
Jacquelyn Reiss

University of Central Florida

Part of the Family, Life Course, and Society Commons

Find similar works at: https://stars.library.ucf.edu/etd2020

This Doctoral Dissertation (Open Access) is brought to you for free and open access by STARS. It has been accepted for inclusion in Electronic Theses and Dissertations, 2020- by an authorized administrator of STARS. For more information, please contact STARS@ucf.edu.

STARS Citation
https://stars.library.ucf.edu/etd2020/1780
LOCAL-LEVEL MATERNAL AND INFANT HEALTH:
A MIXED-METHODS ANALYSIS OF THE RELATIONSHIP BETWEEN SOCIAL
DETERMINANTS OF HEALTH, MATERNAL AND INFANT HEALTH OUTCOMES, AND
PUBLIC HEALTH PROGRAMS IN FLORIDA

by

JACQUELYN REISS
B.A., University of Central Florida, 2017
M.A., University of Central Florida, 2019

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Department of Sociology
in the College of Sciences
at the University of Central Florida
Orlando, Florida

Summer Term
2023

Major Professor: Amy Donley
ABSTRACT

Current data highlight significant disparities in infant and maternal health (IMH) outcomes both when comparing outcomes to other countries and between groups within the U.S. Previous studies indicate that disparities in health outcomes are caused by health inequities. Health inequities are a result of marginalized groups historically being denied resources and exposed to increased risk directly impacting health. These resources and risks are considered social determinants of health (SDoH), such as income, housing, transportation, and access to care. Although SDoH influence individuals across multiple levels of society, communities are sites where individuals directly access protective resources and are potentially exposed to risk. Therefore, given the persistence of poor IMH outcomes and the role communities play as sites in which social factors directly impact health, this study sought to understand the relationship between local-level SDoH and IMH outcomes in Florida as well as the role local health departments play in improving outcomes. To do this, a mixed methods analysis was conducted using secondary quantitative and qualitative data. The secondary quantitative data was compiled to create a dataset for variables that represent community-level SDoH and IMH outcomes, which were all analyzed statistically and utilizing geospatial visualizations. The secondary qualitative data consisted of county-level content from Healthy Start Coalition websites as well as Community Health Needs Assessments and Health Improvement Plans. Findings suggest that there are statistically significant relationships between variables utilized to measure racial residential segregation, neighborhood deprivation, housing stability, rurality and access to care and the variables utilized to measure infant health outcomes. Further, the qualitative data suggest that less than half the sample considered IMH a priority issue. Of the counties who did, many
focused on implementing strategies to impact individual behaviors, however all counties in the sample did discuss SDoH and health equity to varying degrees.
This dissertation is dedicated to my family. I would not have made it this far without your love, encouragement, support, personal sacrifices, and patience.
ACKNOWLEDGEMENTS

First, I would like to thank my advisor and mentor, Dr. Amy Donley, for your continuous support, encouragement, and guidance throughout the entirety of my journey in this program.

In addition, I would like to thank my committee members, Dr. Fernando Rivera, Dr. Yingru Li, and Dr. Michael Rovito for your patience and guidance while completing this dissertation.

Lastly, to all the friends in the program that I’ve meet along the way, thank you for always being a shoulder to lean on and an ear to commiserate with.
TABLE OF CONTENTS

LIST OF FIGURES ........................................................................................................ viii
LIST OF TABLES ........................................................................................................... ix
CHAPTER ONE: INTRODUCTION .............................................................................. 1
CHAPTER TWO: LITERATURE REVIEW .................................................................... 5
 Disparities in Maternal Health Outcomes ................................................................. 6
 Disparities in Infant Health Outcomes ...................................................................... 8
 Social Determinants of Health and Health Inequities .............................................. 9
 Community-Level Social Determinants of Maternal and Infant Health ............... 13
 Neighborhood Deprivation and Residential Segregation ..................................... 14
 Urban-Rural Residence (Rurality) .......................................................................... 15
 Environmental Factors ......................................................................................... 16
 Public Health in the U.S. as a Community-Level Protective Factor to Health Disparities .... 17
CHAPTER THREE: THEORETICAL ORIENTATION ................................................. 27
 Fundamental Causes to Health Inequities ............................................................ 27
CHAPTER FOUR: RESEARCH METHODS ............................................................... 31
 Research Questions ............................................................................................... 31
 Data .......................................................................................................................... 32
 Quantitative Secondary Data .............................................................................. 32
 Dependent Variables – Infant Health Outcomes ................................................... 32
 Dependent Variables – Maternal Health Outcomes ............................................. 33
 Independent Variables – Social Determinants of Health: Access to Care .......... 34
 Independent Variables – Social Determinants of Health: Housing Stability ....... 36
 Independent Variables – Social Determinants of Health: Residential Segregation and Income Inequality ................................................................. 37
 Independent Variables – Social Determinants of Health: Environmental Factors ..... 39
 Qualitative Secondary Data .................................................................................. 39
 Analytic Strategy .................................................................................................... 41
 Quantitative Secondary Data .............................................................................. 41
 Qualitative Secondary Data .................................................................................. 42
CHAPTER FIVE: RESULTS OF QUANTITATIVE AND GEOSPATIAL DATA ANALYSIS ............................................................................................................. 43
LIST OF FIGURES

Figure 1. Live Births Under 2500 Grams (Low Birth Weight) .................................................. 45
Figure 2. Preterm Birth Rate ................................................................................................. 46
Figure 3. Infant Mortality Rate .............................................................................................. 46
Figure 4: Births with Late or No Figure 4. Prenatal Care x Low Birth Weight ............... 51
Figure 5. Percent of Individuals Living Below the Federal Poverty Line x Low Birth Weight... 52
Figure 6. Dissimilarity Index x Low Birth Weight .................................................................. 53
Figure 7. Urban-Rural Continuum Codes x Low Birth Weight ............................................ 54
Figure 8. Births with Late or No Prenatal Care x Preterm Births ........................................ 55
Figure 9. Percent of Individuals Living Below the Federal Poverty Line x Preterm Births .... 56
Figure 10. Percent of People Who Spend 30%+ of Income on Rent x Preterm Births ........ 57
Figure 11. Dissimilarity Index x Preterm Births ................................................................... 58
Figure 12. Percent of Individuals Living Below the Federal Poverty Line x Infant Mortality Rate ........................................................... 59
Figure 13. Urban-Rural Continuum Codes x Infant Mortality Rate ..................................... 60
Figure 14. Dissimilarity Index x Infant Mortality Rate ......................................................... 61
Figure 15. Percent of Individuals Who Spend 30%+ of Income on Rent x Infant Mortality Rate ........................................................................................................ 62
LIST OF TABLES

Table 1. Descriptive Statistics ................................................................................................................. 43
Table 2. Bivariate Correlations ................................................................................................................. 50
Table 3. SDoH x Low Birth Weight ......................................................................................................... 63
Table 4. SDoH x Preterm Births .............................................................................................................. 66
Table 5. SDoH x Infant Mortality Rate .................................................................................................. 69
CHAPTER ONE: INTRODUCTION

Infant mortality rates and maternal morbidity and mortality rates pose a continuous and growing public health concern in the United States. Current data highlight significant disparities in infant and maternal health outcomes both when comparing outcomes to other countries and when comparing outcomes between groups within the United States (U.S.) (CDC 2023; WHO 2023). Previous studies indicate that disparities in maternal and infant health outcomes are often caused by health inequities (Weinstein, Geller, Negussie, and Baciua 2017). Health inequities are a result of structural inequities, which have led to marginalized groups historically being denied resources and exposed to increased risk both of which directly impact life and health outcomes (American Public Health Association 2021). These resources and risks, or social factors, are considered social determinants of health, or the “nonmedical factors such as employment, income, housing, transportation, childcare, education, discrimination, and the quality of the places where people live, work, learn, and play, which influence health” (American Public Health Association 2021).

Although social determinants of health influence individuals across multiple levels of society, including interpersonal, community, and societal or structural levels (Dagher and Linares 2022), communities are sites where individuals directly gain access to protective resources, including access to public health programs, and/or are potentially exposed to risks that impact health, including infant and maternal health. A number of studies highlight how community-level social determinants of health, like racial residential segregation, neighborhood deprivation, housing stability, and exposure to environmental factors impact infant mortality rates, rates of preterm births, rates of low birth weight births, severe maternal morbidity rates,

Therefore, given the persistence of poor infant and maternal health outcomes over time and the role local-level communities play as sites in which social factors directly impact infant and maternal health, this study sought to understand the relationship between local-level social determinants of health and infant and maternal health outcomes in Florida as well as the role local health departments play in improving infant and maternal health outcomes. To do this, a mixed methods analysis was employed using secondary quantitative and qualitative data. The secondary quantitative data was compiled to create a dataset of five-year rates for variables that represent county-level social determinants of health, including measures for residential racial segregation, neighborhood deprivation, income inequality, exposure to environmental risk, access to public transportation, access to prenatal care, and housing stability, as well as infant health outcomes, and maternal health outcomes. These variables were analyzed statistically, and then geospatial visualizations were created to further assess the geographic distribution of infant health outcomes as well as the relationship between the independent and dependent variables.

The secondary quantitative data was analyzed statistically, and geospatial visualizations were created. The secondary qualitative data consisted of county-level Community Health Needs Assessments, Community Health Improvement Plans, and content from Healthy Start Coalition
websites. Once all the data were compiled, each were analyzed quantitatively and qualitatively for themes utilizing the literature and findings from the statistical analysis as a framework. While further research is needed to understand some of these statistically significant findings, the results do suggest that community level social factors do impact infant health outcomes at the county-level. This contributes to the current literature in understanding the pathways in which social determinants impact health and how they vary based on social location.

Findings suggest that there are statistically significant relationships between the Dissimilarity Index, the percentage of individuals per county living below the Federal Poverty Line, the percentage of individuals per county who pay 30% or more of their income on rent, rurality, the percentage of births per county with late or no prenatal care, and the variables utilized to measure infant health outcomes in this study. Further, the qualitative data suggest that less than half the sample considered infant and maternal health a priority issue. Of the 7 counties who did consider infant and maternal health a priority issue, many focused on implementing strategies to impact individual behaviors through either education or clinical intervention, however all the counties in the sample did discuss social determinants of health and health equity to varying degrees throughout the documents.

While further research is needed to understand some of these statistically significant findings at a neighborhood or census tract level, the results do suggest that community level social factors including poverty levels, access to care, and geography, do impact infant health outcomes at the county-level. Given the persistence of maternal and infant health disparities both between groups, states, and countries, it is important to continue to understand the ways in which structural inequities directly impact health in order to improve local level interventions. This
contributes to the current literature in understanding the pathways in which social determinants impact health and how they vary based on social location.
CHAPTER TWO: LITERATURE REVIEW

Infant mortality rates and maternal morbidity and mortality rates pose a continuous and growing public health concern in the United States (U.S.). While infant mortality rates have declined in the U.S. over the last decade, maternal mortality rates have increased (World Health Organization 2023). Although infant mortality rates have improved, the U.S. still reports nearly the highest infant and maternal mortality rates when compared to other high-income, developed countries in the Organization of Economic Cooperation and Development (Organization of Economic Cooperation and Development 2021).

In addition to reporting some of the highest infant and maternal mortality rates when compared to other countries, when assessing infant and maternal health outcomes by social location, there are also stark disparities within the U.S. (Dagher and Linares 2022; Davis 2019; Weinstein et al. 2017). Previous studies have highlighted disparities in health outcomes broadly, including infant and maternal health outcomes (Klawetter 2014; Barr 2019; Dagher and Linares 2022). More specifically, research has found higher rates of infant mortality, low birth weight births, maternal morbidity, and maternal mortality consistently present across populations for individuals living in poverty, non-Hispanic black women, and American Indians and Alaska Natives (AIAN) (Walker and Chestnut 2010; Kruger, Munsell, and French-Turner 2011; Hogan et al., 2012; Klawetter 2014; Crenga, Bateman, Kuklina, and Callaghan 2014; Davis et al. 2016; Mehra. Boyd, and Ickovics 2017; Mayne et al. 2018; Pearl et al. 2018; Kozhimannil, Interrante, Henning-Smith, and Admon 2019; Janevic et al. 2020; Krieger et al. 2020; Ehrenthal, Kuo, and Kirby 2020; Sealy-Jefferson et al. 2020; Dyer, et al. 2021; Vila, Dyer, and Wallace 2021; Singh
Over the last two decades the U.S. was one of eight countries that had a significant increase in the maternal mortality rate (WHO 2023). WHO defines the maternal mortality rate as the number of maternal deaths per 100,000 live births. In 2020, the U.S. ranked 23 out of the 25 Organization of Economic Cooperation (OECD) countries who reported maternal mortality rates, at approximately 24 maternal deaths per 100,000 births, or approximately 860 maternal deaths per year (OECD 2023). Since the OECD 2020 rankings, the Center for Disease Control (CDC) has since reported the maternal mortality rate for 2021, which has nearly doubled in the last four years growing from 17.4 in 2018 to 32.9 maternal deaths per 100,000 births in 2021 (Hoyert 2023).

Further, when assessing the maternal mortality rates across racial groups, in 2020, the rate of maternal deaths amongst non-Hispanic black women was about 2.5 times higher than the U.S. average at about 55 deaths per 100,000 births (Gunja, Gumas, and Williams II 2022). Comparatively, in 2020, the maternal death rate for non-Hispanic white women was about 19 deaths per 100,000 births (Hoyert 2022). This gap in the maternal mortality rate between white and black women continued into 2021 as the maternal mortality rate rose for both white and black women. Despite increases for both groups, there are still stark disparities in outcomes, as National Center for Health Statistics reported the maternal mortality rate was 26.6 for white women compared to 69.9 for black women (Hoyert 2023).
The rates of maternal death throughout the United States were fairly similar to those reported in Florida. In 2020, the maternal mortality rate for the state of Florida was 22.4 with an increase to 39.3 in 2021 (Florida Health CHARTS 2023). Further, throughout the state of Florida, the maternal mortality rate for black women was still about 2.5 times higher than the state average and about 4 times higher than the maternal mortality rate for white women. More specifically, in 2020, the maternal mortality rate for black women was 52.3 per 100,000 births compared to 12.9 for white women. Similarly, and in 2021 the maternal mortality rate for black women in Florida was 95.6 per 100,000 births compared to the rate for white women at 22.1 per 100,000 births.

In addition to disparities in outcomes between racial groups, previous studies have also found urban-rural disparities in the maternal mortality rate (Singh 2021; Dagher and Linares 2022). More specifically, previous studies highlight disparities in maternal mortality rates for those living in small rural areas (Singh 2021; Dagher and Linares 2022). Singh (2021) specifically found that rates for women living in small rural areas were 80% higher compared to women living within a city.

