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Gestational Weight Gain, Level of Education, and Infant Mortality Among African American Women

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Abstract

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Science Teaching Certificate, University of West Georgia, 1998

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BBA, North Texas State University, 1980

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

African American (AA) women in Mississippi have a higher burden of infant mortality, especially those with low income and educational levels, as compared to other regions of the country. However, it is unknown if abnormal gestation weight gain (GWG) is contributing to this increased burden. This quantitative cross-sectional study examined the association between GWG (25-35lbs), level of education, income, and infant mortality among AA women with normal prepregnancy body weight who were between 30 to 47 years old in the state of Mississippi from 2016 to 2018. Biopsychosocial and ecosocial models were used as the theoretical foundation to design the study and assess the findings. Secondary data were obtained from the Mississippi Pregnancy Risk Assessment Monitoring System and binary logistic regression analysis was used for inferential analysis. The findings revealed no statistically significant association between normal GWG (25–35 lbs) and infant mortality when compared to AA women with GWG ≥36 lbs. Income was not statistically significant in predicting GWG. In addition, education levels were not statistically significant in predicting infant mortality. Although the study results were not significant, the findings of this research will contribute to positive social change by providing knowledge to inform the following public health agencies in the state. This study encourages public health researchers to search for additional factors that contribute to abnormal GWG as a known risk factor for an increased risk of infant mortality and inform efforts to reduce infant mortality in the state of Mississippi.

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Dedication

This dissertation is dedicated to my beloved parents and my lovely paternal uncles. I am very grateful to my parents, Chief Onyedumnezie Sylvester Amanambu and Madam Anyaaganaobi Victoria Amanambu, for giving me the opportunity to attend quality private schools from primary to secondary school. During my primary education, my parents often hired my teacher in each grade level to tutor me at home. This helped me improve my learning and deduction skills.

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Chapter 1: Introduction to the Study

In recent years, the relationship between gestational weight gain (GWG) and infant, fetal, and maternal health has been an area of active inquiry in U.S. public health and contemporary clinical practice. For the past 100 years, the appropriate level of GWG during pregnancies has often been a point of contention among U.S. clinicians (National Research Council and Institute of Medicine, 2007). The evolution of the varied research conducted on GWG indicates that pregnant women should diet from the first trimester to the third trimester to limit GWG to ≤ 20 lbs (National Research Council and Institute of Medicine, 2007; Shenassa et al., 2017). This recommendation is based on the concept that excessive weight gain during pregnancy causes toxemia. Practitioners in the 1930s placed a heavy focus on nutrition and health, which provided in-depth insight into the impact of GWG on the health of the pregnancy, fetus, and newborn (National Research Council and Institute of Medicine, 2007; Shenassa et al., 2017). The political climate in the 1960s enhanced the awareness of the disparities in infant mortality among African American (AA) individuals and other minority groups, and researchers in the 1970s systematically reviewed GWG literature, which gave rise to new and improved GWG recommendations (National Research Council and Institute of Medicine, 2007; Shenassa et al., 2017). The interplay and gaps between research and practice have continued to the present date. At present, the main research focus in epidemiology and public health is on the influence of epigenetics on the life course of childbearing women. This research emphasis has shifted to individualized recommendations because of the perpetual evolving state of knowledge in statistical and epidemiologic methods as well as in bench research (Shenassa et al., 2017). Contemporary obstetricians and public health officials strive to achieve a balance between maternal and infant risk of adverse pregnancy outcomes. GWG recommendations have evolved from dietary restriction to the current weight gain during pregnancy guidelines over the last 100 years. The most recent recommendations were established by the American Institute of Medicine (IOM) in 2009 (IOM and National Research Council [NRC] Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009).

In 1970, the IOM published *Maternal Nutrition and the Course of Pregnancy*. This publication was a result of concern relating to the high incidents of infant and neonatal mortality rate in the United States when compared to other industrialized countries (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). Based on this publication, the Committee for Maternal Nutrition members were convinced that a positive relationship exists between birth weight and GWG.

The Committee for Maternal Nutrition members also noted that higher prepregnancy maternal weight tends to reduce the effect of GWG on birth weight. The committee members reexamined the guidelines for weight gain during pregnancy and recommended an average GWG of 20–25 lbs. This recommendation conflicted with the prior recommendation that GWG be limited to 10–14 lbs (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). The 1990 IOM report provided specific recommendations on weight gain during pregnancy. Maternal body mass index (BMI) is used in the stratification of weight gain during pregnancy. Underweight pregnant women have a BMI of <18.5, whereas the BMI for normal-weight pregnant women is approximately 18.5–24.9. A BMI between 25–29.9 is associated with overweight pregnant women, and a BMI of 30 or higher is associated with obese pregnant women (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009).

The current study involved the use of secondary data related to childbirth and death certificates of infants in the state of Mississippi. I used these data to examine the association between normal GWG (25–35lbs), less than normal GWG (25-30lbs), above normal GWG (> 35lbs), level of education, and infant mortality among AA women with normal prepregnancy body weight who were between 30 and 47 years old and lived in the state of Mississippi. I examined the association between these variables to gather important information regarding possible intervention approaches for reducing the incidence, prevalence, and mortality cases related to these risk factors. In addition, the long-term associations of maternal GWG and BMI as it relates to the 2009 IOM recommendations have not been investigated among advanced-aged AA women in Mississippi. Thus, this study provides an additional body of knowledge on this topic and related disciplines to promote meaningful positive social change. The focus of this chapter is to provide an introductory basis for this study. The key areas that will be covered in this section are the background of the study, problem statement, purpose of the study, the posed research questions and hypotheses, theoretical framework, nature of the study, definitions, assumptions, scope of delimitations, limitations, and significance of the study.

Background

Infant mortality is the death of an infant before the infant's first birthday, whereas the infant mortality rate (IMR) is the rate of infants who died, for instance, per every 1,000 live births within a given population (Centers for Disease Control and Prevention

[CDC], n.d.-a). A high proportion of AA women are either poor or within the low socioeconomic status category, which tends to affect AA women's safety, nutrition choices, educational attainment, well-being, access to prenatal care, and their overall healthcare (Baldassari et al., 2016; Pavela et al., 2016), thus impacting the risk of infant mortality (Mathews & Driscoll, 2017).

Since 2014, the IMR in the United States and the state of Mississippi has been declining. However, in 2015, the IMR among varied racial groups increased, with the AA IMR reaching its highest peak since 2011. In 2015, the Mississippi IMR was 9.2%, representing a 12.2% increase from the 2014 rate of 8.2%. Based on this increase, the state was ranked 48th in the nation for infant mortality. In 2016, the IMR in Mississippi decreased by 6.5% from 9.2 to 8.6 deaths per 1,000 live-born infants. There was a 9.6% increase in the White IMR (6.2 to 6.8 deaths per 1,000), and a 12% decrease in the Black IMR (13.0 to 11; Mississippi State Department of Health [MSDH], 2020). Despite this decrease, Mississippi was ranked the 50th in the nation for infant mortality (MSDH, 2017).

The scope of the current study was to examine the association between GWG (25–35 lbs), (25-30lbs), (> 30lbs), level of education, and infant mortality among AA women with normal prepregnancy body weight who were between 30 and 47 years old in the state of Mississippi. I included level of education as an independent variable because a higher level of education is generally associated with fewer instances of infant mortality (Son et al., 2017). I delimited the study to women aged 30–47 years because pregnancies in this age bracket are generally considered to be at higher risk for health complications (Fuchs et al., 2018; Magnus et al., 2019).

