2022

Relationship between Income, Maternal and Infant Factors, and Infant Mortality Rates in African American Communities

Kristen Newman
Walden University

Walden University

College of Health Professions

This is to certify that the doctoral study by

Kristen Newman

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Loretta Shields, Committee Chairperson, Public Health Faculty
Dr. Hebatullah Tawfik, Committee Member, Public Health Faculty
Dr. Namgyal Kyulo, University Reviewer, Public Health Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2022

Abstract

Relationship between Income, Maternal and Infant Factors, and Infant Mortality Rates in African American Communities

by

Kristen Newman

MPH, American Public University, 2013

BSN, The Catholic University of America, 1993

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

Walden University

May 2022

Abstract

Infant mortality is a significant public health issue that provides insight into the health of a community. The purpose of this study was to examine whether a relationship existed between infant mortality and median income by zip code, maternal factors, and/or infant factors in the affluent, African American community of Prince George's County, Maryland. The research theory chosen for this study was the conceptual framework for action on the social determinants of health based upon its action-oriented focus. The secondary data used for this study was linked birth and infant death data for 2010 to 2016 collected by the Department of Vital Statistics at the Maryland Department of Health. A logistic regression showed no clear relationship between income and infant mortality but did show a relationship between infant mortality and several of the maternal and infant factors studied when all births from 2010 to 2016 were analyzed. The odds of infant mortality was higher amongst mothers: ≤ 18 years of age (OR=0.84 95% CI [0.74, 0.96]), with no diploma or GED (OR=1.07 95% CI [1.00, 1.14]), without PNC (OR=1.12 95% CI [1.13, 1.27]), who had multiple terminations or losses (OR=1.23 955 CI [1.15, 1.31]), and were obese at delivery (OR=1.22 95% CI [1.11, 1.35]). The odds of infant mortality was higher amongst infants: ≤ 23 weeks gestation (OR=0.27 95% CI [0.22, 0.34]), weighing < 1000grams (OR=0.46 95% CI [0.39, 0.54]), and were identified as not breastfed at discharge (OR=1.72 95% CI [1.50, 1.99]). Key stakeholders working to improve infant mortality in Prince George's County, Maryland can apply the results of this study to develop new public health programs, engage the community in prevention activities, and enhance current programmatic activities. Supporting non-Hispanic Black women of childbearing age and future generations through improved maternal and infant outcomes will be a platform for positive social change to be replicated.

Relationship between Income, Maternal and Infant Factors, and Infant Mortality Rates in African American Communities

by

Kristen Newman

MPH, American Public University, 2013

BSN, The Catholic University of America, 1993

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

Walden University

May 2022

Dedication

This study is dedicated to improving perinatal outcomes for women in Prince George's County Maryland and working to understand how health outcomes can be improved while ensuring equity is central to that mission.

Acknowledgments

I want to acknowledge my husband and family who have encouraged and supported me throughout this journey. Thank you for pushing me to seek more.

Thank you to Dr. Shields for keeping me on track when I found myself overthinking the process, your guidance, and your support it is so appreciated. I would also like to thank Dr. Tawfik and Dr. Kyulo for their assistance throughout the process.

Table of Contents

List of Tables

List of Figures

Section 1: Foundation of the Study and Literature Review

Introduction to the Study

Infant mortality has been identified as an indication of the health of a community, population, or nation (Centers for Disease Control and Prevention, 2015). This health metric is measured in deaths per 1,000 live births and is one of the maternal child health indicators for the Healthy People 2020 initiatives here in the United States. The Healthy People 2020 goal is to decrease infant mortality in the United States to 6.0 deaths per 1,000 live births by 2020 (Office of Disease Prevention and Health Promotion, 2017). The challenge with this goal is the focus on overall infant mortality rate and not specifically the increasing health disparity that exists for African American infants. African American infants are 2 to 3 times as likely to experience infant mortality than their Caucasian counterparts (Centers for Disease Control and Prevention, 2016). The social determinants of health have been attributed as factors that contribute to infant mortality outcomes and fall under one of five categories: economic stability, education, social and community, health and health care, and neighborhood environment (Healthy People 2020, 2017). Studies of the social determinants of health indicate that there is an intricate relationship between intergenerational poverty, the absence of financial opportunity, and income disparities (Christopher & Simpson, 2014).

Problem Statement

Prince George's County, Maryland is proclaimed as the most affluent African American community in the United States, yet infant mortality remains a significant public health issue there (Proctor, 2017; United States Census Bureau, 2017). Despite a

decrease in the overall infant mortality rate over the past decade, the health disparity for this important health indicator continues to rise (Cheng & Solomon, 2014; Lu & Johnson, 2014; Maryland Vital Statistics, 2015). Recent data show that in 2015, the overall infant mortality rate in this community was 8.9 deaths per 1,000 live births and the rate in the African American community was 13.0 deaths per 1,000 live births (Maryland Vital Statistics, 2016). The infant mortality rate in the African American community in 2014 was 2.8 times that of their Caucasian counterparts. This health disparity showed a marked increase in 2015 when the African American infant mortality rate rose to 4.5 times that of the Caucasian rate (Maryland Vital Statistics, 2016). While this increase is significant and concerning, public health officials have been unable to link this to a definitive reason. The state of infant mortality in Prince George's County Maryland warrants further investigation by the public health community.

Material wellbeing has been directly correlated with health behaviors and outcomes around the world. The impact that wealth has upon health outcomes is evident in developing countries that are experiencing economic growth (Maxwell, 2014). In the United States, poverty is quantified through the federal poverty level which places a monetary value upon the amount of money required for an individual or a family to meet the basic needs of food, shelter, and clothing. The 2017 federal poverty level (FPL) for a family of four is $24,600 (100% FPL) however, to qualify for Medicaid benefits, the income can be equal to or less than $32,718 based upon the Affordable Care Act (Families USA, 2017; National Archives and Records Administration, 2017) An indication of poor economic status, poverty is one of the social determinants of health

that can be directly linked to increases in infant mortality rates (Hauck et al., 2011; Kimball & Wissner, 2015).

Knowing that Prince George's County Maryland is known for its affluence in the African American community, it is important to understand why this wealth has not improved infant mortality for this population. Affluence means that one has wealth, property, and/or material possessions which is the direct opposite of poverty. Based upon the 2016 American Community Survey 1-year estimates, the overall median household income in Prince George's County was $79,184 and in the African American community, the median household income was $79,082 (United States Census Bureau, 2016). In contrast to the affluent Prince George's County, the median household income in State of Mississippi was $41,754 in 2016 while the median household income in the African American community was $29, 381 (United States Census Bureau, 2016). The poorest state in the United States, Mississippi has the highest overall infant mortality rate of any state in the United States at 9.2 deaths per 1,000 live births and 13.0 deaths per 1,000 live births in the African American community (Mississippi State Department of Health, 2016). These rates almost mirror those of Prince George's County and are in opposition of what one would expect in the presence of affluence. As current data indicates affluence has not improved infant mortality in this African American community (Horon et al., n.d.). Examining maternal child health characteristics and maternal child health indicators for both populations may provide important insight into why the infant mortality rates under affluence and poverty show no significant difference. Researchers have shown that affluence should improve infant mortality outcomes however that is not

the case in the African American community in Prince George's County (Huynh et al., 2017). This study seeks to understand the relationship of affluence to infant mortality rates and what maternal and/or child characteristics are influencing current outcomes.

Purpose of Study

The purpose of this quantitative study was to examine possible factors negatively impacting the infant mortality rate in an affluent African American community producing rates similar to that of African American women in Mississippi. Using a correlational design, maternal infant factors for non-Hispanic Black infant deaths in Prince George's County, Maryland were examined in an effort to understand what is impacting the infant mortality rate despite higher-than-average median income levels. The study population included all non-Hispanic Black infant deaths in Prince George's County, Maryland with a linked birth death certificates that died between 2010 and 2017.

The dependent variable was infant deaths (any death prior to one year of life). The independent variables hypothesized as possible contributing factors for infant mortality in Prince George's County were chosen based upon factors that have been indicated in previous studies as contributors or potential risk factors for infant mortality and include: maternal age, zip code at delivery, insurance, previous negative outcomes, birth weight, gestational age at birth, and breastfeeding.

Research Questions and Hypothesis

Research Question 1: Is there a relationship between median income by zip code and infant mortality in the African American community in Prince George's County, Maryland?

$H_0$1: There is no relationship between median income by zip code and infant mortality in the African American community in Prince George's County, Maryland.

$H_1$1: There is a relationship between median income by zip code and infant mortality in the African American community in Prince George's County, Maryland.

Research Question 2: Is there a relationship between infant mortality and maternal factors, including maternal age, maternal education, trimester prenatal care began, maternal smoking, insurance, previous premature birth, previous negative outcomes, and co-morbidities (hypertension, diabetes, or obesity)?

$H_0$2: There is no relationship between infant mortality and maternal factors including maternal age, maternal education, trimester prenatal care began, maternal smoking, insurance, previous premature birth, previous negative outcomes, and co-morbidities (hypertension, diabetes, or obesity)?

$H_1$2: There is a relationship between infant mortality and maternal factors including maternal age, maternal education, trimester prenatal care began, maternal smoking, insurance, previous premature birth, previous negative outcomes, and co-morbidities (hypertension, diabetes, or obesity)?

Research Question 3: Is there a relationship between infant mortality and infant factors including birth weight, gestational age at birth, and breastfeeding?

$H_0$3: There is no relationship between infant mortality and infant factors including birth weight, gestational age at birth, and breastfeeding.

$H_1$3: There is a relationship between infant mortality and infant factors including birth weight, gestational age at birth, and breastfeeding.

Theoretical Framework

The conceptual framework for action on the social determinants of health (CSDH) was chosen for this study (Solar & Irwin, 2010). Research has shown that individuals are more inclined to adopt protective health behaviors and strategies when they possess or have access to knowledge, money, power, and social status in comparison to those who do not (Solar & Irwin, 2010). Previously, the life course perspective has focused upon managing the social determinants of health throughout every phase of development to improve outcomes and long-term health within a population. This theory has often been employed to improve infant mortality outcomes within target populations and communities through programs seeking long-term behavioral and health changes throughout the life course (Lu et al., 2010). While this theory has shown promising results, it was shown to be most effective in conjunction with other theoretical frameworks. The CDSH framework has been further developed as an action-oriented framework that identifies specific recommendations that when implemented will promote change at both the individual and policy levels to aggressively address the social determinants of health (Solar & Irwin, 2010). The key components of this framework concentrate upon: the sociopolitical background; structural determinants and socioeconomic status; and intermediary determinants. When looking at the structural determinants of this framework, health inequalities and income along with education are used to conduct an analysis of socioeconomic status (Solar & Irwin, 2010). Once these variables are understood, the role of social class and ethnicity can be considered in relation to these variables. Infant mortality is a complex public health issue that is

significantly impacted by the social determinants of health. Seeking to understand the impact of affluence on infant mortality, requires an in-depth examination of the relationships that influence these negative outcomes. Factors known to contribute to poor maternal-infant health outcomes were evaluated using this framework to determine how maternal-infant health is impacted in Prince George's County with known affluence. Understanding any correlations may provide insight into the increased poor outcomes in the presence of the proclaimed affluence in this county, and what steps need to be taken to address the health of this population. The ability to produce social change in Prince George's County, Maryland requires that change occurs at multiple levels in the public health continuum. The conceptual framework for action on the social determinants of health was able to provide an appropriate framework for dissecting this significant public health issue and identify how affluence fails to improve current outcomes.

Nature of the Study

The nature of this study was a multilevel cross-sectional quantitative study to understand the continued poor maternal-infant outcomes in Prince George's County, Maryland despite the presence of affluence. In this multilevel study, linked birth and death data were examined to gain insight into the relationship between affluence and infant mortality outcomes in this community. This study sought to further examine the relationship of maternal and infant factors on infant mortality rates of African American infants in Prince George's County. Maternal and infant factors for infant deaths in Prince George's County were analyzed based upon information provided on the infant's birth certificate at time of birth to gain insight into factors that are impacting infant mortality

outcomes in the county despite the median income level in the county overall. Infant mortality data was reviewed in a retrospective analysis of linked birth/death records from 2010-2017, focusing on fifteen to twenty maternal and infant health indicators such as: maternal age, zip code at delivery and death, maternal education, start of prenatal care, gestational age at birth, and weight at birth. Mean income by zip code was also considered to assess the relationship between affluence (median income) and infant mortality in specific zip codes. This quantitative analysis of factors influencing infant mortality rates provided data that can be used to better understand the high incidence of infant mortality in the African American community in Prince George's County despite the noted affluence there.

Literature Review

Whether it is race, education, housing, or healthcare access one's income level impacts their ability to achieve positive health outcomes. One would expect that the higher their income rises, the better their health outcomes will be. Infant mortality outcomes in the African American community continue to be 2.5 times or more than their Caucasian counterparts even in the presence of affluence. The following review of literature was conducted to examine the relationship between income and infant mortality amongst African Americans. This review focused on current published literature and information that considered the impact of wealth on health outcomes with a specific focus on infant mortality and the African American community.

Articles were obtained for this literature review utilizing a variety of databases and websites focusing primarily on articles published within the last five years. The Walden University library was the primary resource used to identify articles through searching the following databases: EBSCO Thoreau, CINAHL, MEDLINE, and Sage Journals. Full text, peer reviewed articles were retrieved in PDF format and 72 were considered. Additional sites searched included Proquest, Google Scholar, the March of Dimes, and the Maternal Child Bureau under Health and Human Services. Though these sites provided numerous articles, many were focused on infant mortality outcomes in other countries and were not in the context of the desired literature for this review. The search words used to identify articles for consideration include: wealth, income, poverty, money, preterm birth, income inequality, infant mortality, health, African American, black, and affluence.