Trends in the disparities in health outcomes between white and black women are reflected in the rates of severe maternal morbidity rates as well. Severe maternal morbidity (SMM) is defined as “an index of 21 indicators of significant events during delivery hospitalizations, including: acute myocardial infarction, aneurism, acute renal failure, respiratory distress, thrombotic pulmonary embolism, amniotic fluid, embolism, cardiac arrest, eclampsia, heart failure, severe anesthesia complications, sepsis, and ventilation, among others” (Dagher and Linares 2022).
Rates of SMM have steadily increased over the last few decades and have a higher prevalence throughout the population compared to maternal mortality, impacting approximately 50 to 100 women per every maternal death (Chen et al. 2021). Previous studies indicate that SMM is often associated with increased age and presence of chronic diseases (Chen et al. 2021). Not only is SMM associated with the presence of chronic conditions, the maternal mortality rate, infant mortality rate, and rates of low birth weight births and preterm births are all associated with the presence of previous chronic health conditions, including diabetes, high blood pressure, and obesity. In alignment with the trends in disparities in the maternal mortality rate, there are also significant disparities in morbidity rates, or the presence of chronic conditions, when comparing rates between white and black women (Cockerham 2017).

Disparities in Infant Health Outcomes

In addition to the U.S. being ranked 23rd for the maternal mortality rate, based on data from 2020, it ranked 33rd in infant mortality rate, with a rate of 5.4 infant deaths per 1,000 live births, when compared to the 39 countries in the OECD who reported infant mortality rates (Dagher and Linares 2022; OECD 2023). In addition to being relatively high compared to other developed, high-income nations, there are also stark disparities in all infant health outcomes between racial groups, including the infant mortality rate, rate of preterm births, and rate of low birth weight births. For instance, throughout the United States the infant mortality rate for non-Hispanic white babies was 4.5 in 2019, compared to the infant mortality rate of 10.6 for black babies (CDC 2022).

In alignment with the infant mortality rate for the U.S., the infant mortality rate for the state of Florida was 5.8 in 2020 and 5.9 in 2020 (Florida Health CHARTS 2023). Further, there
are also disparities between the infant mortality rate for white and black babies throughout the state of Florida. In 2020, the infant mortality rate for black infants was 10.7 per 1,000 births compared to 4.2 for white infants. In 2021, there was a slight increase in the infant mortality rate for black infants at 11.5 per 1,000 births, while the infant mortality rate for white infants remained at 4.2.

Further, as two of the top leading causes of infant mortality, disparities in preterm births (PTB) and low birth weight births (LBW) are also evident when comparing rates between white and black women, which also contribute to and exacerbate disparities in the infant mortality rate (Dagher and Linares 2022). In 2021, approximately 10.5% of babies in the U.S. were born preterm (Osterman et al. 2023; CDC 2023) While the U.S. average was 10.5%, the percent of preterm births for non-Hispanic black women was 14.8%, which is 50% higher than the rate compared to of preterm births for non-Hispanic white women at 9.5% (CDC 2023). Further, in 2021, the rate of low birth weight births in the U.S. was 8.52 per 1,000 live births (Osterman et al. 2023). Compared to the U.S. average of 8.52, in 2019, the rates of low birth weight births were highest for black infants constituting 14.2% of births (Dagher and Linares 2022).

Social Determinants of Health and Health Inequities

Although it is now widely understood across multi-disciplinary health literatures that there are historical, socio-political, economic, and cultural causes behind these differences in health outcomes (Cockerham 2017; Weinstein et al. 2017; Barr 2019), this has not always been the case. Within the last century dominant views of health and illness and societal approaches to health and illness have significantly transformed. Currently, the World Health Organization (WHO) defines health at the individual-level as a “state of complete physical, mental, and social
well-being, and not merely the absence of disease” (World Health Organization Constitution 2022). However, dominant views of health have not always taken social and cultural factors into consideration when attempting to understand and explain health and illness. Following the development of germ theory and the work of physicians, researchers, and scientists in the nineteenth century, including the works of Robert Koch and Louis Pasteur, health was predominantly viewed as the absence of disease and illness, while illness was predominantly viewed as a pathological or physical malfunction within the body (Cockerham 2017; Rocca and Anjum 2020). Based on the findings of these scientists it was believed that illness and disease could be treated and cured by controlling and/or killing the pathogen in the body with drugs or drug-based techniques. This view is commonly referred to as the biomedical model of health and illness.

Germ theory and the notion that disease was marked by the presence of a pathogen within the body led to two interrelated developments: (1) advancements in medical technology and (2) heightened public health measures, including improvements in hygiene, diet, public sanitation, housing, and immunizations (McKeown 2009; Porter 1997; Cockerham 2017) which reduced mortality rates due to infectious diseases. While the decline in infectious diseases in the latter half of the 19th century was largely a result of public health measures, like improvements in public sanitation, housing, and immunizations, a number of factors including the growing authority of and financing behind the medical profession and medical care system shifted the focus throughout U.S. society to clinical medicine, health examinations, individual health behaviors, and the development of medical technology  (Cockerham 2017: 13; Starr 1982: 185 – 197).
While mortality due to infectious diseases was declining, chronic illnesses, like heart disease and cancer, began to emerge as the leading cause of death across Western societies (Cockerham 2017). This emergence of chronic illness altered the attention of scientists and physicians from a single germ to understanding the health of the whole person and their lifestyle. Therefore, while it was understood that lifestyle, like poor sanitation, could lead to disease through the presence of germs, chronic illness shifted the focus of scientists and researchers to understanding how social conditions, like diet, exercise, drug use, exposure to toxic chemicals, and stress impacted individual health over time. Since then, numerous studies have found a relationship between social identity, social conditions, and negative health outcomes (Barr 2019; Cockerham 2017; Cockerham 2013a; Phelan and Link 2013; Braveman et al. 2010; Braveman, Egerter, and Mockenhaupt 2011; Pampel, Krueger, and Denney 2010; Pampel and Rogers 2004; Phelan et al. 2004; Link and Phelan 1995).

However, prior to the understanding that health disparities are largely caused by social factors shaped by systems of power, differences between groups, including health outcomes, were either attributed to natural, biological differences (Bem 1993; Allport1954/1979; Park 1950), behavioral differences, or differences in individual health behaviors (Weinstein et al. 2017). While individual health behaviors do play a part in health outcomes, on their own they fail to explain the social conditions that shape individual life experiences and the persistence of poor health outcomes across populations over time. Therefore, given the persistence of poor outcomes over time and across populations, more current research has begun moving towards understanding how systems of power, like racism and capitalism, create and perpetuate disparities in health outcomes over time (Laster-Pirtle 2020; Crear-Perry et al. 2021).
Current research indicates that macro, mezzo, and micro levels of power not only shape social identity (i.e., who is considered white or what the appropriate gender is), but most often based on one’s social identity, systems of power shape socioeconomic status, who has access to social and economic resources, and who is exposed to disproportionate risk. This historic unequal access to, or uneven distribution of, social and economic resources is often referred to as structural inequity, or, more specifically, when unequal access to, or uneven distribution of, social and economic resources impacts and individual’s health it is referred to as health inequities (Mayne et al. 2018). Both structural and health inequities are a result of social stratification, or the categorization of individuals based on socially constructed categories, like race, class, and gender, that gain meaning from power and are utilized as the foundation for how resources are distributed throughout society (Massey 2007).

Since groups in power and systems of power establish group boundaries and determine how resources are distributed, marginalized groups of individuals have historically been denied resources that directly impact life experiences and outcomes, including health outcomes (Link and Phelan 1995; American Public Health Association 2021). Examples of these resources include social capital (i.e.: social networks, social support, community or neighborhood level social cohesion), economic capital (i.e., cash, assets, wealth, property), access to insurance, access to affordable health care, access to healthy foods, access to safe, and quality transportation and education.

Resources crucial to maintaining one’s health are not only withheld from marginalized groups, but they are also disproportionately exposed to health risks, including environmental hazards, poor neighborhood conditions, poverty, violence, racism, sexism, transphobia, ableism,
and discrimination (American Public Health Association 2021). These resources and risks are considered social determinants of health, or the “nonmedical factors such as employment, income, housing, transportation, childcare, education, discrimination, and the quality of the places where people live, work, learn, and play, which influence health” (American Public Health Association 2021).

Social determinants of health influence individuals via multiple pathways and mechanism across multiple levels of society (macro/society, mezzo/community, and micro/interpersonal/individual) (Dagher and Linares 2022). Although social determinants of health influence individuals across multiple levels of society, neighborhoods or local level communities are central to an individual’s everyday life, and thus sites where social factors tend to directly impact the individual health. Communities are place-based sites where individuals gain access to protective resources (i.e. access to transportation, a safe built environment, healthy foods, safe drinking water, and quality health care) and/or are potentially exposed to direct risks to their health (i.e., exposed to toxins, unsafe living conditions, etc.). In short, communities can either contribute to positive health outcomes or, conversely negatively impact health outcomes (Bernard et al. 2007; Walton 2014; Cockerham 2017; Barr 2019).

Community-Level Social Determinants of Maternal and Infant Health

There are a number of previous studies that have found relationships between community or local-level social factors and maternal health outcomes, including neighborhood deprivation, residential segregation, rural-urban residence, and environmental factors like air and water quality and chemical and lead exposure (Walker and Chestnut 2010; Kruger, Munsell, and French-Turner 2011; Hogan et al., 2012; Klawetter 2014; Crenga, Bateman, Kuklina, and
Neighborhood Deprivation and Residential Segregation

More specifically, previous research has identified relationships between racial residential segregation, or the degree to which two or more racial groups live apart from one another, and adverse pregnancy related health outcomes, hypertension, and hypertensive disorder (Crenga, Bateman, Kuklina, and Callaghan 2014; Mayne et al. 2018; Janevic et al. 2020; Dagher and Linares 2022). For instance, based on their results from a sample of women in Chicago, one study found that racial residential segregation was associated with a higher prevalence of hypertensive disorder of pregnancy (Mayne et al. 2018). Similarly, another study found that women living in zip codes with the highest levels of extremes experienced higher rates of severe maternal morbidity when compared to women living in less polarized zip codes (Janevic et al. 2020). Moreover, using the Index of Concentration at the Extremes (ICE), a recent study conducted in California noted an increased risk of maternal mortality in areas associated with a higher concentration of deprivation (Dyer, et al. 2021).

A few studies have also assessed the relationship between racial residential segregation and infant mortality rates and other adverse birth outcomes including preterm and low birth weight births in the United States (LaViest 1989: 1993; Polednak 1991: 1996; Krieger et al. 2020; Mehra. Boyd, and Ickovics 2017; Dagher and Linares 2022). A recent meta-analysis of studies that explored the association between racial residential segregation and adverse birth
outcomes found that the relationship between segregation and adverse birth outcomes appears to vary by race (Mehra, Boyd, and Ickovics 2017). Further, Mehra, Boyd, and Ickovic (2017) found that Black women in more segregated neighborhoods were at an increased risk of preterm birth when compared to Black women living in less segregated neighborhoods. Additionally, they found that among Black women, exposure was also associated with increased risk for preterm births (Mehra, Boyd, and Ickovics 2017). Other studies also highlight the relationship between racial residential segregation, neighborhood deprivation, and adverse infant health outcomes, including one study that utilize the ICE Index finding a relationship with an increased risk of preterm birth and infant mortality (Dyer et al. 2021). Moreover, studies also found neighborhood poverty levels and structural deterioration associated with adverse birth outcomes as well (Pearl et al. 2018; Sealy-Jefferson et al. 2020; Krieger et al. 2020; Dagher and Linares 2022).

**Urban-Rural Residence (Rurality)**

Current studies that assess the relationship between social determinants of health and maternal health outcomes have also found an increased risk for adverse pregnancy related health outcomes associated with rurality (Hung et al. 2017; Dagher and Linares 2022). For example, one national longitudinal study found women who lived in rural areas had a 9% higher likelihood of mortality and morbidity compared to women who lived in urban areas (Kozhimannil et al. 2019). Overall, most of these studies indicate that adverse outcomes stem from a lack of access to obstetric care (Hung et al. 2017; Dagher and Linares 2022), which also included a loss of hospital services due to the closure of rural hospitals throughout the U.S. While studies have found a relationship between rurality and a loss of hospital and obstetric services overall, further research suggests that rural areas that have larger percentages of non-white residents report higher loss of
hospital and obstetrics services compared to rural areas that are predominately white (Thomas, Holmes, and Pink 2016; CDC 2020).

Studies also found rurality and geographic region of the county associated with higher rates of adverse birth outcomes for infants as well (Ehrenthal, Kuo, and Kirby 2020; Dagher and Linares 2022). Despite these findings, higher rates of infant mortality amongst black infants seem to be fairly consistent across geographic types (Dagher and Linares 2022). Moreover, one study found that when controlling for country-level factors that are also associated with structural racism, including incarceration rates, disparities in educational attainment, income inequality, etc., there were significant disparities in the infant mortality rate between white and black infants (Vilda, Dyer, and Wallace 2021).

Environmental Factors

While there seem to be a limited number of studies in the U.S. that explored the relationship between environmental factors, like air and water quality, and maternal mortality, there have been a few that assessed the association with severe maternal morbidity, which is more prevalent amongst pregnant people and a risk factor for maternal mortality (Dagher and Linares 2022). Moreover, environmental factors that have been found to have an increased risk of pregnancy related hypertensive disorder include an increased presence of particulate matter, nitrogen oxides, ozone, and proximity to major roads and traffic density (Dagher and Linares 2022). Additionally, another systematic review identified that there is an increased risk for gestational diabetes associated with air pollution exposure (Hu et al. 2020). Moreover, studies have also found that increased chemical exposure, which can occur through the air, soil, food, water, and consumer products can contribute to risk factors for maternal mortality and morbidity.
(Boyles et al. 2021) Chemical exposure is not only associated with increased adverse pregnancy related outcomes, but current research has also shown there to be racial disparities in chemical exposure, including amongst pregnant women (Davis et al. 2016; Dagher and Linares 2022). Further, a study in Florida found that increased exposure to air particulate matter was associated with black women having 68-300% higher increased odds for all morbidity outcomes when compared with white women (Salihu et al. 2012).

Studies have also identified relationships between increased exposure to air pollutants during pregnancy and an increased risk for low birth weight and preterm births (Darrow et al. 2009; Ebisu and Bell 2012). Not only are black and Hispanic Americans exposed to chemicals, including lead exposure (CDC 2014), at higher rates than white Americans, but there is also a correlation with an increased likelihood of adverse birth outcomes, including preterm and low birth weight births as well as increased infant mortality rates (Andrews, Savitz, Hertz-Picciotto 1994; Falcon, Vinas, and Luna 2003; Salihu et al. 2012; Bell 2012; Taylor, Golding, Emond 2015).

Public Health in the U.S. as a Community-Level Protective Factor to Health Disparities

While infant and maternal health outcomes are affected by a complex relationship of social, political, economic, and cultural factors that impact individuals through multiple pathways at individual, interpersonal, community, and societal levels, the public health system in the U.S. seeks to improve and protect the health of populations by advocating for policies and programs that seek to improve systems and in turn community condition by mitigating structural inequities that result in health inequities (CDC 2023). Although that is currently how the Public Health National Center for Innovations describes the 10 Essential Public Health Services, the goals of the U.S. public health system have steadily evolved overtime as new developments are
discovered about the persistence of illness and disease throughout the population (Institute of Medicine 1988; CDC 2023).

The eighteenth-century was an important time for the development of public health in the United States. At the time, epidemic diseases were the leading causes of death. Prior to the eighteenth-century epidemic disease was largely viewed as representing poor morality and a plight for the poor (Institute of Medicine 1988). However, during the eighteenth-century, views on the causes and meaning of illness and disease shifted. Instead of believing that disease was caused by moral failure scientists and public officials began to understand that causes behind epidemics were controllable and maintainable through human action (Institute of Medicine 1988). In alignment with the shift in beliefs at the time, major cities across the U.S. developed and began and strictly enforced isolation and quarantine (Hanlon and Pickett 1984; Institute of Medicine 1988). Additionally, the first non-profit, voluntary hospitals were built to care for those who were both physically and mentally ill (Institute of Medicine 1988).