Lisonkova et al. (2017) employed a population-based retrospective cohort design to discuss the association between maternal age and severe maternal morbidities. Lisonkova et al. indicated that women 40 years and above have elevated rates of severe maternal morbidities. Notably, Lisonkova et al. also found that teenage mothers have more severe maternal morbidity than mothers who are 25–29 years of age. Say et al. (2014) indicated that 73% of all maternal deaths from a global perspective were due to direct obstetric complications, whereas 27% of maternal deaths were due to indirect factors. Excluding California and Texas, the maternal rate in the United States increased by 26.6% from 18.8% in 2000 to 23.8% in 2014 (MacDorman et al., 2016). The maternal mortality rate (MMR) between 1999–2017 for non-Delta counties was 13.1, whereas the MMR for Delta counties was 18.5 (Smith et al., 2015). The estimated risk of maternal death in Delta counties is 16%.

Problem Statement

Mississippi has a disproportionately high IMR when compared to other regions of the country (Science 2.0, 2014). Recent research has indicated that a high proportion of AA women are either poor or within the low socioeconomic status category, which tends to affect AA women's safety, nutrition choices, educational attainment, well-being, access to prenatal care, and overall healthcare (Baldassari et al., 2016; Pavela et al., 2016). Further research is needed to understand why Mississippi has such a high IMR.

Infant mortality is an important indicator with respect to the health care of a population and the overall quality of health. In 2018, Mississippi state recorded 37,009 infant births and 312 infant deaths. Important social determinants of health, such as education, poverty, nutrition, and poverty, are closely related to infant mortality. For a prolonged period, Mississippi had one of the highest IMRs in the United States, with approximately 9 infant deaths per 1,000 children that were born in the state. In 2018, IMR was 8.43 in Mississippi. Additionally, there are racial disparities regarding infant mortality in the state of Mississippi; the White IMR is 5.9 deaths per 1,000 live births, whereas the Black IMR is 11.6. Preterm birth, birth defects, and sudden unexpected infant death are the leading causes of infant mortality in Mississippi (MSDH, 2018).

Pregnancy-related deaths among AA women persist in the United States (Moaddab et al., 2016). AA women have a higher rate of hypertension, obesity, diabetes, and cardiovascular conditions (Carnethon et al., 2017; Lo et al., 2013). Additionally, AA women are three to four times more likely to die due to pregnancy complications when compared to their non-Hispanic White counterparts (Berg et al., 2010; Creanga et al., 2015). The IMR in the United States has been decreasing steadily among some demographic groups (Mathews & Driscoll, 2017). In 2014, infant mortality in the United States decreased to 5.82 deaths for every 1,000 live births as opposed to 6.86 infant deaths for every 1,000 live births in 2005 (Mathews & Driscoll, 2017). In contrast, the IMR burden among AA women was 10.93 per 1,000 live births between 2005 and 2014 (Mathews & Driscoll, 2017). Similarly, American Indian or Alaska Native women had the second highest IMR, with 7.59 deaths per 1,000 live births during the same period (Mathews & Driscoll, 2017).

Infant mortality is one of the primary indicators of health status that is used to assess the effectiveness of established health care systems and public health interventions in any country. IMRs are used to provide key information about maternal and infant health status and represent the overall health status of a community or nation (CDC, n.d.-a). Approximately 23,000 infants died in the United States in 2005 (American Health Rankings [AHR], n.d.). In comparison to other developed countries, the IMR in the United States remains consistently higher than the IMR in other industrialized countries (AHR, n.d.). In 2016, the IMR in the United States was 5.9 deaths per 1,000 live births (AHR, n.d.).

The MMR is currently at 66.6 deaths per 100,000 live births among AA women in Mississippi. Data indicate that infant mortality is a critical issue in Mississippi and efforts are needed to decrease IMRs, particularly among AA women. Obstetric outcomes among AA women have often been attributed to structural racism (Bailey et al., 2017; Gil-Gonzalez et al., 2014; Williams & Mohammed, 2013), and maternal obesity and high GWG are health risks associated with adverse birth and pregnancy outcomes (Meng et al., 2018). The trend of adult obesity in the United States substantially increased between 2013 and 2014 (Hales et al., 2017).

Additionally, the prevalence of obesity among women disproportionately varies by race. In 2016, the prevalence of obesity was 54.8% among AA women, 50.6% among Hispanic women, 38% among non-Hispanic White women, and 14.8% among non-

Hispanic Asian women, respectively (Hales et al., 2017). Overall, the odds of infant deaths are higher among obese mothers; obesity is a risk factor likely to increase in women with greater maternal weight or BMI during pregnancy (Meehan et al., 2014). The disproportionality of infant mortality among AA women in Mississippi indicates that further epidemiologic studies are needed to explore the risk and burdens associated with this adverse health outcome, as well as potential links with measures of GWG. In summary, I sought to reveal the precise association between GWG, prepregnancy BMI, and infant mortality.

Purpose

The purpose of this study was to examine the association between GWG (25–35lbs), level of education, income, and infant mortality among AA women with normal prepregnancy body weight who were between 30 and 47 years old in the state of Mississippi from 2016 to 2018. The independent variables in the current study were GWG and level of education and the dependent variable was infant mortality. I controlled for income and smoking status to isolate the effects of the independent variables on the dependent variable. The classification of obesity was based on the BMI measures, which is operationally defined as the body weight in kilograms divided by the person's height in meters squared (kg/m^2; Bodnar et al., 2016). The GWG is the weight gained by a pregnant woman between conception and the birth of the infant. Prior studies have indicated that the risk of several obstetrical complications increases when GWG is outside the recommended range. Few studies have been conducted to determine the association between normal GWG (25–35lbs) and psychosocial factors and infant mortality among AA women with normal prepregnancy BMI who are between the ages of 30 to 47 years old. I used a quantitative method to explore the association between GWG and infant deaths.

Research Questions and Hypotheses

RQ1: What is the association between normal GWG (25–35 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds?

$H_0$1: No association exists between normal GWG (25–35 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds.

H_a1: An association exists between normal GWG (25–35 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds.

RQ2: What is the association between normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income?

$H_0$2: No association exists between normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi with normal prepregnancy body weight (25–35 lbs) who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income.

H_a2: An association exists between normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi with normal prepregnancy body weight (25–35 lbs) who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income.

RQ3: What is the association between the level of education and infant mortality among AA women with normal prepregnancy body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income?

H_03: No association exists between the level of education and infant mortality among AA women with normal prepregnancy body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income.

H_a3: An association exists between the level of education and infant mortality among AA women with normal prepregnancy body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income.

Conceptual Framework

The ecosocial constructs model (Krieger, 2011) and the biopsychosocial (BPS) model (Engel, 1981) guided the study's hypotheses and selection of variables. The key tenets of the models are described below, followed by examples of their applicability to the phenomenon of GWG and infant mortality. These frameworks will be described in more detail in Chapter 2.

The BPS Model

The BPS model is used to examine the variable interactions of sociological, biological, psychological, and other sociocultural factors that influence diseases, illness, and health outcomes (Engel, 1981). The BPS model includes biology (genetic, nervous system, organs, and biochemical), psychology (a person's experiences, mood, personality, and behaviors), and social factors (family and community). Engel (1981) applied the BPS model to the clinical field by examining how healthcare providers approached their patients and their patients' conditions. Essentially, the BPS model allows doctors to apply the scientific method to typical aspects of their medical practice and patient care in ways that were previously unheard of. Under the BPS model, a patient's condition has biological, psychological, and social components and must be approached and treated with these three components in mind rather than focusing on a single component (Engel, 1981).