Poverty and Infant Mortality

The social determinants of health are risk factors known to contribute to infant mortality outcomes in the African American community and are defined by the Centers for Disease Control and Prevention (2018a) as "the conditions in the places where people live, learn, work, and play." Researchers have consistently demonstrated the strong relationship between poverty and infant mortality. Individuals within the lowest income tiers in the United States are at highest risk for experiencing infant death regardless of race or ethnicity (Reno & Hyder, 2018). Beyond individual risk for infant mortality in the

presence of poverty, is neighborhood poverty, which further compounds the risk for higher rates of infant mortality in that community.

The presence of this disadvantaged socioeconomic status according to Lorenz et al. (2016) lends itself to negatively impact health by influencing things such as personal health behaviors, access to care, and availability of community resources. While this further compounds the impact of poverty on overall infant mortality rates, African Americans statistically have the highest infant mortality rate of all racial and ethnic groups in the presence of poverty. This knowledge that poverty results in increased rates of infant mortality would lend one to believe that the opposite is true.

Health Outcomes and Income

Higher incomes have been associated with improved health outcomes and increased life expectancy. The need to understand the correlation between wealth and health continues to grow as current literature indicates that social and socioeconomic factors, are prevalent in shaping both individual and community health. This indicates the existence of a significant gap in the literature which is compounded by the countries insufficient health policies at all levels relative to measures that address socioeconomic disparities impacting the nations' health (David & Collins, 2014). Braveman and Gottlieb (2014) pointed out that income, wealth, and education contribute to outcomes in a wide range of prominent health issues. Disparities in any of these socioeconomic contributors can lead to poor health outcomes.

Egerter et. al., in 2011 identified three pathways by which educational attainment can positively impact health. As individuals continue to increase their educational attainment it impacts the following: health knowledge, literacy, and problem solving; the positions, work environment and income; and their overall social status. Egerter et. al. demonstrated that through increased health knowledge, literacy and problem solving, individuals were more aware of the impact and importance of diet, exercise, and the dangers of smoking all of which led to improved health outcomes. Educational attainment provides the potential for professional work environments and elevated positions that provide improved working conditions, higher salaries, and access to work sponsored resources. These health-related benefits provide employer sponsored health insurance plans, sick leave, and wellness programs all designed to improve overall health which leads to improved outcomes (Egerter et. al., 2011). Based upon this information, one could conclude that increased educational attainment, an indication of higher socioeconomic status, equates to improved health outcomes. Yet in 2011, Hogan et al. found that, African American women with graduate level degrees in Illinois had worse pregnancy outcomes than those of lower educational attainment. The authors used this to illustrate that despite improved socioeconomic status, racial and ethnic disparities were still present in birth outcomes amongst African American women. This poses further questions regarding the impact of income and socioeconomic status in the presence of racial and ethnic minorities.

In the United States, wealth and socioeconomic status are measured in several ways and include an individual's income, educational attainment, home ownership, and other financial accumulation. The assumption is that the more money one has the healthier they should be but wealthier does not guarantee healthier (Cole, 2019). In the African American community, low socioeconomic status has been identified as a key factor in health disparities (Wilson et al., 2017). A significant amount of the literature has focused on outcomes of African Americans of lower socioeconomic status, yet research has now extended to include racial disparities for those of middle and high-income households. Wilson et al. (2017) examined health outcomes for individual's whose incomes exceeded $175,000 to determine if there was evidence of racial and ethnic disparities in the health outcomes of this income group. Despite lower numbers of minorities identified with annual incomes greater than $175,000, the researchers accounted for this limitation and examined data over a 12-year period. While research has shown that African Americans are often seen to be vulnerable socially and economically, racial disparities are still present in studies that control for socioeconomic status (Hogan et al., 2011). This was evident in the study by Wilson et al. (2017) who showed the presence of racial disparities for health outcomes in those with higher incomes. The research further indicates that public health interventions and program planning should not use income as an inclusion or exclusion factor when developing strategies to address poor health outcomes in communities with racial and ethnic minorities (Wilson et al., 2017).

The social determinants of health are comprised of multiple factors including: socioeconomic status, social support networks, and access to care (Artiga & Hinton, 2018). Current literature has placed significant emphasis upon how poverty, unemployment, and education have impacted birth outcomes in the African American community. When considering initiatives designed to address the social determinants of health, policies and practices often focus upon those that are serviced by Medicaid and managed care plans and providers. Individuals qualifying for these services are not only evaluated for their health care needs but social concerns as well. Identified social needs are then addressed based upon various initiatives and partnerships within communities (Artiga & Hinton, 2018). While this shift in policies and practice are needed, they only benefit individuals that qualify for Medicaid services. There is no indication in the literature that privately insured individuals have the same access to care and services as their Medicaid counterparts. The more affluent African American woman who is insured by an employer sponsored health plan is not guaranteed to have better access to care. Employer based health plans are not created equal and only provide employees with coverage options that the organization chooses to include in the plan. Having health insurance alone regardless of the coverage, does not solidify access as faced by women in Prince George's County Maryland. The most recent county health rankings released in March 2019 showed that the ratio of primary health care providers to the population was 1:1870 which is significantly lower than top performers across the country who provide their residents with a 1:726 ratio (University of Wisconsin Population Health Institute,

2019). Kane et. al., 2017 further explored the impact of affluence on birth outcomes and how the presence of affluence in a community or neighborhood benefits all residents regardless of individual economic status. Knowing that preterm birth is the leading cause of infant mortality in the United States, the researchers focused on outcomes where either preterm birth or low birthweight were present.

Using the electronic birth certificate records of just over 1.2 million births in New Jersey from 1996 to 2006, Kane et. al. 2017, first geocoded the desired data and then extracted individual-level and neighborhood level data for all preterm births and low birth weight births during that period. The data were then evaluated using multilevel generalized linear regression models and two-level random-intercept models using all qualified birth data. The study showed that in neighborhoods with very high affluence there was a 19% decrease in low-birth-weight infant births in non-Hispanic Black women versus in neighborhoods with known disadvantage. In 19 of 24 race stratified models, the presence of neighborhood affluence was directly correlated to a decreased risk for poor birth outcomes (Kane et. al., 2017). Affluent neighborhoods include highly educated, wealthy residents whose presence creates stability, attracts institutions, and brings services to the community. This neighborhood affluence is for the benefit of everyone who resides within that community regardless of their individual socioeconomic status. While the literature has shown positive health outcomes in the presence of neighborhood affluence the literature fails to account for communities such as Prince George's County Maryland where affluence is present and poor health outcomes remain. When examining

other affluent communities, there are no predominantly non-Hispanic black counties where affluence is present. Each year a list of the top 10 affluent African American communities are featured however they are individual cities or communities. In 2018, seven of the top 10 communities were located in Prince George's County, Maryland. The other three communities were located in Rockland County, New York and Los Angeles County, California which had overall infant mortality rates of 3.8 and 4.2 deaths per 1,000 live births respectively (New York State Department of Health, 2019; California Department of Health, 2019). These outcomes are significantly lower than Prince George's County Maryland whose overall infant mortality rate was 8.0 (Maryland, 2019).

Infant Mortality and Income Inequality

In the United States there is a strong correlation between income inequality and premature mortality. Ecologic studies have been conducted to measure this relationship and better understand how social factors impact population health (Cooper et al., 2016). Known gaps exist in racial and ethnic measures of population health and are most evident in socioeconomic status variations amongst minority groups in relation to Non-Hispanic White outcomes. This association is illustrated through infant mortality rates and data as a fundamental measurement of overall population health (Elder et al., 2016). Previously infant mortality was thought to be primarily the result of maternal characteristics and social factors such as education, health care access, poverty, and income level. Extensive public health research has been conducted to substantiate the impact of poverty and

socioeconomic disadvantage upon infant mortality rates overall and relative to African American infants.

Infant mortality is measured in deaths per 1,000 live births, with preterm birth as the leading cause of infant mortality here in the United States (Centers for Disease Control and Prevention, 2016c). The impact of income inequality on preterm birth and to a greater extent infant mortality has not been studied extensively. Wallace et al. (2016), conducted a study that examined the impact of inequality on the incidence of preterm birth over a six-year period in 11 states and the District of Columbia. In their analysis the researchers controlled for known individual contributors to preterm birth such as age, marital status, insurance status, prepregnancy weight, substance use, pre-existing medical conditions, year of birth, and parity. Additionally, the researchers calculated the percentage of individuals in each state living below the poverty level and the unemployment rate for the year of birth to control for any state-level economic differences.

Wallace et. al (2016), used a multilevel regression to examine how increasing income inequality impacts the risk of preterm birth. They found that income inequality on average increased by 0.5% annually in all states and years although there were some years where the income inequality decreased at a greater rate or increased at a significantly higher rate. Women that delivered in areas with increased income inequality were more often non-white, single, had poorer health and were on public insurance. After controlling for individual level risk factors, any increase in income inequality at the state

level during the year preceding the birth produced a 7% increase in preterm births for that state. One finding of this study that is of special interest when examining income and the impact on poor birth outcomes was that women with public and private insurance were affected equally when it came to preterm births in the presence of increased income inequality in their state (Wallace et. al., 2016).

While there was evidence of an association between income inequality and preterm birth, the results did not differentiate whether this was apparent at all income levels. Huynh et al. (2017) also found that the incidence of preterm birth and infant mortality was more prevalent in areas where women of less privilege reside. Similar to the research of Wallace et. al., (2016), the results of this study did not account for racial and ethnic differences and the data and analysis presented was based solely on the general population. This indicates a significant gap in the literature requiring further investigation which this study is proposing to further investigate and identify why affluence in a predominantly African American community fails to improve the infant mortality rate.

Researchers Reno and Hyder (2018) conducted a systemic review focused on the social determinants of health as risk factors for infant mortality and the degree to which research has shown a link between each social determinant and infant mortality. In their review of the social determinants of health and their impact on infant mortality, their findings on poverty, neighborhood effects, and income inequality were of special interest to this body of literature. Poverty is a known contributor for driving health outcomes and

infant mortality is no exception. Reno and Hyder determined that the highest rates of infant mortality were seen in those with the lowest income rates thus preempting researchers to consider poverty as a control variable when studying infant mortality causation. Neighborhood effects look at the characteristics of specific neighborhoods and how those impact infant mortality rates within that community as a protective mechanism. Such studies have begun to examine how certain community aspects can improve outcomes of those residing there regardless of individual level factors. The third finding from their review of the literature looked at income inequality and sought to determine if a relationship existed between income inequality and infant mortality in the United States. Income inequality was examined at both the individual level and at the macro-level. The results as expected, indicated that a relationship existed however, persistent income inequality showed a greater impact on infant mortality rates compared to those who were newly exposed to income inequality (Reno & Hyder 2018). Their systemic, review further substantiates the need for studies that examine the effects of affluence on infant mortality knowing that poverty is correlated to poor health outcomes and increased infant mortality rates.

Income and African American Infant Mortality Outcomes

Public health researchers have begun to further examine the disproportionate health disparities experienced by African American women relative to birth outcomes and infant mortality rates. Previous assumptions believed that African American women possessing the necessary material and social resources to achieve positive health

outcomes should experience lower infant mortality rates than those of their impoverished counterparts (Curry et al., 2015). Kothari et al. (2017), found using the Perinatal Periods of Risk (PPOR) Assessment tool that infants weighing 500-1499 grams at birth were most likely to die from maternal health or prematurity factors. In the PPOR assessment, the maternal health/prematurity category primarily encompasses risk factors that fall under preconception health, health behaviors, and/or prenatal care. Women whose infants die due to issues during the maternal health/prematurity category may have: challenges accessing prenatal or other health care; had a previous poor birth outcome such as a prior preterm birth; chronic disease conditions such as diabetes or high blood pressure; substance use history or current substance use; or a pregnancy less than eighteen months from their last pregnancy. Additional risk factors that are identified in the PPOR assessment are age, education, whether the mother has private or public insurance, infection(s), nutrition, and inadequate to no prenatal care. Kothari et. al (2017) noted that above risk factors or behaviors identified during the preconception and prenatal periods placed black infants at the greatest risk due to an increase in preterm birth and low birth weight outcomes within the sample population. As previously stated, premature birth is the leading cause of infant mortality in the African American community and risk was not impacted by the mothers' higher socioeconomic status.

African Americans, Affluent Neighborhoods, and Health Outcomes

Kane et al. (2017) examined birth outcomes and neighborhood influences within the context of affluence. Affluent neighborhoods are an indication of highly educated,

wealthy residents that are generally employed in prestigious occupations. The affluent neighborhood encourages the presence of local institutions designed to create stability within the community while providing for the needs of residents. The presence of neighborhood affluence provides specific implications for health in the availability of institutions that are designed to promote health and benefit all residents of the neighborhood regardless of individual socioeconomic status (Kane et al., 2017). Based upon the results of this study, the incidence of infant mortality in affluent neighborhoods should decrease for the affluent residents living in that neighborhood.

Theoretically, improved birth outcomes in neighborhoods of affluence should be the expected result, however, this is not the experience of African Americans. The Brookings Institution highlighted 124 majority Black cities in the United States in which African American incomes outpace the national average (Perry, 2017). In each of the 124 cities, the population was less than 100,000 people with incomes ranging from $53,915 to $158,750. Sixty five of the 124 cities are located in Maryland and of those, 40 of the cities identified were in Prince George's County (Perry, 2017). Approximately one third of the majority black cities in the United States identified with average incomes above the national average are in Prince George's County, within what would be considered affluent neighborhoods. Health outcomes in contrast, are the opposite of what would be expected in an affluent neighborhood. Based upon the most recent data available, in 2017 the infant mortality rate for NH Black infants was 12.0 deaths per 1000 live births. This rate is more than two times the rate of Hispanic infants and the NH White infant mortality

was less than five deaths and lacked statistical significance. The 2019 Maternal and Infant Report for Prince George's County indicated that infant deaths in Prince George's County made up more than 22% of all infant deaths in the state of Maryland (Prince George's County Health Department Office of Assessment and Planning, 2019). This report indicates that low birth weight infants made up 12.1% of all NH Black births and that the NH Black premature birth rate was 12.4%, an indication of an increased incidence of poor birth outcomes.

