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# Examining Predictors of Birth Outcomes: Implications for Early Childhood Development and Policy

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Abstract

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MS, University of North Texas, 2005

BA, University of Texas at Arlington, 2000

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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## Abstract

While the infant mortality rate has improved significantly in the United States in recent years, a Black-White disparity persists. The problem is the high infant mortality rate in the state of Texas. The purpose of this quantitative multiple logistic regression study was to examine disparities in birth outcomes in the state of Texas by race, ethnicity, and other significant predictors related to socioeconomic status. The Mosley-Chen theoretical framework bridges the gap between social science and biomedicine to identify key predictors of infant mortality including socioeconomic factors for studies in child development. The 2 research questions examined if race and ethnicity would predict infant mortality and if any predictor had a statistically significant impact on women and infant mortality. The methodology of this study used sequential multiple logistic regression analysis, with the inclusion criteria of all available linked birth/infant death records from the National Bureau of Economic Research for 2011–2013, to examine the likelihood that the independent variables could predict infant mortality. The sample size was 11,862,780. The results indicated there was a statistically significant likelihood that race and ethnicity would predict infant mortality and that one predictor, prenatal care, had a statistically significant impact on women and infant mortality. This study's findings can inform positive social change by encouraging researchers and policymakers to further examine the role of racial disparities in health. Additionally, study findings may encourage community groups to examine possible changes in policy and educational practices to benefit women and children in Texas by focusing on racial disparities and equity gaps and their effects on children and families.

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# Dedication

My dissertation is dedicated to my husband, Scott, and to my family. My husband and my family have encouraged me from the beginning and they have been my biggest supporters. I am eternally grateful for their love, support, and encouragement. My dissertation is also dedicated in loving memory of my father.

# Acknowledgments

In addition to my wonderful husband and family, there are several individuals who have been pivotal in my success. I would like to acknowledge and thank the Fort Worth Independent School District for their support in my work so that we can all improve the quality of our students' lives. I would like to acknowledge and thank the many stakeholders for their support and help in this important study. I would also like to thank my committee chair, Dr. Donald Yarosz, for his support and for believing in me, my methodologist, Dr. Patricia Anderson, for her support and help, and my URR, Dr. Shereeza Mohammed, for her support and suggestions. I would like to sincerely thank everyone (Walden professors, Walden staff, and my wonderful, supportive cohorts) for the support during my doctoral journey.

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# Chapter 1: Introduction to the Study

The vision statement of the National Association for the Education of Young Children states, “All young children thrive and learn in a society dedicated to ensuring they reach their full potential” (NAEYC, 2017). In the state of Texas, the Texas Association for the Education of Young Children was founded to “Encourage the improvement of education and well-being of young children” (TAEYC, 2017). The Walden University catalog for the Early Childhood Specialization Program states, “Early childhood, as a field, refers to young children (prenatally through 8 years old) as well as those adults, programs, and agencies that have a significant impact on children’s development and learning” (Walden University, 2012, Early Childhood Specialization, para. 1). Early childhood education spans the age range from birth through age 8 (Hyson & Biggar Tomlinson, 2014). A child’s health in the earliest years, beginning in utero, strengthens their developing biological systems, which enables them to grow and develop into healthy children who thrive and grow to be healthy adults (Shonkoff et al., 2012). Health in the earliest years, beginning with a healthy pregnancy, lays the groundwork for a child’s physical, mental, and cognitive well-being (Center on the Developing Child, 2010). When critical issues occur in a young child’s physical, mental, cognitive, and social emotional development, early childhood educators, social workers, and other community service workers work to intervene and provide services to help the child achieve their potential (Fraley, Roisman, & Haltigan, 2013). This includes providing educational information to mothers and caregivers. In this study, I examined predictors of infant mortality in the state of Texas. The results can inform the development of parent

educational interventions and messaging targeted by early childhood policymakers to help prevent infant mortality.

The death of a baby before their first birthday is an incident of infant mortality. In the United States, the infant mortality rate is higher than other developed countries, 5.9 deaths per 1,000 live births, with significant disparities in infant mortality regarding race (United Health Foundation, 2019). In the state of Texas, the average infant mortality rate is comparable to the national average; however, in certain parts of the state, the infant mortality rate can be as high as six times the state and national average with 12.3 deaths per 1,000 births (Greene, 2018). Information from the Tarrant County Infant Health Network states the infant mortality rate is an estimate of the number of infant deaths for every 1,000 live births and is used as an indicator to measure a community's health and well-being. In both the state of Texas and Tarrant County there are significant disparities in Black-White infant mortality. The national average infant mortality rate is 5.9 infant deaths per 1,000 live births. In Tarrant County, the infant mortality rate for White infants is 7.0, and for Black infants, it is 16.1 (Tarrant County Infant Health Network, 2014). I examined the disparities in birth outcomes for the state of Texas using 2011–2013 data by race and ethnicity as well as other significant predictors related to socioeconomic status. The approach extends previous research conducted to examine if other relevant predictors are both substantively and statistically significant regarding this phenomenon.

Originally, I was going to analyze all available archived records from the Tarrant County Public Health Department (TCPHD) in north Texas for the study period of 2012–2015. However, my application submitted to the TCPHD for the records was denied.

Then I sought to analyze all available linked birth/infant death records from the Centers of Disease Control and Prevention (CDC) for the study period 2014–2016. When that application was submitted, it was denied as well. Similar information was found on the National Bureau of Economic Research's (NBER) website; therefore, I used all available linked birth/infant death records from the NBER for the study period 2011–2013.

The results of this study may provide early childhood policymakers, public health practitioners, and community leaders with information that could inform potential parental educational interventions and educational resources that may be beneficial to expectant and new mothers to prevent further loss of fetal and infant lives.

The following sections will provide the background of the study, the purpose of the study, the research questions and hypotheses, and the theoretical framework used. The problem statement will be discussed and an overview of the methodology used in this study will be given, including a brief description of the approach to compiling all available linked birth/infant death records from NBER for the study period of 2011–2013 (NBER, 2019). The nature of the study will be discussed along with definitions, assumptions, scope and delimitations, and limitations to the study, as well as the significance of the study.

## Background

Mortality is one of the most important measures of social inequality because it indicates a group's success in providing members with the most highly prized of all attributes, life itself (Preston & Haines, 2014, p. 88). Infant mortality rates are a global, national, state, and local problem. In 2015, 4.5 million (75% of all deaths under age 5)

occurred within the first year of life (World Health Organization, 2015). The United States infant mortality rate remains high and although the overall infant mortality rate has improved significantly in recent years, the Black-White disparity persists (Spong, Iams, Goldenberg, Hauck, & Willinger, 2011). In addition, educators, policymakers, and healthcare professionals have given inadequate attention to the causes of racial disparities (Duncan & Kawachi, 2018; Williams & Collins, 2001). Healthy People 2020 identified reducing racial gaps in the infant mortality rate as a critical objective; specifically, the program established a national goal of all racial groups having an infant mortality rate below 6.0 infant deaths per 1,000 live births (Healthy People, 2012). The quality of early experiences influences the development of the brain. A healthy pregnancy and a healthy environment for children age 0 to 3 is imperative for a child's brain, body, and behavioral development (Fox, Levitt, & Nelson, 2010).

The association between socioeconomic factors and child health and development begins in the womb. Prenatal care, nutrition, housing quality, and safety in the home and community affect a child in the womb through age 3, which in turns affects a child's readiness for school and affects their health and development through their life span (Braveman, Egerter, Arena, & Aslam, 2014). Racial differences in maternal health and behaviors may account for as much as a quarter of the racial gap in school readiness (Currie, 2005). A review of the literature for this study outlined the strong need for educators and policymakers to rethink how infant mortality predictors affect a child's health and development. In the literature review I present an overview of prenatal care, pediatric health and care, preventions and interventions during and after pregnancy, and

racial disparities in healthcare in order to identify specific risks for Black women during pregnancy. A focal point of the literature review is recognizing the racial disparities in healthcare and its long-term impact on maternal and infant health outcomes and early childhood development.

As a former early childhood educator and current early childhood policymaker, I recognize the need to work with the parents of students, including those who are parents to siblings not yet in school. In addition, there is also a need to assist the parents of young students with finding resources they need. There is a need to assist the families and students in Tarrant County because many of the parents are unaware of these resources or how to access the resources or they feel apprehension in trusting the resources. Researchers have explored the relationships between educators and parents and have found that the impact can last through adulthood for their children (Seligman & Darling, 2017). Researchers have also found perinatal complications and reduced access to resources partly account for diminished cognitive development in young children (Masten, 2001; McLoyd, 1998).

The results of this study are needed to help early childhood policymakers, educators, social workers, and physicians influence social change through collective impact to end racial disparities in education and in healthcare in a targeted way. In my community, and across the country, these stakeholders continue to work in isolation. The hope is that this study will encourage stakeholders to work, through collective impact, to solve the specific problem of infant mortality by identifying in order of highest likelihood of impact upon infant mortality its most significant predictors including (a) weight of

baby at delivery, (b) gestational age, (c) maternal age at time of delivery, (d) maternal education, (e) marital status, (f) tobacco use during pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at time of delivery, and (j) race of the mother. Knowing which of the predictors have the highest likelihood of impact could help affect positively the quality of prenatal education, care, nutrition, and educational resources throughout the lifespan of all women and children in my community—particularly Black women in this county who have the highest incidence of infant mortality in this population—and potentially throughout the state of Texas.

## Problem Statement

The problem is the high infant mortality rate in the state of Texas. To address this problem, in a quantitative multiple logistic regression study, I examined the predictors of infant mortality in the state of Texas by race and ethnicity and a number of other possibly significant predictors related to socioeconomic status. Taneja and Colquitt (2015) noted that over the last 20 years, the infant mortality rate has been as high as 9.91 infant deaths per 1,000 live births and as low as 6.29. In 2018, Nehme et al. (2018) evaluated data from the Texas Vital Statistics Linked Birth and Death records from 2011–2014 and found rates in Tarrant County as high as 12.3 infant deaths per 1,000 live births. Nehme et al. (2018) found that, while the overall infant mortality rate for the state was close to the national average (5.9) as well as to the Healthy People 2020 objective of 6.0 deaths per 1,000 live births, there was broad variations in rates across counties and especially among different racial groups.

In 2009, there were 29,060 live births from all ages of women in Tarrant County (Ahmed, 2013). Of those births, 1,208 were among Black mothers less than 18 years old and 1,247 women not receiving any prenatal care. The mortality rates of those 29,060 live births were 194 deaths due to infant mortality, 141 deaths due to neonatal mortality, 189 deaths due to fetal mortality, and 330 deaths due to perinatal mortality (Ahmed, 2013). Research has focused on available services during pregnancy, stressors during pregnancy, and socioeconomics of pregnant women (University of North Texas Health Science Center [UNTHSC], 2014). The literature and research on infant mortality is mostly descriptive. Descriptive research is when information is collected without changing the environment. Descriptive research is used to obtain information concerning the status of the phenomena to describe what currently exists in relation to the variables in a situation. There is evidence that quality prenatal care and high-quality early childhood education can have a profound positive effect on a child's academic success (DeBruin-Parecki & Slutzky, 2016). In this study, I replicate and extend previous work by conducting a multivariate analysis of infant mortality to examine predictors in birth outcomes to inform policymakers.

Researchers have investigated the racial phenomenon of infant mortality rate and uncovered social factors such as poverty, education, and teen pregnancy as attributing factors for infant mortality (Rowley & Hogan, 2012; UNTHSC, 2014). However, a review of the literature suggests there are deficiencies in the evidence and gaps in the literature. Mitchell (2012) identified one gap in the literature, suggesting additional research to identify racial disparities to address them and lower the infant mortality rate.

A lack of prenatal care and unhealthy habits among Black women may be reasons for the high infant mortality rates of Black babies in Texas (Mitchell, 2012). In addition, another gap in the literature is that, while some states are making progress in reducing infant mortality, specifically for Black infants, there is less progress in eliminating the Black-White disparities (Brown Speights et al., 2017). As a former early childhood educator in Texas and a doctoral student looking at a problem from the perspective of early childhood policy, I have observed that the same areas with the highest infant mortality rates in Texas are also the areas where, if the children survive, they are students who struggle the most in school. For example, in Tarrant County, only three out of 10 third graders are reading on grade level (Belew, 2018). Without strong reading skills, students are four times more likely to drop out. In Tarrant County, only 30% of the adults have a college education (TownCharts, 2017). This also holds true for the rest of the state. Twenty-seven percent of Texans hold a college degree. A report from the College Board states Texas ranks 40th for the number of people ages 25–34 who hold at least an associate's degree and less than one third of Texans in the same age group have a postsecondary degree. This is below the 41% national average (College Board, 2020). As an early childhood educator, the problem in the state of Texas, is one of too many silos and the need for organizations to work together using collective impact to help our students and families.

As a child progresses from in utero through adulthood, needs must be met in a continuous progression, with success depending on the quality along the way. The My Brother's Keeper Initiative developed by President Obama highlights this progression

and calls it a “cradle to career” initiative (My Brother’s Keeper, 2014). High quality prenatal care, high quality nutrition, and stress-free living environments lead to a healthy infancy and prepare children for success in school. A high-quality early childhood education combined with “learning to read” to be reading on grade level by third grade, leads to “reading to learn” to be math ready by ninth grade. Success in algebra predicts college readiness, which leads to success in college, leading to successful adulthood (Kurlaender, Reed, & Hurtt, 2019). However, if infant mortality persists, children may not have the opportunity to move through these life stages.

The foundation of early childhood development and education begins in fetal life. New scientific and medical advances have informed the understanding that prenatal care has a specific impact on a child and their physical, mental, cognitive, and social emotional development (Behnke et al., 2013; Lee, & Burkam, 2002). Shonkoff et al. (2012) researched brain architecture and found that early experiences affect the development of the brain, which provides the foundation for all future learning, behavior, and health.

Adverse experiences in utero and in early childhood impair brain development with negative effects lasting into adulthood (Shonkoff et al., 2012). In this study, I analyzed the predictors of infant mortality in the state of Texas and racial disparities to inform early childhood policy. Physical, emotional, social, and mental health are dimensions necessary for school readiness in children and are affected by the health of the mother and the child (Halle, Hair, Wandner, & Chien, 2012; Lee, & Burkam, 2002). Research suggests a child’s socioeconomic characteristics affect them directly and

indirectly (Halle et al., 2012). Working with families in a community could lower the infant mortality rate and may improve school readiness. Researchers have indicated that the problem of infant mortality needs to be addressed. Findings from research suggest that support for families and children from impoverished circumstances cannot begin too early (Hurt & Betancourt, 2017). Researchers have agreed that improving the quality of pregnancies and child development from age 0 to 3 has a significance on early childhood education, (Center on the Developing Child, 2010; Halle et al., 2010; Mitchell, 2012; Shonkoff et al., 2012) as well as an impact on a child throughout their entire life. The doctoral program at Walden University specializing in Early Childhood:

> prepares the early childhood professional to create system-wide changes in the early childhood field as a scholar, leader, and advocate on behalf of young children (prenatal to age 8), and provides a broad perspective on the complex, interdisciplinary landscape of the early childhood field, and interacts with other disciplines such as medicine, psychology, and public health. (Walden University, 2012, Early Childhood Specialization, para. 1)

This study builds on previous literature and on previous work done in the community under study.

## Purpose of the Study

The initial problem is that Tarrant County has the highest infant mortality rate in the state of Texas. While the impetus of this study was to examine predictors of infant mortality for one county in Texas, data were obtained data for the entire state of Texas, as county-level data were unavailable. To address this problem, the purpose of this

quantitative multiple logistic regression study examined the predictors of infant mortality in the state of Texas by race and ethnicity and other predictors related to socioeconomic status. Multiple logistic regression analysis was used to examine the likelihood that the following independent variables predict infant mortality (see Osborne, 2014): (a) weight of baby at delivery, (b) gestational age, (c) maternal age at delivery, (d) maternal education, (e) marital status, (f) tobacco use during pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at time of delivery, and (j) race of the mother. The dependent variable is infant mortality. Income level of the mother is not listed as a variable in this study because data from the NBER does not include income and is not available. In this study, maternal education will be used as a proxy for income. Researchers have investigated racial differences and social factors regarding infant mortality with results indicating race and adverse social standings negatively impact birth outcomes (Dunkel Schetter & Tanner, 2012). This quantitative multiple logistic regression study on infant mortality will address a local problem of high infant mortality rates in the state of Texas. The results of this study may inform the work being done in this area by examining the most likely predictors of infant mortality in this sample. The results of this study could shed light on prenatal care education as an important part of early childhood education outreach efforts and early childhood policy development. In addition, the results of this research study could contribute to the professional literature by offering a standard approach to assess future infant mortality reduction across the nation. At the local level,

the results of this study could change a gap in practice ultimately resulting in a change in the dependent variable of the study, that is, the infant mortality rate.

## Research Questions and Hypotheses

In this quantitative, multiple logistic regression study, Black and White disparities were examined in birth outcomes in the state of Texas. In addition, specific socioeconomic variables were examined, in addition to racial/ethnic identity, to determine what, if any, roles these other factors contribute to the dependent variable infant mortality. The independent variables are the influence of the (a) weight of baby at delivery, (b) gestational age, (c) maternal age at delivery, (d) maternal education, (e) marital status, (f) tobacco use during pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at time of delivery, and (j) race of mother. A sequential multiple logistic regression analysis model was used for this study using the 2 research questions listed. Appendix A shows the list of independent variables and the operational coding definitions for each and how each independent variable was measured from the various checklists provided by the NBER.

RQ1: Do race and ethnicity predict infant mortality among babies born to women in the state of Texas for the years 2011–2013?

$H_0$1: There is no statistically significant likelihood that race and ethnicity predict infant mortality among babies born to women in the state of Texas for the years 2011–2013.

$H_1$1: There is a statistically significant likelihood that race and ethnicity predict infant mortality among babies born to women in the state of Texas for the years 2011–2013.

RQ2: Does any predictor have a statistically significant impact on women in the state of Texas for the years 2011–2013?

$H_0$2: No one predictor has a statistically significant impact on women in state of Texas for the years 2011–2013.

$H_1$2: There is a predictor that has a statistically significant impact on women in state of Texas for the years 2011–2013.