The Ecosocial Model

The ecosocial constructs are embodiment, pathways to the embodiment, the sum of the interplay of susceptibility, exposure and resistance, agency, and accountability (Krieger, 2011). Embodiment is a construct and a process that is central to the conceptual framework of ecosocial theory (Krieger, 2011). Embodiment implies that human beings are both biological organisms and social beings (Krieger, 2011). Additionally, embodiment advances certain critical claims suggesting that health status is an indicator and a core measure of a person's lifestyle and past experiences (Krieger, 2011). The ecosocial theory is a multilevel theoretical concept used for investigating disease or varied health outcome distributions. The ecosocial theory blends biological and social processes, historical, dynamic, and ecological perspectives in addressing population-based health issues and social inequalities (Krieger, 2011). The ecosocial theory is also used to explore population-based health surveillance by employing the lenses of biological, ecological, and social environments (Krieger, 2011). The ecosocial theory is based on the concept of reciprocal, cyclical, and synergistic interaction with the proximate environment (Krieger, 2011).

Notably, these complex, interlinked pathways can be used to explore and understand the totality of the life course perspectives and historical and intergenerational effects of health outcomes (Krieger, 2011). Additionally, ecosocial theory can be used to highlight how individuals of varied socioeconomic statuses exhibit differences in terms of resistance, exposure, and susceptibility to diseases (Krieger, 2011). An individual's personal life experiences can be influenced by power structures, groups, social iniquity and inequality, and discrimination (Krieger, 2011). The shared environment is partly responsible for the pattern of health outcome distribution in a given area (Krieger, 2011), and epidemiologists and medical and public health practitioners are responsible for identifying and addressing health disparities, as well as advocating for health equity, iniquity, equality, and injustice to improve population health status (Krieger, 2011).

Summary of the Conceptual Frameworks

In summary, the BPS model was appropriate for the current study because it encompasses the dynamic nature of public health. In the context of the ecosocial model, life course perspectives and socioeconomic gradients justify a critical examination of the effects of GWG on infant mortality among AA women in Mississippi. Overall, these two conceptual frameworks served as appropriate models for the current study due to their alignment with population-based health issues and social inequalities. In the current study, I examined the infant mortality and income disparities faced by AA women. Findings from this study may advance knowledge and maternal health practice in preconceptual and antenatal counseling services in public health and medical disciplines.

Table 1 shows the alignment of ecosocial constructs and the current study's variables that were under inquiry. Table 1 also contains the description of the ecosocial alignment with the confounder, covariate, mediator, and modulator variables. I will provide an in-depth discussion of the etiology of the conceptual framework and its alignment with the current study in Chapter 2.

Table 1

Ecosocial Theory Constructs Alignment with Test Variables

Ecosocial theoretical constructs	Study variables	Type of test variables
Embodiment	Infant mortality	Dependent
Cumulative exposure, susceptibility, and resistance	GWG	Independent
Agency and accountability	Level of education	Independent

Nature of the Study

This study's purpose was to examine the association between GWG (25–35lbs), level of education, income, and infant mortality among AA women with normal prepregnancy body weight who were between 30 and 47 years old in the state of

Mississippi from 2016 to 2018. To accomplish this purpose, I employed a quantitative research method using secondary data.

I sought approval from the Walden University Institutional Review Board (IRB) before accessing the data. The Mississippi Department of Health has a repository of secondary databases, and I used these secondary data sources for the current study. The same data are also available from the Birth Cohort Linked Birth-Infant Death Data file. The CDC Pregnancy Risk Assessment Monitoring System (PRAMS) database contains data regarding maternal experiences and attitudes before and during pregnancy through the period shortly after childbirth (CDC, 2019). These data are population and state specific. The current study included data on AA mothers' infants who died during pregnancy, before childbirth, or after child delivery. I used the Statistical Package for Social Sciences (SPSS) software for both the descriptive and inferential statistics in this study. Binary logistic regression analysis was used to address the posed research questions and hypotheses.

I used deidentified datasets for the data analysis; thus, participants' personal and protected information was not violated or disclosed. I used the statistical power of 80% (.8) with a beta value of 20% (0.2; Type II error/false negative) to estimate the minimum sample size required for the current study. I used the G*Power software to estimate the sufficient minimum sample size and used the predetermined alpha value of 5% (0.05; Type 1 error/false positive) and confidence level of 95% (0.95) to determine the statistical significance. Table 2 shows the study variables: GWG and level of education (independent variables), infant mortality (dependent variable). Income was the confounder variable controlled in this study.

Table 2

Study Variables

Study variables	Types of test variables	Level of measurement
GWG (Normal = 25–35 lbs; Abnormal ≥35 lbs for women with prepregnancy normal weight	IV	Nominal
Education (high school, college, graduate school)	IV	Nominal
IM cases (cases or no-cases)	DV	Nominal
Income	Confounder	Ordinal

Definitions

GWG: GWG is the amount of weight gained by a pregnant woman between conception and just before the birth of an infant (Meehan et al., 2014). This weight gain differs based on prepregnancy BMI for different weight groups.

Income: Income is categorized into low, middle, or upper income based on yearly salary. Low income means less than $42,000 of earnings a year, middle income means $42,000 to $126,000 of earnings a year, and high income means greater than $126,000 of earnings a year (Pew Research Center, 2015).

Infant mortality: Infant mortality is the death of young children under 1 year old (Mathews & Driscoll, 2017).

IMR: IMR is the number of infant deaths under the age of 1 year for every 1,000 live births within a geographical area. For example, IMR could be represented as the number (rate) of the infant deaths per 1,000 live births (Mathews & Driscoll, 2017).

Level of education: Level of education is the highest level of education that a person has attained or completed at primary, secondary, or university level (Vilen et al., 2018).

Normal prepregnancy body weight: Women with normal prepregnancy body weight have a BMI of 18.5–24.9 (calculated as weight in kg/height in m^2) at conception. Normal prepregnancy body weight is between the underweight (<18.8) and overweight (25.0–29.9) classifications (Deputy et al., 2018).

Normal weight: An individual is in the normal weight category if their BMI is 18.5 to < 25 (CDC, n.d.-a).

Obese: An individual is in the obese weight category if their BMI is 30.0 or higher (CDC, n.d.-a).

Overweight: An individual is in the overweight weight category if their BMI is 25.0 to < 30 (CDC, n.d.-a).

Prepregnancy: Prepregnancy refers to an individual before the onset of pregnancy.

Structural racism: Structural racism refers to how societal systems create and reinforce inequity on the basis of race, resulting in a self-perpetuating cycle of discriminatory values, beliefs, and resource allocations (Bailey et al., 2017).

Underweight: Underweight refers to individuals with a body weight of less than 18.5 BMI before the conception or pregnancy period (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). The suggested GWG for women in the underweight category is between 28–40 pounds (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009).

Assumptions

I evaluated information regarding the effects of GWG, psychosocial factors (income), and infant mortality based on evidenced-based literature that informed this research inquiry. I used a cross-sectional survey to address the posed research questions and hypotheses; hence, I did not use clinical data to verify the self-reported information presented in this study. As such, the responses provided by the participants seem accurate and credible. The current study does not provide evidence or proof on the causal association between the risk factor under investigation and infant mortality; as such, other unknown factors may have influenced observed cases of infant mortality. The selected participants for this study may not be a recipient of any health insurance or may not be eligible for Medicare services, yet I assumed that the study participants had access to some form of health care services. This assumption cannot be proven because investigating such an assumption was not the primary goal of the study. In this study, it was possible that access to healthcare and quality of care were influenced by insurance and income statuses. Lack of access to healthcare and health insurance promotes health disparity, inequality, and heavy burden of diseases.

Scope and Delimitations

This study was limited to AA women aged 30–47 who live within the state of Mississippi. Therefore, the findings should not be generalized to reflect infant mortality outcomes among women who are younger than 30 years old or those who are older than

47 years old. The unique sociopolitical and economic context of Mississippi should also provide caution in generalizing the findings outside the state where the study was conducted. The findings only infer correlational association.