Going into the nineteenth century, developments around this new understanding of illness and disease proliferated. This century was marked by great advancements in public health as dirt and filth had been identified as a cause of disease. Based on these findings, social reforms that promoted cleanliness and sanitation at both the individual and community level were developed rapidly throughout the U.S. (Institute of Medicine 1988). While the focus of disease control was still mitigating epidemics, methods employed to meet this goal shifted from “quarantine and isolation of the individual to cleaning up and improving the common environment” (Institute of Medicine 1988). With this shift from reactive strategies to preventative strategies, perspectives shifted from understanding illness and disease as personal failings to understanding illness and
disease through a societal lens, in which health could be improved through public activities but (Institute of Medicine 1988).

While public health agencies, like local health departments, state health departments, the American Public Health Association, and state boards of health, had been developed throughout the nineteenth century (Hanlon and Pickett 1984; Institute of Medicine 1988), at the federal level the Marine Hospital Service was being converted into the Public Health Service to care for the general population (U.S. National Library of Medicine 2012). The Marine Hospital Service was a program developed from the Act for the Relief of Sick and Disabled Seamen of 1798, which led to the development of marine hospitals to provide medical relief for merchant seamen (U.S. National Library of Medicine 2012).

Not only was the nineteenth century a period of rapid growth for public health infrastructure, at the end of the century, there were other significant expansions in scientific knowledge centered around understanding causes of and developing strategies to improve disease, which is now known as the germ theory of disease, gave rise to changes in public health as well (Institute of Medicine 1988). In short, germ theory of disease was developed after scientists discovered bacteria causes disease (Institute of Medicine 1988). The germ theory of disease then formed the basis for the emergence of bacteriology, now a branch of microbiology. During the late nineteenth and early twentieth centuries, germ theory provided a strong scientific basis for the enactment and proliferation of public health measures to control the epidemic diseases that plagued society.

Under the premise of germ theory, laboratory research expanded to understand causes of disease with the hopes of developing strategies for disease prevention (Institute of Medicine
Findings from this research not only lead to the development of immunizations, but also expanded scientific understanding of disease revealing that individuals and the environment can transmit disease (Institute of Medicine 1988). Further, these findings allowed public health agencies, like health departments, to focus on laboratory science and epidemiology, instead of solely focusing on the enforcement of sanitization (Institute of Medicine 1988).

Although immunizations were effective in reducing death rates, there were still numerous illnesses and disease that pathogenic agents had not been clearly identified (Institute of Medicine 1988). Based on these findings, public health shifted its focus again, now emphasizing disease prevention through education and individual personal hygiene (Starr 1982: 191). Through this shift, an increased emphasis had been placed on ensuring individuals receiving regular health examinations. To meet the goal of increasing health examinations, in the early – mid twentieth century, public health agencies began developing health centers to organization both local non-profit agencies and local-health department programs within a localized geographic area (Starr 1982). While public health officials pushed for health centers to coordinate and/or provide medical and social services, there was significant push back from the medical profession and medical societies due to the overlap in these services and those provided by private practice physicians (Starr 1982: 195). Due to this pushback, only a few health centers were built and those that were worked with directly with physicians by providing referral (Starr 1982: 196).

During the mid-twentieth century, there was a significant increase in federal funding for medical organizations, like the Public Health Service, and the creation of other organizations, like the Office of Scientific Research and Development (OSRD), the National Science Foundation (NSF) and the National Heart Institute, which later became the National Institutes of
Health (NIH) (Starr 1982: 342-343). The Roosevelt administration also advocated for the construction of hospitals, not only to benefit local community health and provide access to care, but to increase employment opportunities. This expansion of aid to the nation’s community hospitals increased the number of beds in low-income communities in an attempt to match the number of beds in higher income communities (Starr 1982).

Growth in social welfare programs and policies, specifically regarding health care, continued into the 1960s, however criticism at the time grew around the government’s lack of understanding of community needs (Starr 1982: 365). Given these concerns, President Kennedy made a point to address community needs in his platform as President, later addressed by his successor President Johnson, who announced a war on poverty with medical care being a subset of this antipoverty program, particularly considering new knowledge linking generational poverty and poor health outcomes (Starr 1982: 366). One aspect of addressing the relationship between poverty and poor health outcomes, Johnson developed Medicare and Medicaid, public health insurance plans for those over 65 years of age and those with limited income and resources (Starr 1982: 369).

Through additional legislation like the Public Health Service Act of 1965, the Partnership in Health Act of 1966, Community Mental Health Act of 1963, and the Comprehensive Health Planning Act of 1968, congress continued to expand health services, including through the development of community health centers in low-income neighborhoods, with the goal of community health centers was to provide coverage for underinsured and uninsured Americans (Community Based Health Interventions 2019; Institute of Medicine 1988). In short, throughout the mid- to late- twentieth century, federal level policy advancements sought to improve health
through the expansion of social welfare programs that focused on planning health services, health promotion, health education, financing health services, increased environmental sanitation, epidemiology, and increased research, including recording and analyzing health statistics (Institute of Medicine 1988). While the federal government played a significant role through an increase in funding to social welfare programs and through the development of agencies and institutions that directly aim to improve social welfare, state and local agencies also saw similar growth often funded and supported by federal level financing. In fact, many of the programs developed by the federal government were relegated to the states to directly control, including Medicare and Medicaid (Institute of Medicine 1988).

Despite major cuts to social welfare programs in between the 1970s and 1980s, efforts to expand social services expanded again in the 1990s under President Clinton and in the early 2000s under President Obama. Specifically, President Clinton was able to pass SCHIP (State Children’s Health Insurance Plan), which provides health care for children whose families could not afford private insurance but did not qualify for Medicaid (Lambrew 2007). Following SCHIP, President Obama passed the Affordable Care Act, was the first major piece of comprehensive healthcare reform legislation to pass since the original creation of Medicare and Medicaid in 1965. The Affordable Care Act expanded health insurance access in a number of ways, including implementing an individual mandate, cost control measures, expanding opportunities for persons who don’t have access to affordable plans that opportunity to purchase affordable plans through the marketplace, expanding Medicaid qualifications, extending the amount of time dependents children can receive coverage under the parents plans, developing
state insurance exchanges, and mandating coverage for a minimum level of benefits and for pre-existing conditions (Cockerham 2017: 371).

In addition to expanding access to health care through the expansion, the Afford Care Act also mandated non-profit hospitals to conduct and publicly report a Community Health Needs Assessment (CHNA) every three years (Chaiyachati, Qi, and Werner 2018). Non-profit, community hospitals are still the single most common type of hospital throughout the U.S, which function largely as multipurpose institutions given their role in providing medical devices, labs, and facilities for the community, training doctors, treating patients, and conducting research to improve health at both an individual and population level (Cockerham 2017: 342).

Prior to the requirements to conduct community needs assessments every few years, non-profit hospitals defined community benefit in their own ways, including lower payments from public insurance programs or loss of revenue. Due to their ability to self-define community benefit, most non-profit hospitals did not directly assess community health needs or invest in and work with community organizations to improve social welfare and health (Chaiyachati, Qi, and Werner 2018). Now through the ACA requirements, the CHNA’s are required to be conducted with leaders throughout the community including public health officials at local health departments with the goal of identifying and mitigating needs locally (Chaiyachati, Qi, and Werner 2018). Similarly, in alignment with the expectations set by the Affordable Care Act, the Public Health Accreditation Board (PHAB) also encourages all local public health departments to conduct Community Health Needs Assessments along with community partners (Shah 2018). Now, given the mutual goals to both understand community health via the CHNA’s and improve
community health guided by the ACA and PHAB, data highlight increasing collaborations between local health departments and hospitals (Shah 2018).

Additionally, studies have shown improved health outcomes associated with increased public health funding (Mays and Smith 2011; Bekemeier et al. 2014) and increased community collaboration (Klaiman, Chainani, and Bekemeier 2016; Quinlan, Mitchell, and Mays 2023). Previous studies emphasize that public health systems function collaboratively with other organizations (Mays, Halverson, and Scutchfield 2003; Wholey, Gregg, and Moscovice 2009). When local public health departments collaborate with social service agencies within their local community, studies highlight an increased benefit to health outcomes (Klaiman, Chainani, and Bekemeier 2016; Higgins and Raja 2020). Moreover, a recent study specifically found a positive relationship between the number of maternal health services provided by local health departments and the number of social services agencies collaborated with, suggesting that as services for maternal and infant health increase so do the number of agencies local health departments collaborate with (Quinlan, Mitchell, and Mays 2023). Quinlan, Mitchell, and Mays (2023) also found that areas with a high number of collaborations are more likely to provide localized home visits and prenatal care than those with a lower number of collaborations. Additionally, they found that local health departments with high collaborators were also more likely to have higher levels of engagement with local social service agencies on recommended public health strategies and activities (Quinlan, Mitchell, and Mays 2023).

Altogether, historically though the development of public health infrastructure throughout the U.S., communities are central sites to reducing death rates and rates of disease and illness. Although public health and institutions exist at federal, state, and local-levels, state and local-
level agencies have typically been more directly involved with communities and individuals by providing resources, educational programs, examinations, or a clean, safe environment (Institute of Medicine 1988). Therefore, because of their role in either improving or harming health, communities, including local level resources like local health departments, are vital when it comes to enhancing the health of the population. Thus, while state and federal policies may be able to achieve health equity at a large-scale, like by providing universal health care, regulating the cost of health care and housing, or raising the minimum wage, communities still must play an integral role in this change as communities are the sites where individuals and families engage daily. Because of this direct connection between the individual and community, multi-sector community-level organizations can work to achieve health equity and improve health outcomes locally (Weinstein et al. 2017).

In short, as illustrated by be the recent public health, medical sociology, population health, and health sciences literature, communities play an extremely important role in mitigating or exacerbating health outcomes through multiple mechanism including providing access to social and economic capital or causing direct or indirect harm through exposure to harm or violence (American Public Health Association 2021; Barr 2019; Weinstein et al. 2017; Cockerham 2017). Communities are both sites in which social factors directly impact individual health but are also sites in which public health programs aim to improve health outcomes. Thus, given the persistence of poor infant and maternal health outcomes over time, the relationship between social determinants of health and infant and maternal health outcomes, and the role public health programs play in aiming to improve health outcomes locally the goals of this project are two-fold. The first goal of this study was to assess the relationship between
community-level (measured at the county-level) social determinants of health and infant and maternal health outcomes throughout the state of Florida. The second goal of this study was to assess how the local public health systems conceptualized and aimed to improve poor infant and maternal health outcomes.
CHAPTER THREE: THEORETICAL ORIENTATION

Disparities in infant and maternal health outcomes both when comparing outcomes to other countries and when comparing outcomes between groups within the United States (U.S.) have been widely documented over time (CDC 2023; WHO 2023). Previous studies indicate that disparities in maternal and infant health outcomes are often caused by health inequities (Weinstein et al. 2017), which are thought to be created by or reflections of structural inequities throughout society. Structural inequities are created by groups and systems of power (i.e.: racism, capitalism, sexism) and result in the historic unequal access to resources or increased exposure to risk both of which impact health outcomes, including infant and maternal health outcomes.

Fundamental Causes to Health Inequities

The theory of fundamental causes, originally conceptualized by Link and Phelan (1995), seeks to explain persistent health inequalities over time despite efforts to improve poor health outcomes (McCartney, Dickie, Escobar, and Collins 2020). While Link and Phelan’s (1995) original work on the theory of fundamental causes examined how socioeconomic status and social support were fundamental causes of health inequality many scholars have expanded on the framework over time, including their own later works. Expansions on the theory of fundamental causes are evident in the research that has identified how social factors or conditions and systems of power, including racial capitalism, act as fundamental causes of health inequalities over time (Williams and Collins 2001; Carpio, Link, and Phelan 2008; Phelan, Link, and Tehranifar 2010; Laster Pirtle 2020). While studies highlight those social conditions impact health outcomes and can be considered fundamental causes to health inequities, systems of power, including
racial capitalism shape those social conditions throughout the life course, which implies that both system of power and the social conditions they shape at multiple levels of society function as fundamental causes to disparities in health outcomes or health inequities.

More specifically, fundamental cause theory argues for a social condition to be fundamental cause of health inequalities it must meet four criteria. First, it must influence multiple disease outcomes, meaning that fundamental causes lead to increased risk for two or more adverse health outcomes. Following, it must affect those disease outcomes through multiple risk factors, or in other words, it must lead to increased disease outcomes through multiple social factors that increase risk of illness. Third, it must involve access to “resources that can be used to avoid risks or to minimize the consequences of disease once it occurs,” which suggests that the fundamental causes to health inequalities must also impact access to resources that could be utilized to minimize health risk or illness. The last tenant of the theory suggests that the fundamental cause must impact disease outcomes over time despite intervening mechanisms (Link and Phelan 1995; Phelan and Link 2015).

While studies utilizing the theory of fundamental causes to explain persistent infant and maternal health outcomes overtime are limited, existing theories of fundamental causes, including that of racial capitalism can be utilized to explain continuous disparities in international and national disparities in infant and maternal health outcomes over time. To start, racial capitalism enforces the notion that the exploitation of individuals based on race and the accumulation of capital are “mutually constitutive” and are historically situated (Laster Pirtle 2020).
As documented by Laster Pirtle (2020), racial capitalism is a fundamental cause of health inequities as it impacts multiple disease outcomes through multiple risk factors. This is also evident when assessing disparities in outcomes in infant and maternal health, as rates of infant mortality, preterm births, low birth weight births, severe maternal morbidity, and maternal mortality between white and black women. Previous studies highlight that many adverse pregnancy related health outcomes and adverse birth outcomes can be contributed to existing comorbidities, including hypertension, diabetes, and obesity as well as increased exposure to negative environmental factors, both of which are more prevalent for black women when compared to white women. (Dagher and Linares 2022). Third, racial capitalism directly impacts access to resources that can mitigate negative health outcomes and/or increases exposure to risk (Laster Pirtle 2020). Both increased exposure to risk and access to resources that can mitigate negative health outcomes can result in increased risk of many adverse pregnancy related health outcomes and adverse birth outcomes (Dagher and Linares 2022). Lastly, racial capitalism continues to impact infant and maternal health outcomes over time despite intervening mechanisms, like public health programs. Laster Pirtle (2020) argues that targeted individual level interventions, like increasing educational awareness, cannot reverse the impacts of racism, poverty, and health, nor can it eliminate the relationship between those three systems of power that are historically rooted throughout multiple levels of society.

