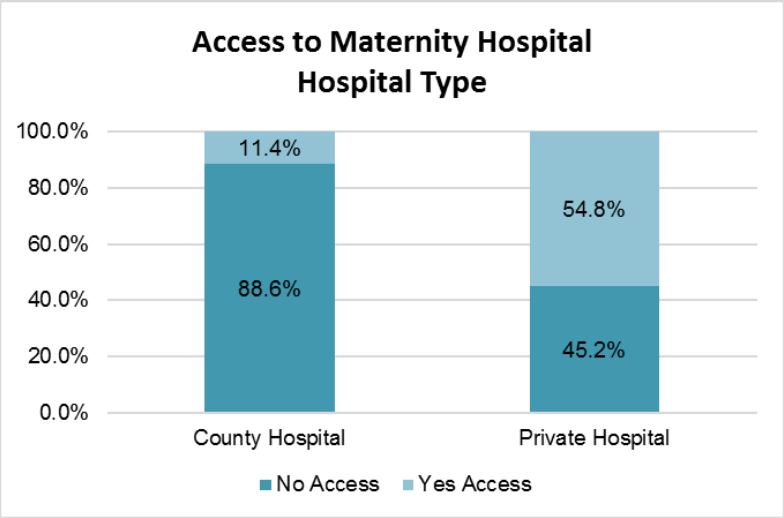

Figure 3.3.g
Access to Maternity Hospital – Hospital Type

Multivariate Analysis – Access to a Maternity Hospital

The analyses for access to maternity hospitals are based on three models: Model 1 examines nativity and race-ethnicity; Model 2 adds social economic status; Model 3 adds health insurance type and hospital type. The first two models indicate relationships between nativity, race-ethnicity, and socioeconomic status and access to maternity hospitals. In Model 1, foreign-born and Latinxs are less likely to have access to a maternity hospital than the U.S.-born and non-Latinx Whites. In Model 2, foreign-born and gravidae with family income less than $35,000 are less likely to access maternity hospitals than their counterparts. Model 3 predicts that gravidae who have income less than $35,000 or utilize county hospitals are less likely to have access to maternity hospitals than those with income of $35,000 and above and those who utilize private hospitals (Table 3.3).

Table 3.3

Logistic Regression – Access to Maternity Hospitals

	Model 1		Model 2		Model 3	
	Odds Ratios	(SE)	Odds Ratios	(SE)	Odds Ratios	(SE)
[a] Foreign-Born	0.38***	(0.27)	0.51*	(0.29)	0.97	(0.34)
[b] Race & Ethnicity						
Non-Latinx Black	0.81	(0.30)	1.22	(0.35)	1.05	(0.38)
Latinx	0.50*	(0.30)	0.69	(0.34)	0.64	(0.36)
[c] No College degree			0.92	(0.30)	0.78	(0.32)
[d] Income < $35,000			0.48*	(0.31)	0.57^	(0.35)
[e] Insurance Other					1.44	(0.40)
[f] County Hospital					0.21*	(0.40)
Nagelkerke R^2	0.12		0.13		0.19	

[a] U.S.-Born as reference
[b] Non-Latinx White as reference
[c] College Degree as reference
[d] Income >$35,000 as reference
[e] Private Insurance as reference
[f] Private Hospital as reference

^*p*<.10 **p*<.05 ***p*<.01 ****p*<.001
SE: Standard Error

Financial Difficulty of More Than $5,000 Due to the Storm

Natural disasters are associated with loss of lives and property. Fortunately, no lives were lost; however, it has been estimated that Texas property losses due to Harvey were about $125 billion (The Office of Texas Comptroller, 2018). Flooding was widespread throughout the Houston metropolitan area, and people from all races, ethnicities and socioeconomic groups were affected. This study wanted to examine which of the gravida's demographic were financially affected. The survey asked if the gravidae had "experienced major financial difficulty of more than $5,000 due to the storm." The question's wording does not lend itself well to analysis concerning the more marginalized individuals as that limitation is high.

Descriptive Statistics

Bivariate results show statistical differences between financial difficulty and nativity, English proficiency, household income, health insurance type, and hospital type.

There are higher percentages of U.S.-born with financial difficulty than foreign-born, 41% vs. 26.8% respectively, with $p < 0.01$ (Figure 3.4.a).

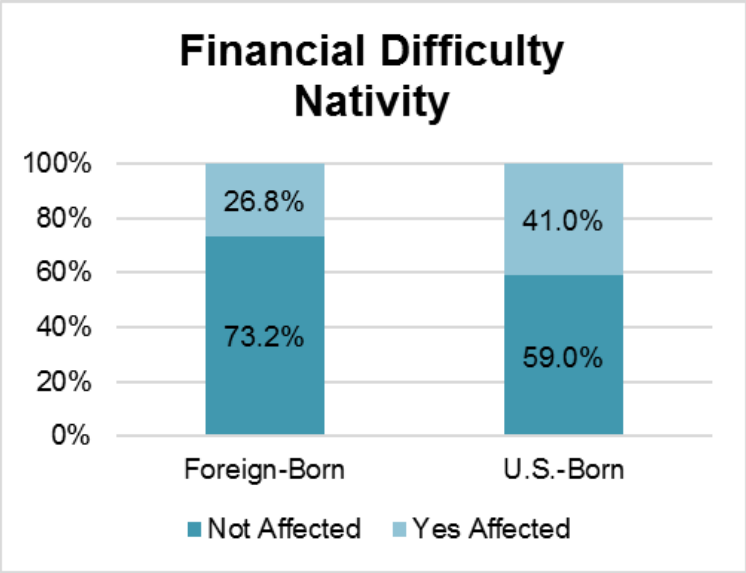

Figure 3.4.a
Financial Difficulty – Nativity

Data show gravidae with family incomes from $35,000 and above experienced financial difficulty more often (47.6%) compared to those with income from $34,999 and below (30.0%), with $p < 0.001$ (Figure 3.4.b).