Limitations

The use of secondary datasets is an inherent limitation. The secondary data included information about birth and death certificates of infants in the state of Mississippi. The datasets are hosted within the CDC PRAMS database (CDC, 2019). The secondary data in question were not designed or tailored to specifically address the posed research questions and hypotheses. The secondary datasets used in this study were surveillance data obtained from pregnant women in the state. As such, I do not generalize the current study findings because this is a single study, and the findings are limited to adverse conditions during the pregnancy period. Lastly, I did not determine causality because this study was not an experimental study.

Significance

The high prevalence of infant mortality in the state of Mississippi illuminates some public health concerns about the effects of GWG on infant mortality among AA women, which had not yet been explored. As such, further research was warranted to thoroughly explore if maternal weight gain and infant death will change the preestablished national guidelines on GWG (Bodnar et al., 2016). The social impact and nature of high IMR at the pre or postnatal stage through the public health and epidemiologic perspectives appears to adversely affect the family system and the overall quality of the life within the highly burdened AA community.

The current study focused on the knowledge regarding the effects of GWG and income on infant mortality. This study also advances practice because it provides evidence-based findings that can be used to address meaningful and practical intervention approaches and inherent limitations that facilitate high infant mortality cases. In addition, the current study provides a wealth of evidence-based information that can be used in maternal or infant health program evaluations across various local or national public health interventions. As such, multifactorial positive social change could be advanced via improved awareness, health-promotion measures, policy-making processes, health literacy education, and other related peer-driven health coach and lifestyle intervention approaches to support existing health programs. Effective application of efficacious maternal–infant public health programs or interventions could substantially lower the incidence and prevalence of infant mortality related to pregnancy and childbearing. Furthermore, the positive social change implications of this study include improvement of preconception, antenatal counseling, and the reduction of risks associated with obesity, GWG during pregnancy, and infant mortality among AA women.

Summary

This chapter provided an introductory assessment of the association between normal GWG (25–35 lbs), level of education, and infant mortality among AA women with normal prepregnancy body weight who were between 30 and 47 years old in the state of Mississippi. I provided an in-depth evidence-based assessment of the problem statement, significance, background, and nature of the study. This assessment provided an empirical basis for the current study and details how the study results address the identified gap in the literature. Three research questions guided the current study:

RQ1: What is the association between normal GWG (25–35 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds?

RQ2: What is the association between less than normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income?

RQ3: What is the association between the level of education and infant mortality among AA women with normal body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income?

I discuss studies that support the ecosocial theoretical framework and the BPS model in Chapter 2. Chapter 2 also contains a review of the most current literature on GWG, physiological patterns and determinants of GWG, trends and outcomes related to GWG, racial and income disparities, and infant mortality. I conclude Chapter 2 with a summary of the literature and research gap and an explanation of the reasoning for the current study.

Chapter 2: Literature Review

The purpose of this study was to examine the association between GWG (25–35lbs), level of education, income, and infant mortality among AA women with normal prepregnancy body weight who were between 30 and 47 years old in the state of Mississippi from 2016 to 2018. GWG is a modifiable risk factor that is linked to adverse pregnancy outcomes among underweight, normal weight, overweight, and obese women (ACOG, 2013; IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). I discuss the literature search strategy and the study's theoretical foundation in this chapter. I also further discuss the study variables, descriptions, and outcomes of GWG, racial and income-related disparities, and infant mortality. I conclude this chapter with a summary of the literature and research gap and an explanation of the reasoning for the current study.

Literature Search Strategy

I used several database search engines and sources to conduct article searches relating to GWG and infant mortality. Most of the literature that I reviewed was published within a 5-year period (2013–2018), except for a few articles that described the ecosocial theoretical constructs or the conceptual framework. I cited and credited the original author for articles that described the study methodology or the theoretical foundation (ecosocial theory) regardless of whether the articles were published outside the 5-year search period. Using Walden Library as a resource, I used the following databases for my literature search: ProQuest, Medline, NCBI, EBISCO, Google Scholar, CINAHL Plus, SAGE, PubMed, Science Direct, and the CDC.

I used the following keywords in my literature search: *infant mortality*, *infant mortality in the U.S*, *infant mortality* and *gestational weight gain*, *infant mortality* and *gestational weight gain* and *normal BMI*, *gestational weight gain (GWG)*, *gestational weight gain* and *African American women*, *psychosocial factor* and *gestational weight gain*, *psychosocial weight gain* and *infant mortality*, *BMI* or *weight* and *gestational weight gain*, *race* and *infant mortality*, *income* and *infant mortality*, *socioeconomic status* and *infant mortality*, *the ecosocial theory*, *the ecosocial theory* and *health*, *the BPS model*, and *the BPS model* and *health*. For example, in Google Scholar, the search term *infant mortality* and *gestational weight gain* generated 118,000 publications in .17 seconds. When filtered to only articles published between 2013–2018, the search produced 16,800 publications in .75 seconds.

When conducting my literature search in any of the selected databases, I randomly selected relevant articles from the populated list that aligned with the research inquiry under investigation. For instance, the current study is a quantitative study; therefore, several qualitative-based studies were not included in the literature review. The selected body of literature used in this current study was peer reviewed. I retrieved all the articles through an electronic or online device and all articles used in the current study were written in English.

Theoretical Foundation

The Ecosocial Theory

The ecosocial theory contains constructs that allow investigators to explain observed phenomena in more detail (Krieger, 2011). Ecosocial constructs include embodiment, pathways to embodiment, sum of the interplay of susceptibility, exposure and resistance, agency, and accountability (Krieger, 2011). The operational definitions of the specific constructs reflect the performance measures of the ecosocial theory. Embodiment is the process central to the conceptual framework of the ecosocial theory (Krieger, 2011). Embodiment represents the idea that humans are both biological and social beings (Krieger, 2011). Embodiment supports the concept of health status as an indicator and a core measure of a person's lifestyle and life-course perspectives (Krieger, 2011). For instance, life-course perspectives together with socioeconomic status variations support the need to explore the effects of GWG and psychosocial factors (income) on infant mortality among AA women in Mississippi. Ecosocial theory could help inform and advance knowledge on pregnancy, prenatal, infant health, and maternal health practices to encourage lifestyle modification to maintain healthy weight gain during pregnancy.

Health status is a critical indicator of a person's lifestyle and life experiences (Krieger, 2011). The ecosocial approach is a holistic approach for studying population health and social inequalities because it integrates biologic and social reasoning, and historical, dynamic, and ecological aspects (Krieger, 2011). Furthermore, the ecosocial theory is based on the concept of reciprocal, cyclical, and synergistic interactions between individuals and their environment (Krieger, 2011). Shared environments can explain patterns of health outcome distribution into a given area (Krieger, 2011). Ecosocial theory can also be used to explain how individuals from different socioeconomic groups differ in resistance, exposure, and susceptibility to diseases

(Krieger, 2011). An individual's experiences are impacted by power structures, groups, social iniquity and inequality, and discrimination (Krieger, 2011).

Researchers can use complex interlinked pathways to explore the totality of the historical, life-course perspectives, and intergenerational effects of health outcomes (Krieger, 2011). Variation of individuals and personal perspectives based on socioeconomic status, resistance, exposures, and susceptibilities to diseases could be explored and explained using the ecosocial theory (Krieger, 2011). For instance, personal life experiences or health outcomes could be influenced by power structures, social iniquity and inequality, groups, and discrimination (Krieger, 2011).