## Theoretical Framework

The theoretical framework used in this study was the Mosley-Chen theoretical framework (Mosley, 1984). The Mosley-Chen theoretical framework states that socioeconomic status is influenced by social, economic, biological, and environmental factors. In this study, maternal education was used as a proxy for income. In 1984, Henry Mosley and Lincoln Chen introduced one of the most widely accepted and prominent infant mortality models (Lopez, 2015; Mosley, 1984). Personal experiences, environmental conditions, and developmental biology work together prenatally through age 0 to 3 to influence the basis of lifelong physical and mental health and development (Center on the Developing Child, 2010). One theory for higher infant mortality rates among Black women is that Black women live in ongoing, high-stress environments (American Institute of Stress [AIS], 2015). Black women experience a greater number of stressors in their lives that may be detrimental to pregnancy and birth outcomes (Dunkel

Schetter & Tanner, 2012; Mosley, 1984). The local school district is looking at ways to eliminate racial inequality in the classrooms. This would be another step in improving the quality of life for Black children and decreasing stressors in their life. Lopez (2015) stated in the Mosley-Chen theoretical framework that socioeconomic factors such as education of the mother and income level of the mother affect birth outcomes. Research in the literature links poor quality prenatal care and childhood adversity to impairments in brain, body, and health development (Center on the Developing Child, 2010). The Mosley-Chen theoretical framework bridges the gap between social science and biomedicine to identify key predictors of infant mortality and the methods in analyzing the results for multidisciplinary studies in child development (Mosley & Chen, 1984). The theoretical framework used in this study could assist in establishing the collective impact link between high-quality prenatal care, high-quality early childhood education, and early childhood policy.

## Nature of the Study

To answer the research questions, I conducted a quantitative multiple logistic regression study on infant mortality to examine the predictors between Black and White disparities in birth outcomes in the state of Texas. Previous researchers have investigated the social, environmental, and biological mechanisms contributing to infant mortality; however, there is little research to fully explain the persistently high rates of Black infant deaths compared to White infant deaths (Vos, Posthumus, Bonsel, Steegers, & Denktaş, 2014). In this study, I performed sequential multiple logistic regression analysis using archived, maternal population-based hospital birth, death, and fetal records collected

from the NBER. The rationale for this selection was because of the study group and the high incidences of infant mortality in that specific group. The chosen design was used to examine predictors of infant mortality and to distinguish which maternal characteristics contribute the greatest risk of mortality overall (see Kothari, Wendt, Liggins, Overton, & del Carmen Sweezy, 2011).

Secondary linked birth, death, and fetal death records were used to conduct this study examining infant mortality in the state of Texas using sequential multiple logistic regression analysis. The records were obtained from NBER databases and records. There was no direct or indirect communication with the study population. Any secondary information or records can be obtained from census and population demographics, which are publicly available and do not require any contact or identification of human participants.

## Definitions

*Adverse birth outcomes*: When an infant is delivered prematurely or has a low birth weight or is small for the gestational age (Braveman et al., 2015, p. 695).

*Antenatal care*: An umbrella term used to describe the medical procedures and care during and after pregnancy (Prost et al., 2013, p. 1).

*Collective impact*: The commitment of a group of actors from different sectors to a common agenda for solving a specific social problem, using a structured form of collaboration (Collective Impact Forum, 2014; Kania & Kramer, 2011, p. 38).

*Epigenetics*: The branch of biology that studies the causal interaction between genes and their products and the changes in gene function (Deans, & Maggert, 2015, p. 635).

*Low birth weight*: Infants born weighing less than 2,500 grams (Lau, Ambalavanan, Chakraborty, Wingate, & Carlo, 2013, p. 856).

*Infant mortality*: The death of a baby before their first birthday; infant mortality is often used as an indicator to measure the health of a community (CDC, 2016, para. 1).

*Prenatal*: Occurring, existing, performed, or used before birth (Walden University, 2012, Early Childhood Specialization, para. 1).

*Prenatal care*: Medical care provided before and during pregnancy to ensure a healthy pregnancy and birth (National Institute of Child Health and Human Development, 2013, "Prenatal Care," para. 3).

*Very low birth weight*: Infants born weighing less than 1,500 grams (Lau et al., 2013, p. 856).

## Assumptions

The review of the literature on infant mortality and the Mosley-Chen theoretical framework reinforced the basis of this study and the research plan in the study. One assumption in this study was the NBER records were accurate regarding the race and ethnicity of the mother and the birth records were complete, accurate, and uniform across hospitals (Mosley, 1984; Mosley & Chen, 1984, 2003). Assuming the records are accurate, the records and the data can impact living children. Another assumption was that there a racial disparity gap exists (Mosley, 1984), but that was tested for in the

models. A third assumption was that the health system and modern medicine must improve the health of all populations (Mosley & Chen, 1984). The Mosley Chen framework proposes an analytical framework for incorporating both social and biological variables and integrates research methods by both social and medical scientists and is suggested for use in collectively impacting children for their physical, cognitive, psychological, social, and emotional development (Mosley & Chen, 1984).

## Scope and Delimitations

The scope of this study was to analyze birth, death, and fetal records in the state of Texas for the years 2011–2013. Taneja and Colquitt (2015) noted that over the last 20 years the infant mortality rate has been as high as 9.91 infant deaths per 1,000 live births and as low as 6.29 (Taneja & Colquitt, 2015), while Nehme et al. (2018) found rates as high as 12.3 (Nehme et al., 2018). The sample size was large enough to make generalizations to the state; however, overall generalizing to the state is problematic due to the NBER not identifying geographic detail in the data for confidentiality purposes. For this study, 11,862,780 was the total number in the sample size. I chose the specific focus of using archived birth, death, and fetal records because it was a convenient sample to research for this geographic area.

## Limitations

In this study I was limited to predicting the likelihood that independent variables would predict infant mortality. In this study, the focus was to look at the likelihood that a limited number of independent variables—namely, (a) weight of baby at delivery, (b) gestational age, (c) maternal age at delivery, (d) maternal education, (e) marital status, (f)

tobacco use during pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at time of delivery, (j) and race of mother—would predict the dependent variable, infant mortality. However, due to limitations in the data, there may be other significant predictors not included in the analyses.

Causality will be difficult to determine from a sequential multiple logistic regression analysis. As noted above, all the possible predictor variables may not have been identified and all possible predictors may not be available for inclusion in the model. This study may be limited to the amount, kind, and quality (validity and reliability) of the data collected, as well as to the limitations of the statistical model employed. Both predictor and dependent variables are subject to limits of data collection methods and individual collecting and recording of the data.

In any study, bias can occur at any stage of the research process. Through proper study design and data analysis, I sought to be aware of researcher bias to reduce bias in this study. Standardized protocols for data collection were used to eliminate interobserver variability of individuals entering data. I was cautious of bias in the selection of the study population because retrospective, archived data were used and outcomes have already occurred (Pannucci & Wilkins, 2010).

In this study, I used sequential multiple logistic regression analysis. I chose this analysis to assess whether one dependent variable, infant mortality, can be predicted from a set of independent variables, the (a) weight of baby at delivery, (b) gestational age, (c) maternal age at delivery, (d) maternal education, (e) marital status, (f) tobacco use during

pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at delivery, and (j) race of mother. The basis of multiple logistic regression is to determine how much variance a dependent variable is explained by the independent variables (Statistics Solutions, 2016).

## Significance

Results of this study may identify characteristics of a population that will help early childhood policymakers, educators, and medical providers develop interventions and educational materials targeted to a specific population. Health and healthy development begin in the womb and lay the groundwork for a lifetime of well-being. Sound health provides the foundation for brain development leading to school readiness and a broad range of learning capacities throughout an individual's life span (Center on the Developing Child, 2010). The results of this study have the potential to inform people on the importance of healthy pregnancies. Chapter 5 will discuss ways to help inform people, as well as policymakers and educators, the impact a healthy pregnancy has on brain development, school readiness, and early childhood education. Potential implications for positive social change from the results of this study are in early childhood policy and education. Collective impact is a long-term commitment by a broad cross-sectional group of stakeholders to solve a specific social problem (Kania & Kramer, 2011). Currently, local, state, and national policies treat early childhood education and health separately (Vandenbroeck, Coussée, & Bradt, 2010). Collective impact could be used to develop policy changes for women and children in Tarrant County and in the state of Texas.

## Summary

The infant mortality rate of Tarrant County, Texas, is the highest in the state. Tarrant County is a large, urban, metropolitan area of North Texas. Typically, large urban areas have higher infant mortality rates (Poeran, Denktaş, Birnie, Bonsel, & Steegers, 2011). The results of this study could promote positive social change by informing early childhood policymakers and educators to make policy changes and educational practice changes for women and children in Tarrant County, and in the state of Texas overall. The research in this study may provide data to early childhood and other policymakers about targeted infant mortality educational interventions and messaging on the importance of healthy pregnancies with parents of children in the 0 to 3 age group, as well as all parents in the community. While the impetus of this study was to examine predictors of infant mortality for one county in Texas, I was only able to obtain data for the entire state of Texas.

In this study, I used sequential multiple logistic regression analysis to answer the research questions asking whether infant mortality can be predicted using a variety of possible predictors. The Mosley-Chen theoretical framework was used because this study bridges education, social science, and medicine. In this study, predictors of disparities in birth outcomes were examined for the state of Texas. A discussion of the research and review of the literature will be presented in Chapter 2 along with the literature search strategy.

# Chapter 2: Literature Review

Infant mortality is the most important measure of health in a community. The infant mortality rate ascertains the health status of a city, county, state, country, or population group because it reflects the social, economic, and environmental conditions of a community (Braveman et al., 2015; CDC, 2016). A woman's health during pregnancy affects a child's cognitive, developmental, social, emotional, and physical health from pregnancy through early childhood and into adulthood. A woman's prenatal health can also be a factor in a child's readiness for school (Halle et al., 2012). The purpose of this quantitative multiple regression study on infant mortality was to examine predictors of disparities in birth outcomes in the state of Texas. In this study, I examined the likelihood that race and ethnicity and other covariates predict infant mortality in the state of Texas. Research from the last four decades indicates county-level infant mortality rates have had marked increases along with marked healthcare inequalities (Kindig, & Cheng, 2013; Rossen, & Schoendorf, 2014; Wingate, Barfield, Petrini, & Smith, 2012). The review of literature presented in this chapter demonstrates the current body of knowledge and efforts, as well as seminal works, on infant mortality rates, prenatal and antenatal care, racial inconsistencies and disparities in healthcare, brain development, poverty, genetics, interventions, and theory.

Socioeconomic, medical, and behavioral risk factors have not fully explained racial disparities in birth outcomes (Christopher, & Simpson, 2014; Preston, & Haines, 2014; Vos et al., 2014). This literature review presents an overview of prenatal care, pediatric health and care, preventions and interventions during and after pregnancy, and

racial disparities in healthcare in order to identify specific risks for Black women during pregnancy. A focal point of this literature review was recognizing the racial disparities in healthcare and the long-term impact on maternal and infant health outcomes and early childhood development.

## Literature Search Strategy

The content of this review was retrieved through the following databases: Thoreau Multi-Database Search, Education Research Complete, SAGE Premier, ScienceDirect, Taylor and Francis Online, ProQuest, Nursing & Allied Health Source, ProQuest Health & Medical Complete, and Google Scholar. The following keywords were used to locate articles and books: *infant mortality, infant mortality rate, infant survival, prenatal, prenatal care, prenatal influences, prenatal nutrition, stress, antenatal care, brain development, cognitive development, intelligence levels, early childhood, early childhood development, school readiness, behavior issues, behavior problems, collective impact, Black, African American, minority, racial disparities, health disparities, health interventions, epigenetics, poverty, Mosley-Chen theoretical framework, and adverse birth outcomes.* The articles and books referenced in this literature review were selected based on their relevance, content, and research methods related to discovering risks for infant mortality and discussed racial differences in birth outcomes and early childhood. The scope of the literature review is limited to mostly articles, books, and webpages from the last 5 years, 2015–2020, and from the last 10 years, 2010–2020. Some seminal books and articles that discuss poverty, racism, and early childhood development, as well as the theoretical framework used have been

referenced. When possible, Google Scholar was used to find current books and articles citing these seminal pieces to use the most current data, research, and literature. In the literature there was sufficient current research and literature on infant mortality, disparities in healthcare, and early childhood brain and behavior development.

## Theoretical Framework

For this study, the Mosley-Chen theoretical framework was used as the theoretical framework. The Mosley-Chen theoretical framework is a useful tool for analyzing fetal and infant mortality. The major theoretical proposition and major hypothesis of the Mosley-Chen theoretical framework states socioeconomic status is influenced by social, economic, biological, and environmental factors (French et al., 2019; Mosley, 1984; Mosley & Chen, 1984, 2003). The Mosley-Chen theoretical framework identifies variables associated with infant mortality (Oppenheimer, 2001; Palloni, 1987). The Mosley-Chen theoretical framework is a two-level analytical model that organizes factors associated with infant mortality into one of two determinant categories: proximate or distal. The proximate level includes biomedical and biodemographic variables such as maternal fertility, environmental contamination, nutrient availability, and injuries (Mosley, 1984; Mosley & Chen, 1984, 2003; O'Hare, Makuta, Chiwaula, & Bar-Zeev, 2013). Socioeconomic status is a distal determinant whose variables include social, economic, cultural, biological, and environmental influences (French et al., 2019; Mosley, 1984; Mosley & Chen, 1984, 2003). Infant mortality is best represented as a paradox; the United States is one of the wealthiest nations in the world, yet for Black women, infant mortality rates are higher than some in developing countries. Disparities in

healthcare for Black women are one reason for high infant mortality rates, one of the social and economic factors of the Mosley-Chen theoretical framework (French et al., 2019; Mosley, 1984; Mosley & Chen, 1984, 2003).

The Mosley-Chen theoretical framework was chosen because the research focuses on the differences in health and mortality between Black and White women. The Mosley-Chen theoretical framework describes the differences of race, genetics, culture, behavior, and socioeconomic factors (Hummer, 1996; Priest & Williams, 2018). The Mosley-Chen theoretical framework has been applied previously in many studies related to infant mortality. Social scientists, medical researchers, and early childhood specialists have used and cited the theoretical framework as it applies to changing health, education, and policy (Hummer, 1996; Mishra, 2015; Quah & Sales, 2000; Zielinski Gutiérrez & Kendall, 2000). The Mosley-Chen theoretical framework connects to this study on infant mortality because it examines the predictors of disparities in birth outcomes and responds to the research questions asking what is the likelihood that race and ethnicity will predict infant mortality among women in the state of Texas for the years 2011–2013 and can infant mortality be predicted by the following independent variables: (a) weight of baby at delivery, (b) gestational age, (c) maternal age at delivery, (d) maternal education, (e) marital status, (f) tobacco use during pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at delivery, and (j) race of mother.

## Literature Review Related to Key Variables

### Infant Mortality

The infant mortality rate can be an indicator of the quality of a health system of a community (Hauck, Tanabe, & Moon, 2011). While birth outcomes have improved over several decades, the United States still ranks near the bottom of the list among developed nations (Healthy People, 2012; Lu, & Johnson, 2014). Evidence indicates healthy women who plan their pregnancies are more likely to have healthy babies. However, over half of U.S. women do not plan their pregnancies (Mitchell, & Verbiest, 2013). Communities continue to work to improve birth outcomes. Fetal and infant death incurs tremendous human and economic costs (Kothari et al., 2011). The following studies were reviewed and synthesized as they relate to the purpose, scope, and research questions in this study. Researchers have investigated the influence of social factors on infant mortality and found there were indeed social factors associated with infant mortality. Socioeconomics and education level were two factors significantly associated with infant mortality (Govande, Ballard, Koneru, & Beeram, 2015). Research has also revealed that socioeconomic characteristics lead to predictors conducive to the practice of unhealthy behaviors (Duncan & Kawachi, 2018; Williams & Collins, 2001). Another factor associated with infant mortality is teenage pregnancy (East, & Felice, 2014; Ganchimeg et al., 2014; Shapiro-Mendoza, & Lackritz, 2012; Sweeney, & Raley, 2014). A third factor associated with infant mortality is high stress environments and stressful life events (Donovan, Spracklen, Schweizer, Ryckman, & Saftlasa, 2016; Dunkel Schetter &

Tanner, 2012; Fullilove, & Wallace, 2011; Kramer, Hogue, Dunlop, & Menon, 2011; Lereya, & Wolke, 2012).

One way that researchers capture the physiologic burden on multiple biological systems and how it relates to stress, stressful living environments, and other environmental stressors is by measuring allostatic loads. Williams, Mohammed, Leavell, and Collins (2010) and Williams, Priest, and Anderson (2016) found that Black women consistently have higher allostatic loads than Black men and White people, and the researchers determined this was due to a "double jeopardy" of racial and gender discrimination that women face. Women and children chronically exposed to high-stress environments are at increased risk for maladaptive outcomes (Buss, Davis, Hobel, & Sandman, 2011; Conradt et al., 2014). The articles and books relating to infant mortality were chosen because they relate to the purpose of this study on infant mortality as it examines the predictors of disparities in birth outcomes and as they relate to the research questions, as well as to the scope of this study.

Educational researchers have previously approached the problem of infant mortality as individual entities (Fiscella & Kitzman, 2009; Jimenez, Wade, Lin, Morrow, & Reichman, 2016). One weakness of this approach is not tapping into other potential research areas for help. Local policymakers are not aware of the magnitude or the impact of the issue of high infant mortality. The approach in this study extended and added to previous research conducted to examine if other relevant predictors are both substantively and statistically significant regarding the phenomenon of high infant mortality. In addition, the results of this study will highlight the benefit of stakeholders coming

together in collective impact to reduce infant mortality and will provide information on the relative importance of the predictors of infant mortality to inform policymakers and early childhood educators on decisions that could affect mothers and children, inform policymakers on the collective impact of prenatal care and early childhood development and education, and develop interventions and outreach programs and early childhood policies.

**Prenatal and Antenatal Care**

Child mortality is regarded as one of the best measures of the health status of a country, and infant mortality continues to present public health challenges for global, national, state, and local healthcare systems (O'Hare et al., 2013). The following studies were reviewed and synthesized as they relate to the purpose, scope, and research questions in this study. Despite technological advances, there is an ever-widening gap in adverse birth outcomes between Black and White women. Low-quality and delayed prenatal care, high stressor environments, poor nutrition, socioeconomics, and smoking, alcohol, and drugs are factors for higher infant mortality rates (Dailey, Humphreys, Rankin, & Lee, 2011; Liu, & Alameda, 2011; Sumner et al., 2011; Wadhwa, Entringer, Buss, & Lu, 2011). Nutrition has a profound effect on health throughout life and is linked with cognitive and social development, especially in early childhood. One consequence of poor nutrition during pregnancy is a higher risk of infant mortality (Black et al., 2013). Women and families who participate in screening programs in conjunction with interventions to manage substance abuse can decrease their risks for adverse birth outcomes (Stillbirth Collaborative Research Network Writing Group, 2011). In addition,

seeking assistance for prenatal depressive symptoms can improve the pregnancy and can decrease postpartum depression, (Fortner, Pekow, Dole, Markenson, & Chasan-Taber, 2011; Insaf et al., 2011), as well as minimize use of cigarettes, alcohol, and drugs. Many deaths in infant mortality stem from very low birth weight and many of the same factors responsible for infant mortality are responsible for very low birth weight infants. Improving prenatal care is key in stopping infant mortality and very low birth weight infants, and one way to improve prenatal care is to improve interventions and promote preventive measures (Declercq et al., 2015; Dong, Yue, & Yu, 2012; Lawn et al., 2014).