The public health community has been struggling to understand and impact disparities in African American infant mortality rates. Minimal progress has been made over the past decade to address this ongoing epidemic and public health emergency and will continue to be at the forefront of public health efforts in the decades to come (Hogan et al., 2011). Improving this critical public health indicator will require significant material and human resources in order to make noteworthy strides in improving infant mortality rates within the African American community. Wilson et. al. discusses the interrelationship between race, social class, and health as something with great complexity (2016). They acknowledged that social and ethnic disparities have been identified when middle-income minority populations were compared to their non-Hispanic white counterparts. Research is limited for the impact of these disparities when incomes approach $75,000 or more due to the available data. This study will examine how disparities impact African American infant mortality rates in a community where the

median household income exceeds $79,000 (United States Census Bureau, 2016). Through analyzing prominent maternal child factors such as maternal age, zip code at delivery, insurance, previous negative outcomes, breastfeeding, and gestational age at birth this study seeks to understand what factors have the greatest impact upon infant mortality rates in affluent African American communities.

Significance, Summary, and Conclusion

Understanding factors that influence infant mortality and how they impact one another is important to improving outcomes in the African American community. Poverty and lower socioeconomic status have been identified as contributing factors for infant mortality rates in the African American community. Although researchers have begun to examine the correlation between higher income levels and infant mortality rates in the African American community there are still many questions to be answered in the literature. With limited studies to explain the influence income has upon infant mortality rates amongst African Americans indicates a gap in the literature and supports the need for additional research on this subject matter.

Understanding the correlation between infant mortality rates and higher income levels in African American communities is important to both population health experts and the public health community. Infant mortality is much more than the death of an infant before the completion of the first year of life. Infant mortality rates indicate the health of a population and high infant mortality rates in African American communities

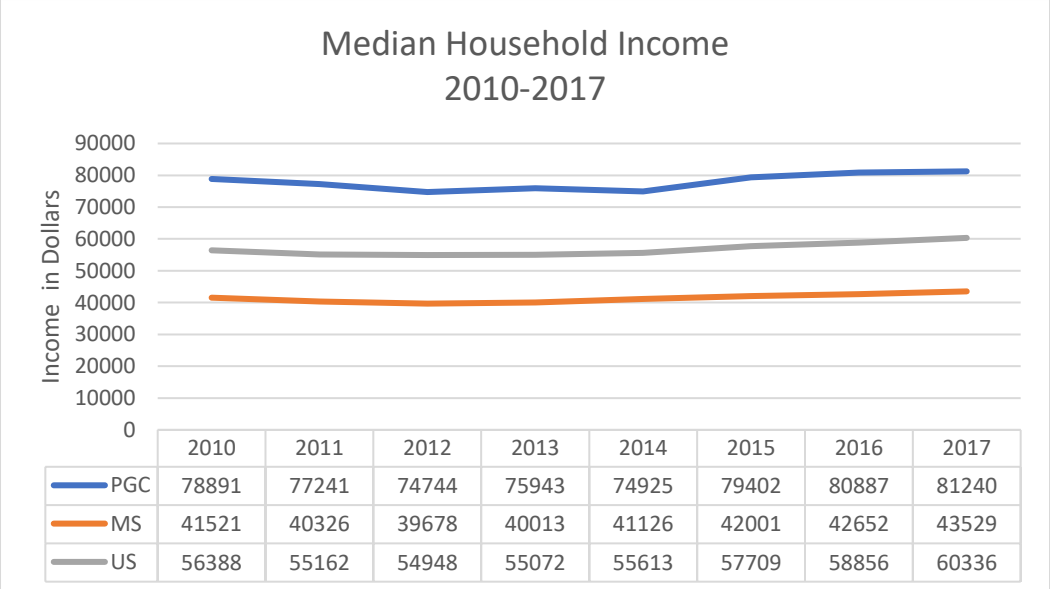
are the result of complex systems issues. This study seeks to explain the relationship between affluence and infant mortality rates in African American communities. The results of this study may provide maternal child public health practitioners and policy makers with critical information about affluent African American communities and how to effectively improve infant mortality outcomes. What shortfalls can current public health systems address to provide women with the support that they need to have successful pregnancy outcomes? Does the community lack resources, adequate services, or educational outreach? What can the community do to improve services and support systems? Are there stakeholders that should be at the table that are not currently? These are all questions that this study can potentially assist the public health community to answer regarding their African American communities. Are there opportunities to promote or provide health equity within the community? Have there been or are there currently missed opportunities in the prevention of infant mortality? These are only some questions that this study may address regarding infant mortality rates in the African American community.

Current literature clearly shows a correlation between poverty and increased infant mortality rates. Studies have shown that significant racial and ethnic disparities continue to exist in infant mortality rates and pregnancy outcomes. Social determinants such as income, educational attainment, and access to care impact pregnancy outcomes and have been shown to negatively impact outcomes in the African American community. The literature that examines the impact of affluence (income) on infant

mortality rates in the general population is limited. In the African American community, the literature is further limited with little to no data about the impact of income levels that exceed $75,000. This study will provide additional insight into how incomes exceeding $75,000 impact infant mortality rates in the African American community and what factors have the greatest impact on pregnancy outcomes.

Figure 1

Comparison of median household income in Prince George's County, Maryland, Mississippi, and the United States 2010-2017



	2010	2011	2012	2013	2014	2015	2016	2017
PGC	78891	77241	74744	75943	74925	79402	80887	81240
MS	41521	40326	39678	40013	41126	42001	42652	43529
US	56388	55162	54948	55072	55613	57709	58856	60336

Note: (Kaiser Family Foundation, 2017).

Definitions of Terms

Defined in this section are key words used in this study.

Comorbidities: Two or more disease processes or medical conditions existing at the same time (Valderas, et.al., 2009).

Gestational age: A clinical term calculated in weeks and days to determine human development timed from the first day of the last menstrual period (Embryology, 2019).

Health disparity: preventable differences in the burden of disease, injury, violence, or opportunities to achieve optimal health as experienced by disadvantaged populations (Centers for Disease Control and Prevention, 2018a).

Infant mortality: The death of an infant prior to his or her first birthday (Centers for Disease Control and Prevention, 2016c).

Infant mortality rate (IMR): The number of deaths during the first year of life divided by the number of live births, multiplied by 1000 (March of Dimes, 2019).

Intergenerational poverty: poverty that continues for two or more successive generations of a family (Wagmiller & Adelman, 2009).

Maternal education: Highest level of education completed by mother at time of delivery. Maternal education data is collected on the birth certificate worksheet as: 8^{th} grade or less; 9^{th}-12^{th} grade, no diploma; high school graduate or GED; some college; Associate degree; Bachelor's degree; Master's degree; Doctorate degree (Maryland Department of Health, 2009)

Maternal Characteristics: include demographic, health, behavior, and socioeconomic factors of the mother during the pregnancy that may or may not influence pregnancy outcomes (Driscoll and Ely, 2019).

Negative Birth Outcomes: addresses the total number of previous live births now dead and the total number of other pregnancy outcomes that did not result in a live birth (Centers for Disease Control and Prevention, 2017).

Premature Birth: the birth of an infant prior to the 37th week of pregnancy. Infants born prematurely require advanced medical care, admission to the intensive care unit, and long term follow up care that corresponds with gestational age at birth. The earlier an infant is born the more complex the care needs are at birth as well as the long-term care requirements. Premature births can be divided into four categories: late preterm (34-36 weeks); moderately preterm (32-34 weeks); very preterm (25-32 weeks); extremely preterm (less than 25 weeks) (Centers for Disease Control and Prevention, 2019b; March of Dimes, 2019).

Prenatal Care: health care received during pregnancy that focuses upon the health of the mother and the fetus. It is designed to reduce the risk of complications during pregnancy that can negatively impact the health of the mother and/or the unborn child. It generally consists of a series of appointments with an obstetrician or midwife, monitoring of fetal growth, lab work, ultrasounds, monitoring for potential complications, and referral to specialists as needed (Eunice Kennedy Shriver National Institute of Child Health and Human Development, 2017).

Assumptions

The following assumptions were made concerning this study:

1. The data came from linked birth-death certificates of infants born to non-Hispanic Black infants of women residing in Prince George's County at the time of death.
2. Maternal and infant factors obtained from the Maryland Department of Health as reported on the infant's birth certificate are accurate.
3. Affluence in the African American community of Prince George's County, Maryland is not indicative of the entire population.

Limitations

The data provided by the Maryland Department of Health for linked birth-death certificates is not inclusive of all infant deaths. There are some infant deaths that the Maryland Department of Vital Records is unable to link when there is no birth certificate available. Portions of the birth certificate are self-reported by the mother and may not be validated by medical documentation such as last menstrual period and previous losses. Missing information on the birth certificate indicating the number of previous losses, last menstrual period, or other variables being addressed by this study can limit the ability to make generalizations to the population. Missing information is documented on birth certificate submissions as unknown when the information is not provided by the mother and the institution filing the birth certificate does not have access to the information.

Significance

This study can contribute to a deeper understanding of how affluence influences infant mortality rates in Prince Georges County, Maryland. Current literature shows that in the presence of affluence infant mortality rates are decreased when compared with those infants born or raised in poverty (Lu et al., 2010). There is a perceived effect of affluence on infant mortality outcomes and an indication that infant mortality rates decrease in the presence of affluence. In the African American community in Prince Georges County, Maryland, data does not support what is known from the literature that affluence should improve outcomes. Understanding the root causes of infant mortality is critical to the health of the population within that community and provides public health leaders with the information needed to impact and improve outcomes for this important health indicator. Through examining the relationship of infant mortality and affluence in Prince George's County, this study will assist practitioners in their ability to develop effective public health programs that meet the needs of the population. Public health organizations typically lack funding to support new programs that practitioners are unable to support with current data (Bakemeier et al., 2013).

In a community promoted and marketed by public officials for its affluent African American population, public health leaders are seeking answers to the high infant mortality rate experienced there. Through this study, I sought to assist the public health community in understanding the role that affluence (income) plays in the infant mortality rate; identifying factors impacting outcomes; and designing effective program planning for the future. Understanding the relationship between affluence (income) and the

incidence of infant mortality has the potential to illicit social change in this community. Applying the data analysis and interpretation presented in this proposed study may assist public health practitioners with future program planning to address the disproportionately high infant mortality rates experienced by African Americans there. Decreasing the infant mortality rate in this population has the potential to impact the overall health and well-being of the community. While there are endless implications for social change in this research study, it will require an action-oriented approach by the public health community to see them come to fruition.

Section 2: Research Design and Data Collection

Introduction

The purpose of this quantitative multilevel cross-sectional study was to understand the relationship of affluence (income), maternal/infant factors and infant mortality among African American women in Prince George's County, Maryland. The study population consisted of all births to non-Hispanic Black mothers residing in Prince George's County, Maryland that resulted in an infant death (infant mortality) from 2010 to 2017 inclusive.

The dependent variable was infant mortality (birth through 365 days of life) in non-Hispanic Black infants residing in Prince George's County, Maryland. The independent or experimental variables hypothesized as possible factors contributing to infant mortality within this population are income, maternal age, zip code at delivery and death, gestational age at birth, maternal education, trimester prenatal care started, weight at birth, breastfeeding, maternal smoking, previous negative outcomes, previous premature birth, hypertension, diabetes, and obesity.

Research Design and Rationale

A multi-level cross-sectional data analysis was conducted using secondary data to investigate the possible relationships that exist between income and infant mortality, maternal characteristics and infant mortality, and infant characteristics and infant mortality. Data analysis examined how individual-level variables influence the aggregate level association of infant mortality in the African American community and maternal

and infant risk factors. Descriptive and inferential statistical analysis were performed to examine infant mortality in non-Hispanic Black infants in Prince George's County Maryland from 2010 to 2017; explore the impact that community income levels have on infant deaths in Prince George's County according to zip code at infants' birth and death, and to examine the effects of maternal and infant factors on infant mortality in the county. This was accomplished through the use of secondary data obtained from the Maryland Department of Health, Division of Vital Statistics for all infant birth and death records. In this study I sought to examine both relationships and patterns in the available linked birth-death data in the non-Hispanic Black population of Prince George's County, Maryland. The use of descriptive statistics examines patterns of behavior such as the initiation of breastfeeding at time of the birth certificate filing. Inferential statistics allow for generalizations to be formulated that identify specific risk factors related to infant mortality, such as no prenatal care, for all non-Hispanic Black Prince George's County residents of reproductive health age. The objective of this study was to determine what effect the independent variables identified in this study have upon the dependent variable infant mortality at an individual level except for income which was be examined by zip code.

Population

The population consisted of infants born to non-Hispanic Black women residing in Prince George's County, Maryland from 2010 through 2017 and those who died prior

to their first birthday where linked birth-death certificate data was available (Maryland Vital Statistics, 2018).

Sample Size

Using the G*Power sample size calculator, I calculated the minimum sample size needed for this study. In order to perform a logistic regression with 80% power, an alpha level of 0.05, with 14 covariates, and an odds ratio of 1.3, a minimum sample size of 568 is required.