However, while the theory of fundamental causes can explain how systems of power, like racism and capitalism cause inequities in infant and maternal health outcomes, the social determinants shaped by inequities impact individual infant and maternal health outcomes at multiple levels of society including interpersonal, community, and societal levels. In other
words, racial capitalism impacts health outcomes through social determinants, conditions, or factors at multiple levels of society. Given the fact that communities are local sites in which social determinants can directly impact infant and maternal health, this study sought to understand the relationship between local-level social determinants of health and infant and maternal health outcomes throughout the state of Florida. Moreover, given the role public health departments play at the community-level and the importance of resources as a protective factor, the second goal of this study was to understand how local public health programs understood and aimed to improve infant and maternal health.
CHAPTER FOUR: RESEARCH METHODS

Given the current literature that highlights the multiple pathways in which social determinants of health impact infant and maternal health outcomes both positively and negatively at individual, interpersonal, community, and societal levels (Dagher and Linares 2022) and the role local public health departments play in improving infant and maternal health outcomes (American Public Health Association 2021; CDC 2023; Quinlan, Mitchell, and Mays 2023), the goals of this project were two-fold. First, to assess the relationship between local- or county-level social determinants of health and maternal and infant health outcomes throughout the state of Florida, a mixed-methods approach was employed, comprised of quantitative statistical and geospatial analyses. Second, to assess the relationship between local public health infrastructure as a protective factor to improve infant and maternal health, secondary qualitative data was pulled from county-level Community Health Needs Assessments (CHNA), Community Health Improvement Plans (CHIP), and Healthy Start Coalition websites to be analyzed for themes.

Research Questions

RQ1: Is there a relationship between county-level social determinants of health and infant and maternal health outcomes throughout the state of Florida?

RQ2: Among counties with the worst reported outcomes, is there a relationship between local-level (county-level) public health systems and infant and maternal health outcomes?

RQ2-A: Among counties with the worst reported outcomes, how do local-level (county-level) public health systems prioritize and conceptualize infant and maternal health?
Data

Quantitative Secondary Data

Quantitative secondary data were pulled from a number of sources including the Florida Department of Health Florida Health Community Health Assessment Resource Tool Set (CHARTS), Florida Department of Health, Bureau of Vital Statistics, Florida Agency for Health Care Administration, the Centers for Disease Control’s Behavioral Risk Factor Surveillance Survey, the American Community Survey, the Environmental Protection Agency, the Office of Economic and Demographic Research, and the Department of Agriculture.

Annual data for each of the variables listed below from each source was pulled for the years 2017 through 2021. An average of the annual data across the five-year span was calculated for all 67 counties across the state of Florida and added to the final dataset utilized in this study. More details on each of the variables in the final dataset are highlighted below:

Dependent Variables – Infant Health Outcomes.

Low Birth Weight: In this study, low birth weight was measured by averaging the annual rate of low birth weight babies born per county across a five-year time frame (between 2017 and 2021). The annual rate of low birth weight babies born across all 67 counties in Florida was found through the Florida Department of Health Florida CHARTS. Florida Health CHARTS receives data this from the Florida Department of Health, Bureau of Vital Statistics. The Bureau of Vital Statistics and, thus, Florida Health CHARTS define low birth weight as live births under 2500 grams or 5.5 pounds.

Preterm Births: Preterm births was measured by averaging the annual preterm birth rate per county across a five-year time frame (between 2017 and 2021).
preterm births per all Florida counties was downloaded from the Florida Department of Health Florida Health CHARTS. Florida Health CHARTS receives this data from the Florida Department of Health, Bureau of Vital Statistics. The Florida Department of Health defines preterm births as “the early birth of a live baby, defined as less than 37 weeks of gestation” (Florida Health CHARTS 2023). Annual preterm birth rates were downloaded for the years 2017 through 2021. The annual rate for all five-years were averaged and utilized to create the variable in the dataset used for this study. 

Infant Mortality Rate: In this study, the infant mortality rate was measured by averaging the annual rate across a five-year time frame (between 2017 and 2021). The infant mortality rates across all Florida counties were found through the Florida Department of Health Florida Health CHARTS. Florida Health CHARTS receives this data from the Florida Department of Health, Bureau of Vital Statistics. Using Florida Health CHARTS, annual data were downloaded for the years 2017 through 2021. The annual rate for all five-years were averaged and utilized to create the variable in the dataset used for this study.

Dependent Variables – Maternal Health Outcomes.

Severe Maternal Morbidity: This study defined severe maternal morbidity as the presence of a complication during a delivery hospitalization. Severe maternal morbidity was measured using the five-year average of the rate of severe maternal morbidity per county across Florida. Annual rates were downloaded from the Florida Department of Health Florida Health CHARTS. Florida Health CHARTS receives this data from the Florida Agency for Health Care Administration.
Maternal Death Rate: For the purposes of this study, maternal deaths were measured by calculating the five-year average of the annual maternal death rate per county for all Florida counties. The annual maternal death rate was found through the Florida Department of Health Florida Health CHARTS, who receives the data from the Florida Department of Health, Bureau of Vital Statistics. Florida Health CHARTS (2023) employs The World Health Organization’s definition of maternal death, which states, “a maternal death [is] the death. Of a woman while pregnant or within 42. Days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.” Using this definition, the annual rate is calculated per 100,000 live births.

Independent Variables – Social Determinants of Health: Access to Care.

Adequate Prenatal Care: Data utilized to measure adequate prenatal care was downloaded from the Florida Department of Health, Florida Health CHARTS. The annual percentage of births with adequate prenatal care was downloaded for the years 2017 through 2021. Once the data was downloaded a five-year average was calculated per each county and utilized in the dataset for this study. Florida Health CHARTS measures adequate prenatal care using The Kotelchuck Index, which is also called the Adequacy of Prenatal Care Utilization (APNCU) Index. The Index considers both when care is initiated (either months 1 and 2, months 3 and 4, months 5 and 6, or months 7 to 9) as well as the “ratio of observed to expected visits” (Florida Health CHARTS 2023). The ratio of observed and expected visits are then categorized into four classifications: “Inadequate (received
less than 50% of expected visits), Intermediate (received 50%-75% of expected visits),
Adequate (received 80%-109% of expected visits), Adequate Plus (received 110% or
more of expected visits).

Late or No Prenatal Care: Late or no prenatal care is defined as the annual percentage of
births per county in which the birthing person either did not receive prenatal care or only
received prenatal care during the 3rd trimester of pregnancy. Annual rates were compiled
per county across all 67 Florida counties from the Florida Department of Health Florida
Health CHARTS. Florida Health CHARTS receives this data from the Florida Department of Health, Bureau of Vital Statistics. Once the annual percentage of births
with late or no prenatal care per county were downloaded for the years 2017 through
2021, five-year averages were calculated and included in the final dataset for this study.

Rurality: Rurality was measured using the Department of Agriculture’s 2013 Urban-
Rural Continuum Codes, which range of 1 to 9 (United States Department of Agriculture
2020). The codes were established by first grouping counties and county equivalents into
two categories, (a) metro and (b) non-metro based on each counties official status
designated by the Office of Management and Budget (OMB).

Metro counties are then broken down into three categories, (1) counties in metro areas of
1 million population or more, (2) counties in metro areas of 250,000 to 1 million
population, and (3) counties in metro areas of fewer than 250,000 population (United
States Department of Agriculture 2020).

Non-metro counties were divided into six categories, which include: (4) urban population
of 20,000 or more, adjacent to a metro area, (5) urban population of 20,000 or more, not
adjacent to a metro area, (6) urban populations of 2,500 to 19,999, adjacent to a metro area, (7) urban population of 2,500 to 19,999, not adjacent to a metro area, (8) completely rural or less than 2,500 urban population, adjacent to metro area, and (9) completely rural or less than 2,500 urban population, not adjacent to a metro area (United States Department of Agriculture 2020).

While the codes have not been updated since 2013, prior to including them in the dataset, codes were updated to reflect 2023 county population-levels.

**Independent Variables – Social Determinants of Health: Housing Stability.**

**Rent 30% or More of Income:** In this study the percent of renter-occupied households with gross rent costing 30% or more of household income per county was measured using the five-year average calculated from annual data found on Florida Department of Health, Florida Health CHARTS. Florida Health CHARTS compiles this data from the United States Bureau of the Censes, American Community Survey. This measure is included in the survey as the Department of Housing and Urban Development (HUD) defines “cost-burdened families as those who pay more than 30 percent of their income for housing and may have difficulty affording necessities such as food, clothing, transportation, and medical care.”

**Percentage of Renters:** Percentage of renters is measured by using the five-year average of annual data on the percent of renter-occupied households per county from the Florida Department of Health, Florida Health CHARTS. Florida Health CHARTS compiles this data from the United States Bureau of the Censes, American Community Survey. Annual data on the percent of renter-occupied households were downloaded from Florida Health
CHARTS between the years 2017 and 2021. Once the data were downloaded, five-year averages were calculated and added to the final dataset utilized for this study.

County-Level Spending on Housing and Urban Development (HUD): For this study, county-level spending on HUD was measured utilizing the five-year average of annual county spending per capita on HUD. Five-year averages were calculated for each county by downloading each county’s annual budget between the years 2017 and 2021 from the Office of Economic and Demographic Research. Each county’s five-year average was then included in the final dataset for this study.

County-Level Spending on Mass Transit: For this study, county-level spending on mass transit was measured utilizing the five-year average of annual county spending per capita on mass transit. Five-year averages were calculated for each county by downloading each county’s annual budget between the years 2017 and 2021 from the Office of Economic and Demographic Research. Each county’s five-year average was then included in the final dataset for this study.

Independent Variables – Social Determinants of Health: Residential Segregation and Income Inequality

Gini Index: To measure income inequality, a five-year average of each counties annual score on the Gini Index between 2017 and 2021 was included in the final dataset for this study. The annual values or scores per county were downloaded from the Florida Department of Health, Florida Health CHARTS, however this data is originally sourced from the United States Bureau of the Census, American Community Survey. More specifically, the Gini Index, or Gini coefficient, “ranges from 0, indicating perfect equality (where everyone receives an equal share), to 1, perfect inequality (where only
one recipient or group of recipients receives all the income)” (United States Census Bureau 2021).

**Dissimilarity Index:** To measure racial residential segregation, a five-year average of each counties annual score on the Dissimilarity Index between 2017 and 2021 was included in the final dataset for this study. The annual values or scores per county on the Dissimilarity Index were downloaded from the Florida Department of Health, Florida Health CHARTS, however this data is originally sourced from the United States Bureau of the Census, American Community Survey. More specifically, the Dissimilarity Index is a measure of evenness, as “segregation is smallest when majority and minority populations are evenly distributed” (United States Census Bureau 2021). The index ranges from 0, which represents complete integration, to 1, which represents complete segregation (United States Census Bureau 2021). Further, Florida Health CHARTS (2023) notes that when the index “is less than 0.3 the county’s population is ‘well integrated’. Values between 0.3 and 0.6 indicate the county’s population is ‘moderately segregated’. Values above 0.6 indicate the county’s population is ‘very segregated.’”

**Individuals Living Below the Poverty Line:** In this study individuals living below the poverty line by calculating the five-year average (2017-2021) of the annual percent of individuals living below the Federal Poverty Line per each county across the state of Florida. Annual data on the percent of individuals living below the Federal Poverty Line was downloaded from Florida Department of Health, Florida Health CHARTS, however the data is originally sourced from the United States Bureau of the Census, American Community Survey.
Independent Variables – Social Determinants of Health: Environmental Factors

Water Violations: For the purposes of this study, water violations are measured as the five-average of the numbers of water violations per county per population served per county. Data on the number of water violations was downloaded from the Environmental Protection Agency.

Air Quality: For the purposes of this study, air quality is measured as the five-average of the percent of good air quality days per county. Data on the percent of good air quality days per county was downloaded from the Environmental Protection Agency. While the data is presented at the county-level, the Environmental Protection Agency only provides data on the air quality for 39 of Florida’s 67 counties.

Qualitative Secondary Data

Secondary qualitative data included the most recent Community Health Needs Assessment (CHNA), Community Health Improvement Plan (CHIP), and content from the Healthy Start websites. CHNA and CHIP documents were analyzed as they are reflections of each county’s conceptualization of health as well as a reflection of how each county prioritizes improving health outcomes. Since this study specifically focuses on infant and maternal health, the content from each county’s Healthy Start Coalition website was also analyzed as a reflection of how each county conceptualizes issues related to infant and maternal health. Florida started funding the Florida Healthy Start Coalition in 1991 (Florida Department of Health 2022). The Healthy Start system “is the organization of activities and services within a community that supports and enhances the community’s ability to promote optimal health and developmental
outcomes for all pregnant women and babies born in Florida” (Florida Department of Health 2022).

Based on the dataset built for this study, a list of the counties with the ten worst preterm birth rates, ten worst infant mortality rates, and ten worst rates of low birth weight births was created. That list formed the sample for the qualitative analysis. Because some counties reported some of the highest rates for multiple outcomes, the total sample size was 19. The counties on that list include the following: Alachua, Bay, Bradford, Columbia, Duval, Flagler, Gilchrist, Gulf, Hardee, Hamilton, Lake, Lafayette, Levy, Liberty, Manatee, Putnam, Union, Wakulla, and Washington. From that list, each county’s most recent Community Health Needs Assessment and Community Health Improvement Plan were downloaded from the Florida Department of Health website.

Further, since the Florida Department of Health has developed Florida Healthy Start, which aims to improve infant and maternal health and functions at the county-level throughout the state, I also went through and analyzed the content on each Healthy Start website of the 19 counties in the sample. While many of the Healthy Start Coalitions function at the county-level some counties work collaboratively and thus those Coalitions represent a region, or several counties. Of the list of counties with the worst infant health outcomes, there were 8 Healthy Start Coalitions, including North Central Florida Healthy Start Coalition, Chipola Healthy Start Coalition, Healthy Start Coalition of Flagler and Volusia Counties, Healthy Start Coalition of Hardee, Highlands, and Polk Counties, Healthy Start Coalition of Bay, Franklin, and Gulf Counties, Healthy Start Coalition of Manatee County, Northeast Florida Healthy Start Coalition, and Central Florida Healthy Start Coalition.
Analytic Strategy

Quantitative Secondary Data

To analyze the secondary quantitative data, a multi-method statistical analysis was conducted. First, descriptive characteristics of all variables in the dataset were run through Statistical Package for the Social Sciences (SPSS) (see Table 1). In addition, to running the descriptive characteristics through SPSS, the data for the dependent variables (health outcomes) were uploaded to ArcGIS online. To do this, new spreadsheets were created with data from each dependent variable alongside geographic indicators including, (County and State FIPS). These new spreadsheets were then uploaded to ArcGIS online and matched with Florida County shapefiles in order to analyze patterns in outcomes via geospatial visualization (see Figures 1-3).

Following, bivariate correlations were run to assess the relationship between the independent variables (SDOHs) and dependent variables (infant and maternal health outcomes) (shown in Table 2). The bivariate correlations were also run to assess relationships between the independent variables before conducting the multivariate analyses with the independent variables that had statistically significant relationships with the dependent variables. Once the bivariate correlations were run, data from all independent variables with statistically significant relationships to the dependent variables were uploaded to ArcGIS online and added as a layer to each map representing a dependent variable, or health outcome (see Figures 4-15).

Lastly, multi-variate nested ordinary least squares (OLS) regression models, or linear regression models were run to assess the relationships, including strength and direction, between all the statistically significant independent variables and dependent variables (see Tables 3-5). Further, nested models were utilized to assess mediation between the independent variables, or
the impact each independent variable had on one another in the multi-variate model. Lastly, when running the linear regression models the Variance Inflation Factor (VIF) rates were calculated for each of the variables in each regression model to further test for multicollinearity, or significantly high correlation between the independent variables in the model.