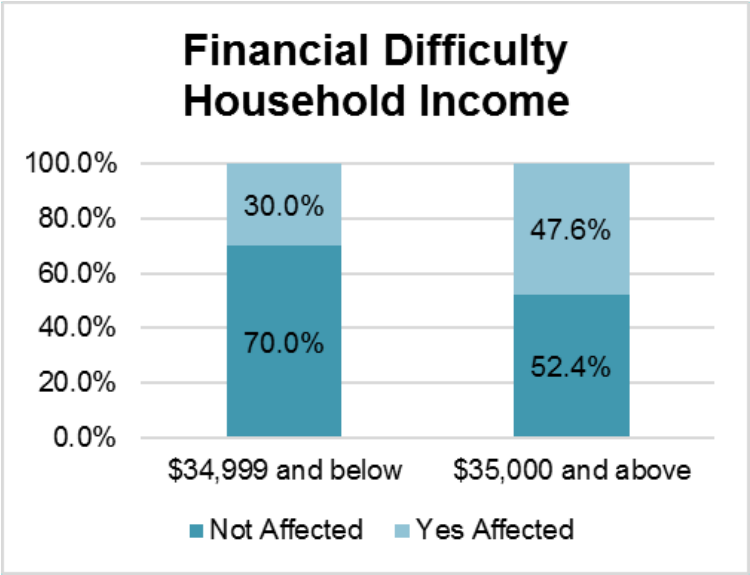

Figure 3.4.b
Financial Difficulty – Household Income

Data show gravidae with private health insurance had more financial difficulty (45.9%) compared to those with "insurance other" - public insurances and those pay out-of-pocket (33.0%), with $p < 0.05$ (Figure 3.4.c).

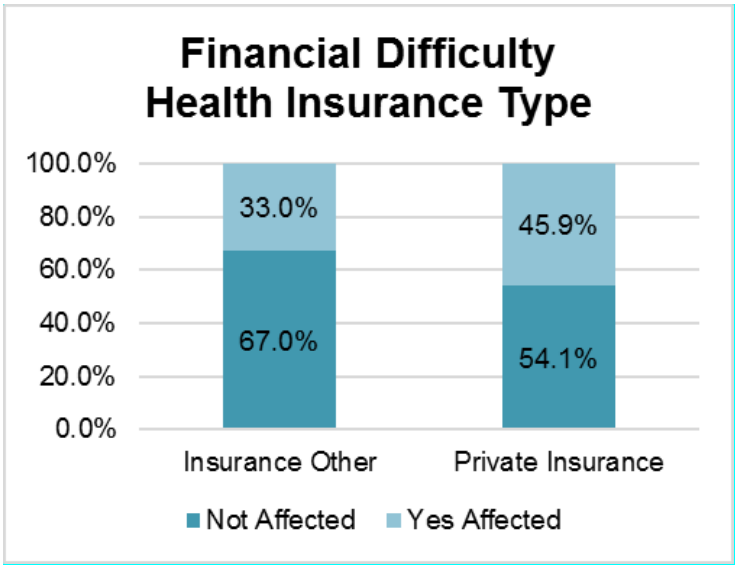

Figure 3.4.c
Financial Difficulty – Health Insurance Type

Data show more gravidae who utilized the private hospital have financial difficulty (45.7%) compared to those using the county hospital (12.9%), with $p < 0.001$ (Figure 3.4.d).

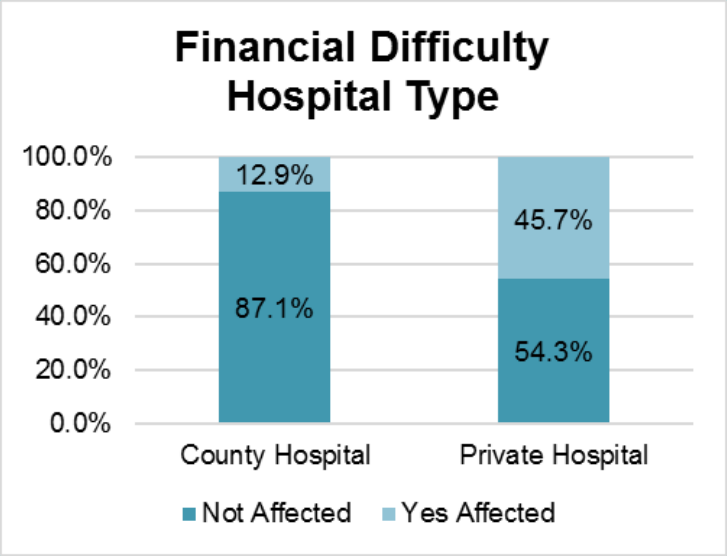

Figure 3.4.d
Financial Difficulty – Hospital Type

The results for financial difficulty contradict existing evidence in that racially ethnic groups, those with lower English proficiency, and lower-income people are often more affected by natural disasters than their counterparts (Milken Institute School of Public Health, 2018; Willison et al., 2019). Further examination of the financial difficulty on the subject's race and ethnicity, nativity, English proficiency, and education is needed to account for this new finding. The results suggest that racial minorities and the foreign-born (Table 3.4.a), people with lower education (Table 3.4.c), and lower incomes (Table 3.4.d) are more affected by Hurricane Harvey.