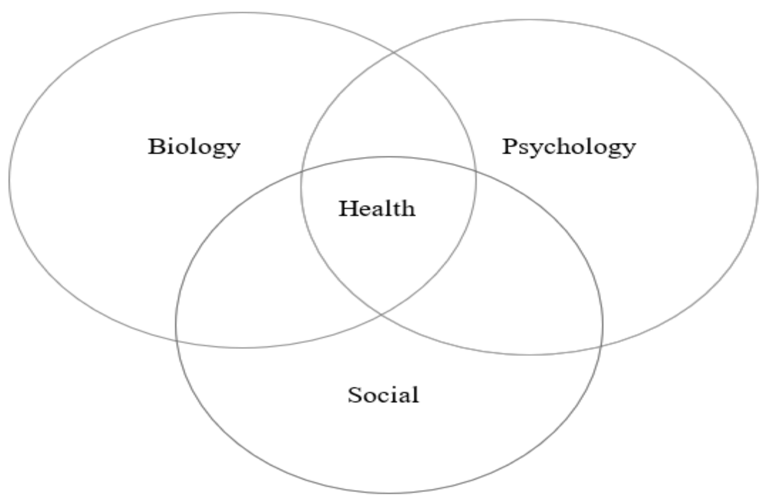
The ecosocial theory posits that environmental factors and the nature of an exposure affect health-outcome distributions (Krieger, 2011). Other researchers have used the ecosocial theory for studies similar to the current study. For instance, Kramer (2016) used the ecosocial theory to guide a cross-sectional study of social determinants of health and health outcomes. Kramer aimed to investigate racial patterns in health outcomes (including pregnancy) among Black and White women in Mississippi.

BPS Model

The BPS model takes the variable interaction of sociological, biological, psychological, and other sociocultural factors that influence diseases, illness, and health outcomes into consideration (Engel, 1981). The BPS model includes biology (genetic, nervous system, organs, and biochemical), psychology (a person's experiences, mood, personality, and behaviors), and social factors (family and community). Engel (1981) applied the BPS model to the clinical field by examining how healthcare providers approach their patients and their patients' conditions. Essentially, the BPS model allows doctors to apply the scientific method to typical aspects of their medical practice and patient care in ways that were previously unheard of. Under the BPS model, a patient's condition has biological, psychological, and social components and must be approached and treated with these three components in mind rather than focusing on a single component (Engel, 1981). Figure 1 shows the BPS model.

Figure 1

The BPS Model



Past researchers have also used the BPS model to study infant and maternal mortality. For example, Herrera et al. (1997) studied a total of 979 mothers and their infants from seven different health centers in Argentina, Columbia, Honduras, and Uruguay. Herrera et al. compared the predictive value of a prenatal biomedical risk scale and a prenatal BPS risk assessment with respect to low birth weight and used the BPS model as a guide. Herrera et al. collected data from prenatal visits between the 14th and

28th week of gestation. The study results indicated that an evaluation of the prenatal BPS risk that is adjusted for other variables—such as length of gestation, neonatal APGAR, prenatal mortality, socioeconomic status, drinking, and smoking—improves the positive predictive value of the assessment of mothers who may give birth to newborns with low birth weight (Herrera et al., 1997).

Additionally, Grondalski (2018) conducted a longitudinal study using a BPS approach to understand why people make health decisions. Grondalski measured participants' self-enhancement, perceived stress, cortisol baseline levels, and stress reactivity and weight gain. More specifically, Grondalski examined if people perceive their physical body size to be smaller than it is and determined how self-enhancement and stress interact to predict subsequent BMI. Grondalski's study results indicated that participants do self-enhance their body sizes to be smaller than they are. Additionally, Grondalski found a significant association between body self-enhancement and BMI, mediated by stress. Preis et al. (2018) used the BPS framework to examine how women perceive birth before they are pregnant. Preis et al. found that, of the three components of the BPS model, psychological factors were the most influential in conceptualizing women's birth beliefs. This finding relates to the current study because I used the BPS model to examine race and income, the role of these factors in weight gain during pregnancy, and how weight gain relates to infant mortality.

Key Variables and Concepts

Introduction to GWG

GWG is the amount of weight gained by a pregnant woman between conception and just before the birth of an infant (American College of Obstetricians and Gynecologists [ACOG], 2013; Meehan et al., 2014). This weight gain is based on prepregnancy BMI for different weight groups (ACOG, 2013). GWG occurs because of biological, sociological, and metabolic factors induced by the growth and development of a fetus, formation of the placenta, accumulation of amniotic fluid, development of maternal tissues, and maternal fat reserves (ACOG, 2013). The total weight gain is made up of fat reserves containing approximately 30% of the total weight gain. The components of total weight gained per pregnancy include approximately 60% water, 30% fat, and 5% protein (Koop-Hoolihan et al., 1999). Body weight is the body mass (in kilograms); BMI is estimated when this body mass is divided by the body height in meters squared (ACOG, 2013). Table 3 shows a compilation of the categories of weight and BMI as per IOM recommendations. The IOM categorized prepregnancy weights based on their respective BMI ranges and GWG in pounds (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009).

Table 3

Conversion Table

Underweight	BMI = 18.5 kg/m^2	28–40 lbs
Normal weight	BMI range = 18.5 kg/m^2 to 24.9 kg/m^2	25–35 lbs
Overweight	BMI range = 25 kg/m^2 to 29.9 kg/m^2	15–25 lbs
Obese	BMI = 30 kg/m^2 and above	11–20 lbs

Table 4 shows the GWG based on the IOM's recommended BMI. The weight gain of underweight women prepregnancy should range from 28–40 pounds, and the weight gain of normal weight women prepregnancy should range from 25–35 pounds. The weight gain of overweight women prepregnancy should range from 15–25 pounds, and the weight gain of obese women prepregnancy should range from 11–20 pounds.

Table 4

GWG Based on the 2009 IOM Recommended BMI

Prepregnancy BMI categories	BMI (kg/m^2)	Total weight gain (lbs)	Rates of weight gain* 2nd and 3rd trimester (lbs/week)
Underweight	<18.5	28–40	1 (1–1.3)
Normal weight	18.5–24.9	25–35	1 (0.8–1)
Overweight	25.0–29.9	15–25	0.6 (0.5–0.7)
Obese (all classes)	>30	11–20	0.5(0.4–0.6)

Physiological Pattern and Determinants of GWG

The GWG period is a critical time for fetal growth and development. GWG involves maternal and placental physiology and includes metabolism (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). Maternal biological and physiology changes and GWG contribute to fetal and placental development (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). This section describes the physiological changes that occur during GWG, such as the placenta and total body water, and describes some of the determinants of GWG.

The Placenta

The placenta is a crucial piece of the physiological changes that occur during GWG because the placenta transports nutrients between the mother and fetus (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). Notably, changes to the mother's body can alter the placenta's structure and therefore impact fetal growth. Changes in the placenta can also affect the mother and impact GWG (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009).

During pregnancy, the fetus, placenta, amniotic fluid, uterus, mammary glands, blood, and adipose tissue store macronutrients such as protein, fat, and crucial mineral water (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). In turn, GWG results from the development of the placenta, fetus, and amniotic fluid. As a woman's pregnancy advances, her body requires an increased amount of minerals, proteins, water, and nutrients to support the growth and development of the fetus, placenta, amniotic fluid, breast tissues, and deposition of fat (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). Also important to GWG are carbohydrates and lipids because they supply essential nutrients to the developing fetus (Guardamagna & Cagliero, 2016). The composition of the placenta varies with gestational age as well as maternal metabolic status (IOM and NRC

Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). Approximately 88% of placental weight is water and the products of conception are attributed to nearly 35% of total weight gain during pregnancy (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009).

Total Body Water

Total body water is also important during GWG. Total body water is mainly controlled by hormones and is extremely flexible throughout the gestation period. Total body water is mostly controlled by hormones and can change drastically throughout pregnancy (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). On average, total body water can range from approximately 7 to 8 liters in a healthy pregnancy (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). Total body water accretion is significantly positively correlated with infant birth weight; therefore, total body water may also impact infant mortality.