**Qualitative Secondary Data**

Once all the Community Health Needs Assessments (CHNA) and Community Health Improvement Plans (CHIP) were downloaded and the list of Healthy Start Coalitions representative of the 19 counties with the worst infant health outcomes was developed each source was analyzed qualitatively and quantitatively for themes. To analyze the data both deductive and inductive approaches were applied. First, the data were coded using a deductive approach, in which the data were coded using a framework developed from the existing literature and the research questions guiding this study. The framework consisted of the following key terms: infant health, maternal health, social determinants of health, healthy equity, health inequities. Once the framework was established, the data were coded for themes, first analyzing the CHNAs and CHIPs by county. After the data were coded using the existing framework, the next phase of the analysis included analyzing the text pulled using the initial codes inductively for any prevalent themes. Once each county’s CHNA and CHIP were analyzed using this two-step process, the process was repeated for each Healthy Start Coalition website.
CHAPTER FIVE: RESULTS OF QUANTITATIVE AND GEOSPATIAL DATA ANALYSIS

Univariate Descriptive Statistics

Table 1 highlights the descriptive statistics for both the dependent and independent variables in the dataset, which represent infant health outcomes, maternal health outcomes, and county-level social determinants of health.

Table 1. Descriptive Statistics

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>N</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low birth weight</td>
<td>67</td>
<td>6.44</td>
<td>13.34</td>
<td>9.03</td>
<td>1.46</td>
</tr>
<tr>
<td>Preterm births</td>
<td>67</td>
<td>8.42</td>
<td>14.62</td>
<td>10.98</td>
<td>1.38</td>
</tr>
<tr>
<td>Infant mortality rate</td>
<td>67</td>
<td>3.38</td>
<td>13.37</td>
<td>7.1</td>
<td>2.31</td>
</tr>
<tr>
<td>Severe maternal morbidity</td>
<td>67</td>
<td>5.72</td>
<td>39.04</td>
<td>19.28</td>
<td>7.24</td>
</tr>
<tr>
<td>Maternal death rate</td>
<td>67</td>
<td>0</td>
<td>299.96</td>
<td>29.43</td>
<td>51.74</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>N</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate Prenatal Care</td>
<td>67</td>
<td>48.36</td>
<td>80.82</td>
<td>68.87</td>
<td>5.9</td>
</tr>
<tr>
<td>Late or No Prenatal Care</td>
<td>67</td>
<td>4.82</td>
<td>12.5</td>
<td>7.64</td>
<td>1.8</td>
</tr>
<tr>
<td>Individuals living below the poverty line</td>
<td>67</td>
<td>8.22</td>
<td>28.62</td>
<td>15.96</td>
<td>4.99</td>
</tr>
<tr>
<td>Rent more than 30% of income</td>
<td>67</td>
<td>28.84</td>
<td>64.50</td>
<td>51.42</td>
<td>6.72</td>
</tr>
<tr>
<td>% of renters</td>
<td>67</td>
<td>10.94</td>
<td>48.30</td>
<td>27.87</td>
<td>7.79</td>
</tr>
<tr>
<td>County-level spending on HUD</td>
<td>67</td>
<td>0</td>
<td>138.78</td>
<td>18.68</td>
<td>21.17</td>
</tr>
<tr>
<td>County-level spending on transit</td>
<td>67</td>
<td>0</td>
<td>234.88</td>
<td>19.14</td>
<td>41.1</td>
</tr>
<tr>
<td>Dissimilarity Index</td>
<td>67</td>
<td>.22</td>
<td>.7</td>
<td>.4182</td>
<td>.11</td>
</tr>
<tr>
<td>Gini Index</td>
<td>67</td>
<td>.40</td>
<td>.50</td>
<td>.48</td>
<td>.04</td>
</tr>
<tr>
<td>Rurality</td>
<td>67</td>
<td>1</td>
<td>8</td>
<td>3.27</td>
<td>2.06</td>
</tr>
<tr>
<td>Water Violations</td>
<td>67</td>
<td>.04</td>
<td>138.67</td>
<td>8.11</td>
<td>18.16</td>
</tr>
<tr>
<td>Air Quality</td>
<td>39</td>
<td>72.25</td>
<td>98.48</td>
<td>87.83</td>
<td>6.64</td>
</tr>
</tbody>
</table>
Dependent Variables – Health Outcomes

Infant Health Outcomes

Low birth weight, preterm births, and infant mortality rate are all represented as the rate per 1,000 live births. Between 2017 and 2021, the average number of low birth weight babies born across Florida was 9.03 with a minimum rate of 6.44 and maximum of 13.34. Each county’s five-year rate is visually illustrated in Figure 1 below. The rate of low birth weight babies born is represented using a visual gradient as representation for the rate of low birth weight babies per county. The gradient associates higher rates with darker colors, while lower rates are represented with lighter colors. Overall, the map shows that many of the counties with higher rates of low-birth weight babies are found in the North of the state. More specifically, the counties with the highest five-year averages were Manatee, Gilchrist, Hardee, Lafayette, and Bradford. Alternatively, the counties with the lowest five-year averages were Monroe, Miami-Dade, Santa Rosa, Okeechobee, and Hamilton.

During that same five-year time frame, the average number of preterm births across the state was 10.98, with a minimum rate of 8.42 and maximum of 14.62 (see Table 1). The range of the five-year rate of preterm births per county is visually represented in the map shown in Figure 2. The rate of preterm births is represented using a visual gradient as representation, which associates higher rates with darker colors and lower rates with lighter colors. Overall, with a few exceptions Figure 2 shows that many of the counties with higher rates of preterm births are found in the North of the state. More specifically, the counties with the highest five-year rates were Lake, Duval, Gilchrist, Flagler, and Union. Alternatively, the counties with the lowest five-year averages were Monroe, Miami-Dade, Santa Rosa, Okeechobee, and St. Johns.
The last variable in the dataset used to measure infant health was the infant mortality rate. The infant mortality rate is calculated annually per 1,000 live births. Between 2017 and 2021, the mean infant mortality rate across all counties in Florida was 7.1 with a minimum of 3.38 and a maximum of 13.37. The range of the five-year rate infant mortality rate per county is visually represented in the map shown in Figure 3 below. The infant mortality rate is represented using a visual gradient as representation, which associates higher rates with darker colors and lower rates with lighter colors. Overall, with a few exceptions Figure 3 shows that many of the counties with higher rates of preterm births are found in the North of the state. Further, of the 67 counties, the counties with the highest 5-year averages were Manatee, Gulf, Columbia, Hamilton, and Washington. Alternatively, the counties with the lowest 5-year averages were Monroe, Miami-Dade, Osceola, DeSoto, and Pasco.

Figure 1. Live Births Under 2500 Grams (Low Birth Weight)
Figure created using ArcGIS Online. Data on rates of low birth weight births downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics.
Figure 2. Preterm Birth Rate
Figure created using ArcGIS Online. Data on rates of preterm births downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics.

Figure 3. Infant Mortality Rate
Figure created using ArcGIS Online. Data on infant mortality rates downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics.
Maternal Health Outcomes

While the rate of low birth weight and preterm births are calculated for every 1,000 live births, severe maternal morbidity is calculated as a rate per 1,000 delivery hospitalizations and the maternal death rate is calculated per 100,000 births. The average rate of severe maternal morbidity across all Florida counties was 19.28 with a minimum of 5.72 and a maximum of 39.04 and the average maternal death rate was 29.43 with a minimum of 0, indicated that there were 0 maternal deaths across the 5-year period, and a maximum of 299.96 per 100,000 births.

Independent Variables- Social Determinants of Health

Access to Care.

The next set of variables, which include access to adequate prenatal care, births with late or no prenatal care, and rurality, were selected to measures access to care. Births with adequate prenatal care and births with late or no prenatal care are calculated as a five-year average with data ranging from 2017 and 2021. During this time, the average rate of adequate prenatal care across all counties in Florida was 68.87 with a minimum of 48.36 and a maximum of 80.82. Additionally, the five-year average of annual rates of late or no prenatal care was 7.64 with a minimum of 4.82 and a maximum of 12.5.

Rurality was measured using the Department of Agriculture’s Urban-Rural Continuum Codes, which range of 1 to 9. The five-year average across all Florida counties on the Urban-Rural Continuum was 3.27. Further, while the Urban-Rural Continuum Codes ranges from 1-9., no counties were classified as 9 in Florida, making the range between 1 and 8.
Residential Segregation and Income Inequality

Residential segregation and income inequality were measured using three separate variables, including the Dissimilarity Index, the Gini Index, and the percentage of people living below the federal poverty line. First, the Dissimilarity Index is a measure of residential racial segregation ranging from 0, which represents complete integration, to 1, which represents complete segregation (United States Census Bureau 2021). The five-year average of each counties rate on the Dissimilarity Index was .4182 with a minimum reported rate of .22 and a maximum reported rate of .7.

Following, the Gini Index measures income inequality also ranging from 0, or perfect equality (where everyone receives an equal share), to 1, perfect inequality (where only one recipient or group of recipients receives all the income)” (United States Census Bureau 2021). The five-year average of each counties rate on the Gini Index was .48 with a minimum reported rate of .40 and a maximum reported rate of .50. Lastly, the five-year average of the percentage of people within a county living below the federal poverty level across the state was 15.96%, with a low of 8.22% and a high of 28.62%.

Housing Stability.

The next set of variables in the dataset measure housing stability in each county. The variables utilized to measure housing stability include percentage of renters within a county, the percentage of people who spend 30% or more of their income on rent, and county-level spending on Housing and Urban Development per capita. First, the five-year average of the percentage of renters within a county was 27.87%. The lowest average of the percentage of renters within a county with 10.94% with the highest average of the percentage of renters within a county at
48.30%. Next, the five-year average of the percentage of renters within a county who spend more than 30% of their income on rent was 51.42%. The lowest average was 28.84% and the highest was 64.50%. Lastly, the five-year average of county-level spending on Housing and Urban Development per capita was $18.68 with a minimum of $0 spent on Housing and Urban Development per capita and a maximum of $138.78 per capita.

Transportation.

Transportation was measured using a five-year average of county-level spending on mass transit per capita. The five-year average of county-level spending on mass transit was $19.14 per capita with a low of $0 per capita and a high of $234.88 per capita spending on mass transit.

Environmental Factors.

Environmental factors were measured through two variables, (1) number of water violations within the county per population served and (2) percentage of good air quality days reported by the Environmental Protection Agency. The five-year average of the rate of water violations across all Florida counties was 8.11 violations per population served. The lowest rate of water violations per population served was .04 and the highest rate was 138.67. Following, the five-year average of the percentage of good air quality days was 87.83% with a low of 72.25% of days and a maximum of 98.48%.

Bivariate Analysis

Once descriptive statistics were run for each of the variables, bivariate analyses were run to test the relationships between each of the dependent variables and independent variables. Given the level of measurement of all the variables, Pearson’s bivariate correlation tests were run amongst all variables in the study to assess the association between each dependent variable and
each independent variable and to test for multicollinearity between the independent variables (shown in Table 2).

Table 2. Bivariate Correlations

<table>
<thead>
<tr>
<th></th>
<th>Low birth weight</th>
<th>Preterm births</th>
<th>Infant mortality rate</th>
<th>Severe maternal morbidity</th>
<th>Maternal death rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate prenatal care</td>
<td>-.137</td>
<td>-.097</td>
<td>.058</td>
<td>.006</td>
<td>-.076</td>
</tr>
<tr>
<td>Late or no prenatal care</td>
<td>.308**</td>
<td>.247**</td>
<td>.031</td>
<td>.052</td>
<td>.102</td>
</tr>
<tr>
<td>Individuals living below the poverty line</td>
<td>.549***</td>
<td>.542***</td>
<td>.429***</td>
<td>.221*</td>
<td>-.030</td>
</tr>
<tr>
<td>Rent more than 30% of income</td>
<td>-.136</td>
<td>-.415***</td>
<td>-.261**</td>
<td>.077</td>
<td>.024</td>
</tr>
<tr>
<td>Percent of renters</td>
<td>.111</td>
<td>.023</td>
<td>-.089</td>
<td>.038</td>
<td>-.107</td>
</tr>
<tr>
<td>County-level spending on HUD</td>
<td>-.097</td>
<td>-.096</td>
<td>-.018</td>
<td>-.001</td>
<td>-.009</td>
</tr>
<tr>
<td>County-level spending on transit</td>
<td>-.040</td>
<td>-.009</td>
<td>-.174</td>
<td>.006</td>
<td>-.130</td>
</tr>
<tr>
<td>Dissimilarity Index</td>
<td>-.327**</td>
<td>-.356**</td>
<td>-.229*</td>
<td>.019</td>
<td>.117</td>
</tr>
<tr>
<td>Gini Index</td>
<td>-.003</td>
<td>-.197</td>
<td>-.058</td>
<td>.217*</td>
<td>-.226*</td>
</tr>
<tr>
<td>Rurality</td>
<td>.221*</td>
<td>.151</td>
<td>.295**</td>
<td>.047</td>
<td>.0031</td>
</tr>
<tr>
<td>Water violations</td>
<td>-.025</td>
<td>-.133</td>
<td>-.081</td>
<td>.079</td>
<td>-.010</td>
</tr>
<tr>
<td>Air quality</td>
<td>.121</td>
<td>.196</td>
<td>.083</td>
<td>.168</td>
<td>.285</td>
</tr>
</tbody>
</table>

Note: Significance levels = *<.1, **<.05, ***<.01

The independent variables that have statistically significant associations with the rate of low birth weight babies per each county were late or no prenatal care, individuals living below the poverty line, the Dissimilarity Index, and rurality (shown in Table 2 and Figures 4-7). Given the small number of cases, relationships were deemed statistically significant with p-values below .1, however there is delineation between the levels of significance presented in Table 2.

In examining the relationship between the rate of low-birth weight babies per county and the percentage of births with late or no prenatal care, it can be concluded that with an r of .308, there is a positive, weak to moderate relationship between these two variables (shown in Table 2). Moreover, the relationship between the births with late or no prenatal care and the rate of low
birth weight babies per county is illustrated via geospatial visualization, which is shown in Figure 4 below. The visualization presents the five-year averages of each county’s rate of low birth weight babies born as well as each counties percent of births with late or no prenatal care. Just as higher rates of low birth weight babies are associated with darker colors on the gradient, higher percentages of late or no prenatal care are associated with larger circles.

Figure 4: Births with Late or No Prenatal Care x Live Births Under 2500 Grams (Low-Birth Weight)

Figure created using ArcGIS Online. Data on rates of low birth weight births and births with late or no prenatal care downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics.

Following, the results of the analysis indicate that there is a positive, moderate to strong relationship between the rate of low birth weight babies per county and the percentage of individuals living below the Federal Poverty Line with an r of .549 (shown in Table 2). The relationship between the percent of individuals living below the poverty line and the rate of low birth weight babies per county is further illustrated via geospatial visualization, which is shown
in Figure 5 below. The visualization presents the five-year averages of each county’s rate of low birth weight babies born as well as each county’s percent of individuals living below the poverty line. Just as higher rates of low birth weight babies are associated with darker colors on the gradient, higher percentages of individuals living below the poverty line are associated with larger circles.