Instrument and Variables

This study was based upon secondary data from the vital statistics birth, death, and linked birth-death records therefore no specific instrument was used. The dependent variable for this study was infant mortality amongst non-Hispanic Black infants. The independent variables included income – based upon median income levels for zip code of infant's residence at time of birth and at death; maternal factors: maternal age, maternal education, trimester prenatal care began, insurance, maternal smoking, previous negative outcomes, previous premature birth, comorbidities (hypertension, diabetes, and obesity); and infant factors: gestational age at birth, birthweight, and breastfeeding.

Data Collection and Analysis

Upon receipt of IRB approval, (IRB approval number 01-22-21-0562254), all infant birth and death records for residents of Prince George's County Maryland from 2010 through 2016 were requested from the Maryland Department of Health, Division of Vital Statistics. The linked birth-death certificate data for all non-Hispanic Black infant

deaths for residents of Prince George's County Maryland were also requested for this time-period. The data although individual level, was provided as non-confidential files with no personal identifiers, using Microsoft excel spreadsheets. Once data was received, it was analyzed using SPSS version 27.

Research Questions and Hypothesis

Research Question 1: Is there a relationship between median income by zip code and infant mortality in the African American community in Prince George's County, Maryland?

$H_0$1: There is no relationship between median income by zip code and infant mortality in the African American community in Prince George's County, Maryland.

$H_1$1: There is a relationship between median income by zip code and infant mortality in the African American community in Prince George's County, Maryland.

Research Question 2: Is there a relationship between infant mortality and maternal factors including: maternal age, maternal education, trimester prenatal care began, maternal smoking, insurance, previous premature birth, previous negative outcomes, and co-morbidities (hypertension, diabetes, or obesity)?

$H_0$2: There is no relationship between infant mortality and maternal factors including: maternal age, maternal education, trimester prenatal care began, maternal smoking, insurance, previous premature birth, previous negative outcomes, and co-morbidities (hypertension, diabetes, or obesity).

$H_1$2: There is a relationship between infant mortality and maternal factors including: maternal age, maternal education, trimester prenatal care began, maternal smoking, insurance, previous premature birth, previous negative outcomes, and co-morbidities (hypertension, diabetes, or obesity).

Research Question 3: Is there a relationship between infant mortality and infant factors including: birth weight, gestational age at birth, and breastfeeding?

$H_0$3: There is no relationship between infant mortality and infant factors including: birth weight, gestational age at birth, and breastfeeding.

$H_1$3: There is a relationship between infant mortality and infant factors including: birth weight, gestational age at birth, and breastfeeding.

Statistical Tests

I this study I sought to determine if there was a relationship between affluence(income) and infant mortality in the African American community in Prince George's County, Maryland. It also looked at the relationships between maternal characteristics and infant mortality and infant characteristics and infant mortality. A descriptive analysis of the data was conducted examine the means, standard deviations, and range of scores for each of the variables (Creswell, 2014). Once the descriptive analysis was completed, an inferential statistical analysis was conducted to make inferences and predictions about income and infant mortality within the African American community in Prince George's County, Maryland. The following risk factors listed here were chosen based upon current literature and include maternal age, maternal

education, trimester prenatal care began, maternal smoking, insurance, previous premature birth, previous negative outcomes, co-morbidities (hypertension, diabetes, obesity), birth weight, gestational age at birth, breastfeeding, and zip code as income. For each research question, I adjusted for covariates that are not being treated as risk factors in that specific research question. These confounders were highlighted in each analysis. A logistic regression was used to evaluate the relationships between income and infant mortality, maternal characteristics and infant mortality, and infant characteristics and infant mortality, to determine the significance of those relationships. A forward stepwise logistic regression was used to assess univariable and multiple variable associations in order to obtain unadjusted and adjusted odds ratios on a 95% confidence interval. A p-value of less than 0.05 will be considered significant. The logistic regression model was appropriate because the outcome variable (infant mortality) is dichotomous (yes/no). Also, logistic regression provides the opportunity to control for covariates. Variables are operationalized in the following table:

Table 1

Independent Variables

Variable	Definition of Variable	Indicator	Category of Data
Maternal Age	Mother's age at time of delivery	1. ≤ 18 2. 19-25 3. 26-34 4. 35-44 5. ≥ 45	
Maternal Education	Mother's completed years of education at delivery	1. 8th grade or less 2. 9-12 grade 3. HS diploma or GED 4. Some college 5. Associates 6. Bachelor's 7. Master's 8. Doctorate	Ordinal
Trimester	Trimester when prenatal care began	1. First 2. Second 3. Third 4. Limited 5. No PNC	Ordinal
Previous Neg Outcomes	Number of previous miscarriages, terminations, or other fetal/infant losses	1. 0 2. 1 3. 2 4. 3 5. 4 6. ≥ 5	Ordinal
Maternal Smoking	Maternal smoking during pregnancy	1. None 2. 3 mo before Pregnancy 3. 1st trimester 4. 2nd trimester 5. 3rd trimester	Ordinal
Insurance	Mother's insurance at time of delivery	1. None 2. Medicaid 3. Private 4. Self-Pay 5. Other	Ordinal
Gestational Age	Completed weeks of pregnancy at birth	1. ≤ 23 weeks 2. 25-32 weeks 3. 32-36 weeks 4. 37-40 weeks 5. > 40weeks	Ordinal
Birthweight	Weight in grams at birth	1. ≤ 1000 grams 2. 1001-1500 grams 3. 1501-2500 grams 4. 2501-3500 grams 5. 3501-4000 grams 6. ≥ 4001 grams	Ordinal
Breastfeeding	Breastfeeding in hospital	1. Yes 2. No	Ordinal

Threats to Validity

The potential for external threats to validity existed due to the potential for unknown data or information in the birth, death, and linked birth-death certificate data files. To account for any statistically significant unknown data points for income, individual maternal characteristics, or infant characteristics generalizations were deferred. An analysis of the data was conducted to determine if such external threats to validity exist for this study.

There are no identified internal threats to validity based upon the proposed study design. The use of secondary retrospective data that examines birth, death, and linked birth-death certificate data from 2010 through 2017 eliminated internal threats such as history, maturation, regression, or instrumentation. This study was inclusive of all non-Hispanic Black linked birth-death certificates during this time-period, and which prevented the threat of participant selection based upon desired characteristics.

Ethical Procedures

Upon receipt of approval from the IRB to begin collecting data, the secondary/archived linked birth-death certificate data from the Maryland Department of Health Division of Vital Statistics were requested. This study requires no physical contact with participants. The data request required the researcher to submit an agreement that stipulated the use of the data and the protection of data to protect individual rights.

Study findings may be made available to community leaders, community collaborators, and advocates working to decrease poor maternal and infant outcomes in Prince George's County. Publication of the study would allow for further access by the community and an opportunity to initiate further data sharing with other maternal infant professionals in the county. The results of this study may also be of interest to other communities in the United States seeking to understand how income levels, and maternal infant characteristics impact infant mortality rates in African American communities.

Conclusion

In this quantitative study a multilevel cross-sectional research design was used to determine if there is a relationship between infant mortality and affluence (as income) while considering maternal and infant health factors.

Section 3: Presentation of Results and Findings

Introduction

This quantitative study explored the relationship between mean household income at birth using zip code as a proxy, maternal characteristics, and infant characteristics and infant mortality in the non-Hispanic Black community in Prince George's County Maryland. There are three research questions and null hypotheses that were posed for this study:

Research Question 1: Is there a relationship between median income by zip code and infant mortality in the African American community in Prince George's County, Maryland?

$H_0$1: There is no relationship between median income by zip code and infant mortality in the African American community in Prince George's County, Maryland.

$H_1$1: There is a relationship between median income by zip code and infant mortality in the African American community in Prince George's County, Maryland.

Research Question 2: Is there a relationship between infant mortality and maternal factors including: maternal age, maternal education, trimester prenatal care began, maternal smoking, insurance, previous premature birth, previous negative pregnancy outcomes, and co-morbidities (hypertension, diabetes, or obesity)?

$H_0$2: There is no relationship between infant mortality and maternal factors

including: maternal age, maternal education, trimester prenatal care began, maternal smoking, insurance, previous premature birth, previous negative outcomes, and co-morbidities (hypertension, diabetes, or obesity).

$H_1$2: There is a relationship between infant mortality and maternal factors including: maternal age, maternal education, trimester prenatal care began, maternal smoking, insurance, previous premature birth, previous negative outcomes, and co-morbidities (hypertension, diabetes, or obesity).

Research Question 3: Is there a relationship between infant mortality and infant factors including birthweight, gestational age at birth, and breastfeeding?

$H_0$3: There is no relationship between infant mortality and infant factors including: birth weight, gestational age at birth, and breastfeeding.

$H_1$3: There is a relationship between infant mortality and infant factors including: birth weight, gestational age at birth, and breastfeeding.

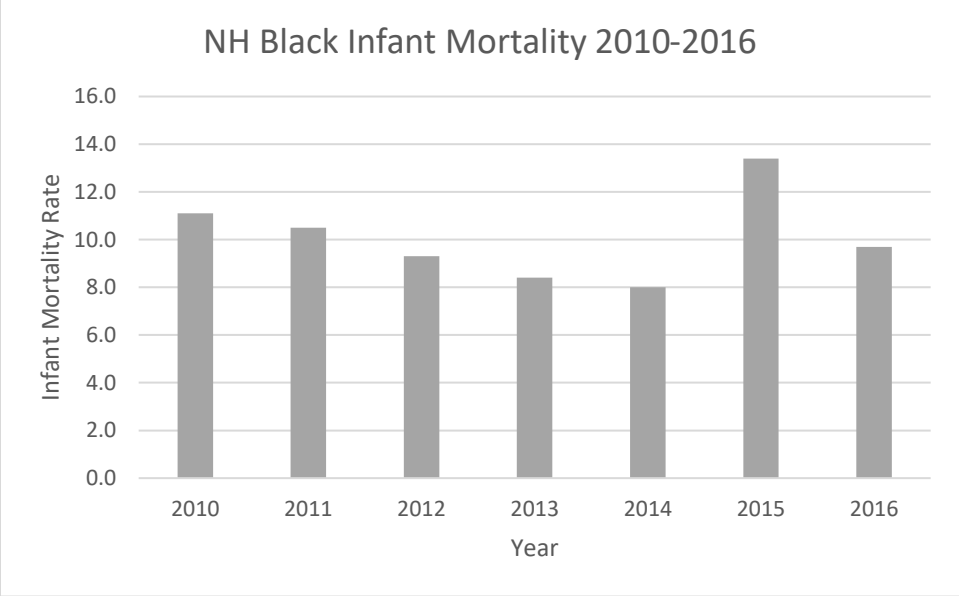
Data Collection of Secondary Data

The data for this study was provided by the Maryland Department of Health Department of Vital Statistics. The data sets provided were from live-birth birth certificates and linked birth-death certificates in Prince George's County, Maryland occurring between 2010 and 2016. Data was provided de-identified, at an individual level. The linked birth-death data set included data for 474 infants and the data set for live births included 47,539 from 2010 through 2016. As indicated in Section 2, the minimal sample size for this study was 568 when computed by G*Power; all live births

and infant deaths in the data sets were included except for 96 live births due to incomplete or inaccurate zip codes within the data set.

Figure 2

NH Black Infant Mortality Rates, Prince George's County, Maryland 2010-2016



Note: (Maryland Vital Statistics, 2017; Maryland Vital Statistics, 2015; Maryland Vital Statistics, 2013, Maryland Vital Statistics, 2011)

Individual level data for infant births and deaths are not publicly available in the State of Maryland and required authorization from the Director of the Vital Statistics Department at the Maryland Department of Health. Access was granted to the linked birth death files through a standard application process. The live birth data files required review by the Maryland Department of Health IRB due to the request for individual level data and access to the data was approved. The study was approved by the Walden

University IRB. The Maryland Department of Health Division of Vital Statistics provided the data requested using Excel spreadsheets in a secured encrypted email. The data required recoding of all variables except zip code prior to entering the data set into SPSS 27.0 to conduct the statistical analysis. Table 2 and Table 3 show all independent variables included in this study and any changes or additions made based upon the data sets received.

Table 2

Independent Variables: Maternal Characteristics

Variable	Definition of Variable	Indicator	Category of Data
Maternal Age	Mother's age at time of delivery	1. ≤ 18 2. 19 to <26 3. 26 to <35 4. 35 to <45 5. 45+ (≥ 45) 6. Not Stated	Ordinal
Maternal Education	Mother's completed years of education at delivery	1. 8th grade or less 2. 9-12 grade 3. HS diploma or GED 4. Some college 5. Associates 6. Bachelor's 7. Graduate (Master's) 8. Not Stated (Doctoral)	Ordinal
Trimester	Trimester when prenatal care began	1. First 2. Second 3. Third 4. No PNC (Limited) 5. Not Stated (No PNC)	Ordinal
Previous Neg Pregnancy Outcomes	Number of previous miscarriages, terminations, or other fetal/infant loss	1. 0 2. 1 3. 2 4. 3 5. 4 6. ≥ 5	Continuous

(continues)

Table continues

Variable	Definition of Variable	Indicator	Category of Data
Maternal Smoking	Maternal smoking during pregnancy	1. None 2. 3mo before Pregnancy 3. 1st trimester 4. 2nd trimester 5. 3rd trimester 6. Unknown	Ordinal
Insurance	Mother's insurance at time of delivery	1. Unknown (None) 2. Medicaid 3. Private 4. Self-Pay 5. Other	Categorical
CHTN	Chronic hypertension	1. Yes 2. No	Categorical
PIH	Pregnancy induced hypertension	1. Yes 2. No	Categorical
GDM	Gestational Diabetes	1. Yes 2. No	Categorical
BMI	BMI Category	1. Underweight 2. Normal 3. Overweight 4. Obese 5. Unknown	Ordinal

Table 3

Independent Variables: Infant Characteristics

Variable	Definition of Variable	Indicator	Category of Data
Gestational Age	Completed weeks of pregnancy at birth	1.$\leq 23\ weeks$ 2. 24 to <33 weeks 3. 33 to <37 weeks 4. 37 to <41 weeks 5.$\geq 41\ weeks$ 6. Unknown	Ordinal
Birthweight	Weight in grams at birth	1. $\leq 1000\ grams$ 2. 1001-1500 grams 3. 1501-2500 grams 4. 2501-3500 5. 3501-4000 grams 6. $\geq 4001\ grams$	Ordinal
Breastfeeding	Breastfeeding status at discharge	1. Yes 2. No 3. Unknown	Categorical

Several of the maternal health specific independent variables not previously included in Table 1 were included in Table 2 to align with the second research question in this study. Each independent variable was coded to mirror the indicators seen in Tables 2 and 3 above prior to conducting the analysis in SPSS.