Determinants of GWG

Most of the acquired weight gain during pregnancy is due to mass accumulation of maternal adipose tissue, intravascular and extravascular fluids, products of conception, and uterus and breast tissues. Prepregnancy BMI and GWG affect gestation and birth weight; however, the effect of maternal GWG on poor birth weight outcomes among women with different prepregnancy BMI categories is unknown (Zhao et al., 2018). Health status, body weight, age, gender, physical activity, body composition, race and ethnicity, and biochemical parameters are factors that affect total energy expenditure

(Taousani et al., 2017). Pregnant women should consume the following to maintain a healthy GWG:

- three meals a day and two snacks to avoid prolonged periods of fasting;
- fruits and vegetables (five per day) and monounsaturated fats with adequate protein;
- fiber-rich carbohydrate and limit carbohydrates with a high glycemic index (i.e., fruit juices and sodas);
- at least two servings of omega-3 rich fish a week or consume omega-3 supplements;
- adequate intake of the following vitamins and minerals: vitamin A (530–550µg/d)* such as beta-carotene and limit food sources of preformed vitamin A, such as liver or cod liver oil; and vitamin D from sunshine exposure (if not feasible, supplement with vitamin D3);
- vitamin B12, iodine, iron, calcium; and
- pasteurized dairy and fruit juices.

Trends and Outcomes Related to GWG

GWG has been studied for decades. Luke et al. (1981) examined the impact of pregravid weight gestational rate of weight gain on birth weight, length, and head circumference. Pregravid weight categories include underweight, normal, or obese. Luke et al. study results indicated that the incidence of antepartum anemia decreased with higher pregravid weight and GWG. Therefore, Luke et al. concluded that a higher pregravid weight and GWG may help insure optimal intrauterine growth.

In contrast, Meng et al. (2018) found that maternal obesity and high GWG are health risks that have been associated with adverse birth and pregnancy outcomes. The trend of adult obesity in the United States substantially increased between 2013 and 2014 (Hales et al., 2017). The prevalence of obesity among women disproportionately varies by race. In 2016, the prevalence of obesity was 54.8% among AA women, 50.6% among Hispanic women, 38% among non-Hispanic White women, and 14.8% among non-Hispanic Asian women, respectively (Hales et al., 2017). Overall, the odds of infant deaths are higher among obese mothers; this risk factor is more likely among women with greater maternal weight or BMI during pregnancy (Meehan et al., 2014).

The GWG guidelines or recommendations were published by the IOM in 1990 (Committee Opinion No. 548, 2013). The IOM's 1990 and 2009 recommendations outlined specific prepregnancy BMI based on the BMI categories endorsed by the World Health Organization and the National Heart Lung and Blood Institute (Hamad et al., 2016). Over the past 30 years, the high prevalence of obesity has been a serious indicator of health burden among women of childbearing age who reside in the United States (Flegal et al., 1998; Mokdad et al., 1999). Between 2017 and 2018, the prevalence of obesity was 39% among U.S. women aged 20–39 and 43.3% among women aged 40–59 (CDC, n.d.-d). Between 1999–2008, the data collected from the National Center for Health Statistics revealed that one-third of childbearing women were obese, and two-thirds of those women were overweight (CDC, 2010).

Notably, the prevalence of obesity increases with an increase in life expectancy; this has become known as the obesity paradox (Dixon et al., 2015). For instance, Dhana et al. (2016) found that men and women with obesity lived 2.9 and 1.7 more years than the normal weight counterparts even with a diagnosis of cardiovascular disease. In the United States, the high prevalence of severe obesity has increased among women of childbearing age (March of Dimes, n.d.). Additionally, high obesity is common among minority groups (Singh & DiBari, 2019; Vahratian, 2009).

Johnson et al. (2015) conducted a study using secondary data from almost 125,000 women from 14 different states. Johnson et al. obtained data through the CDC PRAMS database from 2000 to 2009. The key variables in Johnson et al.'s study included weight gain in pounds and the categories proposed through typical GWG recommendations. Approximately 36% of women in the study gained the normal amount of weight during pregnancy, whereas 44% of women gained above the normal amount of weight and about 20% gained below the recommended weight. These findings indicate that GWG may be problematic for a significant number of pregnant women. Johnson et al. also found that fewer women gained the recommended weight during the 2000 to 2009 time period. Additionally, GWG increased slightly over the years (Johnson et al., 2015).

Goldstein et al. (2017) investigated the relationship between GWG and maternal and infant health outcomes to determine if weight gain above or below the IOM BMI guidelines was detrimental to the mother and infant. Goldstein et al. analyzed 1,309,136 pregnancies and conducted a meta-analysis of observational studies. Odds ratios and absolute risk differences were calculated for the data analysis. About 23% of the women were below the recommended guidelines and 47% were above the recommended guidelines. Goldstein et al.'s study results indicated that GWG below the recommended weight was related to higher risk of preterm birth and having an infant who was classified as small for gestational age. GWG that was above the recommended weight was related to lower risk for preterm birth and greater risk for macrosomia, diabetes mellitus, and cesarean delivery. GWG is commonly associated with having an infant preterm or having an infant who is classified as small or large for gestational age. Goldstein et al.'s study results supported Johnson et al.'s (2015) findings regarding the high prevalence of women gaining above the recommended weight during pregnancy. Overall, Goldstein et al.'s study results support the notion that GWG can negatively and positively impact the mother and infant.

The IMR can provide key information about maternal and infant health status and serves as an important public health marker of the overall health status of a community or nation (CDC, n.d.-a). It was estimated that over 23,000 infants died in the United States in 2015 (AHR, n.d.). The IMR in the United States remains consistently higher than other industrialized countries; in 2016, the IMR in the United States was 5.9 deaths per 1,000 live births (AHR, n.d.).

Pugh et al. (2016a) examined whether obesity prior to pregnancy or excessive weight gain during pregnancy cognitively impairs the child. Pugh et al. collected data on mothers and their children for 14 years, with a total of 574 participants. Pugh et al. measured mathematics, reading, and spelling when the child was 6, 10, and 14 years of age using the Wide Range Achievement Test-Revised and the Weschler Individual Achievement Test Screener. Pugh et al. statistically controlled for maternal race, child sex, parity, employment, family income, maternal intelligence, maternal depression, prepregnancy BMI (in GWG models only), and the home environment. The study results revealed a significant, nonlinear, inverse relationship between prepregnancy BMI and an offspring's academic achievement (Pugh et al., 2016a).

Pugh et al. (2016b) examined whether GWG and prepregnancy BMI was associated with attention-deficit hyperactivity disorder (ADHD) and emotional and behavioral problems. Pugh et al. studied 511 mothers and their child from pregnancy until the child was 10 years old. Pugh et al. measured the child's ADHD symptoms using the Conner's Continuous Performance Test and assessed child behavior using the parent and teacher ratings on the Child Behavior Checklist and Teacher Report Form. Pugh et al. study results revealed that prepregnancy obesity was significantly positively correlated with internalizing and externalizing behavioral problems and attention problems; however, this was not true for GWG. Future research is needed to better understand the role of obesity and weight gain and GWG on maternal and child health outcomes (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). The current study aimed to contribute to this body of literature and fill the research gap. In the next section, I describe disparities that could be linked to GWG and impact pregnancies and infant mortality.