By stratifying the group experiencing financial difficulty on race and ethnicity, and nativity, the data show 29.5% of people reporting being affected by Hurricane Harvey were non-Latinx Blacks and 46.3% were Latinxs. For the foreign-born, the

majority were Latinxs (83.8%), while in the U.S.-born category, the majority are the racial minorities, with 35.7% being non-Latinx Blacks and 33.9% are Latinxs, $p < 0.001$(Table 3.4.a, n = 149).

Table 3.4.a

Financial Difficulty – Race & Ethnicity and Nativity

	Non-Latinx Black (%)	Latinx (%)	Non-Latinx White (%)	Total (%)	Significance (2-sided)
Financial Difficulty – Foreign-Born	10.8	83.8	5.4	100	$p < 0.001$
Financial Difficulty – U.S.-Born	35.7	33.9	30.4	100	
Total Financial Difficulty	29.5	46.3	24.2	100	

When examining English proficiency, the results show that 77.4% of foreign-born Latinxs who speak only/more Spanish experienced financial difficulty compared to 94.5% of U.S.-born Latinxs who are bilingual or fluent in English, $p < 0.001$ (Table 3.4.b, n = 67). The Collective Integration Theory can explain the results.

Table 3.4.b

Financial Difficulty – The Latinx English Proficiency

	Financial Difficulty Foreign-Born (%)	Financial Difficulty U.S.-Born (%)	Significance (2-sided)
More/Only Spanish	77.4	5.6	$p < 0.001$
Spanish/English Equally	19.4	63.9	
Only/More English	3.2	30.6	
Total	100	100	

When examining educational attainment and household income, results show 66% of the affected gravidae had no college degree, of those 75% were non-Latinx Blacks, $p < 0.01$ (Table 3.4.c, n = 150), and 50.7% of them had a household income under $35,000, $p < 0.001$ (Table 3.4.d, n = 136). Even though the results are consistent with existing evidence, they deserve more discussion.

Table 3.4.c

Financial Difficulty – Non-Latin Black & White on Education

	No College Degree (%)	College Degree (%)	Total (%)	Significance (2-sided)
Non-Latinx Black	68.2	31.8	100	$p < 0.01$
Latinx	75.7	24.3	100	
Non-Latinx White	44.4	55.6	100	
Total (%)	66.0	34.0	100	

Table 3.4.d

Financial Difficulty – Non-Latin Black & White on Income

	< $34,999 (%)	> $35,000 (%)	Total (%)	Significance (2-sided)
Latinx	57.1	42.9	100	$p < 0.001$
Non-Latinx Black	68.4	31.6	100	
Non-Latinx White	20.0	80.0	100	
Total (%)	50.7	49.3	100	

Multivariate Analysis – Financial Difficulty

The odds ratios were obtained for financial difficulty by multivariate logistic models that regress nativity, racial/ethnicity, socioeconomic status, health insurance type, and hospital type. Model 1 examines the relationship between financial difficulty and nativity and race and ethnicity. It predicted that the foreign-born would be less likely to experience financial difficulty than the U.S.-born. This relationship still holds in Model 2 when educational attainment and household income are added. It also predicts that people with incomes of less than $35,000 are less likely to experience financial difficulty. This relationship still held in Model 3, where health insurance and hospital types are included. Gravidae utilizing the county hospitals are also less likely to experience financial difficulty than those using the private hospitals. It is more likely non-Latinx Blacks, Latinxs, and gravidae with no college degree will experience financial difficulty, even though the relationship is not statistically significant (Table 3.4.e).

Table 3.4.e

Logistic Regression – Financial Difficulty

	Model 1		**Model 2**		**Model 3**	
	Odds Ratios	(SE)	Odds Ratios	(SE)	Odds Ratios	(SE)
[a] Foreign-Born	0.52**	(0.26)	0.55*	(0.28)	1.05	(0.33)
[b] Race & Ethnicity						
Non-Latinx Black	1.12	(0.29)	1.63	(0.34)	1.65	(0.36)
Latinx	1.05	(0.29)	1.59	(0.33)	1.65	(0.34)
[c] No College degree			1.30	(0.29)	1.43	(0.32)
[d] Income < $35,000			0.38***	(0.30)	0.56^	(0.33)
[e] Insurance Other					0.76	(0.37)
[f] County Hospital					0.20***	(0.38)
Nagelkerke R^2	0.03		0.07		0.15	

[a] U.S.-Born as reference
[b] Non-Latinx White as reference
[c] College Degree as reference
[d] Income >$35,000 as reference
[e] Private Insurance as reference
[f] Private Hospital as reference

^*p*<.10 **p*<.05 ***p*<.01 ****p*<.001
SE: Standard Error

Anxiety in the Four Weeks During or After Harvey

Descriptive Statistics

The bivariate results show that those U.S.-born, those who have a college degree, and those with higher-incomes experience higher anxiety compared to their counterparts. The Discussion Section will discuss these finding further. Figure 3.5.a shows 14.8% of U.S.-born reported experiencing anxiety compared to 8% of foreign-born, $p < 0.01$.

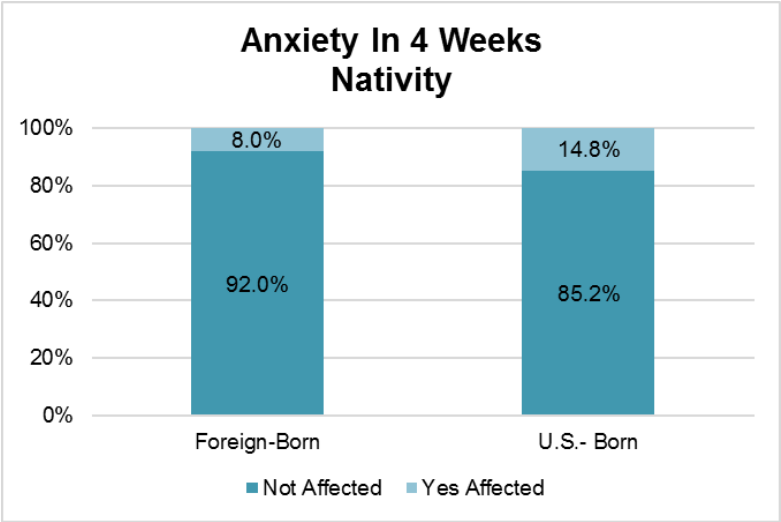

Figure 3.5.a
Anxiety – Nativity

Figure 3.5.b shows higher percentages of gravidae with college degrees (19.0%) experienced anxiety compared to those without college degrees (9.8%), $p < 0.01$.