Descriptive Demographics of NH Black Births

In Prince George's County, Maryland, based upon the data set received, there were 47,434 NH Black births from 2010 through 2016. All births were analyzed except for those that had an incomplete zip code, or a zip code associated with a P.O. Box and not a city or township within the county. Table 4 below depicts the zip code where the mother lived in Prince George's County at the time of the infant's birth and shows the distribution of NH Black live births from 2010 through 2016 who were alive at their first birthday and those that were deceased using the crosstabulation.

Table 4

*Zip Code at Birth * Infant Status Crosstabulation*

		Infant Status			
		Infant Alive	Infant Deceased	Total	Percent Deceased
Zip Code at Birth	20607	486	5	491	1.0
	20608	27	0	27	0.0
	20613	544	6	550	1.1
	20623	142	3	145	2.1
	20705	1078	11	1089	1.0
	20706	2548	19	2567	0.7
	20707	1550	19	1569	1.2

(continues)

Table Continues

		Infant Status			
		Infant Alive	Infant Deceased	Total	Percent Deceased
Zip Code at Birth	20708	2099	17	2116	0.8
	20710	665	10	675	1.5
	20712	374	4	378	1.0
	20715	541	5	546	0.9
	20716	1122	11	1133	1.0
	20720	1225	9	1234	0.7
	20721	1543	17	1560	1.1
	20722	194	2	196	1.0
	20735	1855	15	1870	0.8
	20737	832	11	843	1.3
	20740	393	1	394	0.2
	20742	4	0	4	0.0
	20743	2874	24	2898	0.8
	20744	2341	22	2363	0.9
	20745	1715	17	1732	1.0
	20746	2302	26	2328	1.1
	20747	3032	43	3075	1.4
	20748	2465	25	2490	1.0
	20762	89	2	91	2.2
	20768	3	0	3	0.0
	20769	294	3	297	1.0
	20770	1492	13	1505	0.9
	20771	2	0	2	0.0
	20772	2299	19	2318	0.8
	20774	2877	27	2904	0.9
	20780	19	1	20	5.0
	20781	342	2	344	0.6
	20782	1206	14	1220	1.1
	20783	1044	10	1054	0.9
	20784	1773	12	1785	0.7
	20785	3111	44	3155	1.4
	20903	112	1	113	0.9
	20904	12	0	12	0.0
	20912	344	3	347	0.9
Total		46970	473	47443	1.0

Table 5 below categorizes zip codes which were examined for this study as a proxy for median household income. Zip codes were categorized into low income

(≤ $60,000), medium income ($60,001 – 100,000), and high income (≥100,001) and represent the zip codes at birth listed in Table 4. Infants born to families residing in zip codes identified in the medium income category ($60,001 - $100,000) had the greatest number of infants that were still alive after their first birthday and the greatest number that were deceased prior to their first birthday.

Table 5

*Zip Code at Birth – Proxy for Income * Infant Status Crosstabulation*

		Infant Status			
		Infant Alive	Infant Deceased	Total	Percent Deceased
Zip Code at Birth	Low Income[1]	7134	72	7206	1.0
	Medium Income[2]	34747	355	35102	1.0
	High Income[3]	5089	46	5135	0.9
		46970	473	47443	

Note: [1]Includes Zip Code: 20742; 20710, 20737, 20743, 20745, 20783.

[2]Includes Zip Codes: 20705, 20706, 20707, 20708, 20712, 20740, 20746, 20747, 20748, 20770, 20782, 20784, 20785, 20903 20912, 20608, 20716, 20722, 20744, 20762, 20772, 20774, 20781, 20904.

[3]Includes Zip Codes: 20715, 20735, 20771, 20607, 20613, 20623, 20720, 20769.

In Table 6, the binary logistic regression for zip code as proxy for median household income shows that the results are not significant. Zip code at birth as a proxy for median household income is not a significant predictor of infant mortality in non-Hispanic black women in Prince George's County Maryland, OR=0.957 95% CI [0.80, 1.143] and $p > 0.05$ based upon the significance level 0.626.

Research Question 1: Is there a relationship between median income by zip code and infant mortality in the African American community in Prince George's County, Maryland?

$H_0$1: There is no relationship between median income by zip code and infant mortality in the African American community in Prince George's County, Maryland.

The null hypothesis was tested using a binary logistic regression to determine if there is a significance between infant mortality and median income by zip code. The P-value was 0.626 and is greater than 0.05 indicating that with a 95% confidence level that we can accept the null hypothesis and conclude that there is no relationship between infant mortality and median income by zip code.

Table 6

Binary Logistic Regression: Zip Code at Birth as Proxy for Median Household Income

								95% C.I. Odds Ratio	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Zip Code at Birth	-.044	.091	.237	1	.626	.957	.801	1.143
	Constant	-4.512	.183	610.064	1	.000	.011		

a. Variable(s) entered on step 1: Zip Code at Birth.

Table 7 below, provides a descriptive analysis using crosstabulation for each maternal factor listed in research question two looking at the characteristic indicators for infants alive at their first birthday and those that were deceased prior to dol (day of life) 366. The crosstabulation data indicates that women 26-34yrs (47%) had the largest number of births during this time with those 19-25yrs (29%) following behind. Women over 45yrs of age had the least number of births (0.4%). Age for the purpose of this study is operationalized in 1-year increments. The independent variable maternal education

shows that more than half of all women delivering during this time had a high school diploma or at a minimum some college (52%).

While prenatal care was started most often in the first trimester (56%), there were still women who did not begin prenatal care until the third trimester or had no prenatal care at all (13%). The fourth independent variable of the maternal characteristics shows the descriptive analysis of the number of previous negative outcomes that women experienced prior to this live birth including terminations, miscarriages, stillbirths, and infant deaths. Smoking in pregnancy looks at whether a woman smoked anytime during the three months prior to becoming pregnant up until delivery.

Regardless of infant status, most of the women did not smoke at any time during their pregnancy: infant alive (93%), infant deceased (92%). Insurance at delivery includes those that have Medicaid, Private Insurance, Self-Pay, and those whose insurance status was unknown. Included in the births with unknown insurance status are those that are uninsured an indicator that is not included as an option on the facility worksheet for infant birth certificates.

The final four variables in Table 7 show the distribution of infant status in relation to: maternal chronic hypertension, pregnancy induced hypertension, gestational diabetes, and body mass index (BMI). Most of the pregnancies had no incidence of hypertension for both infant status alive and deceased. Pregnancy induced hypertension indicated that most pregnancies had no incidence of pregnancy induced hypertension for infant status of alive (95%) or deceased (94%). Gestational diabetes according to infant status and the

crosstabulation showed that most infants did not have gestational diabetes documented at delivery: deceased (96.4%) and alive (95%).

The final independent variable of the maternal factors shows the distribution of body mass index of non-Hispanic Black women that gave birth from 2010 through 2016 in relation to the infant status crosstabulation. More than half of the women having a live birth (58.7%) were identified as either overweight or obese regardless of infant status. This is somewhat higher than the overall overweight and obesity rates for non-Hispanic Black residents of the county which ranged from 35-39% during the same time (Prince George's County Health Department, 2016).

Table 7

*Maternal Factors * Infant Status Crosstabulation*

		Infant Status			
		Infant Alive	Infant Deceased	Total	Percent Deceased
Maternal Age	≤ 18	1779	27	1806	1.50
	19-25	13614	134	13748	0.98
	26-34	21950	213	22163	0.96
	35-44	9409	97	9506	1.02
	45+	216	2	218	0.92
	Not Stated	2	0	2	0.00
Total		46970	473	47443	
Maternal Education	8th grade or less	334	1	335	0.29
	9th-12th grade, no diploma	2868	39	2907	1.30
	HS Diploma or GED	11164	116	11280	1.00
	Some College, no degree	13790	136	13926	0.97
	Associates Degree	3230	23	3253	0.70
	Bachelor's Degree	9199	78	9277	0.84
	Graduate Degree	6099	48	6147	0.78
	Not Stated	286	32	318	10.00
Total		46970	473	47443	

(continues)

Table Continues

		Infant Status			
		Infant Alive	Infant Deceased	Total	Percent Deceased
Trimester PNC Started	First Trimester	23250	219	23469	0.93
	Second Trimester	12007	96	12103	0.79
	Third Trimester	4519	13	4532	0.28
	No PNC	1418	38	1456	2.60
	Not Stated	5776	107	5883	1.80
Total		46970	473	47443	
Previous Neg Outcomes	0	25286	211	25497	0.82
	1	10850	103	10953	0.84
	2	5834	73	5907	1.20
	3	2677	44	2721	1.60
	4	1171	21	1192	1.80
	≥ 5	1150	21	1171	1.80
	Unknown	2	0	2	0.00
Total		46970	473	47443	
Smoking Pregnancy	No Smoking	3585	436	44021	1.00
	3mo before conception	1315	11	1326	0.83
	First Trimester	537	9	546	1.60
	Second Trimester	127	1	128	0.78
	Third Trimester	538	7	545	1.30
	Unknown	868	9	877	1.00
Total		46970	473	47443	
Insurance at Delivery	Unknown	11621	135	11756	1.10
	Medicaid	12938	161	16099	1.00
	Private Insurance	17234	179	17383	0.86
	Self-Pay	1479	20	1499	1.30
	Other	698	8	706	1.10
Total		46970	473	47443	
Chronic HTN	Yes	1903	19	1922	0.99
	No	45067	454	45521	0.96
Total		46970	473	47443	
Pregnancy Induced HTN	Yes	2314	29	2343	1.20
	No	44656	444	45100	0.98
Total		46970	473	47443	
Gestational Diabetes	Yes	2330	17	2347	0.72
	No	44640	456	45096	1.02
Total		46970	473	47443	
BMI Category	Underweight	1375	8	1383	0.58
	Normal	15456	137	15593	0.88
	Overweight	12973	117	13090	0.89
	Obese	14598	164	14762	1.10
	Unknown	2568	47	2615	1.80
Total		46970	473	47443	

Table 8 provides a descriptive analysis using crosstabulations for each of the independent variables identified as infant factors in research question three. In Table 8 the greatest number of infants with the status deceased were born before 32 weeks gestation and the greatest number of infants deceased were born weighing less than 1,000 grams. It is important to note that data for gestational age is based upon completed weeks of gestation and does not account for intervals in between. This means that data for births from 40.0 weeks to 40.6 weeks are included in the data for infants delivered at 40 weeks gestation and on day seven it then becomes 41 weeks gestation. Most infants were not breastfed at discharge according to the crosstabulation results shown below for those infants that were deceased and the number of infants that were breastfeeding at discharge were greatest for those with an infant status of alive.

Table 8

*Infant Factors * Infant Status Crosstabulation*

		Infant Status			
		Infant Alive	Infant Deceased	Total	Percent Deceased
Gestational Age	≤ 23 weeks	53	220	273	80.6
	24-32 weeks	1254	118	1372	8.60
	33-36 weeks	3801	34	3835	0.89
	37-40 weeks	39093	94	39187	0.24
	>40 weeks	2682	5	2687	0.19
	Unknown	87	2	89	2.20
Total		46970	473	47443	
Birth Weight	≤ 1000 grams	463	312	775	40.30
	1001-1500 grams	544	21	565	3.70
	1501-2500 grams	3962	50	4012	1.20
	2501-3500 grams	28296	72	28368	0.25
	3501-4000 grams	10746	13	10759	0.12
	≥ 4001 grams	2941	4	2945	0.14
	Unknown	18	1	19	5.30
Total		46970	473	47443	

(*continues*)

Table Continues

		Infant Status			
		Infant Alive	Infant Deceased	Total	Percent Deceased
Breastfeeding at	Yes	35970	118	36088	3.30
Discharge	No	7814	263	8077	32.60
	Unknown	3186	92	3278	28.10
Total		46970	473	47443	

Table 9 below shows the results of the binary logistic regression, the odds ratio (OR), and the 95% confidence interval for each of the ten maternal factors to determine if they are significant predictors of infant mortality in the non-Hispanic Black population in Prince George's County, MD. Maternal age is a significant predictor of infant mortality in non-Hispanic Black women in Prince George's County Maryland, maternal age: OR=0.84 95% CI [0.74,0.96] $p<0.05$ based on the significance level 0.01. Maternal education is a significant predictor of infant mortality in non-Hispanic Black women in Prince George's County Maryland, maternal education: OR=1.07 95% CI [1.00, 1.14] $p<0.05$ based on the significance level 0.045. The trimester prenatal care started is a significant predictor of infant mortality in non-Hispanic Black women in Prince George's County Maryland, OR=1.12 95% CI [1.13, 1.27] $p<0.05$ based on the significance level 0.00. Previous negative birth outcomes are not a significant predictor of infant mortality in non-Hispanic Black women in Prince George's County Maryland, OR=1.23 955 CI [1.15, 1.31] $p<0.05$ based on the significance level 0.00. Smoking and pregnancy is not a significant predictor of infant mortality for births to non-Hispanic Black women in Prince George's County, MD, OR=0.98 95% CI [0.88, 1.09] $p>0.05$ based on the significance

level of 0.74. Insurance at delivery is not a significant predictor of infant mortality for births to non-Hispanic Black women in Prince George's County, MD, OR=0.92 95% CI [0.84, 1.03] p>0.05 based on the significance level of 0.14. Chronic high blood pressure (CHTN), Pregnancy induced hypertension (PIH), and Gestational Diabetes (GDM) are not significant predictors of infant mortality in births to non-Hispanic Black women in Prince George's County, MD; CHTN: OR=1.04 95% CI [0.66, 1.66] p>0.05; PIH: OR=0.80 95% CI [0.55, 1.17] p>0.05; GDM: OR=1.45 95% CI [0.89, 2.37] p>0.05 based upon the significance levels of 0.86, 0.26, and 0.14. Body Mass Index (BMI) is a significant predictor of the probability of infant mortality in births to non-Hispanic Black women in Prince George's County, MD; BMI: OR=1.22 95% CI [1.11, 1.35] p<0.05 based on the significance level of 0.00.