Level of Education

Certain disparities are associated with infant mortality. Lower level of education is often considered a precursor to infant death. Mothers' lack of basic knowledge of how to maintain a healthy pregnancy largely contributes to high IMRs (Agüero & Bharadwaj, 2014; Kiross et al., 2019; Weldearegawi et al., 2015). In the United States, education regarding how to carry and deliver a healthy fetus is considered the norm (Agüero & Bharadwaj, 2014; Kiross et al., 2019; Weldearegawi et al., 2015). Most mothers in the United States have access to a plethora of information, classes, research, and prenatal care. Many believe this education is lacking in other developed and undeveloped countries, which may contribute to the high IMR outside of the United States; however, a significant number of studies revealed that high IMRs are associated with maternal education, even in developed countries (Ahrens et al., 2017; Azeze & Huang, 2014; Kiross et al, 2019; Weldearegawi et al., 2015).

Weldearegawi et al. (2015) found a high causation of infant mortality in rural areas of Ethiopia due to lack of maternal school access. Weldearegawi et al. examined the IMR in rural populations throughout Ethiopia and used access to healthcare and education as nominal factors; however, the researchers were unable to establish other factors such as hygiene and sanitation. Weldearegawi et al.'s study findings indicated that (a) maternal education is not available to most rural areas, and (b) where maternal education was available, the pregnant population—mostly women under 21 years of age—were not interested in such education.

Similarly, Kiross et al. (2019) observed the effect of maternal education on infant mortality. Using a systematic review, Kiross et al. reviewed 31 articles that discussed the effect of primary education on IMR. In addition, Weldearegawi et al. (2015), and Kiross et al found that women ages 13 to 20 had higher pregnant population. Kiross et al. found that a large percentage of published empirical studies revealed a significant relationship between high IMR and low or lack of maternal education.

Most healthcare providers recognize that maternal education is vital for reduction of infant mortality. Many past studies have revealed that maternal education is one of the key factors in decreasing the IMR (Grépin & Bharadwaj, 2015; Keats, 2018; Makate, 2016; Makate & Makate, 2016). Andriano and Monden (2019) researched six specific pathways through which maternal education was influential upon infant survival. First, Andriano and Monden found that socioeconomic status was more likely to influence maternal education; mothers of higher socioeconomic status had a higher likelihood of accepting maternal education. Second, Andriano and Monden found that mothers' acknowledgement and acceptance of modern medical assistance influenced their likelihood to accept maternal education. Third, Andriano and Monden found that primary education provides knowledge on factors such as illnesses and how to treat such illnesses as colds and accepting prenatal care. Fourth, the authors found that education provided influenced mothers' understanding of and changes in hygiene and sanitation behaviors. Fifth, Andriano and Monden found that education facilitates one's knowledge of healthcare needs and preventative care. Finally, the authors found that schooling provides women the potential for autonomy and empowerment within a male-dominated household (Andriano & Monden, 2019). Maternal education offers mothers the ability to improve their environment and increase their awareness of physical and mental needs during pregnancy and provides mothers with knowledge on how to prepare for birth.

Racial and Income Disparities in Infant Mortality

Racial Disparities

Obstetric outcomes among AA women have often been attributed to structural racism (Bailey et al., 2017; Gil-Gonzalez et al., 2014; Williams & Mohammed, 2013). Structural racism is how societal systems create and reinforce inequity because of race, resulting in a self-perpetuating cycle of discriminatory values, beliefs, and resources allocation (Bailey et al., 2017). A high proportion of AA women are either poor or fall into the low socioeconomic status category, which tends to affect AA women's safety, nutrition choices, educational attainment, well-being, access to prenatal care, and overall healthcare (Baldassari et al., 2016; Pavela et al., 2016). Additionally, AA women have a higher rate of hypertension, obesity, diabetes, and cardiovascular conditions (Carnethon et al., 2017; Lo et al., 2013). The specified factors contribute tremendously to AA women's high incidence of adverse maternal and birth outcomes, such as infant mortality. Pregnancy-related deaths among AA persist in the United States (Moaddab et al., 2016). Additionally, AA women in the United States are three to four times more likely to die due to pregnancy complications when compared to their non-Hispanic White counterparts (Berg et al., 2010; Creanga et al., 2015).

In general, IMR in the United States has been decreasing steadily (Mathews & Driscoll, 2017). According to the CDC, infant mortality in the United States decreased to 5.82 deaths for every 1,000 live births in 2014 as opposed to 6.86 infant deaths for every 1,000 live births in 2005 (Mathews & Driscoll, 2017). However, the IMR burden among AA women was 10.93 deaths per 1,000 live births between 2005 and 2014 (Mathews &

Driscoll, 2017). American Indian or Alaska Native women had the second highest IMR of 7.59 deaths per 1,000 live births during the same period (Mathews & Driscoll, 2017). Matoba and Collins (2017) indicated that AA women in the United States have a significantly higher IMR than their White counterparts.

With respect to developed countries, the United States has one of the highest rates of infant mortality and specifically among AA ethnic groups; in 2013, the IMR for AAs was over 11% of all live births (Lorenz et al., 2016). Lorenz et al. (2016) noted that personal behavior, social factors, healthcare access and quality, and the environment disproportionately affect the poor. Lorenz et al. argued that addressing the socioeconomic disparities related to health and healthcare could be beneficial for improving the IMR among AA women. Lorenz et al.'s assertion aligns with the current study because I examined the relationship between income and infant mortality among a sample of AA women while also controlling for other demographic variables.

Brown Speights et al. (2017) assessed the average IMR by state and examined racial disparities in IMR. Brown Speights et al.'s study results indicated that IMR varies by state; however, Brown Speights et al. did find a clear racial disparity. The AA IMR ranged from 6.6 to 13.8, and 13 states saw decreases in the IMR disparity between Black and White residents. Notably, Brown Speights et al. posited that 18 states will see significant decreases in IMR by 2050 if their current trends continue. Brown Speights et al. also calculated that almost 65,000 infant deaths could have been avoided if the Black and White IMR gap was eliminated.

Similarly, Riddell et al. (2017) studied whether AAs and White infants benefit equally from the recent decline in infant mortality across the United States. Riddell et al. collected data on the overall and cause specific IMRs between non-Hispanic Black and White infants. Riddell et al. used a cross-sectional study design and obtained data from the U.S. National Vital Statistics System from 2005 to 2015 to calculate IMR per 1,000 infants. The study results indicated that the IMR for Black infants decreased from 14.3 to 11.6 per 1000 births between 2005 and 2012 but increased from 11.4 to 11.7 between 2014 and 2015. In contrast, the White IMR only slightly decreased from 5.7 to 4.8 between 2005 and 2015 (Riddell et al., 2017).

Wallace et al. (2017) studied racism and racial disparities related to infant mortality. Wallace et al. determined the IMR in each state as well as by race by using birth and infant death records from 2010 to 2013. Wallace et al. examined racial inequalities regarding the following factors:

- educational attainment;
- median household income;
- employment;
- imprisonment; and
- juvenile custody.

Notably, Wallace et al. (2017) disclosed that increasing racial inequality in unemployment gave rise to a 5% increase in Black infant mortality. In addition, a decrease in racial inequity in terms of education gave rise to almost 10% decrease in the Black IMR. Wallace et al. also stated that none of the structural racism measures had a significant impact among White participants with respect to infant mortality. Overall, Wallace et al. helped to highlight the racism experienced by Black individuals and its potential to lead to racial disparities in infant mortality.

Income Disparities

Pickett and Wilkinson (2015) conducted a literature review to investigate if income differences play a causal role leading to worse health. Pickett and Wilkinson found that most studies revealed an association between income and health. Most researchers of previous studies found that large income differences lead to negative health and social consequences. Unfortunately, Pickett and Wilkinson found that income disparities are increasing, leading to decreased health and well-being.