Next, with a p-value below .05 and $r = -.327$, it can be determined there is a statistically significant, negative, weak to moderate relationship between the Dissimilarity Index and the rate of low birth weight babies per county (shown in Table 2). Additionally, the relationship between the Dissimilarity Index and the rate of low birth weight babies per county is illustrated via geospatial visualization, which is shown in Figure 6 below. The visualization presents the five-
year averages of each county’s rate of low-birth-weight babies born as well as each county’s score on the Dissimilarity Index. Just as higher rates of low birth weight babies are associated with darker colors on the gradient, higher scores on the index, which suggest increased segregation, are associated with larger circles.

Figure 6. Dissimilarity Index x Low Birth Weight
Figure created using ArcGIS Online. Data on rates of low birth weight births and the Dissimilarity Index downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics and American Community Survey.

Lastly, there was with an r of .221 weak relationship between rurality and low birth weight babies per county as well (shown in Table 2). Moreover, the relationship between rurality and the percentage of low birth weight babies born per county is illustrated using a geospatial visualization in Figure 7. The visualization presents the five-year averages of each county’s rate of low-birth-weight babies born per 1,000 live births as well as each county’s code based on the Department of Agriculture’s Urban-Rural Continuum Codes. Just as higher rates of low birth
weight babies are associated with darker colors on the gradient, higher scores on the Urban-Rural Continuum are associated with larger circles.

Figure 7. Urban-Rural Continuum Codes x Low Birth Weight
Figure created using ArcGIS Online. Data on rates of low birth weight births downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics. Urban-rural continuum codes sourced from the Department of Agriculture.

Following, the independent variables that had statistically significant associations with the rate of preterm births per county were late or no prenatal care, individuals living below the poverty line, the index of dissimilarity, and the percentage of renters whose rent is more than 30% of their income (shown in Table 2).

When assessing the association between preterm births per county and late or no prenatal care, it can be concluded that there is a positive weak relationship with an $r$ of .247 (shown in Table 2). Moreover, the relationship between the births with late or no prenatal care and the rate of preterm births per county is illustrated via geospatial visualization, which is shown in Figure 8.
below. The visualization presents the five-year averages of each county's rate of preterm births as well as each county's percent of births with late or no prenatal care. Just as higher rates of preterm births are associated with darker colors on the gradient, higher percentages of late or no prenatal care are associated with larger circles.

![Births with Late or No Prenatal Care x Preterm Births](image)

Figure 8. Births with Late or No Prenatal Care x Preterm Births

Figure created using ArcGIS Online. Data on rates of preterm births and births with late or no prenatal care downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics.

Next, the relationship between preterm births and individuals living below the Federal Poverty Line was moderate ($r = .542$). The relationship between the percent of individuals living below the poverty line and the rate of preterm births is further illustrated via geospatial visualization, which is shown in Figure 9 below. The visualization presents the five-year averages of each county's rate of preterm births as well as each county's percent of individuals living below the poverty line. Just as higher rates of preterm births are associated with darker
colors on the gradient, higher percentages of individuals living below the poverty line are associated with larger circles.

While the relationship between preterm births and late or no prenatal care and individuals living below the poverty line were both positive, the association between preterm births per county and the percentage of people whose rent constitutes more than 30% of their income was negative and moderate with an r of -.415. Further, the relationship between the percent of people whose rent constitutes more than 30% of their income per county and the rate of preterm births per county is illustrated via geospatial visualization, which is shown in Figure 10 below. The visualization presents the five-year averages of each counties rate of preterm births as well as each counties percent of people whose rent constitutes more than 30% of their income.

Figure 9. Percent of Individuals Living Below the Federal Poverty Line x Preterm Births
Figure created using ArcGIS Online. Data on rates of preterm births and individuals living below the FPL downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics and American Community Survey.
Similarly, there was a negative weak to moderate relationship between preterm births per county and the Dissimilarity Index ($r = -.356$). Additionally, the relationship between the Dissimilarity Index and the rate of preterm births is illustrated via geospatial visualization, which is shown in Figure 11 below. The visualization presents the five-year averages of each county’s rate of preterm births as well as each county’s score on the Dissimilarity Index. Just as higher rates of preterm births are associated with darker colors on the gradient, higher scores on the index, which suggest increased segregation, are associated with larger circles.

Figure 10. Percent of People Who Spend 30%+ of Income on Rent x Preterm Births
Figure created using ArcGIS Online. Data on rates of preterm births and individuals who spend 30% or more of their income on rent were downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics and American Community Survey.
Next, the independent variables that had statistically significant associations with the infant mortality rate were individuals living below the poverty line, the index of dissimilarity, rurality, and the percentage of renters whose rent is more than 30% of their income (shown in Table 2).

More specifically, the relationship between the percentage of individuals within a county living below the Federal Poverty Line and the county-level infant mortality rate was positive and strong ($r=0.429$). The relationship between the percent of individuals living below the poverty line and the infant mortality rate is further illustrated via geospatial visualization, which is shown in Figure 12 below. The visualization presents the five-year averages of each county's infant mortality rate as well as each county's percent of individuals living below the poverty line. Just
as higher infant mortality rates are associated with darker colors on the gradient, higher percentages of individuals living below the poverty line are associated with larger circles.

The relationship between infant mortality rate and rurality was also positive, however not as strong with an r of .295 (shown in Table 2). Moreover, the relationship between rurality and the infant mortality rate is illustrated using a geospatial visualization in Figure 14. The visualization presents the five-year averages of each county’s infant mortality rate as well as each county’s code based on the Department of Agriculture’s Urban-Rural Continuum Codes. Just as higher infant mortality rates are associated with darker colors on the gradient, higher scores on the Urban-Rural Continuum are associated with larger circles.

Figure 12. Percent of Individuals Living Below the Federal Poverty Line x Infant Mortality Rate
Figure created using ArcGIS Online. Data on rates of infant mortality and individuals living below the FPL downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics and American Community Survey.
Figure 13. Urban-Rural Continuum Codes x Infant Mortality Rate

Figure created using ArcGIS Online. Data on rates of infant mortality were downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics. Urban-rural continuum codes sourced from the Department of Agriculture.

Lastly, the relationships between the county-level infant mortality rate and the percentage of people within a county who spend more than 30% of their income on rent and the county-level infant mortality rate and the index of dissimilarity were both negative and weak with an r of -.261 and -.229 respectively. Furthermore, each of these relationships is illustrated via geospatial visualization presented below as Figures 14 and 15. In each figure the infant mortality rate is represented via color gradient where darker colors are associated with higher infant mortality rates and lighter colors are associated with lower infant mortality rates. Further, Figure 14 also includes the Dissimilarity Index represented via circle where larger circles represent higher scores on the index indicating higher levels of segregation throughout each county. Alternatively Figure 15 includes the percent of individuals who spend 30% or more of their income on rent.
The symbology used to represent the Dissimilarity Index was also used to represent the percent of individuals who spend 30% or more of their income on rent.

When assessing the relationships between the independent variables and the two variables utilized to measure maternal health outcomes there were fewer statistically significant relationships. First, there was a statistically significant association between severe maternal morbidity and both the percentage of individuals living below the poverty line and the Gini Index with p-values below .1. The relationship between the severe maternal morbidity rate and both variables were weak with an r of .221 and .217 respectively. Lastly, the only independent variable that had a statistically significant relationship with the maternal death rate was the Gini Index with an r of -.226.

Figure 14. Dissimilarity Index x Infant Mortality Rate
Figure created using ArcGIS Online. Data on rates of infant mortality and the Dissimilarity Index downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics and American Community Survey.
Figure 15. Percent of Individuals Who Spend 30%+ of Income on Rent x Infant Mortality Rate
Figure created using ArcGIS Online. Data on rates of infant mortality and individuals who spend 30% or more of their income on rent were downloaded from FDoH Florida Health CHARTS, originally sourced from the FDoH Bureau of Vital Statistics and American Community Survey.

**Multivariate Analysis**

After running the bivariate correlations to assess the relationship between each of the independent variables and the dependent variables, all dependent variables with multiple statistically significant relationships were incorporated into multi-variate nested ordinary least squares (OLS) regression models, or linear regression models (shown in Tables 3-5). The nested models were run to examine the impact the independent variables had on each other, also referred to as mediation. When running the linear regression models the Variance Inflation Factor (VIF) was calculated for each of the variables in each regression model to test for multicollinearity. Overall, the VIF scores did not indicate high correlation between the
independent variables in the models as most scores were within the 1-2 range indicating either no correlation or moderate correlation.

Table 3. SDoH x Low Birth Weight

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late or No Prenatal Care</td>
<td>.250**</td>
<td>.255**</td>
<td>.269**</td>
<td>.151*</td>
</tr>
<tr>
<td>Rurality</td>
<td>-</td>
<td>.162**</td>
<td>.114</td>
<td>.027</td>
</tr>
<tr>
<td>Dissimilarity Index</td>
<td>-</td>
<td>-</td>
<td>-4.265**</td>
<td>-3.564**</td>
</tr>
<tr>
<td>Individuals living below the poverty line</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.128***</td>
</tr>
<tr>
<td>Significance Level</td>
<td>.01</td>
<td>.006</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>.081</td>
<td>.120</td>
<td>.203</td>
<td>.352</td>
</tr>
<tr>
<td>F-statistic</td>
<td>6.802</td>
<td>5.509</td>
<td>6.589</td>
<td>9.946</td>
</tr>
</tbody>
</table>

Note: Significance levels = *<.1, **<.05, ***<.001

The first set of models, which are shown in Table 3, illustrate the relationship between late or no prenatal care, rurality, the Dissimilarity Index, the percentage of individuals living below the poverty line, and the rate of low birth weight babies born per every 1,000 live births. Model 1 specifically tests the relationship between the percentage of births with late or no prenatal care and the percentage of low birth weight babies. Overall, the model is statistically significant with a p-value of .01 and F-statistic of 6.802. While the model is statistically significant, the adjusted R-square indicates it only accounts for 8.1% of the variance in the percentage of low birth weight births per county. While only explaining 8.1% of the variance, the unstandardized Beta coefficient suggests that for every one-unit increase in the percentage of births with late or no prenatal care, the rate of low birth weight births increases by .25.

Following, the second model (shown in Table 3), highlights the relationship between the percentage of births with late or no prenatal care per county, rurality, and the rate of low birth weight births per county. The model is statistically significant overall, with a p-value of .006 and
an F-statistic of 5.509, suggesting there is a relationship between the independent and dependent variables.

When specifically looking at the relationship of each independent variable and the dependent variable, it can be inferred that both independent variables have statistically significant relationships with the independent variable both with p-values below .05 (Table 3). Further, based on the unstandardized Beta coefficients it can be concluded that adding rurality into the model has a partiality mediating effect with magnification. This can be concluded because the relationship remains statistically significant, and the unstandardized Beta coefficient increases to .255 indicating that for every one unit increase in the percentage of births with late or no prenatal care there is a .255 increase in the percentage of low birth weight babies per county.

While the relationship between rurality and percentage of low birth weight births is statistically significant the standardized beta coefficients in the model suggest that the percentage of births with late or no prenatal care has a stronger impact on the dependent variable than rurality (.314 and .228 respectively). Nonetheless, the unstandardized Beta coefficient indicates that for every one unit increase on the scale of Urban-Rural Continuum Codes there is a .162 increase in the percentage of low birth weight births per county.

In model 3 (Table 3), a third independent variable, the Dissimilarity Index, was added to the model. When adding the Dissimilarity Index to the model, it had a partially mediating effect with magnification on late or no prenatal care and a complete mediating effect on rurality rendering the relationship with the percentage of birth weight babies not significant.
Alternatively, the relationship between the percentage of births with late or no prenatal care and the percentage of low-birth weight babies born per county significant (p-value <.05). From the unstandardized Beta coefficient, it can be concluded the for every one unit increase in the percentage of late or no prenatal care, there is a .269 increase in the percentage of low birth weight babies born per county. Lastly, in model 3, there was also a statistically significant relationship between the Dissimilarity Index and the percentage of low-birth weight babies born per county (p-value <.05). The model indicates that for every one unit increase on the Dissimilarity Index there is a 4.265 decrease in the percentage of low birth weight babies.

The last model in Table 3 assesses the relationship between all four independent variables (late or no prenatal care, rurality, the Dissimilarity Index, and the percentage of individuals living below the poverty line) and the percentage of low birth weight babies born per county. When adding the percentage of individuals per county who live below the poverty line into the model, the model remained significant with a p-value below .001 and an F = 9.946. The adjusted R-square indicates that all the independent variables in the model predict 35.2% of the variance in the percentage of low birth weight babies born per-county.

Further, when adding the percentage of individuals living below the poverty line to the model the variable had partial mediating effects on the other two independent variables with statistically significant relationships with the dependent variable (Table 3). Although the relationship between rurality and low birth weight babies remained insignificant, there were still statistically significant relationship between late or no prenatal care and low-birth weight and the Dissimilarity Index and low-birth weight. Model 4 suggests that for every one unit increase in the percentage of births with late or no prenatal care there is a .151 increase in the percentage of
low birth weight births per county. Alternatively, there is an inverse relationship between the Dissimilarity Index and low birth weight and for every one unit increase on the Dissimilarity Index there is a 3.564 decrease in low-birth weight babies.

Lastly, there is a statistically significant relationship between the percentage of individuals living below the poverty line per county and the percentage of low birth weight babies born per county with a p-value below .001. Based on the standardized beta coefficient of .438, it can be concluded that the percentage of individuals living below the poverty line also has the strongest impact on the percentage of low-birth weight babies born per county. While the standardized beta coefficient indicates that it is the strongest predictor in the model, the unstandardized beta suggests that for every one unit increase in the percentage of individuals living below the poverty line per county there is a .128 increase in the percentage of low birth weight babies born per county.

Table 4. SDoH x Preterm Births

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late or No Prenatal Care</td>
<td>.190**</td>
<td>.138</td>
<td>.164*</td>
<td>.053</td>
</tr>
<tr>
<td>Rent more than 30% of income</td>
<td>-</td>
<td>-.079***</td>
<td>-.058**</td>
<td>-.055**</td>
</tr>
<tr>
<td>Dissimilarity Index</td>
<td>-</td>
<td>-</td>
<td>-.3456**</td>
<td>-.2487*</td>
</tr>
<tr>
<td>Individuals living below the poverty line</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.125***</td>
</tr>
<tr>
<td>Significance Level</td>
<td>.044</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>.047</td>
<td>.178</td>
<td>.228</td>
<td>.403</td>
</tr>
<tr>
<td>F-statistic</td>
<td>4.222</td>
<td>8.147</td>
<td>7.510</td>
<td>12.128</td>
</tr>
</tbody>
</table>

Note: Significance levels = *<.1, **<.05, ***<.001

The second set of models (Table 4) assesses the relationship between the percentage of births with late or no prenatal, percentage of persons whose rent costs more than 30% of their income, the Dissimilarity Index, the percentage of individuals living below the poverty line and the percentage of pre-term births per county.
The first model tests the relationship between the percentage of births with late or no prenatal care and the percentage of preterm births per county. Overall, the model is statistically significant with a p-value of .04 and a F-statistic of 4.22. While significant, the percentage of births with late or no prenatal care only account for 1.9% of the variance in the percentage of preterm births per county.