Research Question 2: Is there a relationship between infant mortality and maternal factors including: maternal age, maternal education, trimester prenatal care began, maternal smoking, insurance, previous premature birth, previous negative outcomes, and co-morbidities (hypertension, diabetes, or obesity)?

$H_0$2: There is no relationship between infant mortality and maternal factors including: maternal age, maternal education, trimester prenatal care began, maternal smoking, insurance, previous premature birth, previous negative outcomes, and co-morbidities (hypertension, diabetes, or obesity).

Table 9

Binary Logistic Regression Maternal Factors (Unadjusted)

							95% C.I. Odds Ratio	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Maternal Age	-.044	.058	.576	1	.448	.957	.855	1.072
	Maternal Education	.018	.030	.370	1	.543	1.018	.961	1.079
	Trimester PNC Started	**.179**	**.030**	**34.969**	**1**	**.000**	**1.196**	**1.127**	**1.269***
	Previous Neg Preg Outcomes	**.187**	**.032**	**33.928**	**1**	**.000**	**1.205**	**1.132**	**1.283***
	Smoking Pregnancy	.033	.052	.408	1	.523	1.033	.934	1.144
	Insurance at Delivery	-.076	.051	2.197	1	.138	.927	.838	1.025
	Chronic HTN	.009	.235	.001	1	.970	1.009	.639	1.600
	Pregnancy Induced HTN	-.231	.193	1.441	1	.230	.793	.544	1.158
	Gestational Diabetes	.337	.248	1.842	1	.175	1.400	.861	2.276
	BMI Category	**.194**	**.047**	**17.128**	**1**	**.000**	**1.214**	**1.107**	**1.330***

Variable(s) entered on step 1: Maternal Age, Maternal Education, Trimester PNC Started, Previous Neg Outcomes, Smoking Pregnancy, Insurance at Delivery, Chronic HTN, Pregnancy Induced HTN, Gestational Diabetes, BMI Category.

The null hypothesis was tested using a binary logistic regression to determine the strength of significance between infant mortality and maternal factors. In the unadjusted model, there were seven maternal factors that were not significant predictors of the probability of infant mortality in this population. Trimester prenatal care started, previous negative pregnancy outcomes and BMI category were identified as significant predictors of infant mortality in this population with P-values <0.05. When accounting for cofounders in the adjusted model, maternal age at birth and maternal education were also significant predictors for infant mortality with P-values <0.05.

Thus, we reject the null hypothesis and conclude that there is a relationship between infant mortality and maternal factors.

Table 10

Binary Logistic Regression Maternal Factors (Adjusted)

								95% C.I. Odd
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower
Step 1[a]	**Maternal Age**	**-.172**	**.068**	**6.434**	**1**	**.011**	**.842**	**.737**
	Maternal Education	**.066**	**.033**	**4.009**	**1**	**.045**	**1.068**	**1.001**
	Trimester PNC Started	**.182**	**.030**	**36.242**	**1**	**.000**	**1.199**	**1.130**
	Previous Neg Outcomes	**.205**	**.033**	**38.475**	**1**	**.000**	**1.227**	**1.150**
	Smoking Pregnancy	-.018	.054	.107	1	.743	.983	.884
	Insurance at Delivery	-.077	.053	2.130	1	.144	.926	.836
	Chronic HTN	.041	.237	.030	1	.862	1.042	.655
	Pregnancy Induced HTN	-.222	.195	1.298	1	.255	.801	.547
	Gestational Diabetes	.373	.250	2.220	1	.136	1.452	.889
	BMI Category	**.200**	**.049**	**16.743**	**1**	**.000**	**1.222**	**1.110**
	Constant	-6.042	.840	51.692	1	.000	.002	

a. Variable(s) entered on step 1: Maternal Age, Maternal Education, Trimester PNC Started, Previous Neg Outcomes, Smoking Preg
Insurance at Delivery, Chronic HTN, Pregnancy Induced HTN, Gestational Diabetes, BMI Category.

Table 11 below shows the results of the binary logistic regression for infant factors to determine if they are significant predictors of infant mortality in the non-Hispanic Black population in Prince George's County, MD. Gestational age at birth is a significant predictor of infant mortality in non-Hispanic Black women in Prince George's County Maryland; gestational age: OR=0.27 95% CI [0.22, 0.34] $p<0.05$ based on the significance level (p-value) 0.00. Birth weight is a significant predictor of infant

mortality in non-Hispanic Black women in Prince George's County Maryland; birth weight: OR=0.46 95% CI [0.39, 0.54] $p < 0.05$ based on the significance level (p-value) 0.00. Breastfeeding status at discharge, is a significant predictor of infant mortality in non-Hispanic Black women in Prince George's County Maryland; breastfeeding status: OR=1.72 95% CI [1.50, 1.99] $p < 0.05$ based on the significance level (p-value) 0.00.

Research Question 3: Is there a relationship between infant mortality and infant factors including: birth weight, gestational age at birth, and breastfeeding?

$H_0$3: There is no relationship between infant mortality and infant factors including: birth weight, gestational age at birth, and breastfeeding.

The null hypothesis was tested using a binary logistic regression to determine the strength of significance between infant mortality and infant factors. Each of the infant factors tested: gestational age at birth, birth weight, and breastfeeding at discharge; were significant predictors of the probability of infant mortality occurring in this population. When accounting for cofounders in the adjusted model in Table 12, significant predictors for infant mortality were consistent with the independent variables addressed in the unadjusted model. The P-values for each factor were 0.000 and are less than 0.05 indicating that with a 95% confidence level we can reject the null hypothesis and conclude that there is a relationship between infant mortality and infant factors.

Table 11

Binary Logistic Regression Infant Factors (Unadjusted)

								95% C.I. Odds Ratio	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	**Gestational Age**	**-2.277**	**.054**	**1765.739**	**1**	**.000**	**.103**	**.092**	**.114***
	Birth Weight	**-1.798**	**.042**	**1861.026**	**1**	**.000**	**.166**	**.153**	**.180***
	Breastfeeding at Discharge	**1.146**	**.055**	**437.493**	**1**	**.000**	**3.145**	**2.825**	**3.502***

a. Variable(s) entered on step 1: Gestational Age, Birth Weight, Breastfeeding at Discharge.

Table 12

Binary Logistic Regression Infant Factors (Adjusted)

								95% C.I. Odds Ratio	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	**Gestational Age**	**-1.287**	**.107**	**144.347**	**1**	**.000**	**.276**	**.224**	**.341***
	Birth Weight	**-.774**	**.084**	**84.601**	**1**	**.000**	**.461**	**.391**	**.544***
	Breastfeeding at Discharge	**.544**	**.072**	**56.518**	**1**	**.000**	**1.723**	**1.495**	**1.986***
	Constant	1.223	.215	32.397	1	.000	3.398		

a. Variable(s) entered on step 1: Gestational Age, Birth Weight, Breastfeeding at Discharge.

Specificity and Sensitivity

The specificity of the model in relation to the analysis of maternal factors, was at 100.0% as illustrated in APENDIX A, and the sensitivity of the model was .0%. The overall classification of the model was 99.0%. The specificity in this study was used to calculate the probability that an infant will die before its first birthday and the sensitivity measures the probability that the infant will survive. The specificity and sensitivity of the model for infant factors was not identical to the maternal factors analysis and is also illustrated in APENDIX A The specificity of the model was at 99.9% and the sensitivity of the model was 43.8%. The overall classification of the model was 99.4%.

Summary

Non-Hispanic Black women experiencing incidents of infant mortality in Prince George's County, Maryland may have varying risks based upon specific maternal and infant factors. Income was examined relative to zip code at birth and identified that families with higher median household incomes did have better outcomes and there is a misnomer that the entire county is experiencing affluence. This study also showed evidence that maternal and infant factors play a significant role in infant mortality outcomes for births to non-Hispanic Black women in Prince George's County, MD. In Section 3, the results and statistical findings were presented for my study on the relationship between income, maternal and infant factors, and infant mortality rates in African American communities. The secondary analysis conducted for this study used data from the Maryland Department of Health, Department of Vital Statistics to examine if associations existed between infant mortality in the non-Hispanic Black community of

Prince George's County, MD, and income (using median household income), maternal factors, and/or infant factors. Infant mortality was assessed as infant status (dependent variable) and through a secondary analysis sought to identify whether there were any associations between infant mortality and the independent variables: maternal factors (maternal age, maternal education, trimester prenatal care began, previous negative pregnancy outcomes, insurance at delivery, smoking during prenatal period, chronic hypertension, pregnancy induced hypertension, gestational diabetes); infant factors (gestational age at birth, birth weight, breastfeeding at discharge); and zip code at delivery (proxy for income).

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

Infant mortality is a known, significant public health issue comprised of complex health, socioeconomic, racial, and generational factors. Despite taking positive steps forward to decrease the overall infant mortality rate, the health disparity experienced by the non-Hispanic Black population continues to grow (Proctor, 2017; United States Census Bureau, 2017). In Prince George's County this health disparity has fluctuated with non-Hispanic Black families experiencing infant mortality at a rate ranging from 2.8-4.6 times that of their non-Hispanic White counterparts (Cheng & Solomon, 2014; Lu & Johnson, 2014; Maryland Vital Statistics, 2015). In Section 4, the interpretation of key findings and how they align with the conceptual framework for action on the social determinants of health (CSDH), limitations of the study, recommendations for future research, and implications for professional practice and implications for social change.

Conceptual Framework for Action on the Social Determinants of Health

The CSDH theory suggests that long-term behavioral and health changes throughout the life-course can be used to improve infant mortality outcomes within target populations and communities (Lu et al., 2010). Through further development this theory expanded to an action-oriented framework that identifies specific recommendations that when implemented will promote change at both the individual and policy levels to aggressively address the social determinants of health (Solar & Irwin, 2010). Understanding the depth of socioeconomic status and those determinants that impact

infant outcomes and perpetuate a system that is riddled with health disparities, inequalities, and those factors that are indirectly connected to these barriers to improving infant mortality in the non-Hispanic Black community. The maternal factors explored in this study: age, educational attainment, trimester prenatal care began, and body mass index are not addressed as they relate to the social determinants of health and the actions needed to overcome their continued impact on infant outcomes.

The CADSH (Conceptual Framework for Action on the Social Determinants of Health) shows that it isn't enough to accept that previous negative pregnancy outcomes or a woman's body mass index are maternal factors that impact infant mortality outcomes. Rather, it looks to identify what actions need to be taken to address them and understand how they are related to the social determinants of health. What measures should be put into place to ensure that the next pregnancy outcome does not result in another infant mortality statistic? What barriers exist for this woman and how do they tie into the social determinants of health that she and her family experience in their community? These include health literacy, access to high-risk obstetric physicians, transportation, access to healthy foods, and the ability to take time off from work to attend appointments.

Interpretation of Findings

The findings of this study in alignment with the theoretical framework provides additional insight into what the literature has conveyed previously. In Research

Question 1 the null hypothesis was valid and there was no statistical significance found between zip code at birth or mean household income. Although the data did not show a clear relationship between the zip code that was proxy for income, nor did the mean household income based upon the zip code, it did provide insight relative to income and infant mortality. Income is challenging to assess in relation to infant mortality because data is not available at the individual level as the data for the maternal and infant factors were. In retrospect, the use of median household income only provides a broad generalization and does not allow for an accurate assessment of the relationship between income and infant mortality. In some of the zip codes included in the high-income category ≥ $100,001, the median household income ranges extended from $15,000 to $500,000 creating a skewed assessment of actual incomes within the zip code. For example, if there were six households with incomes that were ≥ $500,000 within a zip code and there are six households with incomes of $15,000, the median household income in that zip code would be $257,500 which makes it appear as though individuals living in that area are not impacted by income as a social determinant of health although fifty percent of the households are below the poverty level. The Crosstabulation for Zip Code at Birth – as proxy for income indicated that infant mortality in the study population was more prevalent in zip codes that were identified as low or middle income. Without individual level data, the true impact of income cannot be realized in relation to infant mortality within each zip code.

The range for the median household incomes in the zip codes with the greatest numbers of infant deaths from 2010 through 2016 was $40,000 to $80,000. Given the information above, this indicates that the range for actual household income sits along a larger gradient, and we do not have enough information to make statements of relationship. Furthermore, when considering the social determinants of health and the data from Research Question 1, there are other factors that we have not considered such as: the cost of housing in relation to income earned if the household has health insurance. This income range when considered in relation to household size may be limiting and keep the resident from qualifying for supportive services. This indicates that there is a need for further investigation to understand if there is a relationship between income and infant mortality that is connected to the social determinants of health.