Antenatal care is continuing high-quality care after birth so that a child may live to their first year of life. A child dying in the first year of life is counted as infant mortality. Women and children living in high stressor environments during and after pregnancy is one factor of infant mortality (Saadeh et al., 2013). Effective antenatal care is as important as prenatal care for a healthy child (Boland-Prom, & MacMullen, 2012; Hollowell, Oakley, Kurinczuk, Brocklehurst, & Gray, 2011).

In this study, I examined the predictors between Black and White disparities in birth outcomes in the state of Texas. Researchers investigated the implications of prenatal stressors in preterm birth, infant birthweight, and infant mortality and concluded prenatal severe life events played a role in increasing preterm births, low birthweight, and infant mortality (Dunkel Schetter & Tanner, 2012). Prenatal care can be used as a successful, preventive healthcare service (Hilmert et al., 2014; Witt Cheng et al., 2014). Despite this knowledge, Tarrant County has the highest infant mortality rate in the state of Texas. Researchers have approached the problem (Taneja, & Colquitt, 2015); however, the

articles and books relating to prenatal and antenatal care were chosen because they relate to the purpose of this study on infant mortality as it examines the predictors of disparities in birth outcomes and as they relate to the research questions, as well as to the scope of this study. Fiscella and Kitzman (2009) and Jimenez et al. (2016) previously approached the problem of infant mortality as individual entities. One weakness of this approach is not tapping into other potential research areas for help. Local policymakers are not aware of the magnitude or the impact of the issue of high infant mortality. The approach in this study will extend and add to previous research conducted to examine if other relevant predictors are both substantively and statistically significant regarding the phenomenon of high infant mortality. In addition, the results of this study will highlight the benefit of stakeholders coming together in collective impact to reduce infant mortality and will provide information on the relative importance of the predictors of infant mortality to inform policymakers and early childhood educators on decisions that could affect mothers and children, inform policymakers on the collective impact of prenatal care and early childhood development and education, and develop interventions and outreach programs, and develop early childhood policies.

**Racial Disparities in Healthcare and Poverty**

Disparities in healthcare have been one of the most critical public issues in many communities. The following studies were reviewed and synthesized as they relate to the purpose, scope, and research questions in this study. Racial and ethnic minorities often receive lower quality healthcare (Collins, Soskolne, Rankin, & Bennett, 2013; Wingate, & Barfield, 2011), and many researchers hypothesize African Americans' continuing

experiences with racism may lie at the root of well-documented race-based health disparities (Braveman et al., 2015; Kramer et al., 2011; Lee, & Burkam, 2002; Mays, Cochran, & Barnes, 2007, p. 201). Racism is a cause of detrimental health conditions for women and children stemming from access to and quality of care (Newman, 2016). The roots of these disparities are complex and are ingrained in historic and contemporary inequities and involve many participants at every level, including healthcare (Braveman et al., 2015; Lee, & Burkam, 2002; Margerison-Zilko et al., 2015; Ncube, Enquobahrie, Albert, Herrick, & Burke, 2016). Distrust of the medical community by African Americans stems from the history of racial discrimination and exploitation rooted in experiences extending back to slavery and continuing to the present day (Corbie-Smith, Thomas, & George, 2002; Dula, 1994; Randall, 1995; Whetten et al., 2006). The integration of knowledge of health and human development is important and difficult. A crucial factor for determining health is the environment in which people live and work and how they cope with their environment. The quality of early childhood affects the quality of future populations and their prosperity in the society in which these children were raised (Keating, 2016). The disparity between Black and White infant mortality rates has increased, despite overall improvement in infant survival (Mazul, Salm Ward, & Ngui, 2017; Rossen, & Schoendorf, 2014; Zhang et al., 2013). Many communities, including my own in Tarrant County, have persistent and increasing racial disparities in healthcare, including infant mortality rates. Racial disparities continue into early childhood and can affect early childhood development and school readiness. In one community, this complex issue led to the development of the Lifecourse Initiative for

Healthy Families (Frey, Farrell, Cotton, Lathen, & Marks, 2014). Frey et al. (2014) studied the Lifecourse Initiative in hopes of reducing racial disparities in birth outcomes. The researchers concluded community participation in the Lifecourse Initiative provided effective solutions to improve racial infant mortality disparities. The researchers also concluded the Lifecourse Initiative would be successful in other communities. The information found in this study could be applied in my community. At the national level, the Department of Health and Human Services created an action plan to support communities as well as to accelerate national momentum in reducing racial and ethnic healthcare disparities (U.S. Department of Health and Human Services, 2011). Differences continue to exist between persistently impoverished populations by race, sex, and geographical location, which translates their poverty into infant mortality (Biggs, King, Basu, & Stuckler, 2010; Hogue, & Silver, 2011; Loggins, & Andrade, 2014; MacDorman, 2011; Wang, Schumacher, Levitz, Mokdad, & Murray, 2013; Zhang et al., 2013). The articles and books relating to racial disparities in healthcare and poverty were chosen because they relate to the purpose of this study on infant mortality as it examines the predictors of disparities in birth outcomes and as they relate to the research questions, as well as to the scope of this study. Educational researchers (Fiscella & Kitzman, 2009; Jimenez et al., 2016) have previously approached the problem of infant mortality as individual entities. One weakness of this approach is not tapping into other potential research areas for help. Local policymakers are not aware of the magnitude or the impact of the issue of high infant mortality. The approach in this study will extend and add to previous research conducted to examine if other relevant predictors are both substantively

and statistically significant regarding the phenomenon of high infant mortality. In addition, in this study I will highlight the benefit of stakeholders coming together in collective impact to reduce infant mortality and will provide information on the relative importance of the predictors of infant mortality to inform policymakers and early childhood educators on decisions that could affect mothers and children, inform policymakers on the collective impact of prenatal care and early childhood development and education, and develop interventions and outreach programs, and develop early childhood policies.

**Early Childhood Development**

Research indicates that initiating supportive interventions during pregnancy is beneficial for families. The following studies were reviewed and synthesized as they relate to the purpose, scope, and research questions in this study. Through the lens of collective impact, researchers have examined the predictors between maternal behavior during pregnancy, birth outcomes, and early childhood development (Cao, Laplante, Brunet, Ciampi, & King, 2014; Center on the Developing Child, 2010; Glover, 2014; Kania, Hanleybrown, & Splansky Juster, 2014; Kania, & Kramer, 2013; Karp, & Lundy-Wagner, 2016; MacEwan, Holgate, Friedman, & Bingulac, 2015; Shonkoff, 2010). Prenatal health services can improve prenatal care and birth outcomes, as well as have a lasting impact on child health and cognitive development (Center on the Developing Child, 2010; Crosnoe, Bonazzo, & Wu, 2015; Davis, & Thompson, 2014; Kania et al., 2014; Kania, & Kramer, 2013; Karp, & Lundy-Wagner, 2016; Lee, & Burkam, 2002; MacEwan et al., 2015; Shonkoff, 2010). The need for healthcare from prenatal through

age 3 is more crucial than at other times throughout life. Quality prenatal and antenatal care can ensure a strong start to life, as well better prepare a child for school and learning. School readiness and later achievement in life develop in pregnancy and continues age 0 to 3. Researchers look for elements in children for school readiness and one key element is socioemotional skills (Center on the Developing Child, 2010; Kania et al., 2014; Kania, & Kramer, 2013; Karp, & Lundy-Wagner, 2016; MacEwan et al., 2015; Pritchard, Bora, Austin, Levin, & Woodward, 2014; Shonkoff, 2010). Cognitive, socioemotional, and physical development are intricately linked from prenatal through age 3 and poor health can lead to developmental problems (Center on the Developing Child, 2010; Currie, 2005; Kania et al., 2014; Kania, & Kramer, 2013; Karp, & Lundy-Wagner, 2016; Lee, & Burkam, 2002; MacEwan et al., 2015; Shonkoff, 2010; Wasserman, & Zambo, 2013; Zero to Three Policy Center, 2012). A baby's development before birth can have a significant impact on future learning; therefore, high quality prenatal and antenatal care is a critical component of early childhood education and early childhood policy (Center on the Developing Child, 2010; Hyson, & Biggar Tomlinson, 2014; Lee, Zhai, Brooks-Gunn, Han, & Waldfogel, 2014; Kania et al., 2014; Kania, & Kramer, 2013; Karp, & Lundy-Wagner, 2016; Kochanska, Boldt, Kim, Yoon, & Philibert, 2015; MacEwan et al., 2015; Shonkoff, 2010). Major advances in neuroscience demonstrate how exposure to biological and psychosocial risk factors during pregnancy through age 3 affects brain structure and function and compromises children's future development (Center on the Developing Child, 2010; Currie, 2005; Hodel et al., 2015; Shonkoff, 2010; Shonkoff et al., 2012; Twomey et al., 2013; Walker et al., 2011). Women and children living in

poverty are at risk for their mental and physical health and development (Pilyoung, & Blanco, 2014). The results of this study have implications for families, the local school district, the community, healthcare workers, and policymakers to reduce opportunity gaps so women can have healthy pregnancies, which lead to healthy children, ready for success in school and in life. The articles and books were chosen because of their relation to early childhood development and because they relate to the purpose of this study on infant mortality as it examines the predictors of disparities in birth outcomes and as they relate to the research questions, as well as to the scope of this study. Educational researchers (Fiscella & Kitzman, 2009; Jimenez et al., 2016) have previously approached the problem of infant mortality as individual entities. One weakness of this approach is not tapping into other potential research areas for help. Local policymakers are not aware of the magnitude or the impact of the issue of high infant mortality. The approach in this study will extend and add to previous research conducted to examine if other relevant predictors are both substantively and statistically significant regarding the phenomenon of high infant mortality. In addition, the results of this study will highlight the benefit of stakeholders coming together in collective impact to reduce infant mortality and will provide information on the relative importance of the predictors of infant mortality to inform policymakers and early childhood educators on decisions that could affect mothers and children, inform policymakers on the collective impact of prenatal care and early childhood development and education, and develop interventions and outreach programs, and develop early childhood policies.

**Genetics**

Since the 1950s, there have been dramatic advances in human genetics. The following studies were reviewed and synthesized as they relate to the purpose, scope, and research questions in this study. In recent studies, researchers have suggested researching genes to explain the disparity in infant mortality between Blacks and Whites (Barker, 2012; Braveman et al., 2015) as well as eliminating the disparities overall in healthcare. Genetic research has also found specific defects causing infant mortality and birth defects. Nutritional deficiencies (Safi, Joyeux, & Chalouhi, 2012) and prenatal smoking (Markunas et al., 2014; Petkovsek, Boutwell, Beaver, & Barnes, 2014) during pregnancy can adversely affect the fetus and may persist beyond childhood (Petkovsek et al., 2014) and at a genetic level affecting future generations. DNA samples can be used to identify markers in blood and genes to predict preterm delivery (Fernando et al., 2015). Pursuing research on genetic contributors in disparities is controversial and needs to be carefully evaluated. While there have been great advancements in science and while these advances may improve our lives and prolong them, there are still racial disparities in our healthcare system. History abounds with descriptions of diseases thought to be specific to particular racial groups. Many of these accounts have been discredited as political and economical; however, the accounts still inform biomedical research (American Psychological Association, 2012). There is rich variation, including genetic variation, in the human species and the meanings attached to race and ethnicity shape interpretations of scientific findings (Do, Frank, & Finch, 2012; Obasogie, 2015). Using racial and ethnic descriptions can perpetuate the barrier to equal healthcare; however, ignoring

racial and ethnic differences in medicine and biomedical research will not make them disappear and researchers should continue to use them as starting points for further research, while keeping in mind the potential social costs associated with linking race with genetics (Cruickshank, & Beevers, 2013, p. 87). Researchers studying genetics and health disparities must acknowledge the strong evidence social and environmental factors play in health outcomes and ask how genes can be better used to direct health interventions (Fullerton, Knerr, & Burke, 2012). Straddling the fine line using genetics is however, still very important since there is ample evidence that poor quality prenatal care can affect both the short term and long term health of a child in utero, in early childhood development, and into adulthood and can be the cause of development disorders, psychopathological conditions, diabetes, cardiovascular disease, and obesity during both childhood and adulthood (Denktaş et al., 2012; Fox et al., 2010). The articles and books relating to genetics were chosen because they relate to the purpose of this study on infant mortality as it examines the predictors of disparities in birth outcomes and as they relate to the research questions, as well as to the scope of this study. The research on genetics also relates to the racial disparities looked at in this study. Fiscella and Kitzman (2009) and Jimenez et al. (2016) previously approached the problem of infant mortality as individual entities. One weakness of this approach is not tapping into other potential research areas for help. Local policymakers are not aware of the magnitude or the impact of the issue of high infant mortality. The approach in this study will extend and add to previous research conducted to examine if other relevant predictors are both substantively and statistically significant regarding the phenomenon of high infant mortality. In

addition, in this study I will highlight the benefit of stakeholders coming together in collective impact to reduce infant mortality. The results of this study can also provide information on the relative importance of the predictors of infant mortality to inform policymakers and early childhood educators on decisions that could affect mothers and children, early childhood development and education, develop interventions and outreach programs, and develop early childhood policies.

**Interventions**

Many parents and their babies are at a significant disadvantage because of poverty and despite improvements in obstetrical and neonatal care, Black women and infants continue to experience excess mortality (Carter, Holditch-Davis, Tanaka, & Schwartz, 2013). The following studies were reviewed and synthesized as they relate to the purpose, scope, and research questions in this study. Intervention programs offer parents and babies opportunities missed from situations while in poverty. Positive effects from interventions improve the social, emotional, and cognitive outcomes for children born to parents in poverty (Garner et al., 2012). Large social change requires a collective impact coordination. Most organizations have approached with an isolated impact; however, early childhood education requires multiple stakeholders to ensure children are successful (Kania & Kramer, 2011). The medical community, educators, and policymakers must now complement one another and focus on interventions to reduce threats to children from prenatal through age early childhood for optimal brain development, school readiness, and school success (Garner et al., 2012). While reviewing the literature for this study, several studies were found that researched interventions and how they can improve

a woman's pregnancy and a child's development; however, a gap in the literature of was found. Carter et al. found higher rates of preterm delivery among Black women with minimal investigation on these differences and other risk factors and how they may contribute to higher infant mortality rates for Black women (Carter et al., 2013). Intervention programs can have the potential to make positive social change. One intervention in particular is very successful in healthy pregnancy outcomes, involvement of the paternal father, specifically Black fathers (Mincy, 2015). This is significant information that could be shared with my community because the majority of infant deaths in Tarrant County are Black.

In response to high infant mortality rates, communities developed and engaged in fetal and infant mortality reviews (FIMR). FIMR teams work to better understand challenges communities face in reducing infant mortality rates, provide information about local maternal and infant healthcare systems, develop strategies to address local problems, and assist communities in taking action to reduce infant mortality rates (Aune, Saugstad, Henriksen, & Tonstad, 2014; Hutchins, Grason, & Handler, 2004; Johnson, Malnory, Nowak, & Kelber, 2011; Koontz, Buckley, & Ruderman, 2004). In addition, work can be done with the Tarrant County Infant Mortality Task Force and the City of Fort Worth Public Health Department to gather information for this study as well as partner with them and my community to make a positive social impact in reducing infant mortality rates (Taneja, & Colquitt, 2015; Tarrant County Public Health, 2013; Tarrant County Voices for Health, 2012; Tarrant County Voices for Health, 2013; U.S.

Department of Health and Human Services, and Centers for Disease Control and Prevention, 2013).

Researchers study behavior to reduce infant mortality rates. Several articles researched found various types of behavioral support during pregnancy. El-Mohandes, Kiely, Gantz, & El-Khorazaty, 2011, researched integrated behavior interventions to reduce infant mortality rates; specifically, in Black women. El-Mohandes et al. (2011) determined behavioral interventions had a strong impact on reducing preterm birth. Reducing risks such as smoking, depression, and intimate partner violence, significantly reduced negative birth outcomes (El-Mohandes et al., 2011). In addition, women who participated in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) during pregnancy significantly improved the birth outcome of their child; however, if a woman smoked while participating in WIC, the beneficial effect of WIC was negatively counteracted (Marshall et al., 2013). Edmunds et al. (2014) and Rowley and Hogan (2012) studied behavioral interventions to reduce infant mortality rates. The researchers discussed prenatal participation in a public health nutrition program and its effects on the mother and infant. The researchers found the behavior of eating healthy for yourself and your child reduced the risk of rapid infant weight gain and gestational diabetes.

Early intervention is important for the health of both the mother and the infant and is studied globally, nationally, and locally. Golden and Earp discussed interventions as promoting health from a social organization perspective (Golden & Earp, 2012). In addition, Golden and Earp discussed the importance of a sustainable intervention

program and the relationships between organizations and individuals. Callejo and Geer discussed their research on a community-based intervention program in Brooklyn, New York to disseminate health information (Callejo & Greer, 2012). Callejo and Greer also discussed the importance of building relationships between families and community workers and its effectiveness in intervention programs. Along with building relationships to increase the effectiveness of an intervention program, empowering families and community workers can also impact intervention programs and its outcomes. Baffour and Chonody researched empowerment strategies and how to facilitate knowledge to positively impact family health outcomes and eliminate health disparities (Baffour & Chonody, 2012). Baffour and Chonody found facilitation of behavioral changes had a direct relationship on a woman's health and a child's health disparities. Early interventions are important for the health of women and children and impact infant mortality and early childhood development. The studies researched are potential resources for both this study and to use in my community. The articles and books relating to interventions were chosen because they relate to the purpose of this study on infant mortality as it examines the predictors of disparities in birth outcomes and as they relate to the research questions, as well as to the scope of this study. Fiscella and Kitzman (2009) and Jimenez et al. (2016) have previously approached the problem of infant mortality as individual entities. One weakness of this approach is not tapping into other potential research areas for help. Local policymakers are not aware of the magnitude or the impact of the issue of high infant mortality. The approach in this study will extend and add to previous research conducted to examine if other relevant predictors are both

substantively and statistically significant regarding the phenomenon of high infant mortality. In addition, in this study I will highlight the benefit of stakeholders coming together in collective impact to reduce infant mortality. I will also provide information on the relative importance of the predictors of infant mortality to inform policymakers and early childhood educators on decisions that could affect mothers and children, inform policymakers on the collective impact of prenatal care and early childhood development and education, develop interventions and outreach programs, and develop early childhood policies.