The second model tests the relationship between the percentage of births with late or no prenatal care, the percentage of people whose rent is equal to or more than 30% of their income, and the percentage of preterm births per county. The model overall is statistically significant with a p-value below .001 and an F-statistic of 8.147. Further, when adding the percentage of persons who spend more than 30% of their income on rent into the model, the two independent variables accounted for 17.8% of the variation in the percentage of preterm births per county. Although the overall model remains statistically significant, when adding the percentage of people whose rent accounts for more than 30% of their income to the model, it has a complete mediating effecting on the percentage of births with late or no prenatal care. With a significance level below .01, model suggests that for every one unit increase in the percentage of people who pay more than 30% of there is a .079 increase in the percentage of preterm births per county.

Following, the Dissimilarity Index is added in to the third model to test the relationship between the percentage of births with late or no prenatal care, the percentage of people whose rent is equal to or more than 30% of their income, the Dissimilarity index, and the percentage of preterm births per county (shown in Table 4). The overall model is statistically significant with a significance level below .001 and F-statistic of 7.510. The three variables in the model account for 22.8% of the variance in the percentage of preterm births per county.
When adding the Dissimilarity index into the model, it has a mediating effect on both the percentage of births with late or no prenatal care and the percentage of individuals whose rent account for more than 30% of their income. More specifically, it had a partially mediating effect with magnification on the percentage of births with late or no prenatal care. In this model, the relationship between the percentage of births with late or no prenatal care and the percentage of preterm births is statistically significant with an unstandardized beta coefficient of .164, which suggests that for every one unit increase in the percentage of births with late or no prenatal care there is a .164 increase in the percentage of preterm births per county.

While there was a positive relationship between those two variables, there is a statistically significant inverse relationship between the remaining two independent variables in the model and the percentage of preterm births per county. First, for every increase in the percentage of persons who spend more than 30% of their income on rent, there is a .058 decrease in the percentage of pre-term births per county. Second, for every unit increase on the Dissimilarity Index there is a 3.456 decrease in the percentage of preterm births per county.

Lastly, the percentage of individuals living below the poverty line was added into the fourth model. The overall model is statistically significant with a p-value below .001 and an F-statistic of 12.128. Additionally, the model predicts 40.3% of the variability in the percentage of pre-term births per county. When adding the percentage of individuals living below the poverty line to the model, it has mediating effects on the remainder of the independent variables, including rendering the percentage of births with late or no prenatal care insignificant. Moreover, it has partially mediating effects on the percentage of people who spend more than 30% of their income on rent and the Dissimilarity Index. The model suggests that for every increase in the
percentage of persons who spend more than 30% of their income on rent there is a .055 decrease in the percentage of pre-term births per county. Similarly, for every unit increase on the Dissimilarity Index there is a 2.487 decrease in the percentage of preterm births per county.

Table 5. SDoH x Infant Mortality Rate

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissimilarity Index</td>
<td>-4.948*</td>
<td>-3.738</td>
<td>-2.316</td>
<td>-1.806</td>
</tr>
<tr>
<td>Rurality</td>
<td>-</td>
<td>.287**</td>
<td>.274**</td>
<td>.169</td>
</tr>
<tr>
<td>Rent more than 30% of income</td>
<td>-</td>
<td>-</td>
<td>-.064</td>
<td>-.054</td>
</tr>
<tr>
<td>Individuals living below the poverty line</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.160**</td>
</tr>
<tr>
<td>Significance Level</td>
<td>.062</td>
<td>.020</td>
<td>.019</td>
<td>.001</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>.038</td>
<td>.088</td>
<td>.105</td>
<td>.205</td>
</tr>
<tr>
<td>F-statistic</td>
<td>3.597</td>
<td>4.177</td>
<td>3.584</td>
<td>5.246</td>
</tr>
</tbody>
</table>

Note: Significance levels = *<.1, **<.05, ***<.001

The last set of OLS regression models run assesses the relationship between the percentage of persons whose rent costs more than 30% of their income, the Dissimilarity Index, rurality, the percentage of individuals living below the poverty line and the percentage of pre-term births per county (shown in Table 5) The first model tests the relationship between the Dissimilarity Index and the infant mortality rate per county. Overall, given the small sample size, the model is on the cusp of significance with a p-value of .062 and an F-statistic of 3.597 and accounts for 3.8% of the variables in the infant mortality rate. Further, the model shows that for every unit increase on the Dissimilarity Index there is a 4.948 decrease in the infant mortality rate.

The second model tests the relationship between the Dissimilarity Index, rurality, and the infant mortality rate (see Table 5). The overall model is statistically significant with a p-value of .020 and a F-statistic of 4.177 and the model accounts for 8.8% of the variability in the infant mortality rate. When adding rurality into the model, it has a completely mediating effect on the
dissimilarity index. While the relationship between the Dissimilarity Index and the infant mortality rate is no longer significant, model 2 suggests that for every unit increase in the Urban-Rural Continuum Codes there is a .287 increase in the infant mortality rate.

The percentage of people who spend 30% or more of their income on rent was included in the third model (shown in Table 5). The overall model is statistically significant with a p-value of .019 and an F-statistic of 3.584. Further, the model accounts for 10.5% of the variability in the infant mortality rate. Although when adding the percentage of people who spend 30% or more of their income on rent to the model the relationship with the infant mortality rate is insignificant, the relationship between rurality and the infant mortality rate remained significant with a p-value below .05 suggesting that for every one unit increase on the Urban-Rural Continuum Codes, there is a .274 increase in the infant mortality rate.

The second model tests the relationship between the Dissimilarity Index, rurality, the percentage of people who spend 30% or more of their income on rent, the percentage of individuals living below the poverty line, and the infant mortality rate (see Table 5). When adding the percentage of individuals living below the poverty line to the model, it had a complete mediating effect on all the other independent variables in the model. Nonetheless, the model was statistically significant with a p-value of .001 and a F-statistic of 5.246 and accounted for 20.5% of the variability in the infant mortality rate per county. When specifically assessing the relationship between the percentage of individuals living below the poverty line and the infant mortality rate, it can be concluded that for every increase in the percentage of individuals living below the poverty line there is a .160 increase in the infant mortality rate.
Overall, the analysis shows that most of the statistically significant relationships between the independent variables selected for analysis in this study were with the dependent variables utilized to measure infant health outcomes compared to variables utilized to measure maternal health outcomes. Of the independent variables that had statistically significant relationships with the rate of low-birth weight babies born per county, rate of preterm births, and the infant mortality rate are the percent of individuals living below the Federal Poverty Line, the percent of individuals who spend 30% or more of their income on rent, Dissimilarity Index, rurality, and percent of births with late or no prenatal care.

Moreover, the variable that had the strongest impact on each of the variables representing infant health outcomes is the percent of individuals living below the Federal Poverty Line. This relationship is also highlighted in Figures 12-15, which illustrate the positive relationship between the variables that were utilized to represent infant health outcomes (infant mortality rate, rate of low birth weight babies, rate of preterm births) and the percent of individuals living below the Federal Poverty Line. Further, the geospatial visualizations highlight that with exceptions higher rates of low birth weight babies, preterm births, and infant mortality are concentrated in the Northern region of the state.
CHAPTER SIX: RESULTS OF QUALITATIVE DATA ANALYSIS

Community Health Needs Assessments and Community Health Improvement Plans

Overall, about half of the counties in the sample acknowledged infant health outcomes as an issue, however less than half of the 19 counties in this sample (n=7), identified infant health as a priority area on both the Community Health Needs Assessment and Community Health Improvement Plan. While seven of the counties clearly identified infant health as a priority area, none of the 19 counties directly identified maternal health as a priority area. Nonetheless, some did categorize infant health under maternal and child health and others incorporated strategies that also include pregnant and birthing people (i.e.: awareness campaigns, educational courses, ensuring access to prenatal care).

Of the counties that identified infant and/or maternal health as a priority area, most employ the same technique in identifying county-level issues and developing strategies to target them. More specifically, most counties follow the National Association of County and City Health Officials (NACCHO) and the Centers for Disease Control (CDC) Mobilizing for Action Through Planning and Prevention (MAPP). MAPP is a collaborative process, which considers community collaboration amongst stakeholders as well as community members and also emphasizes understanding health disparities and create strategies to improve health equity.

Given that that most of these seven counties utilized the same approach to identifying county-level public health issues, many discussed infant and maternal health outcomes similarly. Most often each county described trends and disparities in infant health outcomes, including infant mortality, low birth weight births, late entry into prenatal care, and other birth characteristic of the birthing person including age. To do this, the CHNAs and CHIPs often
provided data from Florida Health CHARTS on pregnancy and birth related health outcomes. Although most of the Community Health Needs Assessments highlighted county level statistics that highlight disparities in infant health outcomes, some counties more concretely connected disparities in health outcomes to social determinants of health, whilst others did not make the connection as concretely. Despite this, each of the seven counties did discuss social determinants of health either throughout the Community Health Needs Assessment or the Community Health Improvement Plan.

Furthermore, while each of the seven counties described infant health outcomes similarly, there were a few different approaches proposed by each county to improve health outcomes. For instance, some focused on increasing the percentage of parents who breastfeed, others focused on providing prenatal education and care for low-income parents, while a few counties focused specifically on reducing teen pregnancy. While strategies specifically related to infant and maternal health described varied, most focused on education and clinical interventions. For example, a few did emphasize improving health outcomes, including reducing rates of preterm and low birth weight births by increasing access and early entry access to prenatal care.

Another county who also including maternal and child health as priority listed their goal as “promote healthy birth outcomes.” To do this, the objectives they created were reduce the rate of mothers who smoke during pregnancy and increase the percentage of mothers who initiate breastfeeding by 5%. Similarly, many other counties suggested increasing education on breastfeeding to increase the number of parents who initiate breastfeeding and reduce disparities between the number of white and black women who initiate breastfeeding.
While education is a key component to public health, it is also important that parents have the ability to breastfeed, which also requires various levels of social support given the time constraints breastfeeding poses and the inability for parents to breastfeed once they work. The Health Impact Pyramid, also referenced in some Community Health Needs Assessments, highlights that strategies that have the greatest impact on a population often target address socioeconomic factors that contribute to poor health outcomes as opposed to strategies that increase individual effort and seek to improve individual behaviors (Frieden 2010). Although most strategies focused on individual behaviors, many did acknowledge social factors that impact maternal and infant health outcomes throughout the documents and many also incorporated improving social determinants of health including housing stability, transportation, and income inequality.

Moreover, aside from the seven counties that directly identified infant health outcomes as a priority area, six incorporated strategies that aim to improve infant and/or maternal health under other priority areas like health disparities, creating a healthier county, healthy weight, improve chronic disease etc. Most of the strategies listed specifically relating to infant or maternal health focused on either increasing breastfeeding support or reducing teen pregnancy through education as well. For example, one county who did not list maternal health as a priority area, sought to “raise awareness of healthy choices (i.e.: behaviors and breastfeeding) and their impact on chronic and infectious disease.” The goal of this priority area is “to inform the community about the impact of health on quality of life and life expectancy.”

Lastly, the remaining six counties did not identify infant health as a priority area, nor did they incorporate strategies to improve infant and/or maternal health under any other priority area.
Although those remaining six counties did not identify infant health as a priority area nor incorporate strategies to improve infant and/or maternal health under any other priority area, one of those counties did acknowledge that infant health outcomes are an issue and that given the number of issues, they felt the Healthy Start program already filled the need to improve infant health outcomes.

Further, while none of the 19 counties identified maternal health as a priority area and only 13 either identified infant health as priority area or incorporated strategies to improve infant health under other priority area, all 19 counties did address social determinants of health and health equity in their Community Health Needs Assessments and Community Health Improvement Plans with a few even making health disparities or social determinants of health, like poverty and housing, a priority area. Even though most of the Community Health Needs Assessments and Community Health Improvement Plans discussed social determinants, health disparities, and health equity, they level each county incorporated these concepts into their strategies significantly varied. As mentioned, some counties incorporated social determinants of health and health disparities as a priority area for targeted improvement, while others just referenced the concepts in explaining the needs assessment process, but never mentioned them again in the analysis, identification of priority areas, or strategies for improvement.

Healthy Start Websites

After reviewing each of the Community Health Needs Assessments and Community Health Improvement Plans to assess how each of the 19 counties conceptualizes and prioritizes infant and maternal health, each county’s Healthy Start Coalition website was analyzed for
themes to further examine how goals of each Coalition align with the data that suggest causes of poor health outcomes are rooted in societal or structural social determinants of health.

In total, there were eight Healthy Start Coalitions that represented the 19 counties with the worst infant health outcomes in the state. Of those eight Coalitions, two shared the same website, so only seven websites were reviewed in this study. Further, of those seven websites, most were active, however one solely functioned via Facebook, and another did not seem to have updated materials.

In examining the content on each Coalition’s website, it became evident that each county’s Coalition hosts similar programs, or at least a core set of programs. In addition to the Healthy Start program, most Coalition’s also have a (1) Connect, which connects pregnant people in need of services with services throughout the county, (2) Nurse-Family Partnership, which provides in-home visits throughout the pre- and post-natal period, and (3) a dad’s education program. For the most part, these programs are largely consistent since they function under the Florida Healthy Start Coalition.

While those were the Healthy Start, Nurse-Family Partnership, and Connect programs were most common, some Coalitions had other programs focused on safe sleep, teen pregnancy, substance misuse and use disorder, safe haven for newborns, an infant home visiting programs, and one Coalition has a doula program coming soon as well. In addition to these programs, many websites also provided a list of resources for those in need of social services related to socioeconomic causes of poor health, or social determinants of health. Lists included resources for United Way, Medicaid, Women, Infants, and Child (WIC) Program, mental health and substance use disorder counseling, health care providers, childcare, employment services, public
transportation, housing, food and clothing assistance, utilities assistance, crisis centers, and homeless shelters. Of the coalitions who listed resources, two provided the lists via separate pdf per county with a list of resources by topic. Alternatively, while some coalitions provided detailed resources, one coalition created a tab for social determinants of health and specifically used it to explain what social determinants of health and health disparities are but did not provide any localized resources.

All together the findings from the qualitative data highlight that counties do understand that there are elevated rates of adverse pregnancy related health outcomes and adverse infant health outcomes prevalent within the population, however many do not consider it to be a priority issue. Nonetheless, throughout the Community Health Needs Assessments, Community Health Improvement Plans, and Healthy Start Coalition websites there are multiple references to the impact of social determinants of health on health and infant and maternal health outcomes specifically.
CHAPTER SEVEN: DISCUSSION AND CONCLUSION

Given the persistent disparities in infant and maternal health outcomes when compared to both other countries and amongst demographic groups within the country (OECD 2023) and the role of local-level communities as sites in which social factors directly impact health outcomes (Dagher and Linares 2022), the purpose of this study is two-fold. First, this study sought to understand the relationship between local-level social determinants of health and infant and maternal health outcomes across the state of Florida. Following, based on the findings of the statistical analysis and the role of local public health departments in improving health outcomes, this project sought to understand the role of the local public health system in improving infant and maternal health outcomes.