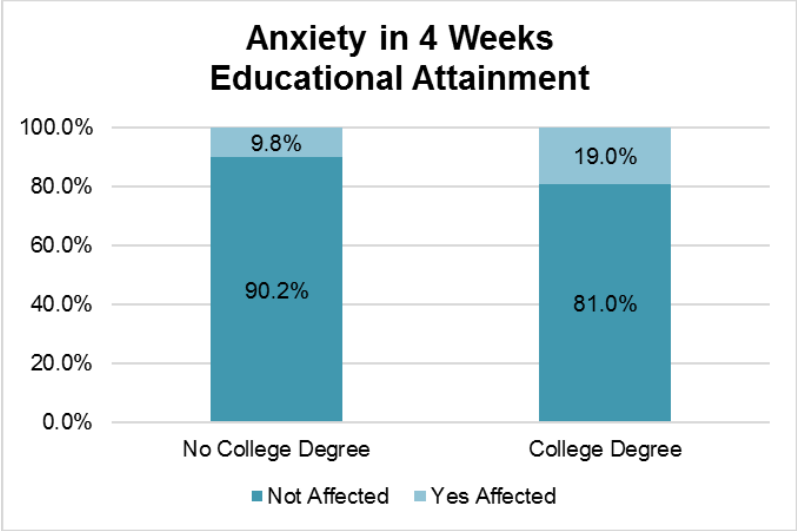

Figure 3.5.b
Anxiety – Educational Attainment

Figure 3.5.c shows higher percentages of gravidae with income of $35,000 and above (21.2%) experienced anxiety than those with income of $34,999 and below (7.9%), $p < 0.001$.

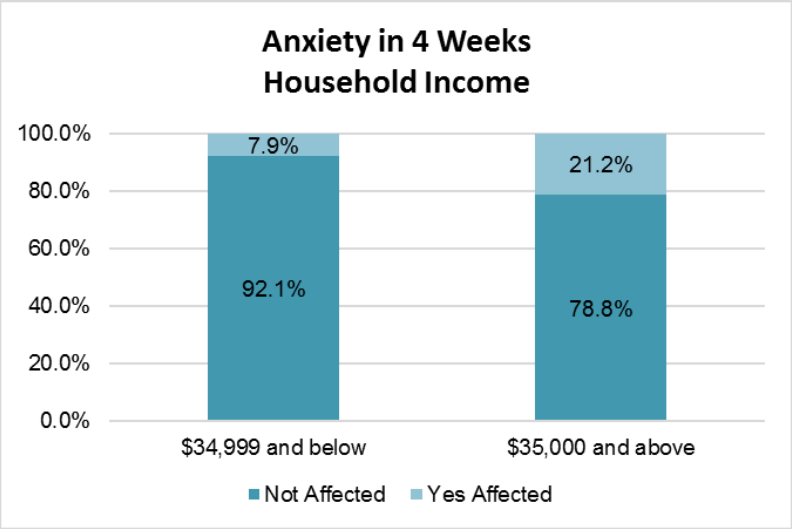

Figure 3.5.c
Anxiety – Household Income

Multivariate Analysis – Anxiety

If a hurricane happens again, who will more likely report feeling anxiety for at least four weeks? To answer that question, Logistic Regression was run using three Multivariate models. Table 3.5 shows the odds ratios from the models for anxiety on nativity, race and ethnicity, social-economic, health insurance type, and hospital type. Model 1 shows no statistical significance when regressed on nativity and racial and ethnicity. It is less likely that people with income below $35,000 will have anxiety after socioeconomic status was added to Model 2. Model 3 shows it is less likely that people who utilize county hospitals will have anxiety.

Table 3.5

Logistic Regression – Anxiety

	Model 1		**Model 2**		**Model 3**	
	Odds Ratios (SE)		Odds Ratios (SE)		Odds Ratios (SE)	
[a] Foreign-Born	0.56	(0.37)	0.76	(0.39)	1.12	(0.42)
[b] Race & Ethnicity						
Non-Latinx Black	0.61	(0.36)	0.98	(0.42)	1.04	(0.45)
Latinx	0.63	(0.35)	1.08	(0.39)	1.15	(0.40)
[c] No College degree			0.84	(0.35)	0.94	(0.38)
[d] Income < $35,000			0.36**	(0.38)	0.49	(0.41)
[e] Insurance Other					0.74	(0.44)
[f] County Hospital					0.30*	(0.60)
Nagelkerke R^2	0.03		0.07		0.10	

[a] U.S.-Born as reference
[b] Non-Latinx White as reference
[c] College Degree as reference
[d] Income >$35,000 as reference
[e] Private Insurance as reference
[f] Private Hospital as reference

*p<.05 **p<.01
SE: Standard Error

CHAPTER IV:

DISCUSSION

A higher percentage of gravidae who were foreign-born, who were non-Latinx Blacks or Latinxs, especially those who speak only/mostly Spanish, who did not have college degrees, who had family incomes of less than $35,000, who had no private health insurance, and who usually used the county hospital had no access to medical services or a maternity hospital during Hurricane Harvey. These results are consistent with the literature showing the foreign-born, racial minorities, people with an English barrier, those with lower socioeconomic status, and public health insurance users often have problems accessing medical facilities and health services (Ali & Watson, 2018; Baer et al., 2019; Batai et al., 2019; Callaghan et al., 2019; Canedo et al., 2018; Cohen et al., 2019; Garcia et al., 2020; Jang & Kim, 2019; Okunrintemi et al., 2019). The results also indicate that higher percentages of the U.S.-born in our "whole population" were affected by Hurricane Harvey. Higher percentages of Latinxs who speak only English had financial difficulty and anxiety compared to Latinxs with less English fluency. Social Cohesiveness and Segmented Integration theories may explain these unexpected results.