## Summary and Conclusions

While the infant mortality rate is largely accepted as a measure of health within a community, the infant mortality rate alone does not provide a complete picture for all the underlying factors contributing to infant deaths. Teenage pregnancy increases the risk of adverse birth outcomes (Kenny et al., 2013), inadequate weight gain during pregnancy affects infant mortality rates (Davis & Hofferth, 2012), maternal stress during pregnancy impacts birth outcomes as well as an infant's cognitive ability and school readiness (Glover, 2014), disparities in healthcare affect infant mortality (Heywood, 2013; Padilla et al., 2014), and intervention programs can positively impact a community's infant mortality rate (Meghea, Raffo, VanderMeulen, & Roman, 2014; Schlenker, Dresang, Ndiaye, Buckingham, & Leavitt, 2012). In this study, I examined predictors of disparities in birth outcomes in the state of Texas. The methodology within the Mosley-Chen theoretical framework offers an opportunity to research these disparities within a specific population that will enable my community to incorporate educational interventions and

programs as well as public health components to identify these disparities to combat the identified dangers. A review of the literature suggests more research and more literature are needed to eliminate racial disparities and to lower the infant mortality rate (Chase-Lansdale & Brooks-Gunn, 2014; Sama-Miller et al., 2017; Sommer et al., 2012). Child development, cognitive development, socioemotional development, and school readiness begin prenatally (Center on the Developing Child, 2010; Shonkoff et al., 2012). Results of this study may provide policymakers and educators with information on timeframes, interventions, and resources that may be beneficial to expectant and new mothers to prevent further loss of fetal and infant lives. In addition, the results of this study can provide intervention resources as related to racial disparities to inform early childhood educators and professionals and policymakers to develop programs for mothers and children. Programs that intentionally combine services for parents and children can help families move toward economic security and create conditions that promote child and family well-being (Sama-Miller & Baumgartner, 2017). The review of literature demonstrates the current body of knowledge and efforts, as well as seminal works, on infant mortality rates, prenatal and antenatal care, racial inconsistencies and disparities in healthcare, brain development, poverty, genetics, interventions, and theory. Chapter 3 will detail the research design and approach, the setting, the population studied, the methodology, the data analysis plan, and ethical procedures. Using the Mosley-Chen theoretical framework in this study will allow my community to ascertain factors associated with infant mortality to reduce adverse birth outcomes.

# Chapter 3: Research Method

Chapter 3 includes a description of the research design and approach, the population setting and sample, instrumentation and materials, data collection and analysis procedures, measures taken to ensure participant rights, and limitations to the research. The initial problem was that Tarrant County has the highest infant mortality rate in the state of Texas. While the impetus of this study was to examine predictors of infant mortality for one county in Texas, data were obtained data for the entire state of Texas, as county level data were unavailable. The purpose of this quantitative multiple logistic regression study on infant mortality was to examine the predictors of infant mortality in the state of Texas by race and ethnicity and other possible significant predictors related to socioeconomic status. Previous research has investigated the social, environmental, and biological factors contributing to infant mortality; however, a clear foundation has not been discovered to fully explain the persistently high rates of Black infant deaths when compared to White infant deaths (Vos et al., 2014).

## Research Design and Rationale

The research design of this quantitative multiple logistic regression study was to examine predictors of disparities in birth outcomes in the state of Texas. The research was conducted by analyzing the linked birth/infant death records from the NBER, for the study period of 2011–2013 using Statistical Package for Social Sciences (SPSS) software. This study is built on the Mosley-Chen theoretical framework, which proposes socioeconomic factors affect disease incidences and outcomes. Sequential multiple logistic regression analysis was used in this nonintervention research study to test the

independent variables—(a) weight of baby at delivery, (b) gestational age, (c) maternal age at delivery, (d) maternal education, (e) marital status, (f) tobacco use during pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at delivery, and (j) race of the mother—against the dependent variable, infant mortality. There were no time or resource constraints in this study because archived birth, death, and fetal records from the NBER were used. The design choice of this study is consistent with the Mosley-Chen theoretical framework, which is used by researchers to learn about the causes of infant mortality and how to develop interventions to lower the infant mortality rate (Lopez, 2015). The research design of this study is connected to the research questions by examining race and ethnicity predictors for infant mortality and to examine which predictors have the greatest impact on women and infant mortality. The predictors researched were the independent variables. Each independent variable is defined in the operational definition of variables section. In addition, the appendix lists each variable and its coding.

## Methodology

The Mosley-Chen theoretical framework was selected for its prominent use in infant mortality models (Mosley, 1984; Mosley & Chen, 1984, 2003). Linked birth/infant death records from the NBER, for the study period of 2011–2013, with the inclusion criteria including all infants born between the study period of 2011–2013, were used to attempt to address ethnic disparities for developing strategies to decrease overall infant mortality in the state of Texas. The data were examined to determine whether the data

included any outliers or abnormal data prior to conducting the multiple logistic regression analysis.

## Population

This quantitative multiple logistic regression study was a nonexperimental study; therefore, no intervention was necessary during the study. Secondary data from the NBER were analyzed. First, I gained approval from the IRB of Walden University. In this study, I used vital records for all known linked birth, death, and fetal deaths that occurred in the state of Texas for the study period 2011–2013. After receiving IRB approval from Walden University, I uploaded the data from the NBER into SPSS software. The total number in the sample was 11,862,780.

In this study, I used the Mosley-Chen theoretical framework and included all known feto-infant deaths in the state of Texas for the 3-year period 2011–2013. All the cases were reviewed to ensure all records met the required age at death for the Mosley-Chen theoretical framework.

## Sampling and Sampling Procedures

For this study, I used archived data from the NBER. The sample size and population of this study were all the vital records for all known linked birth, death, and fetal deaths that occurred in the state of Texas for 2011–2013. This sample size and population were chosen to best answer the research questions and the purpose of this study. The sampling procedure used in this study was a target sample. For this quantitative study, a target sample was chosen so that all the archived records could be used for generalizing the target population (Creswell, 2012).

## Archival Data

In this quantitative multiple logistic regression study, I conducted an analysis of all the linked birth/infant death records for 2011–2013 maintained by the NBER to investigate the research questions. For this study no instrument was used; existing records in a dataset were analyzed. Archival data from the NBER were used in this study. These records are routinely used in public health and education in Texas. The records are based on self-reports and medical records. After receiving permission from the IRB of Walden University, the data were imported into SPSS. Please see the appendix for the data files available from the NBER. The data checklists noted in the appendix illustrate that the independent variables used are available in the data files with many overlapping. In the appendix, each independent variable is listed and is matched with a variable from the data file checklists, and each independent variable has an operationally defined code for analysis.

## Operational Definition of Variables

*Weight of baby at delivery*: Low birth weights and very low birth weights contribute greatly to infant mortality rates (Lau et al., 2013). A birth weight less than 2,500 grams (5 pounds, 8 ounces) is diagnosed as *low birthweight*. Babies weighing less than 1,500 grams (3 pounds, 5, ounces) at birth are considered *very low birth weight* (Stanford Children's Health, 2017, para. 1). Please see the appendix for operational coding.

*Gestational age*: Infants born with low birth weight are at an increased risk for infant mortality. The primary causes of low birth weight are preterm birth and being

small for gestational age. Infant mortality from low birth weight and small for gestational age are associated with low-income families (Katz et al., 2013). Fetal mortality is divided into 3 periods: early (less than 20 completed weeks of gestation), intermediate (20–27 weeks of gestation), and late (28 weeks of gestation or more) (MacDorman, & Gregory, 2015, p. 2). Please see the appendix for operational coding.

*Maternal age at delivery*: Maternal age has an effect on birth outcome. Women 18 years of age and younger have the highest odds of small for gestational age and have an increased risk of infant mortality (Kozuki et al., 2013). For this study, the age of the mother was divided into four categories: under 15, 15–19, 20–34, and 35 and over. Please see the appendix for operational coding.

*Maternal education*: Infant mortality declines with higher education. Education of the mother is a proxy measure of socioeconomic status and is associated with significant changes in birth weight distributions and infant mortality. In all racial and ethnic groups, birth outcomes improve with higher education (Gage, Fang, O'Neill, & DiRienzo, 2013). For this study, maternal education was divided into five categories: less than high school, high school graduate/some college, associate's degree, bachelor's degree, and advanced degree. Please see the appendix for operational coding.

*Marital status*: The Apgar score system is used to estimate the probability of survival of an infant at birth and is used to appraise the need for resuscitation. The mortality of Black newborns is consistently higher in the postnatal period and is affected by socioeconomic status, maternal education, and marital status at the time of birth (Li et

al., 2013, p. 4). For this study, marital status was divided into two categories: married or not married at time of birth. Please see the appendix for operational coding.

*Tobacco use during pregnancy*: Tobacco is one of the most commonly used substances used during pregnancy (Floyd et al., 2008). During pregnancy there are no safe levels of exposure to tobacco products (Brown et al., 2016). For this study, tobacco use was divided into two categories: cigarettes not used in pregnancy, and cigarettes used in pregnancy. Please see the appendix for operational coding.

*Prenatal care, if any, and month it began*: The risk of premature birth, stillbirth, early and late neonatal death, and infant death increases linearly with decreasing prenatal care. Women under the age of 20, Black women, and women without a high school education are the highest risks of adverse birth outcomes when little or no prenatal care is used (Partridge, Balayla, Holcroft, & Abenhaim, 2012, p. 787). For this study prenatal care was divided into four categories: no prenatal care, prenatal care began in 1st trimester, prenatal care began in 2nd trimester, and prenatal care began in 3rd trimester. Please see the appendix for operational coding.

*Amount of time between births*: The amount of time between births affects birth outcomes. Preterm birth complications are estimated to be responsible for 35% of the world's 3.1 million annual neonatal deaths and are the second most common cause of death after pneumonia in children under 5 years old (Blencowe et al., 2012, p. 2162). Preterm birth prevention currently has few high impact solutions and recent investments in discovery research show increasing recognition of this important knowledge gap (Blencowe et al., 2012, p. 2171). Short birth intervals, less than 33 months between

births, is associated with increased risk of neonatal mortality (Selemani et al., 2014, p. 242). Please see the appendix for operational coding.

*Insured or not insured*: Broader health coverage generally leads to better access to necessary care and improved health, with the largest gains accruing to poorer people. Population health can be improved through the reduction of financial barriers to needed services (Moreno-Serra, & Smith, 2012, p. 917). For this study, insurance coverage was divided into four categories: Medicaid used, private insurance used, self-pay, and other. Please see appendix for operational coding.

*Race of mother*: Infant mortality rates are detailed by race and origin of mother on both the birth and death records; infant mortality rates vary considerably by race and ethnicity of the mother (Mathews, MacDorman, & Thoma, 2015, p. 4). For this study, the race of the mother was divided into six categories: White, Non-Hispanic, Black, Native American, Asian, and Hispanic. Please see appendix for operational coding.

**Data Analysis Plan**

For this study, a quantitative multiple logistic regression study on infant mortality was conducted using secondary data from both the Mosley-Chen theoretical framework and analyses of the data. The data collection method used linked birth/infant death records from the NBER, for the study period of 2011–2013 arranged in a birth cohort format. The data were imported into SPSS. Anomalies and a normal distribution were calculated to ensure clerical errors do not affect the data.

The following research questions were used:

RQ1: Do race and ethnicity predict infant mortality among babies born to women in the state of Texas for the years 2011–2013?

$H_0$1: There is no statistically significant likelihood that race and ethnicity will predict infant mortality among babies born to women in the state of Texas for the years 2011–2013.

$H_1$1: There is a statistically significant likelihood that race and ethnicity will predict infant mortality among babies born to women in the state of Texas for the years 2011–2013.

RQ2: Does any predictor have a statistically significant impact on women in the state of Texas for the years 2011–2013?

$H_0$2: No one predictor has a statistically significant impact on women in state of Texas for the years 2011–2013.

$H_1$2: There is a predictor that has a statistically significant impact on women in state of Texas for the years 2011–2013.

Sequential multiple logistic regression analysis was used for the analysis, adjusting for multiple comparisons, as appropriate. Odds-ratios and confidence intervals are presented along with the results of the regression analysis. Statistical tests that were used to test the hypotheses are an omnibus chi-square test, a classification table, and a pseudo-$R^2$ indices (see Osborne, 2014). Procedures to be used to account for multiple statistical tests were the Hosmer-Lemeshow test used to test a statistic that asymptotically follows an $X^2$ distribution to assess whether the observed event rates match expected event rates in subgroups of the population (Statistical Solutions, 2016). With the results, I

will report on the testing of the hypotheses and whether the evidence supports the research questions and hypotheses.

## Threats to Validity

Reliability and validity are two criteria used to judge the quality of all standardized quantitative measures. Reliability refers to the consistency of an instrument's ability to produce the same score repeatedly. Validity focuses on ensuring the instrument measures what it says it will measure (Lodico, Spaulding, & Voegtle, 2010). For this study, no instrument was used; archival data in a dataset from the NBER was analyzed. The records analyzed were existing linked birth/infant death records for the study period of 2011–2013. These records are routinely used in public health and education in Texas. The records are based on self-reports and medical records. There are several benefits to using archival data: one, the data has already been collected therefore saving time; and two, the data can be used without obtaining or using personal information. One barrier to using archival data is that the data has been collected by someone else and the quality control in the data collection may have inaccuracies, thus raising questions about validity. There are four types of validity: construct, internal, external, and statistical conclusion validity. Construct validity is the degree to which inferences can be made in a study and involves generalizing from a measure to the concept of a measure (Research Methods Knowledge Base, 2006). Internal validity is the approximate truth about inferences regarding cause-effect relationships and whether observed changes can be attributed to a program or intervention and not to other possible causes (Research Methods Knowledge Base, 2006). External validity is related to

generalizing and refers to the degree to which the conclusions in a study would hold true for other persons in other studies at other times (Research Methods Knowledge Base, 2006). Statistical conclusion validity is the least considered, most misunderstood, and often the most important of the four validity types because it is relevant whenever a study is determining if there is a relationship in a study. Statistical conclusion validity is the degree to which conclusions reached about relationships in the data are reasonable (Research Methods Knowledge Base, 2006).

In this study, the focus will be to look at the likelihood that the independent variables: (a) weight of baby at delivery, (b) gestational age, (c) maternal age at time of delivery, (d) maternal education, (e) marital status, (f) tobacco use during pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at time of delivery, and (j) race of mother, will affect the dependent variable, infant mortality. Threats to construct validity in this study could be generalizing from the study to the construct of infant mortality. In this study, definitions and measurements were established for the variables used; however, there is always the possibility of claiming to understand how the measures relate to one another (García-Pérez, 2012). Threats to internal validity in this study could be the statistical inferences about the likelihood is valid for the populations being studied. An example of a threat to internal validity would be an omitted variable bias. Hypothesis tests should have the intended significance level (UMass Online, 2015). The solution would be to include the omitted variables, ensure extraneous variables have been controlled for, and confounding variables have been eliminated (García-Pérez, 2012). In this study, extraneous and

confounding variables have been controlled for; however, there is always the possibility. Threats to external validity in this study could be the statistical inferences about the likelihood generalizations from the population and setting being studied to other populations and settings. An example of a threat to external validity would be differences in populations between populations studied and the population of interest (UMass Online, 2015). External validity is sought by observing and measuring the dependent variable under natural conditions or under an appropriate representation of them (García-Pérez, 2012, p. 1). In this study, there may be limits in terms of its external validity to other samples in other geographic locations. Threats to statistical conclusion validity in this study could be the data from the study could not reveal a link between the independent variables and the dependent variable. The variation in the dependent variable could be attributed to other causes (García-Pérez, 2012).

## Ethical Procedures

For this study I received IRB approval from Walden University to conduct this quantitative multiple logistic regression study. The IRB approval number for this study is 03-17-18-0442158. This study did not use human participants, only archived data from the NBER. This study used linked birth/infant death records from the NBER for the study period of 2011–2013. The records were obtained from existing databases within the NBER and I did not have any direct or indirect communications with the study population. All data were uploaded directly into SPSS software from the NBER website with any participant information removed. All other secondary information, such as census and population demographics, will be obtained from publicly available sources

and do not require any contact or identification of human participants. After the data were analyzed, the data will be kept in a password protected file for 5 years. Federal law states the data must be kept on file for 3 years; Walden University states it must kept for 5 years. After that, the data will be destroyed. Other ethical issues are not applicable since I will not be conducting a study in the environment I work in, there is no conflict of interest or power differentials, nor am I using any incentives in this study.

## Summary

In this study, I used quantitative multiple logistic regression to examine predictors of disparities in birth outcomes for women living in the state of Texas. This study was built on the Mosley-Chen theoretical framework, which proposes socioeconomic factors affect disease incidences and outcomes. Sequential multiple logistic regression analysis was used in this nonintervention research study to test the independent variables against the dependent variable, infant mortality. By using secondary data sources, there was no direct or indirect involvement of participants. This chapter presents both demographic and descriptive data of the research participants as well as information on the instruments and measures used in this study. In Chapter 4 the findings from this study are discussed and in Chapter 5 the conclusions and recommendations from this study are discussed.

# Chapter 4: Results

The purpose of this chapter is to describe the data that were collected and analyzed using multiple logistic regression analysis on the linked birth/infant death records from the NBER for the study period of 2011–2013 and to discuss the results of the data analysis. In this study, I examined predictors of disparities in birth outcomes in the state of Texas by race and ethnicity and other significant predictors related to socioeconomic status, using quantitative multiple logistic regression analysis. While the impetus of this study was to examine predictors of infant mortality for one county in Texas, I was only able to obtain data for the entire state of Texas.

In this study, I used multiple logistic regression analysis to examine the likelihood that the following independent variables would predict infant mortality (see Osborne, 2014). The independent variables were (a) weight of baby at delivery, (b) gestational age, (c) maternal age at delivery, (d) maternal education, (e) marital status, (f) tobacco use during pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at delivery, and (j) race of the mother. The dependent variable was infant mortality. The research questions and hypotheses used in this study were:

RQ1: Do race and ethnicity predict infant mortality among babies born to women in the state of Texas for the years 2011–2013?

$H_0$1: There is no statistically significant likelihood that race and ethnicity predict infant mortality among babies born to women in the state of Texas for the years 2011–2013.

$H_1$1: There is a statistically significant likelihood that race and ethnicity predict infant mortality among babies born to women in the state of Texas for the years 2011–2013.

RQ2: Does any predictor have a statistically significant impact on women in the state of Texas for the years 2011–2013?