Data analysis of Research Question 2 showed that the null hypothesis was not valid, and the alternate hypothesis was correct. The data showed that there is a clear relationship between infant mortality and specific maternal factors: maternal age, maternal education, trimester prenatal care began, previous negative outcomes, and body mass index (indicator of obesity). The data did not show a significant relationship between infant mortality and maternal smoking, insurance at delivery, chronic hypertension, pregnancy induced hypertension, and gestational diabetes.

In examining the data for infant births and deaths from 2010-2016 in Prince George's County Maryland, the outcomes of this study did not align with other studies

that utilized linked infant birth and death information from the CDC (Centers for Disease Control). In this study, maternal age was identified to have a clear relationship with maternal age. Based upon the National Vital Statistics Report that was released in 2019, it was found that women less than 20 years of age and those 35 years or greater, showed an increased incidence of infant death. Infants born to mothers who were 20 years to 35 years of age showed a decreased incidence of infant death before one year of age (Ely & Driscoll, 2019). The findings of this study did not align with the National Vital Statistics Report. The greatest incidence of infant death in Prince George's County, Maryland, from 2010-2016 was found to be for mothers 19 years-44 years of age with the greatest incidence in women 26 years-34 years of age. These calculations are based upon the number of deaths in each age group in relation to the number of infants born from 2010-2016. The percent of women ≤18 years of age who experienced infant mortality did show the highest incidence of infant mortality/death when considering only women 18 years of age or younger. While this is an interesting finding it is not a representation of the incidence of infant deaths by maternal age in relation to all births from that time-period.

The data showed that there was not a direct relationship between infant mortality and insurance at delivery. This is contrary to other recent studies one of which examined the incidence of infant mortality by payment source for delivery. That study indicated that when the mother had private insurance, the risk of infant mortality was the lowest where conversely, the risk was highest when the mother was a self-pay patient at delivery

unknown, Medicaid, private insurance, self-pay, Tri-Care, and other. The greatest number of infant deaths were seen in those that had Medicaid at delivery with the second highest incidence amongst those with unknown insurance status. The unknown category includes those without insurance at time of delivery. What is not differentiated in those mothers that deliver with Medicaid is whether their Medicaid is Emergency Medicaid or regular Medicaid. Women receiving Emergency Medicaid do not receive prenatal care under their coverage because Emergency Medicaid only covers the delivery of the baby. Therefore, many women with Emergency Medicaid are late to prenatal care or receive limited care due to the out-of-pocket costs. When examining this maternal factor, knowing if the mother was insured during the prenatal period and if she received prenatal care to fully assess the impact of the insurance at delivery. Furthermore, with the Affordable Care Act, some states were able to implement Medicaid Expansion Plans which in turn increased the number of women who were able to receive Medicaid during their pregnancy. Data from states that implemented Medicaid expansion indicated a 14.5% decrease in the infant mortality rate amongst African American infants which was more than two times that of states that did not implement the Medicaid expansion (Bhatt, & Beck-Sagué, 2018).

Research Question 3 examined the relationship between infant mortality and infant factors which proved the null hypothesis to be invalid and the alternate hypothesis to be correct. The infant factors studied were gestational age at delivery, birth weight, and

breastfeeding at discharge. Based upon the data for infant births and infant deaths that occurred prior to the first birthday from 2010 through 2016, the relationship between each of the infant factors were significant predictors of the probability of infant mortality occurring in this population. The data showed that most of the infant deaths that occurred during the period studied, were born at a gestational age less than 32 weeks (71.4%). Almost half of the infant deaths occurred to infants delivered at less than 23 weeks and 65.9% had a birth weight less than 1000 grams. Breastfeeding at discharge was statistically significant based upon the data provided and at face value this infant factor indicates that there is a relationship between breastfeeding and infant mortality. However, three fourths of the infant deaths were coded as either not breastfeeding at discharge or the information was unknown. This finding is not surprising when correlated with the percent of infants born less than or equal to 23 weeks gestation and weighing less than 1000 grams. Less than 21% of infants delivered with signs of life prior to the completion of 23 weeks gestation survive resuscitative efforts in the delivery room and only 30% of those that survive live past the first seven days of life (Anderson et.al., 2016). In light these survival rates infants born prior to 23 weeks gestation would not have been started on oral feedings so soon after birth. Breastfeeding at discharge in this instance would be considered positively linked to infant survival.

Limitations of the Study

This study was based upon data from birth certificate data and linked birth death certificates for infants born in Prince George's County, MD from 2010 through 2016. Information contained in this dataset relies on hospital staff to accurately obtain information from the medical record and information that is self-reported by the birthing person. Individuals may not understand the questions being asked or they may not report accurate information due to the potential for stigmatism. This can be seen when individuals are asked to self-report their smoking status (tobacco) during their pregnancy and they under-report in hopes to minimize the magnitude of the unfavorable behavior.

A second limitation as stated in the previous section is the inability to accurately assess individual level income information. This potentially affects the researcher or public health entity's ability to understand how the social determinants of health impact the population and/or community. The final limitation identified was again related to the self-reported information on the birth certificate. Incomplete information such as zip codes missing one or more numbers, zip codes out of the county, addresses containing P.O. Boxes, and unknown data points from omitted information by the individual filling out the birth certificate worksheet.

Recommendations for Future Research

Infant mortality continues to raise numerous questions as individuals seek to crack the secret code to improve outcomes by eliminating racial and health disparities and addressing the impact that the social determinants of health have on this important

public health issue. Future research is needed to delve deeper into the underlying causes for the live births that occur prior to 23 weeks gestation and those that are born weighing less than 1000 grams. Understanding the impact of access to care, transportation, socioeconomic status, maternal age, health literacy, chronic health conditions, previous negative outcomes and other potential contributors to these outcomes is important to moving the needle to improve infant mortality in the non-Hispanic Black community in Prince George's County, MD. Finally, future research also needs to begin to look upstream to begin to address the systemic roots of these community realized consequences of the current system in place.

Implications for Professional Practice and Social Change

This study examined the relationship between income, maternal and infant factors, and infant mortality in Prince George's County, MD. The study population was specific to non-Hispanic Black women and their infants residing in the county at the time of birth and requires additional statistical analysis to determine if all maternal and infant factors translate to all non-Hispanic Black women of childbearing age.

Moving the needle on infant mortality in the non-Hispanic Black community requires a collaborative approach from all key stakeholders. Taking the information learned from this study and applying it to practice is not just for a single agency or entity. Infant mortality is an indication of the health of a community and in the case of Prince George's County, Maryland, it indicates that the non-Hispanic Black community is

unhealthy. While some factors that contribute to perinatal outcomes are specific to pregnancy, some begin in childhood, and still others are generational. This study has shown that more than half of the non-Hispanic Black women that gave birth from 2010 through 2016 were either overweight or obese. The public health community needs to further investigate why such a large percentage of women are not at a healthy weight when they become pregnant. Prevention needs to begin in the schools as a topic that is incorporated into health classes and draws age-appropriate correlations to weight, health, and disease risk. Preconception health needs to be taught at pediatric visits with a focus on those risk factors that impact both physical health and mental health with screenings that monitor individual risk and how to manage it for optimal outcomes.

When women are concerned about meeting their own basic needs or those of their family, they are unable to address anything beyond that moment. It is our responsibility to provide them with the tools needed to have successful pregnancies and for their infants to realize their full potential.

This means that all decision makers need to be at the table and not just those representing the boots on the ground. It requires increased financial investment, programmatic support, and bringing outliers to the table when critical discussions are being made. While the director of housing may not see how they are connected to infant mortality, it is our responsibility as public health professionals to explain their role and the importance of stable housing during pregnancy.

Finally, the community needs to know that we are addressing the public health issue known as infant mortality. That this issue is an indicator of the health of the population in the very community where they reside. Current data tells us that the non-Hispanic Black community is not healthy, and this poor health is impacting pregnancy outcomes at a disproportionate rate to those of their non-Hispanic White counterparts. If we fail to engage the community and get their buy-in to begin addressing these issues the needle will remain frozen and infant mortality will remain an on-going challenge with little hope for a resolve in sight.

References

Anderson, J.E., Baer, R.J., Partridge,J.C., Kuppermann, M., Franck,L.S, Rand, L., et.al, (2016, July 1). Survival and major morbidity of extremely preterm infants: A population-based study. *Pediatrics*. *138* (1). doi: e20154434.10.1542/peds.2015-4434

Anderson, T.M., Laviste Ferres, J.M., You Ren, S., Moon, R.Y., Goldstein, R.D., Marino Ramirez, V., et.al, (2019, April). Maternal smoking before and during pregnancy and the risk of sudden unexpected infant death. *Pediatrics. 143* (4). doi: 10.1542/peds.2018-3325

Artiga, S., & Hinton, E. (2018). Beyond health care: The role of social determinants in promoting health and health equity. *Kaiser Family Foundation*. Retrieved from https://www.kff.org/racial-equity-and-health-policy/issue-brief/beyond-health-care-the-role-of-social-determinants-in-promoting-health-and-health-equity/

Bekemeier, B., Chen, A.L., Kawakyu, N., & Yang, Y. (2013, December). Local public health resource allocation: limited choices and strategic decisions. *American Journal of Preventative Medicine*, *45*(6), 769-75. doi: 10.1016/j.amepre.2013.08.009.

Bhattm C.B., & Beck-Sagué, C.M. (2018, April). Medicaid expansion and infant mortality in the United States. *American Journal of Public Health, 108*, 565-567. doi: 10.2015/AJPH.2017.304218.

Braveman, P., & Gottlieb, L. (2014). The social determinants of health: It's time to

consider the causes of the causes. *Public Health Reports*, *129*(1_suppl2), 19–31. https://doi.org/10.1177/00333549141291s206

Braveman, P. A., Cubbin, C., Egerter, S., Williams, D. R., & Pamuk, E. (2010). Socioeconomic disparities in health in the United States: What the patterns tell us. *American Journal of Public Health*, *100*(Suppl 1), S186–S196. http://doi.org/10.2105/AJPH.2009.166082

California Department of Public Health. (2019). Infant mortality rate, by race/ethnicity. Retrieved from https://www.kidsdata.org/topic/295/infantmortality-race/table

Centers for Disease Control and Prevention. (2015). Linked birth and infant death data. *National Vital Statistics System*. Retrieved from https://www.cdc.gov/nchs/nvss/linked-birth.htm

Centers for Disease Control and Prevention. (2016a). Health, United States, 2016 – Individual charts and tables: Table 010 Infant, neonatal, post neonatal, fetal, and perinatal mortality rates, by detailed race and Hispanic origin of mother: United States, selected years 1983-2014. Retrieved from https://www.cdc.gov/nchs/data/hus/2016/010.pdf

Centers for Disease Control and Prevention. (2016b). PRAMS data. Retrieved from https://www.cdc.gov/prams/

Centers for Disease Control and Prevention. (2016c). Infant mortality. Retrieved from https://www.cdc.gov/reproductivehealth/MaternalInfantHealth/InfantMortality.htm

Centers for Disease Control and Prevention. (2017, January 5). Facility worksheet for the live birth certificate. Retrieved from https://www.cdc.gov/nchs/data/dvs/facility-worksheet-2016.pdf

Centers for Disease Control and Prevention. (2018a). Social determinants of health: know what affects health. Retrieved from https://www.cdc.gov/socialdeterminants/

Centers for Disease Control and Prevention. (2018b). Health disparities. Retrieved from https://www.cdc.gov/healthyyouth/disparities/index.htm

Centers for Disease Control and Prevention. (2019, July). Linked birth and infant death data. *National Vital Statistics System*. Retrieved from https://www.cdc.gov/nchs/nvss/linked-birth.htm

Centers for Disease Control and Prevention. (2019, October 21). Premature birth. Retrieved from https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm

Cole, W. M. (2019). Wealth and health revisited: Economic growth and wellbeing in developing countries, 1970 to 2015.*Social Science Research, 77*, 45–67. https://doi.org/10.1016/ j.ssresearch.2018.09.003

Cooper, R. S., Kennelly, J. F., Durazo-Arvizu, R., Oh, H., Kaplan, G., & Lynch, J. (2016). Relationship between premature mortality and socioeconomic factors in black and white populations of US metropolitan areas. *Public Health Reports, 116*(5), 464–473. https://doi.org/10.1016/s0033-3549(04)50074-2

Cheng, T. & Solomon, B. (2014, February). Translating life course theory to clinical practice to address health disparities. *Journal of Maternal Child Health*, *18*(2). doi: 10.1007/s10995-013-1279-9

Christopher, G. & Simpson, P. (2014, September 1). Improving birth outcomes requires closing the racial gap. *American Journal of Public Health*, *104*(S1). doi: 10.2105/AJPH2013.301817.

Collins, J., Rankin, K., & David, R. (2011, April). African American women's lifetime upward economic mobility and preterm birth: The effect of fetal programming. *American Journal of Public Health, 101*(4). doi: 10.2105/AJPH.2010.195024

Creswell, J.W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th Ed.). Thousand Oaks: California: Sage Publications.

Curry Owens, T., & Jackson, F. M. (2015). Examining life-course socioeconomic position, contextualized stress, and depression among well-educated African-American pregnant women. *Women's Health Issues, 25*(4), 382–389. https://doi.org/10.1016/ j.whi.2015.05.001

David, R. J., & Collins, J. W. (2014). Layers of inequality: Power, policy, and health. *American Journal of Public Health, 104*(S1), 8–10. https://doi.org/10.2105/ajph.2013.301765

Driscoll, A.K, & Ely, D.M. (2019, September 25). Maternal characteristics and infant outcomes in Appalachia and the Delta. *National Vital Statistics Reports, 68*(11). Retrieved from https://www.cdc.gov/nchs/data/nvsr/nvsr68/nvsr68_11-508.pdf.