To do this, a mixed-methods analysis was conducted utilizing quantitative and qualitative data. First, a statistical analysis was run to assess whether there was a relationship between the selected social determinants of health, including variables that represent access to prenatal care, housing stability, racial segregation, income inequality, and environmental factors and infant and maternal health outcomes. Following, using the quantitative data, ArcGIS was utilized to create a visual representation of all statistically significant relationships. Lastly, the qualitative data, including Community Health Needs Assessments, Community Health Improvement Plans, and Healthy Start websites, were analyzed qualitatively and quantitatively for themes derived from both the literature and guiding research questions for this study.

Major Findings

Findings of the quantitative analysis showed that a handful of the selected independent variables representing county-level social determinants of health had statistically significant
relationships with the dependent variables selected to measure infant health outcomes. Overall, the findings suggest that amongst the 67 counties in Florida, there are statistically significant relationships between the percent of individuals living below the Federal Poverty Line per county, rurality, the percent of individuals who spend 30% or more of their income on rent, the Dissimilarity Index, the percentage of births with late or no prenatal care, and infant health.

Of the independent variables that had statistically significant relationships with infant health, the variable that had the most impact on the infant mortality rate, rate of preterm births, and rate of low birth weight births was the percent of individuals per county living below the Federal Poverty Line. Further, when assessing the relationship between the independent variables (percentage of births with late or no prenatal care, the Dissimilarity Index, the percentage of individuals living below the Federal Poverty Line, and rurality) and the infant mortality rate, the findings of the multivariate nested linear regression model suggests that the percentage of individuals per county living below the Federal Poverty Line renders tall other independent variables while still accounting for about 40% of the variation in the infant mortality rate per county.

Although it appears that the percentage of individuals living below the Federal Poverty Line is the strongest predictor of infant and maternal health in the dataset, the findings also suggest that other social determinants, including residential racial segregation (the Dissimilarity Index), rurality, the percentage of persons per county who pay over 30% of their income on rent, and the percentage of births with late or no prenatal care, also impact infant health outcomes throughout the state. This is evident in the results of the bivariate correlations and the fact that the Dissimilarity Index, the percentage of individuals who spend 30% or more of their income on
rent, and the percentage of births with late or no prenatal are not rendered insignificant when including the percentage of individuals living below the Federal Poverty Line into the other multivariate models assessing factors that impact the rate of low birth weight and preterm births.

In addition to the findings from the statistical analysis, when uploading the quantitative data to ArcGIS, the geospatial visualization illustrates regional differences in outcomes across the state. More specifically, the maps suggest that higher rates of low birth weight babies, preterm births, and infant mortality are also concentrated in the Northern region of the state. Altogether, with exceptions, the findings from the geospatial and statistical analysis are fairly consistent with the literature and also support the premises of the theory of fundamental causes as well.

First, it should be noted further inquiry is needed to understand the relationship between the Dissimilarity Index and infant health outcomes at the census tract or zip code level throughout the state. The relationship should be examined further because the findings suggest that, contrary to the literature, counties with higher rates of residential segregation based on the Dissimilarity Index report lower rates of preterm and low birth weight births. This should be explored further because while this relationship appears statistically significant, as a base line both the state of Florida and a majority of its counties report disparities in infant health outcomes. Since most counties still report disparities in infant health outcomes when comparing outcomes between racial groups, the findings can also suggest that there may be more stark differences in infant health outcomes between white and black babies in more segregated counties, or in other words, more positive outcomes infant health outcomes present amongst white babies may be skewing the county averages. Because of this issue, outcomes should be compared at the
neighborhood or census tract level to assess how outcomes vary between racial groups based on the Dissimilarity Index. Given that most counties in Florida report poor outcomes when compared to national and international averages as well as statistically significant disparities in outcomes between white and black mothers and infants, the findings may also suggest that areas with increased homogeneity provide alternative protective factors, which can include increased social support and less frequent encounters of interpersonal racism and discrimination.

Although further inquiry is needed to understand the relationship between the Dissimilarity Index and infant health outcomes, findings of the bivariate correlations and multivariate regression models suggest that there is a relationship with residential racial segregation, income inequality, access to care, and infant health outcomes. Even though these relationships vary, the overall findings are consistent with the literature that highlight how social conditions, including residential segregation, SES, and geographic location, impact health outcomes, including infant health outcomes (Cockerham 2017; Cockerham 2013a; Braveman et al. 2010; Braveman, Egerter, and Mockenahupt 2011; Pampel, Krueger, and Denney 2010; Barr 2019; Dagher and Linares 2022).

While the findings of this study do not align with the current literature that indicates a strong relationship between racism, poverty, and poor health outcomes, as described above, this deviation may be able to be explained by the fact that as a baseline Florida reports poor infant and maternal health outcomes with stark disparities in infant and maternal health outcomes between white and black women and babies in an overwhelming majority of Florida’s counties. Because of this, it’s imperative to explore this relationship more in-depth at a localized level. However, the remainder of the findings are still in alignment with the literature which highlights
the positive relationship between poor social conditions and poor health outcomes. More specifically, despite the fact that the findings suggest that the percentage of individuals living below the Federal Poverty Line was the independent variable that had the strongest impact on infant health, the other variables that had statistically significant impact on infant health outcomes, including rurality, the percentage of individuals paying more than 30% of their income on rent, and the percentage of births with late or no prenatal care, are consistent with findings from previous studies (Hung et al. 2017; Barr 2019; Ehrenthal, Kuo, and Kirby 2020; Dagher and Linares 2022).

First, previous research has found a relationship between neighborhood deprivation and increased poverty levels and poor health broadly, including infant and maternal health outcomes (Barr 2019; Dagher and Linares 2022) supports the results that indicate statistically significant relationships between poverty levels and the percent of individuals paying more than 30% of their income on rent per county and infant health outcomes. Further, a few studies indicate that limited access to quality obstetric care is associated with poor infant health outcomes (Hung et al. 2017; Ehrenthal, Kuo, and Kirby 2020; Dagher and Linares 2022), which also supports the findings suggesting statistically significant relationships between rurality, late or no access to prenatal care, and infant health outcomes. This is also evident in the studies that assess urban-rural differences in health outcomes, which also indicate worse outcomes in more rural areas which has largely been ascribed to be an issue related to access to care following the decline of hospital and obstetric services in rural areas across the U.S. (Hung et al. 2017; Kozhimannil et al. 2019; Dagher and Linares 2022).
Furthermore, while not all of the social determinants in the dataset had statistically significant relationships with infant health, the findings generally support the overarching premise of the theory of fundamental causes, which highlights how social factors linked to socioeconomic status influence health outcomes consistently over time despite interventions (Phelan et al. 2004; Link and Phelan 1995). This is evident in the results that indicate that increasing poverty levels are related to higher infant mortality rates as well as rates of preterm and low birth weight births. Since rates of preterm and low birth weight births are some of the leading causes of infant mortality, these findings fit within the first and second criteria of the theory of fundamental causes indicating that a social condition is a fundamental cause if it impact multiple disease outcomes through multiple pathways.

Next, the third criteria of the theory of fundamental causes is that the social condition must also impact access to resources. While the data presented in the tables do not exactly highlight this, the bivariate correlations between the independent variables suggest a moderate relationship between the percentage of individuals living below the poverty line and the percentage of births with late or no care and births with adequate care suggesting that poverty also impacts access to resources. Fourth, despite the persistent interventions of Healthy Start Coalitions, it appears that the relationship between the percentage of individuals living below the Federal Poverty Line and poor infant health outcomes is persistent over time.

Moreover, the results of the qualitative analysis highlighted that amongst the counties with the worst infant health outcomes, many county-level health departments did not consider infant and maternal health as a priority area for improvement. Although a majority of counties did not consider infant and maternal health as a priority area, some did incorporate strategies to
improve infant and maternal health within other priority areas, like Healthy Weight, Overall Health, or Health Disparities.

Additionally, throughout the Community Health Needs Assessments and Community Health Improvement Plans, all of the 19 counties selected for analysis discussed social determinants of health and health equity in a handful of ways. While all 19 counties acknowledged social determinants of health and health equity, the level in which these concepts were incorporated within improvement strategies varied significantly. Although many counties did attempt to incorporate strategies that focus on improving social factors that influence infant and maternal health outcomes, most strategies focused on individual-level behaviors, like increasing educational awareness and clinical intervention.

While strategies that aim to increase individual effort and individual behavior are important, as indicated by the Health Impact Pyramid, they are limited in the impact they can make across at the population-level (Frieden 2010). Moreover, the Health Impact Pyramid indicates that strategies that have the ability to make the most impact at the population level often target socioeconomic factors that influence health. Although the CHNAs and CHIPs suggest that many of the counties are striving to improve social conditions that impact health, previous literature suggests that when there are stronger collaborations amongst infant and maternal public health providers and other social service agencies maternal and infant health outcomes improve (Quinlan, Mitchell, and Hays 2023). Further, these findings are also supported by the growing literature that argues the importance of understanding structural determinants of health and targeting root causes of health inequities alongside interventions that target individual level behaviors given the persistence of health inequities over time (Crear-Perry et al. 2021).
Limitations

While the analyses of this study did yield significant results, there are a few limitations of this study. The first limitation to note is the limited number of cases in the statistical analysis, which can both impact the results of the statistical analysis and limits the generalizability of the findings. Although there were only 67 cases in the dataset, they did represent the entirety of the population of this study (Florida counties). Further, since this intent of the study was to focus on Florida counties, generalizability was not the goal and instead this data should only be interpreted as relevant amongst the counties included in the analysis.

Further, the second limitation to this study is that all the data (both quantitative and qualitative) were limited to what was publicly available online. In terms of the quantitative data, by having access to a larger dataset, like PRAMS, additional measures may have been included to further our understanding of the relationships between local-level social determinants of health and infant and maternal health outcomes. Following, the qualitative data was also limited to the Community Health Needs Assessments, Community Health Improvement Plans, and Healthy Start Coalition website content. While this provides a good starting point to understand how the local-level public health departments and Healthy Start Coalitions understand and aim to improve infant and maternal health outcomes, it would be beneficial to continue this research by conducting interviews with local public health providers per each county.

Moreover, another possible limitation is that while the variables were representative of a five-year time frame, given the fact that social determinants of health impact individuals throughout the life course and not all individuals live in the counties they are born into throughout their life course, these data are limited in what they can explain about the individual
impact of social determinants of health. To understand how social factors influence health over the life course, longitudinal data at the individual level may be more appropriate. However, this study sought to understand county-level social factors associated with poor infant and maternal health outcomes.

*Future Research*

Although the study is not generalizable because of the small sample size, it can be utilized as a starting point to understand how community level social determinants of health impact infant and maternal health outcomes throughout the state of Florida. The analysis and data can be expanded on in a number of ways, including exploring differences at the census tract-level and by incorporating more variables that might better account for or better measure the social factors that impact infant and maternal health outcomes, including the Index of Concentration at the Extremes. By both exploring these outcomes at a neighborhood level via census tracts and expanding on the variables incorporated in the analysis, a more in-depth understanding can be acquired about the findings from this study, including the relationship between the Dissimilarity Index and infant health outcomes.

Additionally, the qualitative data can be expanded on in a few ways. First, to gain a better understanding of how the county-level infant and maternal public health system operates and understands infant and maternal health, interviews can be conducted with Healthy Start and health department representatives throughout the state. Following, given the complex nature of how social determinants of health impact infant and maternal health through individual, interpersonal, community, and societal factors, it would be important to conduct interviews with providers and people who have recently given birth per each county. To incorporate an equity
focus, it is imperative to incorporate the voices of non-white people who have given birth in Florida recently.

Conclusion

Overall, given the persistence of poor infant and maternal health outcomes over time and the role local-level communities play as sites in which social factors directly impact individual health (Dagher and Linares 2022), this study sought to understand both the relationship between local-level social determinants of health and infant and maternal health outcomes in Florida as well as the role local health departments in Florida play in improving infant and maternal health outcomes. To do this, a mixed methods analysis was employed using quantitative, geospatial, and qualitative data.

From the analysis, the findings suggest that there are significant relationships between the Dissimilarity Index, the percentage of individuals per county living below the Federal Poverty Line, the percentage of individuals per county who pay 30% or more of their income on rent, rurality, the percentage of births per county with late or no prenatal care, and the variables utilized to measure infant health outcomes in this study. More specifically there were positive relationships between the percentage of individuals per county living below the Federal Poverty Line, the percentage of individuals per county who pay 30% or more of their income on rent, rurality, the percentage of births per county with late or no prenatal care, and the infant health outcomes suggesting that as poverty levels, the percentage of people paying more than 30% of their income on rent, rurality, and the percentage of births with late or no prenatal care increased so did the infant mortality rate, rate of preterm births, and rate of low birth weight births per county.
Further, when assessing the role of the local health department in improving infant and maternal health outcomes throughout the counties with the worst reported infant health outcomes, over half of the counties in the sample did not consider infant or maternal health a priority issue. Moreover, many counties who did incorporate strategies to improve infant and maternal health in their health plans, most strategies (with exceptions) related to improving infant and maternal health outcomes focused on improving individual behaviors as opposed to social determinants of health. Although strategies tended to focus on individual behaviors, all the counties in the sample did discuss social determinants of health throughout the Community Health Needs Assessments, Community Health Improvement Plans, and the Healthy Start Coalition websites. While further research is needed to understand some of these statistically significant findings, the results do suggest that community level social factors do impact infant health outcomes at the county-level. This contributes to the current literature in understanding the pathways in which social determinants impact health and how they vary based on social location.
APPENDIX A: INSTITUTIONAL REVIEW BOARD APPROVAL LETTER
EXEMPTION DETERMINATION

June 12, 2023

Dear Jacquelyn Reiss:

On 6/12/2023, the IRB determined the following submission to be human subjects research that is exempt from regulation:

<table>
<thead>
<tr>
<th>Type of Review:</th>
<th>Initial Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title:</td>
<td>Local-Level Infant and Maternal Health: A Mixed-Methods Analysis of the Relationship Between Local-Level Social Determinants of Health, Maternal and Infant Public Health Programs, and Maternal and Infant Health Outcomes throughout the State of Florida</td>
</tr>
<tr>
<td>Investigator:</td>
<td>Jacqueline Reiss</td>
</tr>
<tr>
<td>IRB ID:</td>
<td>STUDY00005663</td>
</tr>
<tr>
<td>Funding:</td>
<td>None</td>
</tr>
<tr>
<td>Grant ID:</td>
<td>None</td>
</tr>
</tbody>
</table>
| Documents Reviewed: | • HRP-251-FORM-Reiss, Category: Faculty Research Approval;  
• IRB Reiss 5663 HRP-255-SR-Form V2, Category: IRB Protocol; |

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made, and there are questions about whether these changes affect the exempt status of the human research, please submit a modification request to the IRB. Guidance on submitting Modifications and Administrative Check-in are detailed in the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within the IRB system. When you have completed your research, please submit a Study Closure request so that IRB records will be accurate.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu. Please include your project title and IRB number in all correspondence with this office.

Sincerely,

[Signature]

Page 1 of 2
APPENDIX B: LIST OF QUALITATIVE DATA SOURCES
<table>
<thead>
<tr>
<th>County</th>
<th>Healthy Start Coalition Name</th>
<th>Healthy Start Website</th>
<th>CHNA + CHIP Links</th>
</tr>
</thead>
</table>
REFERENCES


Centers for Disease Control and Prevention. 2014. Fourth National Exposure Report, Updated Tables; Centers for Disease Control and Prevention: Atlanta, GA, USA.