$H_0$2: No one predictor has a statistically significant impact on women in state of Texas for the years 2011–2013.

$H_1$2: There is a predictor that has a statistically significant impact on women in state of Texas for the years 2011–2013.

Data collection, data analysis, the results of the data collection and analysis, and tables reporting the data analysis will be included in this chapter.

## Data Collection

My data collection process was different from what I proposed. When I submitted a data request to the Tarrant County Public Health Department (TCPHD), the TCPHD denied the data request and application stating they could not release confidential medical information. I then submitted a data request to the CDC. The CDC denied the request stating that because the county had denied the request for county data, they did not want to supersede their request. I found similar data that I requested from the county and the CDC on a public website, the NBER. I revised my proposal IRB application and, with the approval of my committee, submitted to the IRB at Walden University. Walden approved my revised IRB application, IRB approval number 03-17-18-0442158. With IRB approval, I uploaded the linked birth/infant death records from the NBER for the study

period 2011–2013 directly into SPSS software and began to run a multiple logistic regression analysis.

In my initial proposal, I wanted to examine the predictors of infant mortality in Tarrant County for the years 2012–2015, analyzing the linked birth/infant death records from the Tarrant County Public Health Department. While I was denied the data from the TCPHC, I was able to find similar data from the NBER for years 2011–2013; however, the data were for the entire state of Texas, not just Tarrant County. The independent variables and dependent variable remained the same and the data set provided the covariates and were matched to the independent variables. Both the independent variables and the data set information are listed in the appendix. In this study basic univariate analysis was not used because there was more than one variable; in this study, I used quantitative multiple logistic regression. In addition, there was no threat to external validity due to there being no difference in the population studied and the population of interest.

**Description of the Sample**

In this study, I used all available linked birth/infant death records from the NBER for the study period 2011–2013, with the inclusion criteria including all infants born during the study period. The total number in the sample was 11,862,780. The files for the study years 2011, 2012, and 2013 were directly imported from the NBER website into SPSS software.

After importing the data into SPSS, I used indicator coding as standard dummy variable coding (Field, 2018), with referent codes; please see the appendix. In Table 1, I

used referent (dummy) codes to represent subgroups in the study to enable the use of a single regression equation to represent multiple groups (see Trochim, 2006). The demographic characteristics aligned with the descriptive statistics: the 10 independent variables, the dependent variable, the geocode, and the socioeconomic proxy, WIC. Table 1 presents descriptive information in the sample used in the study. The data for this study were for the entire state of Texas rather than a specific population; see Table 1.

For the multiple logistic regression analysis, I ran an initial hierarchical analysis to fit competing models and to decide which combinations were best (Field, 2018). After I ran the initial analysis, it appeared it would be best to enter the data into SPSS as two steps/blocks: one with race by itself in Step 1 (Block 1) and all the covariates in Step 2 (Block 2). See Table 2.

Frequencies for the dependent variable and the independent variables are illustrated in Table 1. In Table 1, several key outcomes emerged in the demographic analysis. One outcome was mother's race. Black women comprised 14.76% of the sample; however, race was statistically significant. I will discuss this in Tables 2 and 3 and in the results section. Another outcome was mother's age. Women under the age of 15 comprised .1% of the sample; however, age of the mother was statistically significant. I will discuss this in Tables 2 and 3 and in the results section. A third outcome was prenatal care. Women receiving no prenatal care comprised 1.4% of the sample; however, the month when prenatal care began was statistically significant. I will discuss this in Tables 2 and 3 and in the results section.

Table 1 presents the dependent variable, infant mortality, and the descriptive statistic, living or not living, and the independent variables: (a) weight of baby at delivery, (b) gestational age, (c) maternal age at delivery, (d) maternal education, (e) marital status, (f) tobacco use during pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at delivery, and (j) race of the mother. Table 1 also presents the descriptive statistics of the mother's race, the mother's age, the mother's education, the marital status of the mother, cigarette use or nonuse of the mother during pregnancy, the mother's residence, how the mother paid (Medicaid, private insurance, self-pay, and other), if WIC was used during pregnancy, and when prenatal care began.

Table 1

*Descriptive Statistics, Dependent Variable, and Independent Variables*

| Dependent variable | Living | Not living | Total | Missing cases | Total in sample |
|---|---|---|---|---|---|
| Living/Not living | 9,798,693 | 29,162 | 9,827,855 | 2,034,925 | 11,862,780 |
| Percent | 82.6% | .2% | | 17.2% | 100% |
| Mother's race | Non-Hispanic | Total | Hispanic | Total | 11,862,780 |
| Independent variables | | | | | |
| Mother's race | | | | | |
| White* | 6,411,998 | 54.05% | 2,616,434 | 22.06% | |
| Black | 1,750,528 | 14.76% | 152,165 | 1.28% | |
| Native American | 116,662 | .98% | 21,888 | .18% | |
| Asian | 750,656 | 6.33% | 42,449 | .36% | |
| Mother's age | | | | | |
| Under 15 | 8,757 | .1% | | | |
| 15–19 | 748,054 | 7.6% | | | |
| 20–34* | 7,606,942 | 77.4% | | | |
| Over 35 | 1,464,102 | 14.9% | | | |
| Mother's education | | | | | |
| Less than high school | 1,657,423 | 16.9% | | | |
| High school grad/some college | 4,524,321 | 46% | | | |
| Associate's degree | 768,339 | 7.8% | | | |
| Bachelor's degree* | 1,844,410 | 18.8% | | | |
| Advanced degree | 1,033,362 | 10.5% | | | |
| Marital status | | | | | |
| Not married* | 3,955,273 | 40.2% | | | |
| Married | 5,872,582 | 59.8% | | | |
| Cigarette use | | | | | |
| No* | 9,016,053 | 91.7% | | | |
| Yes | 811,802 | 8.3% | | | |
| Mother's residence | | | | | |
| State and county the same* | 7,169,931 | 73% | | | |
| State same, county different | 2,437,968 | 24.8% | | | |
| State different | 199,642 | 2% | | | |
| Foreign resident | 20,314 | .2% | | | |
| Pay status | | | | | |
| Medicaid* | 4,274,384 | 43.5% | | | |
| Private insurance | 4,654,622 | 47.4% | | | |
| Self-pay | 415,868 | 4.2% | | | |
| Other | 482,981 | 4.9% | | | |
| WIC use | | | | | |
| No* | 5,349,843 | 54.4% | | | |
| Yes | 4,478,012 | 45.6% | | | |
| Prenatal care began | | | | | |
| No prenatal care* | 141,066 | 1.4% | | | |
| 1st trimester | 7,291,902 | 74.2% | | | |
| 2nd trimester | 1,952,088 | 19.9% | | | |
| 3rd trimester | 442,799 | 4.5% | | | |

*Note.* * = Referent codes.

Information presented in Table 1 described the multivariate relationships between the descriptive characteristics and the dependent variable, infant mortality. Additional analyses are presented in the other tables and figures.

## Results

### Analysis of Data

Multiple logistic regression analyses were conducted to examine the likelihood that the independent variables in this study would predict infant mortality (see Osborne, 2014).

**Variables in the equation and odds ratios**. ***Step 1: Race***. In this study, I entered race by itself in Step 1 of the logistic regression analysis, please see Table 2. For the independent variable, race of the mother, and the covariate, mother's race, White, Black, Native American, Asian, and Hispanic were dummy coded and entered; White was the referent code.

In Table 2, Step 1 and Step 2 are represented by B which are the values for the logistic regression equations, also called beta weights, and are used to compare the strength of and the relationship of the independent variables on the dependent variable, infant mortality (Bruin, 2006). Also in Table 2, Sig is represented and coefficients having *p*-values less than 0.05 are statistically significant (Bruin, 2006).

In multiple logistic regression analysis, *p*-values and coefficients work together to illustrate the relationship and determine if they are statistically significant by describing the relationship between the independent variable and the dependent variable (Frost, 2019). In this analysis, there is sufficient evidence to warrant the rejection of the claim

that the race of the mother is not a significant factor so for RQ1, the null hypothesis would be rejected; the race of the mother did predict infant mortality among babies born to women in the state of Texas for the years 2011–2013. The *p*-value of .05 or lower is statistically significant and the *p*-value = .000. Therefore the independent variable race of mother is significant, (see Step 1, Table 2). For Step 1, the Chi-square $\chi^2$ = (4, N = 11,862,780) = 2954.8, *p*-value < 0.001, with 4 being the degrees of freedom and the Sig. .000. With this *p*-value and Chi-square, the race of the mother is statistically significant and the null hypothesis would be rejected. The Hosmer and Lemeshow Test was significant with a Sig. of .000 with 2 degrees of freedom, a Chi-square of 18.316, in four steps. For an analysis to have a good fit, the Hosmer and Lemeshow Test's significance should have a *p*-value of > 0.05. However, the size of the sample affected this test. The Hosmer and Lemeshow Test only gives significance of a poor fit for an analysis 65% of the time and the larger (or smaller) the sample, it will detect a poor fit (Bartlett, 2014).

***Step 2: Variables in the equation and odds ratios***. In this study, I entered all the covariates in Step 2 of the logistic regression analysis, (Table 2). The independent variables were (a) weight of baby at delivery, (b) gestational age, (c) maternal age at time of delivery, (d) maternal education, (e) marital status, (f) tobacco use during pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at time of delivery, and (j) race of the mother. The following covariates from the dataset were used: mother's race, mother's age, mother's education, marital status, cigarette use, mother's residence, pay status, WIC, and when prenatal care began. The weight of the baby at the time of delivery, gestational age, and

the amount of time between births was not input into steps and/or blocks in this analysis. In multiple logistic regression in SPSS, variables are identified, formatted, and typed prior to inputting into SPSS and these three variables are numerical variables with the measure defined on a scale. The other variables used were nominal, ordinal, and dichotomous (Kent State University, 2019). The independent variables and covariates used in the odds ratios are described in the results section.

Table 2

*Logistic Regression*

| Independent variables | Step 1 | Sig. | Step 2 | Sig. |
|---|---|---|---|---|
| Mother's race | | | | |
| White | | | | |
| Black | .759 | .000 | .750 | .000 |
| Native American | .216 | .000 | .104 | .066 |
| Asian | –.119 | .000 | .018 | .517 |
| Hispanic | .104 | .000 | .164 | .000 |
| Mother's age | | | | |
| Under 15 | | | .433 | .002 |
| 15–19 | | | .194 | .000 |
| 20–34 | | | | |
| Over 35 | | | .177 | .000 |
| Mother's education | | | | |
| Less than high school | | | .305 | .000 |
| High school grad/some college | | | .287 | .000 |
| Associate's degree | | | .125 | .000 |
| Bachelor's degree | | | | |
| Advanced degree | | | –.191 | .000 |
| Marital status | | | | |
| Married | | | –.114 | .000 |
| Cigarette Use | | | | |
| Yes | | | .172 | .000 |
| Mother's residence | | | | |
| State and county the same | | | | |
| State same, county different | | | .341 | .000 |
| State different | | | .731 | .000 |
| Foreign resident | | | –.784 | .000 |
| Pay status | | | | |
| Medicaid | | | | |
| Private insurance | | | –.236 | .000 |
| Self-pay | | | .198 | .000 |
| Other | | | .014 | .593 |
| WIC use | | | | |
| Yes | | | –.636 | .000 |
| Prenatal care began | | | | |
| No prenatal care | | | | . |
| 1st trimester | | | –1.466 | .000 |
| 2nd trimester | | | –1.571 | .000 |
| 3rd trimester | | | –2.214 | .000 |
| Constant | –5.999 | .000 | –4.496 | .000 |

*Note*. All coefficients significant at the 0.001 level, except where otherwise noted.

Table 3 presents the odds ratios relative to the coefficients and the reference category from the variables in the equation from Step 2. Odds ratios are used in logistic regression analysis to present the effect of a predictor on the likelihood that a certain outcome will occur (Grace-Martin, 2019).

Table 3

*Odds Ratios, 95% C.I. for Exp. (B)*

| Independent variables | Exp. (B) | Lower | Upper |
|---|---|---|---|
| Mother's race | | | |
| White | | | |
| Black | 2.118 | 2.056 | 2.181 |
| Native American | 1.110 | .993 | 1.240 |
| Asian | 1.019 | .963 | 1.077 |
| Hispanic | 1.179 | 1.143 | 1.216 |
| Mother's age | | | |
| Under 15 | 1.542 | 1.170 | 2.031 |
| 15–19 | 1.214 | 1.164 | 1.265 |
| 20–34 | | | |
| Over 35 | 1.194 | 1.156 | 1.234 |
| Mother's education | | | |
| Less than high school | 1.357 | 1.294 | 1.424 |
| High school grad/some college | 1.332 | 1.282 | 1.384 |
| Associate's degree | 1.133 | 1.075 | 1.195 |
| Bachelor's degree | | | |
| Advanced degree | .826 | .784 | .871 |
| Marital status | | | |
| Married | .892 | .867 | .918 |
| Cigarette use | | | |
| Yes | 1.188 | 1.141 | 1.237 |
| Mother's residence | | | |
| State and county the same | | | |
| State same, county different | 1.407 | 1.371 | 1.444 |
| State different | 2.078 | 1.952 | 2.212 |
| Foreign resident | .457 | .331 | .630 |
| Pay status | | | |
| Medicaid | | | |
| Private insurance | .790 | .794 | .816 |
| Self-pay | 1.219 | 1.160 | 1.282 |
| Other | 1.015 | .962 | 1.070 |
| WIC use | | | |
| Yes | .529 | .515 | .545 |
| Prenatal care began | | | |
| No prenatal care | | | |
| 1st trimester | .231 | .221 | .241 |
| 2nd trimester | .208 | .198 | .218 |
| 3rd trimester | .120 | .110 | .129 |

*Note*. All coefficients significant at the 0.001 level, except where otherwise noted.

Information in Table 3 presented the odds ratios the effect of a predictor would have on the likelihood that one outcome would occur (see The Analysis Factor, LLC, 2020). The independent variable, race of the mother, and the independent variable, when prenatal care began, were predicted by the model and both variables were statistically significant.

**Results by Independent Variable**

Table 2 presented the results of the logistic regression, with two steps. In evaluating statistical assumptions for this study, I required at least two independent variables for multiple logistic regression analysis, and this study has ten. The variables in this study were all recoded into dichotomous variables, commonly referred to as dummy coding. A good sample size is at least twenty cases per independent variables in the analysis, this study had 11,862,780 for the entire sample size for ten independent variables (see Statistics Solutions, 2019).

Step 1 presented the mother's race ran by itself and Step 2 presented all the descriptive statistics ran together. In Table 2, I used referent (dummy) codes to represent subgroups in the study to enable the use of a single regression equation to represent multiple groups (see Trochim, 2006).

Information presented in Table 2 described the logistic regression analysis in two steps to predict the probability that an observation will fall into one of two categories for the dichotomous dependent variable, infant mortality (see Lund Research Ltd., 2018). The results of this analysis contains sufficient evidence to warrant the rejection of the claims of the null hypotheses as the race of the mother is a significant factor for RQ1: the

race of the mother did predict infant mortality among babies born to women in the state of Texas for the years 2011–2013; and for RQ2: the predictor of when prenatal care began had the greatest impact on women in the state of Texas for the years 2011–2013. The independent variables and covariates used in the odds ratios are described below.

**Race**. For the independent variable, race of the mother, and the covariate, mother's race, White, Black, Native American, Asian, and Hispanic were dummy coded and entered; White was the referent code. In multiple logistic regression analysis, *p*-values and coefficients work together to illustrate the relationship and determine if they are statistically significant by describing the relationship between the independent variable and the dependent variable (Frost, 2019).

In this analysis, there is sufficient evidence to warrant the rejection of the claim that the race of the mother is not a significant factor so for RQ1, the null hypothesis would be rejected; the race of the mother did predict infant mortality among babies born to women in the state of Texas for the years 2011–2013. The *p*-value of .05 or lower which is statistically significant and the *p*-value = .000. Therefore the independent variable race of mother is significant, (see Step 2, Table 2). For Step 2, the Chi-square $\chi^2$ = (19, N = 11,862,780) = 8664.6, *p*-value < 0.001, with 19 being the degrees of freedom and the Sig. .000. With this *p*-value and Chi-square, the race of the mother is statistically significant and the null hypothesis would be rejected. The Hosmer and Lemeshow Test was significant with a Sig. of .000 with 8 degrees of freedom, a Chi-square of 70.749, in ten steps. For an analysis to have a good fit, the Hosmer and Lemeshow Test's significance should have a *p*-value of > 0.05. However, the size of the sample affected

this test. The Hosmer and Lemeshow Test only gives significance of a poor fit for an analysis 65% of the time and the larger (or smaller) the sample, it will detect a poor fit (Bartlett, 2014).

The variables in the equation output also gives the Exp. (B), or odds ratio predicted by the model. The odds ratio is computed by raising the base of the natural log to the $b^{th}$ power where *b* is the slope from the logistic regression equation (Wuensch, 2019). In Table 3, the odds that mother's race predicts infant mortality is 2.118 times more likely for Black women, please see Table 3, mother's race. This can be converted to a probability of 68%. $\hat{Y} = \underline{ODDS / 1 + ODDS = 2.118 / 3.118} = .679 = 68\%$.

**Age**. For the independent variable, maternal age at time of delivery, and the covariate, mother's age, age 20 – 34, under 15, teen mom 15–19, and 35 and over were coded and entered; age 20–34 was the referent code. In multiple logistic regression analysis, *p*-values and coefficients work together to illustrate the relationship and determine if they are statistically significant by describing the relationship between the independent variable and the dependent variable (Frost, 2019).

The variables in the equation output also gives the Exp. (B), or odds ratio predicted by the model. The odds ratio is computed by raising the base of the natural log to the $b^{th}$ power where *b* is the slope from the logistic regression equation (Wuensch, 2019). In Table 3, the odds that mother's age predicts infant mortality is 1.542 times more likely for women under the age of 15, please see Table 3, mother's age. This can be converted to a probability of 61%. $\hat{Y} = \underline{ODDS / 1 + ODDS = 1.542 / 2.542 =} .606 = 61\%$.

**Education**. For the independent variable, maternal education, and the covariate, mother's education, bachelor's degree, less than high school, high school graduate with some college, associate's degree, and advanced degree were coded and entered; bachelor's degree was the referent code. In multiple logistic regression analysis, *p*-values and coefficients work together to illustrate the relationship and determine if they are statistically significant by describing the relationship between the independent variable and the dependent variable (Frost, 2019).