Egerter S, Braveman P, Sadegh-Nobari T, Grossman-Kahn R, & Dekker M . (2011). Education matters for health. Exploring the social determinants of health: issue brief no. 6. Robert Wood Johnson Foundation.

Elder, T. E., Goddeeris, J. H., & Haider, S. J. (2016). Racial and ethnic infant mortality gaps and the role of socio-economic status. *Labour Economics*, *43*, 42–54. https://doi.org/10.1016/ j.labeco.2016.04.001

Ely, D.M., & Driscoll, A.K. (2019, August 1). Infant mortality in the United States, 2017: Data from the period linked birth/infant death file. *National Vital Statistics Reports*. *68*(10). Retrieved from https://www.cdc.gov/nchs/data/nvsr/nvsr68/nvsr68_10_tables-508.pdf

Embryology. (2019). Gestational age. Retrieved from Gestational Age - Embryology (unsw.edu.au)

Eunice Kennedy Shriver National Institute of Child Health and Human Development (2017, January 31). What is prenatal care and why is it important? Retrieved from https://www.nichd.nih.gov/health/topics/pregnancy/conditioninfo/prenatal-care

Families USA. (2017, February). Federal poverty guidelines. Retrieved from http://familiesusa.org/product/federal-poverty-guidelines

Faul, F., Erdfelder, E., Buchner, A., & Lang, A-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*, 1149-1160.

Hauck, F., Tanabe, K., & Moon, R. (2011, August). Racial and ethnic disparities in

infant mortality. *Seminars in Perinatology*, *35*(4). https://doi.org/ 10.1053/ j.semperi.2011.02.018

Healthy People 2020. (2017, October 13). Social determinants of health. *Office of Disease Prevention and Health Promotion*. Retrieved from https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health

Hogan, V. K., Rowley, D., Bennett, T., & Taylor, K. D. (2011). Life course, social determinants, and health inequities: Toward a national plan for achieving health equity for African American infants—a concept paper. *Maternal and Child Health Journal*, *16*(6), 1143–1150. https://doi.org/10.1007/s10995-011-0847-0

Horon, I. (n.d.). Maryland vital statistics annual report 2014: Department of health and mental hygiene vital statistics administration. Retrieved from https://health.maryland.gov/vsa/Documents/Reports%20and%20Data/Annual%20Reports/2014annual.pdf

Horon, I., Sparks, G., & Hurt, S. (n.d.). Maryland vital statistics annual report 2015: Department of health and mental hygiene vital statistics administration. Retrieved from https://health.maryland.gov/vsa/Documents/15annual.pdf

Huynh, M., Spasojevic, J., Li, W., Maduro, G., Van Wye, G., Waterman, P., & Krieger, N. (2017). Spatial social polarization and birth outcomes: preterm birth and infant mortality – New York City, 2010–14. *Scandinavian Journal of Public Health*, *46*(1), 157–166. https://doi.org/10.1177/1403494817701566

Hye-Jin, K., Kyoung-Bok, M., Yoo-Joong, J., & Jin-Young, M. (2021, April). Disparities in infant mortality by payment source for delivery in the United States. *Preventive Medicine*, *145*. doi: 10.1016/j.ypmed.2020.106361

Kaiser Family Foundation, (2012, December). Focus on health care disparities: Key facts. Retrieved from https://www.kff.org/racial-equity-and-health-policy/issue-brief/disparities-in-health-and-health-care-5-key-question-and-answers/ Answers |

Kane, J. B., Miles, G., Yourkavitch, J., & King, K. (2017). Neighborhood context and birth outcomes: Going beyond neighborhood disadvantage, incorporating affluence. *SSM - Population Health*,*3*, 699–712. https://doi.org/10.1016/j.ssmph.2017.08.003

Kim, D., & Saada, A. (2013, June). The social determinants of infant mortality and birth outcomes in western developed nations: A cross-country systemic review. *International Journal of Environmental Research and Public Health*, *10*(6). doi: 10.3390/ijerph10062296.

Kimball, R. & Wissner, M. (2015, November/December). Religion, poverty, and politics: Their impact on women's reproductive health outcomes. *Public Health Nursing*, *32*(6). doi: 10.1111/phn.12196

Kothari, C. L., Romph, C., Bautista, T., & Lenz, D. (2017). Perinatal periods of risk analysis: Disentangling race and socioeconomic status to inform a black infant mortality community action initiative. *Maternal and Child Health Journal*, *21*(S1), 49–58. https://link.springer.com/article/10.1007/s10995-017-2383-z

Lefmann, T., & Combs-Orme, T. (2014). Prenatal stress, poverty, and child outcomes.

Journal of Child and Adolescent Social Work, 31; 577-590. doi: 10.1007/s10560-014-0340-x

Lincolnshire County Council. (2014, August). Joint strategic needs assessment: Pregnancy and maternal health. *National Health Service*. Retrieved from Project Communication Plan (research-lincs.org.uk)

Lorenz, J. M., Ananth, C. V., Polin, R. A., & D'Alton, M. E. (2016). Infant mortality in the United States. *Journal of Perinatology*, *36*(10), 797–801. https://doi.org/10.1038/jp.2016.63

Lu, M., Johnson, K. (2014, September 1). Toward a national strategy on infant mortality. *American Journal of Public Health*. *104*(51). doi: 10.2015/AJPH.2013.301855

Lu, M., Kotelchuck, M., & Halfon, N. (2010, Winter). Closing the black-white gap in birth outcomes: A life-course approach. *Ethnicity & Disease*, *20*. Retrieved from www.ncbi.nlm.nih.gov/pmc/articles/PMC4443479/#!po=0.847458.

March of Dimes. (2019). Peristats: Infant mortality rate. Retrieved from https://www.marchofdimes.org/peristats/about-us/calculations?reg&top&id=15

March of Dimes. (2019, October). Premature babies. Retrieved from https://www.marchofdimes.org/complications/premature-babies.aspx

Maryland Vital Statistics. (2012, August). Infant mortality in Maryland, 2011. Retrieved from https://health.maryland.gov/vsa/Documents/Reports%20and%20 Data /Infant%20Mortality/Infant_Mortality_Report_2011.pdf

Maryland Vital Statistics. (2013, August). Infant mortality in Maryland, 2012. Retrieved from https://health.maryland.gov/vsa/Documents/Reports%20 and%20Data/Infant%20Mortality/Infant_Mortality_Report_2012.pdf

Maryland Vital Statistics. (2014, September). Infant mortality in Maryland, 2013. Retrieved from https://health.maryland.gov/vsa/Documents/Reports%20and%20Data /Infant%20Mortality/Infant_Mortality_Report_2013.pdf

Maryland Vital Statistics. (2015, September). Infant mortality in Maryland, 2014. Retrieved from https://health.maryland.gov/vsa/Documents/Reports%20and%20Data/Infant%20Mortality/Infant_Mortality_Report_2014.pdf

Maryland Vital Statistics. (2016, September). Infant mortality in Maryland, 2015. Retrieved from https://health.maryland.gov/vsa/Documents/Reports%20and%20Data/Infant%20Mortality/Infant_Mortality_Report_2015.pdf

Maryland Vital Statistics. (2018, September). Infant mortality in Maryland. Retrieved from https://health.maryland.gov/vsa/Documents/Reports%20and%20Data/Infant%20Mortality/Infant_Mortality_Report_2017_20180919.pdf

Maryland Vital Statistics. (2019, October). Infant mortality in Maryland, 2018. Retrieved from Infant_Mortality_Report_2018.pdf (maryland.gov)

Mississippi Vital Statistics. (2015, March). Mississippi annual vital statistics report 2013. Retrieved from https://msdh.ms.gov/phs/stat2013.htm

Mississippi State Department of Health (2016). Infant mortality report. Retrieved from imr-2016_review_18882611_81b2541c9654a1110ae7854c2606c22d71d0153e.pdf (ms.gov)

Mississippi State Department of Health (2018). Infant mortality report. Retrieved from https://msdh.ms.gov/msdhsite/_static/resources/8015.pdf

National Archives and Records Administration. (2017, January 31). Annual update of the HHS poverty guidelines. *Federal Register*. Retrieved from https://www.federalregister.gov/documents /2017/01/31/2017-02076/annual-update-of-the-hhs-poverty-guidelines

New York Department of Health. (2019, February). Rockland County health indicators by race/ethnicity 2014-2016. Retrieved from https://www.health.ny.gov/statistics/community/minority/county/rockland.htm

Office of Disease Prevention and Health Promotion (2017). Maternal, infant, and child health: Morbidity and mortality. Healthy People 2020. Retrieved from https://www.healthypeople.gov/2020/topics-objectives/topic/maternal-infant-and-child-health

Online Etymology Dictionary. (n.d.). Affluent. Retrieved from http://www.dictionary.com/browse/affluent

Paul, P., Pennell, M. L., & Lemeshow, S. (2013). Standardizing the power of the Hosmer-Lemeshow goodness of fit test in large data sets. *Statistics in medicine*, *32*(1), 67–80. https://doi.org/10.1002/sim.5525

Perry, A.M. (2017, November 15). Black incomes outpace the national average in 124 majority black cities: So where's the investment. *Brookings Institution*. Retrieved from https://www.brookings.edu/blog/the-avenue/2017/11/15/black-

incomes-outpace-the-national-average-in-124-majority-black-cities-so-wheres-the-investment/

Pickett, K. E., & Wilkinson, R. G. (2015). Income inequality and health: A causal review. *Social Science & Medicine*, *128*, 316–326. https://www.sciencedirect.com/science/article/abs/pii/S0277953614008399?via%3Dihub

Prince George's County Health Department Office of Assessment and Planning. (2019). 2019 Maternal and Infant Health Report. Retrieved from https://www.princegeorgescountymd.gov/ArchiveCenter/ViewFile/Item/3107

Proctor, C. (2017, August 18). The heart of black affluence in Prince George's County. Washington Business Journal. Retrieved from https://www.biz journals. com/washington/news/2017/08/18/the-heart-of-black-affluence-in-prince-georges.html

Reno, R., & Hyder, A. (2018). The evidence base for social determinants of health as risk factors for infant mortality: A systematic scoping review. *Journal of Health Care for the Poor and Underserved*, *29*(4), 1188–1208. https://doi.org/10.1353/hpu.2018.0091

Rosenthal, L. Lobel, M., (2011). Explaining racial disparities in adverse birth outcomes: Unique Sources of stress for black American women, *Social Science & Medicine,72*(6); 977-983.

Save the Children. (2015). The urban disadvantage: State of the world's mothers 2015. Retrieved from http://www.savethechildre.org/atf/cf/%7B9def2ebe-10ae-432c-9bd0-df91d2eba74%7D/SOWM_2015.pdf

Singh, G.K., & Yu, S.M. (2019). Infant mortality in the United States, 1915-2017: Large social inequalities have persisted for over a century, *International Journal of MCH and AIDS. 8*(1). doi: 10.21106/ijma.271

Solar, O. & Irwin, A. (2010). A conceptual framework for action on the social determinants of health: Social Determinants of Health Discussion Paper 2. *World Health Organization*. Retrieved from http://apps.who.int/iris/bitstream /handle/10665/44489/9789241500852_eng.pdf;jsessionid=56A24EAE176430F09 C4497FF8E3DEEBD?sequence=1

Soriano, F.I. (2013). *Conducting needs assessments: A multidisciplinary approach* (2nd ed.). Thousand Oaks, CA: Sage Publications

Sparks, P.J., Sparks, C.S., & Campbell, J.J. (2013, April). An application of Bayesian spatial statistical methods to the study of racial and poverty segregation and infant mortality rates in the US. *GeoJournal*, *78*(2). Retrieved from https://link.springer.com/article/10.1007/s10708-011-9445-3

United States Census Bureau. (2016). American fact finder: Community facts. Retrieved from https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

University of Wisconsin Population Health Institute, (2019, March). County health rankings and roadmaps. Retrieved from http://www.countyhealthrankings.org/ app/maryland /2019/measure/factors/131/description

Valderas, J.M, Starfield, B., Sibbald, B., Salisbury, C., & Roland, M. (2009, July). Defining comorbidity: Implications for understanding health and health services. *Annals of Family Medicine, 7*(4): 357-363. doi:10.1370/afm.983.

Wagmiller, R.L. & Adelman, R.M. (2009, November). Childhood and intergenerational poverty: The long-term consequences of growing up poor. National Center for Children in Poverty. Retrieved from http://www.nccp.org/publications/

Wallace, M. E., Mendola, P., Chen, Z., Hwang, B. S., & Grantz, K. L. (2016). Preterm birth in the context of increasing income inequality. *Maternal and Child Health Journal*, *20*(1), 164–171. https://doi.org/10.1007/s10995-015-1816-9

Westcott, L. (2015, May 4). Washington's poorest infants are ten times more likely to die than richest. *Newsweek*. Retrieved from https://www.newsweek.com/washington-global-infant-maternal-mortality-328148

Wilson, K. B., Thorpe, R. J., & LaVeist, T. A. (2017). Dollar for dollar: Racial and ethnic inequalities in health and health-related outcomes among persons with very high income. *Preventive Medicine*, *96*, 149–153. https://doi.org/10.1016/j.ypmed.2016.08.038

Appendix A: Specificity and Sensitivity

Specificity and Sensitivity of the Model: Maternal Factors

		Predicted		
		Infant Status		
Observed		Infant Alive	Infant Deceased	Percentage Correct
Infant Status	Infant Alive	46970	0	100.0
	Infant Deceased	473	0	.0
Overall Percentage				99.0

a. The cut value is .500

Specificity and Sensitivity of the Model: Infant Factors

		Predicted		
		Infant Status		
Observed		Infant Alive	Infant Deceased	Percentage Correct
Infant Status	Infant Alive	46940	30	99.9
	Infant Deceased	266	207	43.8
Overall Percentage				99.4

b. The cut value is .500