Social Cohesiveness and Segmented Integration

As immigrants arrive in the U.S., they integrate into the new culture on different paths according to their background and the public's reception at that moment (Portes & Zhou, 1993; Zhou & Xiong, 2005). Language is part of the culture that they must integrate. When immigrants have strong social capital ties within their ethnic communities, they will seek support in their everyday lives and during times of stress (Cherry & Allred, 2012; Singh, McBride, & Kak, 2015). Their shared culture serves as a social capital collectiveness that helps them overcome their shortcomings and hardships (Call et al., 2014; Chawla et al., 2015). The support they received from others sharing

their native culture is one factor as to why the foreign-born in this study reported being less affected by Hurricane Harvey than their U.S.-born counterparts (7.4% vs. 12.7% respectively, figure 3.1.d).

Immigrants with low English proficiency often lean on their ethnic enclave to lessen their disparities in the new country (Call et al., 2014; Chawla et al., 2015). As immigrants acculturate into American society, their English improves, especially for younger immigrants and U.S.-born children (Portes & Rumbaut, 2014). As a result, they tend to disassociate themselves from their enclaves as they see them as hindering their English proficiency (Chiswick & Miller, 2005). The more they acculturate into the new culture, the more they weaken their collective cultural consciousness and the less of their cultural heritage they pass on to their American-born children. The term "Latinx" refers to a diverse group of immigrants of Latin backgrounds; therefore, their paths into the new society vary. Some of them with higher socioeconomic status have no problem entering the American society. At the same time, some of them feel comfortable staying in their enclaves, and some of them are in between cultures. People in this latter group are often U.S.-born (47.2% in this study) or immigrated to the U.S. as young children. They speak both languages or mostly English (92.6% in this study), retain some of their culture, and assimilate into American culture. When the hurricane came, perhaps they did not feel comfortable enough to lean on their enclave to get support, nor did they feel comfortable receiving support from the same government that marginalized their ethnicity. That may explain why there were higher percentages of Latinxs with English proficiency (10.6% for bilingual and 15% for those who spoke more/only English) reporting being affected by Hurricane Harvey compared to 8.6% of those who spoke only/more Spanish (Table 4.1).

Table 4.1

Latinx English Proficiency

	Only/More Spanish (%)	Both Language Equally (%)	More/Only English (%)	Significance (2-sided)
No Affected	91.4	89.4	85.0	$p < 0.01$
Yes Affected	8.6	10.6	15.0	
Total	100	100	100	

The Legality of the Foreign-Born

Another factor that is very important to an immigrant is the legality of their residential status. Three quarters (74.9%) of the foreign-born in this study were Latinx. With an abundance of hostile rhetoric about immigration, fear of deportation affects the undocumented and the documented in every aspect of their daily life (Arbona et al., 2010; Chu et al., 2019). Hurricanes have come and gone, and one can always rebuild what one lost. With deportation, however, not only do immigrants lose all they have built, but they also return to the place they fled because opportunities and safety were not there for them. When everything is put into perspective, the effect of Hurricane Harvey on the Latinx, especially the foreign-born, pales in comparison to the daily fear of being deported. This is another crucial factor that may explain why more foreign-born Latinxs did not report being affected by Hurricane Harvey or experiencing post-storm anxiety.

Who were the Affected U.S.-Born?

The results revealed a disadvantage to those who were U.S.-born. Looking further into the data of the affected U.S.-born, 63.3% had no college degree, 52.1% had household incomes of $34,999 or less, 34.7% were non-Latinx Blacks, and 34.1% were Latinxs. These findings were consistent with literature that suggests that those with no college education, low-income, non-Latinx Backs, and Latinxs are known vulnerable groups during natural disasters (Becquart, Naumova, Singh, & Chui, 2018; Collins et al., 2019; Flores et al., 2020). Table 4.2 shows the results.

Table 4.2

Affected U.S.-Borns' Demographics

Affected U.S.-Born's Demographics		%	Total %
Educational Attainment	No College Degree	63.3	100
	College Degree	36.7	
Income	$34,999 and below	52.1	100
	$35,000 and above	47.9	
English Proficiency	Only/More Spanish	7.3	100
	Both Language Equally	53.2	
	More/Only English	39.4	
Race & Ethnicity	Non-Latinx Other	1.4	100
	Non-Latinx Black	34.2	
	Latinx	33.6	
	Non-Latinx White	30.7	
Health Insurance	Other	65.5	100
	Private	34.5	
Hospital	County	10.4	100
	Private	89.6	

Experiencing Financial Difficulty

In the questionnaire, "more than $5,000" was set as a strict cut-off for people experiencing financial difficulty. This contributes to why on the broader view, this study shows 47.6% of high-income gravidae claimed they had financial difficulty compared to 30% of lower-income gravidae. However, when the data were stratified, 50.7% of the people in the affected group had household incomes of less than $35,000, with many people of this group, even a much lower loss could produce "financial difficulty." Further, the database includes gravidae with high-income, and these people generally live in more expensive housing where even a small amount of damage could easily cost $5,000. Thus, in this case, those with higher incomes would suffer less financially than the low-income group. In this case, the database probably undercounts the low-income gravidae experiencing financial difficulty and overcounts the high-income ones, which masks the true picture that 60% of the affected people have no college education, and the majority of them are racial minorities – 29.5% non-Latinx Blacks and 46.3% Latinxs. A

limitation in the survey design failed to account for household income when determining a cut off for the definition of financial difficulty. In future studies, a percentage of household income may be a more inclusive assessment.