The variables in the equation output also gives the Exp. (B), or odds ratio predicted by the model. The odds ratio is computed by raising the base of the natural log to the $b^{th}$ power where *b* is the slope from the logistic regression equation (Wuensch, 2019). In Table 3, the odds that mother's education predicts infant mortality is 1.357 times more likely for women with less than a high school diploma, (Table 3), mother's education. This can be converted to a probability of 58%. $\hat{Y} = \underline{ODDS / 1 + ODDS =}$ $\underline{1.357 / 2.357 =}$ .575 = 58%.

**Marital status**. For the independent variable, marital status, and the covariate, marital status, married and not married were coded and entered; married was the referent code. In multiple logistic regression analysis, *p*-values and coefficients work together to illustrate the relationship and determine if they are statistically significant by describing the relationship between the independent variable and the dependent variable (Frost, 2019).

The variables in the equation output also gives the Exp. (B), or odds ratio predicted by the model. The odds ratio is computed by raising the base of the natural log

to the $b^{th}$ power where *b* is the slope from the logistic regression equation (Wuensch, 2019). In Table 3, the odds that the mother's marital status predicts infant mortality is .892 times more likely for women who are married, (Table 3), marital status. This can be converted to a probability of 47%. $\hat{Y} = \underline{ODDS / 1 + ODDS = .892 / 1.892 =} .471 = 47\%$.

**Cigarette use**. For the independent variable, tobacco use during pregnancy, and the covariate, cigarette use, cigarettes used and cigarettes not used were coded and entered; cigarettes used was the referent code. In multiple logistic regression analysis, *p*-values and coefficients work together to illustrate the relationship and determine if they are statistically significant by describing the relationship between the independent variable and the dependent variable (Frost, 2019).

The variables in the equation output also gives the Exp. (B), or odds ratio predicted by the model. The odds ratio is computed by raising the base of the natural log to the $b^{th}$ power where *b* is the slope from the logistic regression equation (Wuensch, 2019). In Table 3, the odds that cigarette use during pregnancy predicts infant mortality is 1.188 times more likely for women who smoke during pregnancy, (Table 3), cigarette use. This can be converted to a probability of 54%. $\hat{Y} = \underline{ODDS / 1 + ODDS = 1.188 / 2.188 =} .542 = 54\%$.

**Residence**. For the covariate, mother's residence, state and county the same, state the same and county different, state different, and foreign resident were coded and entered; state and county the same was the referent code. While the NBER did not identify geographic details in the data for confidentiality purposes, mother's residence was used as a geocode to analyze for this study. While I wanted to analyze data for

Tarrant County, the dataset from NBER contained data for the state of Texas in order to preserve confidentiality for residents. In multiple logistic regression analysis, *p*-values and coefficients work together to illustrate the relationship and determine if they are statistically significant by describing the relationship between the independent variable and the dependent variable (Frost, 2019).

The variables in the equation output also gives the Exp. (B), or odds ratio predicted by the model. The odds ratio is computed by raising the base of the natural log to the $b^{th}$ power where *b* is the slope from the logistic regression equation (Wuensch, 2019). In Table 3, the odds that a mother's residence predicts infant mortality is 2.078 times more likely for women moving into the state of Texas from another state, and 1.407 times more likely for women living in the same state but different counties in Texas, (Table 3), mother's residence. This can be converted to a probability of 68% and 58%. $\hat{Y} = \underline{ODDS / 1 + ODDS = 2.078 / 3.078 =} .675 = 68\%$ and $\hat{Y} = \underline{ODDS / 1 + ODDS = 1.407 / 2.407 =} .584 = 58\%$.

**Pay status**. For the independent variable, mother's insurance coverage or noncoverage at time of delivery, and for the covariate, pay status, Medicaid, private insurance, self-pay, and other were coded and entered; Medicaid was the referent code. In multiple logistic regression analysis, *p*-values and coefficients work together to illustrate the relationship and determine if they are statistically significant by describing the relationship between the independent variable and the dependent variable (Frost, 2019).

The variables in the equation output also gives the Exp. (B), or odds ratio predicted by the model. The odds ratio is computed by raising the base of the natural log

to the $b^{th}$ power where *b* is the slope from the logistic regression equation (Wuensch, 2019). In Table 3, the odds that a mother's pay status predicts infant mortality is 1.219 times more likely for women who self-pay, (Table 3), pay status. This can be converted to a probability of 55%. $\hat{Y} = \underline{ODDS / 1 + ODDS = 1.219 / 2.219 =} .549 = 55\%$.

**WIC**. For the covariate, WIC, WIC used during pregnancy and WIC not used during pregnancy were coded and entered; WIC was the referent code. In this study, WIC was used as a proxy for socioeconomic status. According to Jackson (2015), the socioeconomic disadvantages of those enrolled in WIC compared to those not eligible for WIC and/or those who are eligible and choose not to enroll, there are substantial correlations between socioeconomic measures and WIC participation (Jackson, 2015). In a study from 2015 from Feeding America, 4.65 million Texans, including 1.9 million children, had limited access to enough food for a healthy lifestyle ranking Texas as number 2, behind California, for food-insecure individuals and number 7 for child food-insecurity (Camp, 2015). The Tarrant Area Food Bank states, 1 in 6 people in Tarrant County struggles with hunger with 1 in 4 children uncertain about where their next meal will come from. When compared to other states, Texas has the second highest number of hungry children and Tarrant County is one of the top ten counties in the United States with the highest number of hungry people overall (Tarrant Area Food Bank, 2019).

To be eligible for WIC, women and/or children must meet all four eligibility requirements. The four requirements are: categorical, residential, income, and nutritional risk. Categorically, WIC serves women, infants, and children; therefore, women who are pregnant, postpartum, and or breastfeeding qualify, and infants up to their first birthday

and/or children up to their fifth birthday qualify. Residentially, women and/or children must live in the state and/or in the local service area for which they apply. For income, women and/or children must be at or below an income level standard set by the state and/or local service area. Nutritionally, women and/or children must be seen by either a doctor, a nurse, or a nutritionist who determines if the woman and/or child(ren) is at nutritional risk meaning that woman and/or child(ren) has either/or a medically-based or dietary-based condition. For example, anemia, low weight, or a "poor diet" (USDA, 2019).

In multiple logistic regression analysis, *p*-values and coefficients work together to illustrate the relationship and determine if they are statistically significant by describing the relationship between the independent variable and the dependent variable (Frost, 2019).

The variables in the equation output also gives the Exp. (B), or odds ratio predicted by the model. The odds ratio is computed by raising the base of the natural log to the $b^{th}$ power where *b* is the slope from the logistic regression equation (Wuensch, 2019). In Table 3, the odds that WIC used during pregnancy predicts infant mortality is .529 times more likely for women who use WIC during pregnancy, (Table 3), WIC. This can be converted to a probability of 35%. $\hat{Y} = \underline{ODDS / 1 + ODDS = .529 / 1.529 =} .345 =$ 35%.

**When prenatal care began**. For the independent variable, when prenatal care began, and for the covariate, when prenatal care began, no prenatal care, 1st trimester, 2nd trimester, and 3rd trimester were coded and entered; no prenatal care was the referent

code. In multiple logistic regression analysis, *p*-values and coefficients work together to illustrate the relationship and determine if they are statistically significant by describing the relationship between the independent variable and the dependent variable (Frost, 2019).

The variables in the equation output also gives the Exp. (B), or odds ratio predicted by the model. The odds ratio is computed by raising the base of the natural log to the $b^{th}$ power where *b* is the slope from the logistic regression equation (Wuensch, 2019). In Table 3, the odds that the month prenatal care began predicts infant mortality is .120 times more likely for women who begin prenatal care in the third trimester, (Table 3), when prenatal care began. This can be converted to a probability of 11%. $\hat{Y} = \underline{ODDS / 1 + ODDS} = .120 / 1.120 = .107 = 11\%$.

**Results by Research Questions**

In this study, I used multiple logistic regression analysis to examine the likelihood that the independent variables would predict infant mortality, the dependent variable, (see Osborne, 2014), and answer the 2 research questions: do race and ethnicity predict infant mortality among babies born to women in the state of Texas for the years 2011–2013; and do any predictors have a statistically significant impact on women in the state of Texas for the years 2011–2013? A multiple logistic model is commonly used to analyze data when the endpoint is a dichotomous variable (Abbott & Carroll, 1984). In this study the dependent variable is dichotomous variable, living or not living.

**Research Question 1.** In answer to the first research question, about the predictive value of race and ethnicity regarding infant mortality in Texas for the years

2011–2013, results show the independent variable mother's race to be statistically significant ($p$ = .000). There was sufficient evidence to warrant the rejection of the claim that the race of the mother is not a significant factor so for RQ1, the null hypothesis is rejected. In Step 1 of the data analysis, the Chi-square result indicated a $p$-value < 0.001.

**Research Question 2.** To answer the second research question, about identifying predictors with the greatest impact for women in Texas in the years 2011–2013, the analysis of the data indicated the independent variable when prenatal care began, particularly the third trimester, as the most significant in determining infant mortality, specifically for Black women. From the data analysis, the logit [p = probability of Infant Mortality] = log [p / (1-p)] = $\beta_0 + \beta_1$ (When Prenatal Care Began). For the independent variable, when prenatal care began, the dataset provided the covariates and were matched to the independent variables and for this variable were coded: no prenatal care, the first trimester, the second trimester, and the third trimester, see Appendix and Table 2. For the third trimester, $\beta$ is -2.124 with $p < 0.05$ ($p = 0.000$) indicating prenatal care beginning in the third trimester is a significant predictor of infant mortality, (Table 2). The results of the analysis contain sufficient evidence to warrant the rejection of the claim of the null hypothesis for RQ2: one predictor, when prenatal care began, had the greatest impact on women in the state of Texas for the years 2011–2013, specifically for Black women.

## Summary of Results

After determining the odds ratios and percentages, I input the data into an Excel spreadsheet and I created two forest plots with the odds ratios and confidence intervals, please see Figures 1 and 2. A forest plot is a graphical display of estimated results

representing an analysis of the odds ratios and confidence intervals (Lalkhen, 2008). In both Figures 1. and 2., the variables are listed on the y axes and the odds ratios are listed on the x axes. In Figure 1., the forest plot lists the race and ethnicities used in Step 1 (Block 1) as odds ratios used in the analysis with 95% confidence intervals. From the multiple logistic regression analysis for the independent variable race of mother, Black was the most significant in determining infant mortality with an odds ratio of 2.137 and is therefore statistically significant. In Figure 2., the forest plot lists all the independent variables used in Step 2 (Block 2) as odds ratios used in the analysis with 95% confidence intervals. From the multiple logistic regression analysis for the independent variable when prenatal care began, the third trimester was the most significant in determining infant mortality with an odds ratio of 0.120 and is therefore statistically significant.

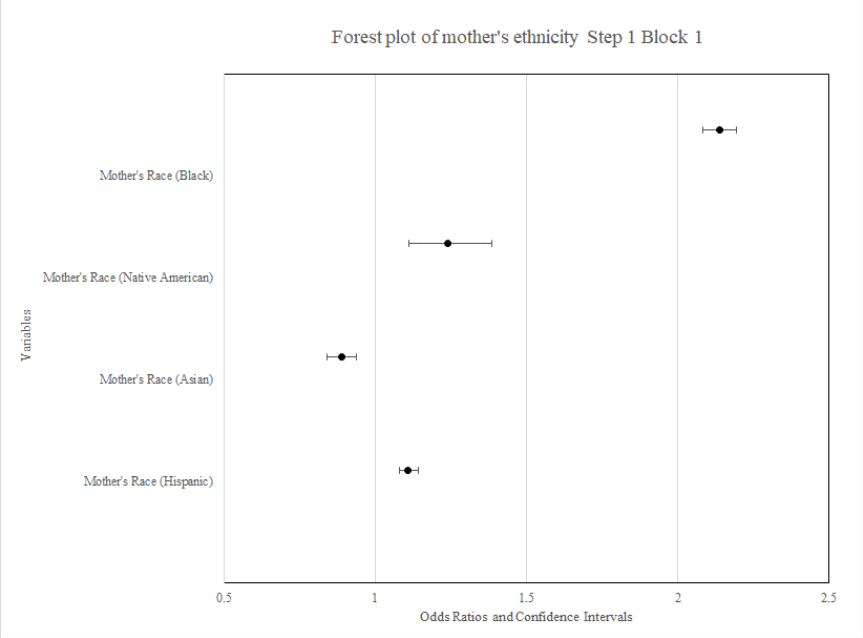


*Figure 1*. Forest plot of odds ratios and confidence intervals, Step 1 (Block 1).

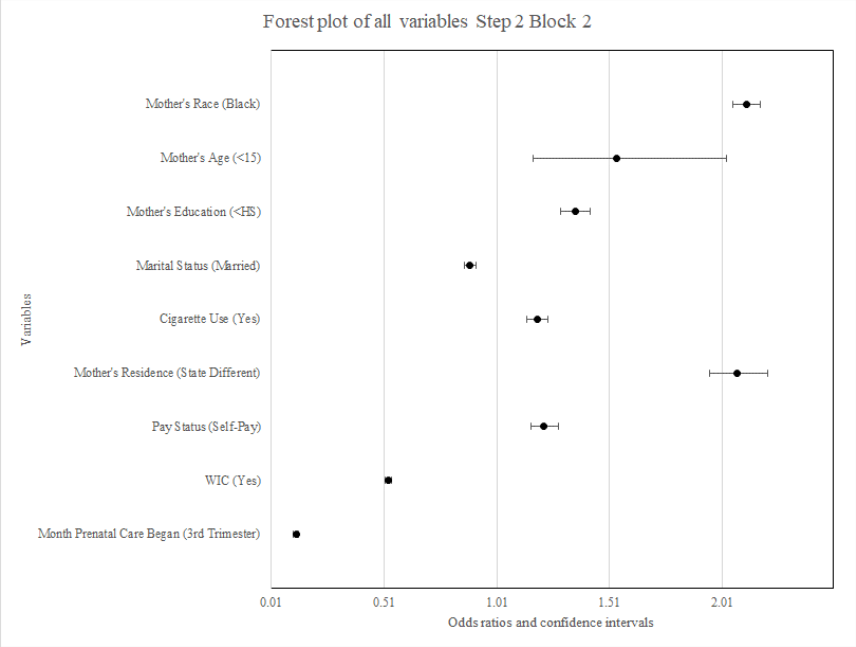


*Figure 2*. Forest plot of odds ratios and confidence intervals, Step 2 (Block 2).

In analyzing the data, several of the variables had an impact on Black women in the state of Texas for the years 2011–2013; they were: the mother's race, the mother's age, the mother's education, the pay status at the time of delivery, and when prenatal care began. For the mother's race, Black women was the most significant group; for the mother's age, the group under 15 was the most significant; for the mother's education, less than high school was the most significant; for the pay status at the time of delivery, self-pay was the most significant; and for when prenatal care began, the third trimester was the most significant. The *p*-value of 5% or lower is statistically significant and the *p*-value = .000, therefore it is significant, please see Step 2, Table 2. For Step 2, the Chi-square $\chi^2$ = (19, N = 11,862,780) = 8664.6, *p*-value < 0.001, with 19 being the degrees of freedom and the Sig. .000. With this *p*-value and Chi-square, there is sufficient evidence to warrant the rejection of the claim that the predictor that had the greatest impact on women in the state of Texas for the years 2011–2013, specifically Black women, was when prenatal care began and therefore is statistically significant and the null hypothesis would be rejected. The Hosmer and Lemeshow Test was significant with a Sig. of .000. For an analysis to have a good fit, the Hosmer and Lemeshow Test's significance should have a *p*-value of > 0.05. However, the size of the sample affected this test. The Hosmer and Lemeshow Test only gives significance of a poor fit for an analysis 65% of the time and the larger (or smaller) the sample, it will detect a poor fit (Bartlett, 2014).

From the multiple logistic regression analysis, the multicollinearity stayed the same for mother's race in both Steps and Blocks with the odds ratios at 43% and after controlling for the other variables, the data suggests Black women are two times more

likely to lose their infants to infant mortality. This is consistent with the literature and previous research. In this study I looked at the variables using multiple logistic regression analysis and grouped the variables by race alone and with all variables together. However, because this study looked at the data in this specific manner, and because the data sample was for the entire state of Texas and so large, more research is needed to ensure positive social change can occur in my community to include providing information on the relative importance of the predictors of infant mortality to being able to inform policymakers and early childhood educators on decisions that can advise policymakers on the collective impact of prenatal care and early childhood development and education.

In this study, there were no post-hoc analyses of statistical tests and there were no additional statistical tests of the hypotheses that emerged from the analysis of the main hypotheses.

## Summary

The purpose of this chapter was to describe the data that were collected and analyzed using multiple logistic regression analysis on the linked birth/infant death records from the NBER for the study period of 2011–2013. This was not a conventional study in that the sample size was large, the entire state of Texas, when I wanted to study one county in Texas. Even with the large sample, the data were significant with larger confidence intervals and a larger standard error. Multiple logistic regression is a model for predicting categorical outcomes from categorical and continuous predictors (Field, 2018). Regression analysis is a form of inferential statistics with the *p*-values assisting in

determining if the relationships observed can be generalized to the larger population (Frost, 2019). The results of the data analysis from this multiple logistic regression study contains sufficient evidence to warrant the rejection of the claims of the null hypotheses as the race of the mother is a significant factor for RQ1: the race of the mother did predict infant mortality among babies born to women in the state of Texas for the years 2011–2013, and for RQ2: the predictor of when prenatal care began had the greatest impact on women in the state of Texas for the years 2011–2013. In this study the model showed, after controlling for socioeconomics, mother's race and when prenatal care began was statistically significant and answered the research questions. This study is similar to other studies that historically have been associated with socioeconomics and like the other studies (Rajan, Roy, & Delgado, 2020), this study suggests the need for the development of policies and interventions that can help overcome challenges faced by socially and economically vulnerable and historically marginalized groups of people for positive social change and to inform policymakers and early childhood educators on decisions that could advise policymakers on the impact of prenatal care and early childhood development and education.

In Chapter 5 I will discuss the interpretation of the findings, discuss the limitations of the study, discuss recommendations for future work, and discuss implications for social change based on the study.

# Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this chapter is to summarize the key findings from this study, interpret the findings of the study, discuss the limitations of the study, describe recommendations for further research, and describe potential impacts for positive social change. In this quantitative study, I examined predictors of disparities in birth outcomes in the state of Texas by race and ethnicity and other significant predictors related to socioeconomic status. Multiple logistic regression analysis was used to examine the likelihood that the following independent variables would predict infant mortality (see Osborne, 2014): (a) weight of baby at delivery, (b) gestational age, (c) maternal age at time of delivery, (d) maternal education, (e) marital status, (f) tobacco use during pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at delivery, and (j) race of mother. In this multiple logistic regression analysis, the following 2 research questions and hypotheses were tested:

RQ1: Do race and ethnicity predict infant mortality among babies born to women in the state of Texas for the years 2011–2013?

$H_0$1: There is no statistically significant likelihood that race and ethnicity predict infant mortality among babies born to women in the state of Texas for the years 2011–2013.

$H_1$1: There is a statistically significant likelihood that race and ethnicity predict infant mortality among babies born to women in the state of Texas for the years 2011–2013.

RQ2: Does any predictor have a statistically significant impact on women in the state of Texas for the years 2011–2013?

$H_0$2: No one predictor has a statistically significant impact on women in state of Texas for the years 2011–2013.

$H_1$2: There is a predictor that has a statistically significant impact on women in state of Texas for the years 2011–2013.

Data collection, data analysis, the results of the data collection and analysis, and tables reporting the data analysis will be included in this chapter.

The results of the data analysis from this multiple logistic regression study contain sufficient evidence to warrant the rejection of the claims of the null hypotheses, as the race of the mother is a significant factor for RQ1; the race of the mother did predict infant mortality among babies born to women in the state of Texas for years 2011–2013. For RQ2, the predictor of when prenatal care began had the greatest impact on women, specifically Black women, in the state of Texas for years 2011–2013.

## Interpretation of the Findings

In this study, I examined predictors of disparities in birth outcomes in the state of Texas by race and ethnicity and other significant predictors related to socioeconomic status using quantitative multiple logistic regression analysis. As stated in Chapter 2, I built this study on the work of Mosley and Chen (1984), who proposed that socioeconomic factors affect disease incidence and outcomes. At the local level, this study could change a gap in practice, ultimately resulting in a change in the dependent variable of the study—that is, the high infant mortality rate. For this study, I chose the

Mosley-Chen theoretical framework because the research focused on the differences in health and mortality between Black and White women. The Mosley-Chen theoretical framework describes the differences of race, genetics, culture, behavior, and socioeconomic factors (Hummer, 1996). This framework has been applied in many studies relating to infant mortality. Early childhood specialists, social scientists, and medical researchers have used and cited this theoretical framework as it applies to changing education, health, and policy (Hummer, 1996; Mishra, 2015; Quah & Sales, 2000; Zielinski Gutiérrez & Kendall, 2000). In this study, I used the Mosley-Chen theoretical framework to examine and confirm the predictors of disparities in birth outcomes and confirmed for RQ1 that race and ethnicity would predict infant mortality among women in the state of Texas for years 2011–2013, and for RQ2, the predictor of when prenatal care began had the greatest impact on Black women in the state of Texas for years 2011–2013.

In a similar study conducted by UTHSC, Nehme et al. (2018) stated that socioeconomics and income inequality were the factors with the greatest impact on infant mortality in Texas. However, based on the data in their research (see Nehme et al., 2018, p. 3), I argue that race, not socioeconomics, has the greatest impact on infant mortality in Tarrant County. Nehme et al. stated that zip code 76164 has an infant mortality rate six times higher than that of zip code 76107. Nehme et al. also claimed that such "stark" zip-code-level differences occur within many counties in Texas. In the Center for Public Policy Priorities report, a map with Tarrant County lists 76107 as one of the wealthiest zip codes and 76164 as one of the poorest (Lee & Sohn, 2016). Despite its economic

resources, Tarrant County, according to a study by the Center for Public Policy Priorities, there are gaps in children's education and health across race and ethnicity (Lee & Sohn, 2016). In 2014, the total child population of Tarrant County was 526,083, with 16% Black children and 36% White children (Lee & Sohn, 2016). In the Center for Public Policy Priorities report, a map showing the child population of Tarrant County by race and ethnicity from the 2010 census reveals that, for zip code 76107, the majority race listed is White; for the zip code 76164, the majority race listed is Black (Lee & Sohn, 2016). Like many counties in Texas, Tarrant County has a history of segregating places where children live as well as a history for resisting school desegregation. This history has had cumulative effects for both educational and economic benefits and disadvantages that have been passed on from generation to generation. The policies and practices may be from Tarrant County's past, but they still have a profound effect on the present. Current policies do not undo past injustices in education and health, and this leaves one of every three Black children living in poverty in Tarrant County (Lee & Sohn, 2016). Therefore, although Nehme et al. (2018) were accurate in stating that socioeconomics is a factor, I would argue that race is the factor contributing to the high infant mortality rates. Often in discussions about race, people become uncomfortable and instead of focusing on and isolating race (condition two in *Courageous Conversations About Race*), counternarratives will be brought and discussed instead; such as socioeconomics instead of race (Singleton, 2015). I agree with Nehme et al. (2018) that there are gaps in both the literature and in practice regarding infant mortality and little evidence of policymakers changing systemic, racist practices in education and in healthcare. The results of my

study can extend the knowledge in the literature that can affect mothers and children by changing the policies in Tarrant County, and in the state of Texas, that affect Black women and children, specifically regarding racial disparities.

In a comparable study, Williams et al. (2016) discussed race, socioeconomic status, and health with their study providing an overview of racial disparities in health and illustrating how differences in socioeconomic status across racial groups is a major contribution to racial disparities in health. Williams et al. discussed how all indicators of socioeconomics are strongly patterned by race with socioeconomics then becoming a key causality of racial disparities in health. Williams et al. also found that observed racial disparities in health reflect the differences in socioeconomics; however, even after taking socioeconomics into account and adjusting for income and education, racial disparities in health remain. Striking racial differences in socioeconomics at the neighborhood and community level are driven by residential segregation by race (Williams et al., 2016). The researchers concluded that social disparities in health are large, pervasive, and persistent over time and they reflect larger inequalities in our society (Williams et al., 2016). I agree with Williams et al. that there are gaps in the literature regarding race. The results of this study can extend the knowledge in the literature, which can affect mothers and children by encouraging researchers to examine racial disparities in residential segregation and healthcare and by informing policymakers on the collective impact of prenatal care and early childhood development and education, develop interventions and outreach programs, and develop early childhood policies.

In a related study, Rajan et al. (2020) discussed their analysis of racial disparities in education and healthcare and found similar results with historically marginalized groups. Rajan et al. discussed how their study was a great first step in exploring racial disparities; however, they suggested that national studies are needed to further explore racial disparities, and they recommended the development of policies and interventions to overcome racial and socioeconomic barriers.

The literature review in Chapter 2 for this study demonstrated the current body of knowledge and efforts, as well as seminal works, on infant mortality rates, prenatal and antenatal care, racial inconsistencies and disparities in healthcare, early childhood and brain development, poverty, genetics, and interventions. In the paragraphs below, the findings from this study will confirm and extend knowledge from the peer-reviewed literature in Chapter 2.

**Infant Mortality Rates**

The March of Dimes is a national voluntary health agency founded in 1938 by President Franklin D. Roosevelt to support research and services to polio. Today, the Foundation works to improve the health of women, infants, and children and families by preventing birth defects, premature birth, and infant mortality through research, community services, education, and advocacy. The March of Dimes created a Data Book for policymakers providing national and state data highlighting infant mortality, birth defects, preterm and low birth weights, health insurance, and health promotion strategies. There are considerable disparities in infant mortality rates based on race and ethnicity. Nationwide, the infant mortality rate for babies born to Black mothers is 11.1 per 1,000

live births, compared with 5.1 for Whites, 5.0 for Hispanics, 7.6 for Native Americans, and 4.1 for Asian/Pacific Islanders, with the south as the highest region in the United States for infant mortality (Office of Government Affairs, March of Dimes, 2016). In the March of Dimes' Data Book, they discuss the significant disparities in rates of infant mortality and the importance of prenatal care as one way to prevent infant mortality. The March of Dimes has documented that Black women have higher rates of receiving late or no prenatal care compared to other ethnic groups (Office of Government Affairs, March of Dimes, 2016). This statement confirms the literature with the results of the data analysis and gives sufficient evidence to warrant the rejection of the claims of the null hypotheses that the predictor that had the greatest impact on Black women in the state of Texas for the years 2011–2013 was when prenatal care began. Local policymakers are not aware of the magnitude or the impact of the issue of high infant mortality. The results of this study can help extend the knowledge in the literature that can affect mothers and children, inform policymakers on the collective impact of prenatal care and early childhood development and education, develop interventions and outreach programs, and develop early childhood policies.

**Prenatal and Antenatal Care**

The American Academy of Pediatrics released a policy statement regarding the effects of racism on children's health and in the policy statement they urge doctors and policymakers to address racial bias and racial discrimination in healthcare (American Academy of Pediatrics, 2009; Trent, Dooley, Doug, & Dougé, 2019). Disparities in prenatal and antenatal care, including throughout childhood and continuing into

adulthood, can result in disparities in health, health outcomes, brain development, school readiness and school success/failure, disease, and mortality. Dr. Trent, coauthor of the policy states, and researchers Trent et al. (2019) discuss in their research, "the biological mechanism that emerges from chronic stress leads to increased and prolonged levels of exposure to stress hormones at the cellular level and this prolonged exposure leads to inflammatory reactions that predispose individuals to chronic disease" (American Academy of Pediatrics, 2009; Trent et al., 2019). The experiences that shape parents' lives continue into their children's lives and cycles over and over. This statement confirms the literature with the results of the data analysis and gives sufficient evidence to warrant the rejection of the claims of the null hypotheses that the predictor that had the greatest impact on Black women in the state of Texas for the years 2011–2013 was when prenatal care began. The results of this study can help extend the knowledge in the literature that could affect mothers and children, inform policymakers on the collective impact of prenatal care and early childhood development and education, develop interventions and outreach programs, and develop early childhood policies.

**Racial Disparities in Healthcare and Poverty**

Since the 1600s, the oppression of people of color has been systemic and rationalized using a white racist framing of stereotypes, ideologies, images, narratives, and emotions. One type of racial disparity occurring still today is within the field of medicine. Centuries of slavery, segregation, and modern white oppression severely restrict access to socioeconomic resources and adequate healthcare (Feagin & Bennefield, 2014). Since the 1900's, reducing racial inequalities in education and in healthcare has

been a high priority; however, racial disparities continue and in some cases, the disparities have increased, especially for infant mortality rates (Pappas, Queen, Hadden, & Fisher, 1993; Singh & Stella, 2019). These articles discuss the disparities and large social inequalities that have existed for over a century and discusses how racial disparities are still high for African Americans, especially for African American women and the infant mortality rate (Pappas et al., 1993; Singh & Stella, 2019). A 2013 review of the literature, published by the American Medical Association Journal of Ethics, examined racial disparities in healthcare and found that patients of color, from children to the elderly, received inadequate pain management compared to White patients (Wyatt, 2013). The results of this study confirms the literature with the results of the data analysis and gives sufficient evidence to warrant the rejection of the claims of the null hypotheses as the race of the mother is a significant factor for RQ1: the race of the mother did predict infant mortality among babies born to women in the state of Texas for the years 2011–2013. Researchers Geronimus and Thompson, and researchers Jackson, Knight, and Rafferty discuss in their research how public policies and practices that reflect existing racist ideological viewpoints harm African Americans (Geronimus & Thompson, 2004; Jackson, Knight, & Rafferty, 2010). There is a gap in the literature with little evidence of policymakers changing systemic, racist practices in education and in healthcare. The results of this study can inform the research literature on current racist practices in education and healthcare to potentially inform policymakers on the importance of prenatal care that will in turn affect early childhood development and education.

**Early Childhood Development**

Children living in long-term poverty have developmental deficiencies and delays. Guo and Harris built on the work of Korenman, Miller, and Sjaastad's seminal study that found of the 10-to-15-point differentials in IQ in children in the lowest 10th of the socioeconomic distribution, 2 of the points could be attributed to specific health problems and up to 7 points could be attributed to differences in the home environments (Korenman, Miller, & Sjaastad, 1995). Also, Korenman et al. found substantial disadvantages in cognitive development among children living in poverty including verbal memory, vocabulary, math and reading achievements, and behavior problems (Korenman et al., 1995). Guo and Harris expanded upon this work in analyzing the multiple mechanisms affecting a child's intellectual development (Guo & Harris, 2000). In the March of Dimes' Data Book, they state low birth weight can be a predictor of developmental delays and mortality in infants (March of Dimes, 2018). As stated in Chapter 2, the research indicates that initiating supportive interventions during pregnancy is beneficial for families. This statement confirms the literature with the results of the data analysis and gives sufficient evidence to warrant the rejection of the claims of the null hypotheses that the predictor that had the greatest impact on Black women in the state of Texas for the years 2011–2013 was when prenatal care began. Researchers have examined the predictors between maternal behavior during pregnancy, birth outcomes, and early childhood development. Through the lens of collective impact, the results of this study can help extend the knowledge in the literature to potentially inform

policymakers on the importance of prenatal care and birth outcomes to potentially develop interventions and outreach programs for Black women.

**Genetics**

Contributions from both genetics and socioeconomics influence infant (and adult) mortality for African Americans. Researchers Kuzawa and Sweet investigated racial disparities in healthcare and have evidence to support epigenetic pathways linking prenatal (or lack of) care to early childhood development to adult diseases with the higher rates of perinatal health disparities affecting childhood development and adult health. The effects of maternal stress during pregnancy, after pregnancy, and the effects of stress on children is linked to epigenetic adult race-based health disparities (Kuzawa & Sweet, 2009). This in turn along with systemic racism and systemic racist practices, cycles over and over affecting health. Kuzawa and Sweet's research discussing epigenetic developmental processes sheds new light on health disparities. A better understanding of epigenetics and its processes will be critical in developing affective interventions (Krieger, 2011). In her book Krieger confirms the literature with the results of the data analysis and gives sufficient evidence to warrant the rejection of the claims of the null hypotheses as the race of the mother is a significant factor for RQ1: the race of the mother did predict infant mortality among babies born to women in the state of Texas for the years 2011–2013. The biological impact of social forces at the genetic level is a new area and coupled with the results of this study, can potentially extend the knowledge in the literature that could affect mothers and children, in both education and in healthcare, and could potentially inform policymakers on the importance prenatal care and early

childhood development and education to help develop interventions and outreach programs, and develop early childhood policies. In addition, epigenetics also challenges the concept of genetic race. Kuzawa and Sweet state, “not only are traditional racial categories poor predictors of gene frequencies, a fact that has been argued for decades, but developmental and epigenetic processes help to clarify why genes do not determine biological factors (Kuzawa & Sweet, 2009)”.

**Interventions**

Racial residential segregation is a fundamental cause of racial disparities in healthcare. By physically separating families by color in certain areas of a community, Black families are blocked from essential resources (Duncan & Kawachi, 2018; Williams & Collins, 2001). Today, the degree of residential racial segregation remains high for most black families in the United States. In their book Duncan and Kawachi build upon Williams and Collins’ work and review evidence that suggests that segregation is a primary cause of racial differences in socioeconomic status, in education, in employment, and in healthcare (Duncan & Kawachi, 2018; Williams & Collins, 2001). Effective efforts to reduce racial disparities in healthcare also need to work on reducing racial disparities in socioeconomics and in education and in policy. Collective impact is needed to work on reducing racial disparities in all aspects of our society so that the interventions will be successful in all areas. As stated in Chapter 2, along with building relationships to increase the effectiveness of an intervention program, empowering families and community workers can also impact intervention programs and its outcomes. Baffour and Chonody found early interventions are important for the health of women and children

and impact infant mortality and early childhood development (Baffour & Chonody, 2012). This statement confirms the literature with the results of the data analysis and gives sufficient evidence to warrant the rejection of the claims of the null hypotheses that the predictor that had the greatest impact on Black women in the state of Texas for the years 2011–2013 was when prenatal care began. The results of this study will highlight the benefit of stakeholders coming together using collective impact to reduce infant mortality and can provide information on the importance of prenatal care to potentially inform policymakers and early childhood educators on decisions that could affect mothers and children, to help develop interventions and outreach programs, and to develop early childhood development and education policies.

## Limitations of the Study

The results of this study provide a strong starting point for generalizing but is not without limitations. As stated in Chapter 1, in this study I was limited to predicting the likelihood that a number of independent variables will predict infant mortality. In this study, the focus was to look at the likelihood that a limited number of independent variables, namely the (a) weight of baby at delivery, (b) gestational age, (c) maternal age at time of delivery, (d) maternal education, (e) marital status, (f) tobacco use during pregnancy, (g) when prenatal care began, (h) the amount of time between births, (i) mother's insurance coverage or noncoverage at time of delivery, and (j) race of mother, will predict the dependent variable, infant mortality. However, due to limitations in the data, there may be other significant predictors not included in the analyses and/or significant predictors not included in the data set or predictors listed/not listed as an

independent variable. One example of a significant predictor not listed as an independent variable was mother's residence. Mother's residence was not one of the independent variables listed; however, it was used as a geocode. While the NBER did not identify geographic details in the data for confidentiality purposes, mother's residence was used as a geocode to analyze for this study. While in this study I wanted to analyze data for Tarrant County, the dataset from NBER contained data for the state of Texas to preserve confidentiality for residents. For the covariate, mother's residence, state and county the same, state the same and county different, state different, and foreign resident were coded and entered; state and county the same was the referent code. Another example of a significant predictor not listed as an independent variable was WIC. WIC was not one of the independent variables listed; however, it was used as a proxy for socioeconomics. For the covariate, WIC, WIC used during pregnancy and WIC not used during pregnancy were coded and entered; WIC was the referent code. An example of significant predictors not included in the analyses were the independent variables gestational age, weight of the baby at the time of delivery, and the amount of time between births. In the data set the covariates gestation, birth weight, and live birth order were provided; however, they were not input into steps and/or blocks in this analysis because in multiple logistic regression in SPSS, variables are identified, formatted, and typed prior to inputting into SPSS and these three variables are numerical variables with the measure defined on a scale. The other variables used and analyzed were nominal, ordinal, and dichotomous (Kent State University, 2019).

Limitations of the study could include the potential of reporting bias; however, the development and maintenance of the U.S. Vital Statistics System is a federal agency mandated by legislation to produce national health statistics with cooperation from local, state, and federal government organizations (National Research Council Committee on National Statistics, 2009). In a research study, Partridge et al. found that misclassifications and measurement errors were reported with 5.1% of prenatal visits missing from birth certificates in Washington state. The CDC and the Texas Department of Health require when prenatal care began on birth certificates. Fortunately, with the sample size of this study, the data affords significant associations.