Experiencing Anxiety in the Storm's Aftermath

In this study, the results for anxiety mirror the results for financial difficulty. Perhaps then it is financial difficulty that causes anxiety. However, when checking the correlation between financial difficulty and anxiety, the data show only a weak positive relationship with Spearman's correlation $r_s = 0.12$, $p < 0.05$. If financial difficulty is not the reason, what reasons drive higher-income and college-educated people to experience higher anxiety than their counterparts? Further examining the correlations between anxiety and educational attainment shows Spearman's correlation $r_s = 0.13$ ($p < 0.01$), and $r_s = 0.19$ ($p < 0.001$) for income. The results indicate that neither of them is a strong driving force for anxiety as they all have weak relationships, but all are contributors. If so, then what factors protect people of low socioeconomic status from reporting anxiety in the questionnaire? This group often endures more hardship and adversities in life than those with higher incomes. Their homes are flooded every time there is a big rain, and to them, Hurricane Harvey was just another big rain. Studies show that people who live in communities with higher social cohesion and support are better prepared for disasters (Cagney, Sterrett, Benz, & Tompson, 2016; Woodward, Walsh, Senn, & Carey, 2018). They often use the strategy called "shift-and-persist" by focusing on the meaning of life to cope with reality (Chen & Miller, 2012; Chen et al., 2019; Desmond, 2016). Hurricane Harvey caused havoc throughout the Houston metropolitan area and many Gulf Coast regions in Texas (Afiune, 2017; National Centers for Environmental Information-NCEI, 2020; The Office of Texas Comptroller, 2018). In a way, it felt like "we are in it together." It gave people a sense of solidarity. Early news images flashed on television

showed Houston citizens receiving support from different organizations. That could have given people a sense of community cohesiveness.

Who Is More Likely to Use the County Hospital?

Throughout the study, the use of the county hospital seemed to be one of the most important predictors of individuals being affected by the storm based on the regression models. What is it about the county hospital that made it an important factor? The county hospital in Houston is a publicly funded hospital that provides medical care for indigent citizens. The services these patients receive are generally paid by Medicaid, CHIP, or Gold Card (a public health insurance program created by Harris Health System to allow the county's citizens to pay for their medical services on a sliding scale according to their income levels). Data from this study show 98.2% of gravidae who had no private health insurance utilized the county hospital, as did 84.5% of the foreign-born, 78.3% of Latinxs – especially for those who spoke only or mostly Spanish, 85.4% of those with no college degree, and 92.8% of those with family income less than $35,000, $p < 0.001$ in all cases. Table 4.3 compares the demographic of the gravidae who used the county hospital and those who used the private hospital.

Table 4.3

Demographics of County Hospital and Private Hospital Users

		Hospital Type		
		County Hospital	Private Hospital	Significance (2-sided)
Insurance Type	Non-private	98.2%	38.5%	< 0.001
	Private	1.8%	61.5%	
	n	1,699	3,233	
Nativity	Foreign-Born	84.5%	23.6%	< 0.001
	U.S.-Born	15.5%	76.4%	
	n	1,688	3,218	
Race & Ethnicity	Non-Latinx Other	2.0%	9.2%	< 0.001
	Non-Latinx Black	16.4%	16.3%	
	Latinx	78.3%	34.3%	
	Non-Latinx White	3.3%	40.1%	
	n	1,703	3,239	
Language Proficiency	Only/More Spanish	79.1%	27.9%	< 0.001
	Both Language Equally	18.5%	46.3%	
	Only/More English	2.4%	25.7%	
	n	1,329	1,092	
Educational Attainment	No College Degree	85.4%	41.0%	< 0.001
	College Degrees	14.6%	59.0%	
	n	1,674	3,233	
Income	$34,999 and below	92.8%	29.9%	< 0.001
	$35,000 and above	7.2%	70.1%	
	n	1,318	3,064	

Sampling Method - Advantage

The major strength of this study is the utilization of a perinatal database from Baylor College of Medicine, Ben Taub General Hospital, and Texas Children's Hospital. This database includes extensive information collected by trained professionals who have no role in the study, avoiding sampling biases. The study utilized the Harvey amendment created right after the hurricane, so the event was still fresh in people's minds. That being said, there are still limitations to the study.

Limitations of the Study

The study did not conduct focus groups to guide the questionnaire or follow up in-depth qualitative research after the questionnaire as the IRB approval for the study was de-identified data. Participants in the BCM's IRB were enrolled by a convenience method from gravidae who delivered their babies at the Texas Children's Hospital and Ben Taub General Hospital; therefore, it may not reflect Houston metropolitan population's characteristics nor U.S. population at large. Table 4.4 below illustrates the characteristics of the study population, Houston, and U.S. (Greater Houston Partnership, 2020; Jankowski, 2019; The United States Census Bureau, 2017a, 2017b, 2017c).

Table 4.4

Demographic Characteristics of The Study, Houston, and U.S.