## Recommendations

The results of this study identify the need for future research to examine the role of discrimination in accounting for racial disparities in health. Ford and Harawa (2010) and Rajan et al. (2020) discuss how race, ethnicity, and social stratification influence society, health, and education. A priority for future research is to thoroughly and methodically quantify all the risks in the social environment that differ by race and racial differences in health outcomes (Williams et al., 2016). The results of this study have revealed that racial disparities are extensive, pervasive, and have persisted for a very long time. The inequalities and racial disparities in health reflect larger inequalities in our society. Race, socioeconomics, and gender all matter for health separately and in combination (Williams et al., 2016). There is an increase in research in exploring race as a social, not biologic, construct as well as examining the intersectional relationship between ethnicity and race (Ford & Harawa, 2010; Rajan et al., 2020). Future research is

needed to better understand what happens when these social constructs and social statuses interact so that policymakers and early childhood educators can make informed decisions that could affect mothers and children, to inform policymakers on the collective impact of prenatal care and early childhood development and education, and develop interventions and outreach programs, and develop early childhood policies.

The literature review in Chapter 2 for this study demonstrated the current body of knowledge and efforts, as well as seminal works, on infant mortality rates, prenatal and antenatal care, racial inconsistencies and disparities in healthcare, early childhood and brain development, poverty, genetics, and interventions. In the paragraphs below, the findings from this study will recommend further research that is needed.

**Infant Mortality Rates**

In her article, Fox reports the United States is the worst place for newborns, in the industrialized world, with more infants dying on their first day of life than in 68 other countries (Fox, 2013). Save the Children states politics, culture, and racism play a role in the high infant mortality rate and reports the United States also has one of the highest rates of maternal mortality, especially for Black women, with 1 in 2,400 women dying in childbirth (Save the Children, 2013). The United States is one of only two developed countries (Serbia is the other) where the rate of women dying from pregnancy has gotten worse since 1990 with Black women particularly at risk (Jones, 2019). One hope from this study for further research is that it will be a catalyst for strategic shifts in thinking and in developing policy changes and educational practice changes for women and children in Tarrant County, and in the state of Texas.

**Prenatal and Antenatal Care**

In the report by Save the Children, researchers state that prenatal care is essential to prevent infant mortalities and low-cost, evidence-based interventions could reduce the infant mortality rate by up to 75% (Save the Children, 2013). Also, working with women and their children from birth through the age of 4 improves a child's health, their brain and socioemotional growth, and their school readiness. One hope from this study is that further research will engage stakeholders from multiple disciplines using collective impact to eradicate racial disparities and inform early childhood policymakers and educators to develop policy changes and educational practice changes for women and children in Tarrant County, and in the state of Texas. Save the Children advocates the U.S. Congress create a new National Commission on Children focusing on racial disparities and the equity gaps and its effects on families (Save the Children, 2013).

**Racial Disparities in Healthcare and Poverty**

In her article researcher Szokan examines the associations between race and infant mortality in the United States. She discusses the sociological concept of race: "race is a social concept used to categorize humans into large and distinct populations or groups by anatomical, cultural, ethnic, genetic, geographical, historical, linguistic, religious, and/or social affiliation" (Szokan, 2014). Scientists agree that race is not a biological concept but a social one. Conley and Bennett developed a framework used by researchers Herd et al. (2019) that discusses how historical and contemporary experiences in the United States affect African Americans' health and mortality (Conley & Bennett, 2000; Herd et al., 2019). Residential and social separation, chronic stress, and

deindustrialization of the United States all have contributed to African Americans' health and mortality (Conley & Bennett, 2000; Herd, et al., 2019). Finch, Frank, and Hummer (2000), and Lorch and Enlow (2016), state inequality in death rates is understood to reflect inequality in life conditions and those inequalities are social. In their articles the message is clear that racial and health disparities exist from social inequalities (Finch et al., 2000; Lorch, & Enlow, 2016). Their articles also state research on infant mortality must become more interdisciplinary and more comprehensive (Finch et al., 2000; Lorch, & Enlow, 2016). The results of this research study can initiate additional research by engaging stakeholders from multiple disciplines using collective impact to potentially inform early childhood policymakers and educators to make policy changes and educational practice changes for women and children in Tarrant County, and in the state of Texas.

**Early Childhood Development**

In their report the National Research Council researchers state the problems of our youngest children and their parents remains a quiet crisis that policymakers and educators must address. The researchers detail how a significant number of children in the United States are affected by one or more of these risk factors: inadequate prenatal care, isolated parents, substandard child care, poverty, and insufficient attention (National Research Council, 2000). These risk factors also endanger the healthy development of children and their school readiness. The National Research Council report states that how an individual functions from preschool through adulthood is determined by the experiences they have in their first 3 years (National Research Council, 2000). The report discusses

the benefits of prenatal care and its ties to brain development; however, the report also discusses how the percentage of women receiving no prenatal care has increased (National Research Council, 2000). This results from this study can be a catalyst for strategic shifts in thinking and in developing policy changes and educational practice changes for women and children in Tarrant County, and in the state of Texas. The National Research Council recommends that all pregnant women have universal access to comprehensive prenatal care as a core component of any healthcare package. Another recommendation by the National Research Council is key to meeting this goal: local, state, and national policymakers remove the barriers that stop women from receiving comprehensive prenatal care (National Research Council, 2000). This includes racial disparities and their barriers.

**Genetics**

In their article, Williams et al. (2016) discuss the misuse of genetics in relation to "race". They discuss how the most genetic variation is found among individuals, not population groups; therefore, variation in biological characteristics is not innate and cannot be placed in "racial" categories (Williams et al., 2016). Sadly, deeply entrenched racist beliefs persist. Williams et al. (2016) discuss a 2005 survey of U.S. physicians with 81% of the doctors believing race should be used as a biological basis and found 85% of the doctors prescribe drugs targeted towards specific "racial" groups (Williams et al., 2016). The researchers also discuss how the misuse of genetics is also found in research literature. Williams et al. (2016) discusses a 2004 paper in the *New England Journal of Medicine* in which the authors hypothesized that blacks were biologically different from

whites due to unspecified biological characteristics (Williams et al., 2016). In their article, Williams et al. (2016) discusses the "slavery hypothesis" and its continued misuse in genetics in modern health disparities research. The "slavery hypothesis" uses a model that argues the elevated rates of hypertension in Blacks versus Whites stems from a genetic trait that transpired during the capture of and forced journey during slavery and was viewed as a response to the effects of heat, stress, and food and water deprivation during the capture and transport of slaves. The critical review of this hypothesis is the inconsistency regarding population genetics and the high mortality rate during the slave trade (Williams et al., 2016). The researchers in the article discussed genetics and racial disparities in health and the researchers stated more research is needed to understand how social interactions combine with biology to affect disease (Williams et al., 2016). The results of this study can initiate further research and engage stakeholders to reflect on the racial inequalities in our society. In addition, the results from this study can encourage stakeholders from multiple disciplines to use collective impact to eradicate racial disparities as well as inform early childhood policymakers and educators to make policy changes and educational practice changes for women and children in Tarrant County, and in the state of Texas.

**Interventions**

In their article, researchers Rocque and Paternoster build on Morris' study that discusses how Black girls experience stereotypical perceptions and obstacles in school that limits their academic potential (Morris, 2007; Rocque & Paternoster, 2011). In both articles the researchers discuss how interventions and discipline aimed at Black girls is to

make them more “ladylike,” yet this approach discourages behaviors that lead to educational success (Morris, 2007; Rocque & Paternoster, 2011). The researchers observed educators focusing more on Black girls’ social and emotional aspects than on their academic progress with the teachers directing their discipline at the perceived, stereotype of the “loud, angry, Black girl” (Morris, 2007, p. 499; Rocque & Paternoster, 2011). The researchers observed the girls were actively participating in class; however, teachers interpreted their questions and assertions as negative, “bossy,” rude, and combative, with the discipline towards Black girls to “mold” them into the White stereotype of feminine, quiet, and passive, as if their behavior and personality were flawed (Morris, 2007, p. 499; Rocque & Paternoster, 2011). The results from this study can further research and can encourage stakeholders from multiple disciplines using collective impact to undertake reform in interventions to counteract negative outcomes for Black women and girls by making policy changes and educational practices in Tarrant County, and in the state of Texas.

## Implications

Infant mortality is not a health problem; infant mortality is a social problem with health consequences (Gortmaker & Wise, 1997; Torche, 2011). Documentation of the problem of infant mortality goes back to the 1700s in the literature. While the priority is to train and educate doctors, healthcare professionals, educators, and policymakers, the more pressing priority is to address racial disparities in our society and in our healthcare and education systems and to follow-up with more social, financial, and educational

support to women and children (Akukwe & Nowell, 1999; Turner, & Fuller, 2011; Wagner, 1988).

Not everyone in the United States has access to and/or the benefit to healthcare opportunities. Research indicates people of color in the United States experience less than average health outcomes from cradle to grave and they are much more likely to die as infants, have higher rates of diseases and disabilities, and have shorter life spans (LaVeist, Gaskin, & Richard, 2009). While some argue that healthcare reform would be more expensive, research indicates the opposite is true. Minimizing inequities in healthcare is good for not only stopping racial inequities within our society, the return on investment would be financially good for the country as well. A study commissioned by the Joint Center for Political and Economic Studies conducted by researchers from John Hopkins University and the University of Maryland provides an understanding on how racial disparities in healthcare is a financial burden to both the healthcare system and to society overall (LaVeist et al., 2009). In their study LaVeist et al. found that more than 30% of direct medical costs of people of color was due to racial disparities in healthcare and cost more than $230 billion dollars over a 4-year period. The indirect costs of racial disparities for the same period was close to $1.24 trillion dollars with more than 59% of these costs attributable to African Americans (LaVeist et al., 2009). As policymakers look for ways to pay for healthcare reforms, the results of this study suggest eliminating health inequities could provide a huge source for savings (LaVeist et al., 2009). In addition, the Census Bureau estimates by 2042 half of the people living in the United

States will be of color; therefore, it is imperative we begin focusing on eliminating racial disparities within our society (LaVeist et al., 2009).

The United States spends more on healthcare than any other country, but its health outcomes are generally worse than other wealthy, developed nations and the scope of the health disadvantages involves more than life expectancy. The United States also ranks at the bottom for both prevalence and mortality for multiple diseases, risk factors, and injuries (Woolf & Aron, 2013). Woolf and Aron discuss that one reason the health disadvantages are varied and extensive in the United States is that the United States lacks universal healthcare coverage with barriers to access in affordable healthcare (Woolf & Aron, 2013).

In his book, Tough shares an account from Geoffrey Canada as he was establishing the school, the Harlem Children's Zone. Geoffrey Canada says, "The big question in America is, are we going to try to make this country a true meritocracy or will we forever be a class of people in America who essentially won't be able to compete because the game is fixed against them (Tough, 2008)?" In this example Geoffrey Canada is describing the Black families in Harlem but it is the same for all Black families in our country. In establishing the school, Geoffrey Canada said saving a few children no longer felt like enough; he was interested in saving kids by the tens of thousands because that's how the United States is losing Black children, by the tens of thousands (Tough, 2008).

President Obama established the My Brother's Keeper initiative to address the persistent opportunity gaps boys and young men of color face throughout our society.

The initiative is a cradle to career initiative focusing on six milestones to help connect young people to mentoring, support networks, and the skills needed to help boys and young men be successful in school, in college, in careers, and give back to their communities (My Brother's Keeper, 2014).

Both President Obama and Geoffrey Canada understand what economists describe as "human capital." Human capital refers to the skills, abilities, and resources each individual possesses. The human capital perspective also is different from a "deficit model" in that people can have deficits, for example, living in poverty, but that is not a moral failing but rather a lack of resources and the answer is to give more to resources and to specific resources, knowledge, and skills (Tough, 2008). In addition, both President Obama and Geoffrey Canada understand the idea of collective impact. As I stated in Chapter 1, collective impact is a long-term commitment by a broad, cross-sectional group of stakeholders to solve a specific social problem (Kania & Kramer, 2011). Currently, local, state, and national policies treat early childhood education and health separately (Vandenbroeck et al., 2010). Collective impact work could be used to develop additional local, state, and federal programs and policies for women and children in Tarrant County, the state of Texas, and in our country, as well as scrutinize current programs and policies.

The results of this study have meaningful implications that can extend the knowledge in the literature and can further additional research that can potentially affect mothers and children in Tarrant County, and in the state of Texas. I hope that my study can inform policymakers on the importance of prenatal care that in turn affects early

childhood development and education, to possibly develop interventions and outreach programs, and develop early childhood policies for educational and healthcare changes for women and children in Tarrant County, and in the state of Texas. My hope is by engaging stakeholders from multiple disciplines using collective impact racial disparities in both education and in healthcare can potentially be reduced and can inform early childhood policymakers and educators to make policy changes and educational practice changes for women and children in Tarrant County, and in the state of Texas. One way to achieve this would be to share my findings with various organizations throughout Tarrant County and in the state of Texas. One organization I want to share my findings with is the Tarrant County Infant Health Network. By sharing my findings with this organization, I would also be sharing my findings with their partners: the Fort Worth Independent School District, Child Care Associates, Educational Alignment for Young Children, First3 Years, the Parenting Center, the Lena Pope Home, the Rainwater Charitable Foundation, the United Way of Tarrant County, Raising Fort Worth, the Healthy Tarrant County Collaboration, the Infant Health Network, the National Collaborative for Infants and Toddlers, and the University of North Texas Health Science Center. Another organization I want to share my findings with is the Center for Public Policy Priorities (CPPP). The CPPP is based in Texas and is a nonpartisan, nonprofit policy institute committed to improving public policies to better the social conditions of low-income Texans (Center for Public Policy Priorities, 2020).

Current national data for the United States reveals dramatically high levels of racial inequalities and health disparities with relatively little change over time (Williams

et al., 2016). Williams et al. (2016) discuss in their research perceived racial discrimination is one aspect of racism that is progressively receiving more attention from researchers, educators, and policymakers. The results of this study can inspire other researchers, educators, and policymakers to explore the role of discrimination in accounting for racial disparities in health and education. One way I hope to achieve this is by presenting at local, state, and national conferences for educators and policymakers. In addition, I hope to publish my findings in professional and academic journals so that I can disseminate my findings to educators, policymakers, and healthcare professionals in the hope of creating social change.

## Conclusion

In a study by the New England Journal of Medicine from 1992, an almost 30-year-old article, the researchers discuss the best method to prevent infant mortality is prenatal care (Schoendorf, Hogue, Kleinman, & Rowley, 1992). The results of their study are similar to the results of my study; the researchers found that the lack of early prenatal care was associated with 40% chance of infant mortality (Schoendorf et al., 1992). The researchers in this study determined prenatal care was the best method available to prevent infant mortality (Schoendorf et al., 1992). Researchers Berg, Wilcox, and d'Almada, built on Schoendorf et al.'s (1992) work looking at racial disparities between Black and White women (Berg, Wilcox, & d'Almada, 2001). Racial disparities date back to some of the earliest health records in the United States with blacks having poorer health than whites because of the disparities. The United States has pervasive racial disparities and is in dire need of remedying racial injustices; however, policymakers have

been slow to respond. The implication is then to eliminate racial disparities and develop policies to ensure racial disparities are eliminated (Williams & Sternthal, 2010). Racism is a disease that infects entire communities and the symptoms of racism cannot be treated in isolation. Researches Novoa and Taylor discuss in their policy brief that a fractured and unequal healthcare system further exasperates racial disparities and they state racism, not race, threatens the lives of Black women and infants (Novoa & Taylor, 2018). The entire community must be healed and research shows collective impact is a powerful way to success, along with the support of the public and private partnerships. To quote Geoffrey Canada, "in the end, it's going to make America a stronger country (Harlem Children's Zone, 2020)". Du Bois, was a sociologist, historian, civil rights activist, author, writer, and editor and was the first African American to earn a doctorate from Harvard (Biography, 2020). In 1899, Du Bois wrote a book detailing insightful analysis indicating that racial inequality is an indicator for poor health for African Americans and the implications are the need for policies to reduce racial disparities in health and in education (Williams & Sternthal, 2010). Du Bois' seminal work highlights the need for identifying and implementing individual and institutional interventions that would diminish the consequences of racism (Williams & Sternthal, 2010).

One of the main reasons I chose Walden University was for their vision of social change. Walden University's 50-year focus has been to inspire scholars to make social change in their communities. The cornerstone of Walden University's 2017 report is "working to better foster social change through research, practice, and the education of motivated scholar-practitioners (Walden University, 2017)". Goal 3 of *Walden 2020* is

raising social change consciousness. Seventy-four percent of the total student population of Walden University is female and 41% of the total student population of Walden University is Black (Walden University, 2017). In 2011 Walden University became the largest granter of doctorates to Blacks in the United States (Walden Magazine, 2020). The results of this study can make positive social change in my community. Racism unfairly advantages individuals and communities and it undermines the potential of our whole society. My study potentially has implications for positive social change to include providing information on the relative importance of the predictors of infant mortality and to be able to inform policymakers and early childhood educators on decisions that could advise policymakers on the collective impact of prenatal care and early childhood development and education. The results of my study, in collaboration with various stakeholders in Tarrant County, and throughout Texas, through collective impact, could potentially reduce the number of infant mortalities for Black women and children.

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Appendix: List of Data Files and Independent Variables

| Independent Variables (IV) | Linked Birth / Infant Death Records | Operational Definition Coding |
|---|---|---|
| Race of Mother [IV 10/(j)] | Mother's Race | White * |
| | | Non-Hispanic * |
| | | Black |
| | | Native American |
| | | Asian |
| | | Hispanic |
| Maternal Age [IV 3/(c)] | Mother's Age | Age 20 to 34 * |
| | | Under 15 |
| | | Teen 15-19 |
| | | 35 and Over |
| Maternal Education [IV 4/(d)] | Mother's Education | Bachelor's Degree * |
| | | Less than HS |
| | | HS Grad some College |
| | | Associate's Degree |
| | | Advanced Degree |
| Marital Status [IV 5/(e)] | Marital Status | Not Married * |
| | | Married |
| Tobacco Use During Pregnancy [IV 6(f)] | Cigarette Use | Cigarettes Not Used in Pregnancy * |
| | | Cigarettes Used in Pregnancy |
| (Geocode) | Mother's Residence | State-County the Same * |
| | | State Same County Different |
| | | State Different |
| | | Foreign Resident |
| Mother's Insurance Coverage or Noncoverage at Time of Delivery [IV 9/(i)] | Pay Status | Medicaid * |
| | | Private Insurance |
| | | Self-Pay |
| | | Other |
| (Socioeconomic) | WIC | No, WIC Not Used * |
| | | Yes, WIC Used |
| When Prenatal Care Began [IV 7/(g)] | When Prenatal Care Began | No Prenatal Care * |
| | | 1st Trimester |
| | | 2nd Trimester |
| | | 3rd Trimester |
| Gestational Age [IV 2/(b)]; Weight of the Baby [IV 1/(a)]; The Amount of Time Between Births [IV 8/(h)] | Gestation; Birth Weight; Live Birth Order | Not in Logistic Run Analyses |

*Note*. * = Referent Codes