		Study 10/2017 to 07/2018 (%)	Houston 2018 (%)	US 2017 (%)
Nativity	Foreign-Born	44.5	23.3	13.4
Race & Ethnicity	Non-Latinx Other	6.7	9.9	6.2
	Non-Latinx Black	16.3	17.0	12.3
	Latinx	49.4	37.6	17.6
	Non-Latinx White	27.4	35.5	61.5
Marital Status	Married	81.6		65.9
Education Attainment	No College Degree	56.2	66.9	69.1
	College Degrees	43.8	33.1	30.9
Household Income	$34,999 and below	48.8		30.9
	$35,000 and above	51.2		38.5
	Median ($)		56,077	57,652
Insurance Type	Uninsured		18.9	15.4
	Government	58.9	27.7	17.5
	Private Insurance	40.8	60.0	74.5
Number of Birth	n	5,194	103,000	3,994,223
Median Age	Years	30.0	34.6	37.8
Household size	Number	3.5	2.9	2.6

Suggestions for Future Research

Research that would complement this study would be geographical modeling. The database includes participants' zip codes before Hurricane Harvey and where they evacuated to when the hurricane made landfall. That information, combined with information from FEMA and private insurance claims for each zip code, would allow government agencies to foresee how severely another storm may affect different areas and demographics. Policies could be implemented to eliminate or soften the suffering citizens must endure when nature strikes.

Another study might utilize zip codes from this study and combining them with data from Harris Health Department on COVID-19. Information from both data sets will help health officials focus more on the vulnerable demographics concerning healthcare delivery.

CHAPTER V:

CONCLUSION

Natural disasters happen whether we like them or not, but governments can mitigate their impact. Houston neighborhoods such as Bellaire, Greenspoint, and Meyerland often flood during heavy rains (Barker, 2019a, 2019b; Geigel, 2020; Lanza, 2016; Perera, 2017). With Hurricane Harvey producing up to 60 inches of rain in less than a week, severe flooding happened not only in the most flood-prone areas but also in those that had never flooded before. As climate change progresses, hurricanes will happen more frequently and produce heavier rainfall (Benedetto & Trepanier, 2020; Gramling, 2020; Kossin, 2018). The bayou system is a great way to mitigate floods, but the system is old and needs to be upgraded. After Hurricane Harvey, four bayous in the Houston area: Brays Bayou, Hunting Bayou, White Oak Bayou, and Clear Creek Bayou have been widened, yet many homes are still in the flood plan (Borenstein & Bajak, 2017; Zaveri, 2018). A consortium was formed after Hurricane Harvey to find solutions to mitigate flooding (Greater Houston - Flood Mitigation Consortium, 2019). Widening the bayous should not be the only solution. Stricter zoning regulations leading to fewer homes and businesses being built in flood-prone areas, more tree-planting, more dual use green spaces to serve as parks in dry periods, and more reservoirs to store excess rainwater during wet periods can all help. The government needs to develop infrastructure to better support neighborhoods and to advocate for greener living (Houghton & Castillo-Salgado, 2017); allowing flooding year after year is disruptive and costly. Results from this study show this to be the case.

Higher percentages of people affected by Hurricane Harvey were foreign-born, Latinxs, especially those who speak only or mostly Spanish, had family incomes less than $35,000, did not have private health insurance, and utilized the county hospital. They all

had less access to medical services during Hurricane Harvey, and these same groups and gravidae without college degree had little access to a maternity hospital.

The study also found higher percentages of U.S.-born, Latinxs who spoke English/Spanish equally or more English, households with income from $35,000 and up, having private health insurance, and private hospital users reported financial difficulties of at least $5,000 due to Hurricane Harvey. Also, from the affected group, the study found U.S.-born, college degree holders, and those with household incomes from $35,000 and above reported experiencing anxiety for four weeks during or after the storm.

It needs to be pointed out that 1) the gravidae who had no access to medical services had very similar demographics to those who had no access to a maternity hospital; 2) gravidae who experienced financial difficulty had very similar demographics with those who experienced anxiety; and 3) the demographics of people who had no access to medical services and/or a maternity hospital shared few demographic characteristics to people who experienced financial difficulty or anxiety. Having no access to medical services and/or a maternity hospital results from structural disparity in healthcare, an inherent part of racial inequity, whereas experiencing anxiety results from financial difficulty due to shortsighted governmental planning. Even though minorities and people of lower socioeconomic status in the study did not report losing more than $5,000 due to Hurricane Harvey, they likely suffered more than the non-Latinx Whites and college degree holders who did, simply because what they had was less likely to reach the threshold for claims with the city (Lozano, 2018). They had a tough time rebuilding as 18% of the people in Houston who evacuated from their homes because of Hurricane Harvey still lived in temporary housing three years after the storm, and 80% of them had their family incomes less than half of the city's median (Scherer & Morris, 2020; University of Houston-Hobby School of Public Affairs, 2020).

The models from multivariate regression predict that 1) Latinxs and county hospital users will be less likely to have access to medical services (OR=0.51, 95% CI:0.25-1.07 for Latinx; OR=0.17, 95% CI:0.08-0.35 for county hospitals); and 2) people with income less than $35,000 and county hospital users will be less likely to have access to maternity hospital (OR=0.57, 95% CI:0.29-1.13 for income less than $35,000; OR=0.21, 95% CI:0.10-0.46 for county hospitals). Descriptive statistics showed ethnic minorities had less financial difficulty than non-Latinx Whites due to the financial limitation being set too high. The skewed data led to multivariate regression to predict that people with income of less than $35,000 (OR=0.56, 95% CI: 0.29-1.08) and county hospital users (OR=0.20, 95% CI: 0.90-0.42) will be less likely to experience financial difficulty**.** Multivariate regression models predict decreased odds of experiencing anxiety for four weeks for people with income less than $35,000 (OR=0.36, 95% CI:0.17-0.75). The data reflect the scope of the questionnaire not being designed to capture the psychological aspects of the gravidae in Houston, where there is a large population of non-European immigrants.

Despite the limitation of the data, this study is important. It suggests that health insurance matters as it is the first step toward shortening the healthcare disparity gap and better health. In this study, higher percentages of people with private health insurance had access to medical services and a maternity hospital during Hurricane Harvey than those without it. Nevertheless, many groups in this study have lower rates of private health insurance. They are the foreign-born, non-Latinx Blacks, Latinxs, especially the Spanish speakers, those with no college degree, and those with household incomes below $35,000 (19.7%, 23.9%, 16.5%, 5.6%, 11.7%, and 5.4% respectively, $p < 0.001$ in all cases). Higher education is important even in the age of technology, where information can be easily accessed in many ways. In this study, higher percentages of people without college

degrees were affected by Hurricane Harvey and had less access to maternity hospitals than people with college degrees. While further study is needed, current analyses offer unique windows into immigrants' resilience to handle the crisis. Even though a higher percentage of immigrants had no access to medical services or a maternity hospital compared to the U.S.-born, fewer of them claimed to be affected by the storm or experienced anxiety because of it.

There is some irony in the fact that while this thesis was being edited, Houston was being hit by another hurricane. Thankfully, Nicholas was a weak hurricane. Bad weather in Houston is not going away due to its proximity to the coast and rapid global climate change. Climate change is causing the oceans to warm. Warmer oceans fuel hurricanes, causing them to happen more frequently and be more intense and deadly (Benedetto & Trepanier, 2020; Centers for Disease Control and Prevention, 2013; Kossin, 2018; The Office of Texas Comptroller, 2018). Climate change also produces extreme temperatures for locations, such as the sub-freezing temperature in Texas in February 2021 or the heat wave in the western U.S. this summer. The hot and dry weather leads to the mega-drought and wildfires in the northwest, Canada, and Australia. At the same time, seawater begins to encroach on small island nations and low coastal land in many countries.

When are we going to stop the rapid global climate change? The problems are at our doorsteps. Doing nothing is not an option. The same goes for "wait and see" stalling tactics. It is not a Democrat or Republican issue, conservative or progressive problem, or only one country's problem; it is a problem for everyone. There is no time to waste. This study confirms this fact by highlighting those impacted the most.

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APPENDIX A:

SPSS CODES

		Code	Note
Nativity	U.S.-born	1	
	Foreign-born	0	
Race Ethnicity	Non-Latin Other	1	Asian, Native American, Pacific Islanders
	Non-Latin Black	2	
	Latinx	3	
	Non-Latin White	4	
Spanish fluency	Only Spanish/more Spanish	1	
	Spanish English equally	2	
	Only English/more English	3	
Education	No college	0	Less than high school, high school/GED, some college
	College	1	Bachelor, master, doctoral, professional degree
Income	$34,999 and below	1	
	$35,000 and above	2	
Health Insurance	Insurance other	0	Public insurance, Out-of-pocket
	Private insurance	1	
Hospital	County hospital	0	Ben Taub General Hospital
	Private hospital	1	TCH Pavilion for Women
Maternal marital status	Married	1	
	Not married	0	Divorce, separated, never married, widowed
Number of people in the household		Numerical	
Maternal age		Numerical	

Affected by Hurricane Harvey	Yes	1	
	No	0	
Access to medical services	Yes	1	
	No	0	
Access to maternity hospital	Yes	1	
	No	0	
Financial difficulty experience	Yes	1	
	No	0	
Anxiety in 4 weeks	Yes	1	
	No	0	

APPENDIX B:

DEMOGRAPHIC QUESTIONNAIRE

Maternal date of birth	
Maternal Ethnicity	Hispanic/Latino
	Not Hispanic/Latino
Maternal Country of birth	List of countries
Maternal Race - American Indian/Alaska native	Yes
	No
	Empty
Maternal Race - Asian	Yes
	No
	Empty
Maternal Race – Native Hawaiian, Pacific Islander	Yes
	No
	Empty
Maternal Race – Black or African American	Yes
	No
	Empty
Maternal Race - White	Yes
	No
	Empty
Maternal race – not reported	Yes
	No
	Empty
Hospital	Ben Taub General Hospital
	TCH Pavilion for Women
Marital status	Divorce
	Married
	Separated
	Single – never married
	Widowed
Primary language spoken at home	Only Spanish
	More Spanish than English
	Both Equally
	More English than Spanish
	Only English
Language patient speak/read	Only Spanish

	More Spanish than English
	Both Equally
	More English than Spanish
	Only English
Language spoken in childhood	Only Spanish
	More Spanish than English
	Both Equally
	More English than Spanish
	Only English
Language spoken at home	Only Spanish
	More Spanish than English
	Both Equally
	More English than Spanish
	Only English
Language patient think	Only Spanish
	More Spanish than English
	Both Equally
	More English than Spanish
	Only English
Language spoken with friends	Only Spanish
	More Spanish than English
	Both Equally
	More English than Spanish
	Only English
Maternal education	Less than high school
	High school/GED
	Some college
	College degree
	Master's degree
	Doctoral/professional degree
Number of people in the household	Numerical
Maternal household income	Less than $34,999
	$75,000 and above
Method of payment	Medicaid
	CHIP
	Private
	No insurance
	Unknown
	Other
Date of delivery	

APPENDIX C:

HARVEY QUESTIONNAIRE

Affected by Hurricane Harvey	Yes
	No
	Empty
Access to medical services	Yes
	No
	Empty
Access to maternity hospital	Yes
	No
	Empty
Financial difficulty experience	Yes
	No
	Empty
Experiencing Anxiety in 4 weeks	Yes
	No
	Empty