Komro et al. (2016) examined the relationship between wages and infant mortality in the United States. Komro et al. collected data by state and month from 1980 through 2011. Komro et al.'s study results indicated that states' wages were significantly negatively correlated with infant mortality. There was a 1% to 2% decrease in lower birth weight for each dollar increase above minimum wage and in turn, a 4% decrease in infant mortality. Komro et al. also calculated that there would have been over 2,700 fewer births relating to low-birth-weight infants and more than 500 fewer infant mortality over the span of 1 year. Siddiqi et al. (2015) also studied the relationship between income and infant mortality. Siddiqi et al. noted that contextual determinants such as income inequality may be related to IMR. Siddiqi et al. collected data on state-level income inequality and IMRs from the U.S. CDC Wonder database for the time period of 1990 to 2007. Siddiqi et al.'s regression analyses revealed a significant interaction between income inequality and time. Specifically, as time increased, the relationship between income inequality and IMR became stronger.

Elder et al. (2016) studied the relationship between socioeconomic status and race and population health, specifically focusing on infant mortality. Elder et al. collected secondary data on mothers from 2000 to 2004 from Vital Statistics; the data included information on White, Black, Asian, Mexican, Native American, and Puerto Rican mothers. Notably, Elder et al.'s study results revealed major racial gaps in infant mortality, indicating that race plays a critical role in this health outcome. Interestingly, Mexican mothers experienced low IMRs despite their typically low socioeconomic status; this finding further highlights challenges faced by AA pregnant women when compared to other racial groups with low socioeconomic status (Elder et al., 2016).

Similarly, Kothari et al. (2016) examined the relationship between race, socioeconomic status, and infant birth weight, which can be related to infant mortality. Kothari et al. studied a sample of 2,861 AA pregnant women in the United States. The predictor variables are race and socioeconomic status that were dichotomized into Black and White low socioeconomic status and higher socioeconomic status, and the criterion variable was infant birth weight. Kothari et al. found that the most important factors for determining birthweight were race and socioeconomic status of the individual mother rather than at the community level. Furthermore, AA pregnant women were significantly more likely to deliver a baby of low birth weight than White mothers. Additionally, low socioeconomic status mothers had a higher chance of delivering a low-birth-weight baby than high socioeconomic status mothers. AA mothers of high socioeconomic status who lived in a racially incongruous neighborhood (where most of the neighborhood was comprised of White women) were almost 15% more likely to have a child of low birth weight; this indicates that community characteristics such as neighborhood racial congruity may be associated with better infant health outcomes (Kothari et al., 2016).

Lin et al. (2018) investigated whether infant health differed by race and by income and whether maternal demographics, health behaviors, obstetric history, mental health, and prenatal care played a role in infant health. Lin et al. used a cross-sectional design and the sample consisted of over 20,000 women from one county. Lin et al. collected data from 2008 to 2014. Lin et al.'s study had three outcome variables: infant full-term gestation, normal birth weight, and infant survival through their first year. The main predictor variables were maternal demographics (including race and income), health factors, and prenatal care. Lin et al. conducted a regression and mediation analyses and classified over 87% of infants as normal birth weight and as living to their first year. Lin et al. identified that White mothers were more likely to have higher incomes than mothers of color. This is important because high-income mothers were also found to have the fewest risk factors and better infant health overall than low-income mothers. Lin et al. also found that receiving prenatal care in the first trimester was beneficial for White infants and higher income infants, but not for AA infants or low-income families. Having a poor birth outcome in the past was also a risk factor for low-income infants and infants of color (Lin et al., 2018).

Maternal Age and Advanced Maternal Age

Maternal age is the age of a birthing mother at the time of delivery, and advanced maternal age refers to mothers who are 35 years old or older during the delivery of their child. Maternal age has been associated with reproductive risk. Advanced maternal age is a risk factor for varied reproductive outcomes such as female infertility, fetal anomalies, pregnancy loss, still birth, fetal anomalies, and varied obstetric complications. In spirit of these observations, a greater number of women in the last 4 decades have been pursuing educational and career goals than ever before (Sauer, 2015). Women between 20 and 29 years old have lesser general reproductive risk and exhibit the lowest rate of fetal, neonatal, infant, and maternal mortality (Donoso et al., 2014). Thus, women of advanced maternal age, especially women who are pregnant for the first time, tend to have adverse neonatal and maternal outcomes when compared to younger women (Schimmel et al., 2015).

Fertility declines and risk of adverse fetal outcomes increases with advancing age (Ndiaye et al., 2018). Nevertheless, the innovations in reproductive science have seemed to somewhat compensate for this usual decline in fertility. The impact of advanced maternal age and late motherhood on perinatal outcome have been extensively studied among females 35 years of age or older (Goisis et al., 2017). Conception at an advanced maternal age may raise the risk of perinatal mortality, gestational diabetes, preeclampsia, and cesarean section deliveries (Ndiaye et al., 2018).

Numerous findings have shown heightened risk of adverse pregnancy outcomes for women of advanced maternal age; however, few studies have demonstrated how the effect of age differs by method of conception and parity (Bock et al., 2019). Despite the increasing rate of pregnancy among such women due to assisted reproductive technology, the dangers of advanced maternal age vary by maternal features, which can be poorly identified (Ndiaye et al., 2018).

Advanced motherly age at childbirth is deemed a key risk factor for natal outcomes (Ndiaye et al., 2018); however, it is not clear to what magnitude this relationship is confounded by maternal features. Advanced maternal age is related to undesirable fetus–maternal health consequences (Goisis et al., 2017). This explanation may be linked to functional developments related to aging, such as declining quality of the oocyte (Bock et al., 2019). Pregnancy at advanced maternal age (35 years or older) has risen in various developed nations over the past few decades, with current rates stated as high as 9.1% in the United States and 28.1% in Japan; however, advanced maternal age at childbirth has been shown to be connected to increased pregestational morbidity and related risk factors that can contribute to high-risk pregnancy (Ogawa et al., 2017).

Summary and Conclusions

This chapter provided a description of the theoretical frameworks for this study. I also described previous studies that relate to the current study and the research gap. The bulk of the literature review included studies published within the past 5 years, thus establishing that the phenomenon of focus is a current issue. The databases used for literature search included Walden University Library, ProQuest, Medline, NCBI, EBISCO, Google Scholar, CINAHL Plus, SAGE, PubMed, Science Direct, and the CDC.

The current study was guided by the ecosocial theory and the BPS model. The following constructs are critical to the ecosocial theory:

- embodiment,
- pathways to embodiment,
- sum of the interplay of susceptibility,
- exposure and resistance, and
- accountability (Krieger, 2011).

The current study examined race and income and their impact on infant mortality. Thus, the ecosocial theory relates to the current study because income contributes to socioeconomic status and environment, and race can be linked to inequalities.

Similarly, the BPS model takes the sociological, environmental, psychological, and other sociocultural factors that influence diseases, illness, and health conditions and health outcomes into consideration (Engel, 1981). The BPS model includes:

- biology (cells, nervous system, and organs);
- psychology (the person's experiences and behaviors); and
- social (family and community) components (Engel, 1981).

GWG is the amount of body weight measured in pounds that a pregnant woman gains from the time of conception to the onset of maternal labor. GWG occurs because of biological, sociological, and metabolic factors (ACOG, 2013). Table 3 shows the IOM prepregnancy BMI recommendations that were used in the current study. These recommendations differ depending on the following categories: underweight BMI, normal weight BMI, overweight, and obese. The recommended rates of mean range weight gained in the second and third trimesters are measured in pounds per week (see the far-right column in Table 3).

The period of GWG involves both maternal and placental physiology, including changes in metabolism (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). The placenta is crucial during GWG because it transports nutrients between the mother and fetus (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). Total body water is also important during GWG. Total body water is mainly controlled by hormones and extremely flexible through gestation period (Davis et al., 2014), ranging from approximately 7 to 8 liters (IOM and NRC Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). Health status, body weight, age, gender, physical activity, body composition, race and ethnicity, and biochemical parameters are factors that affect total energy expenditure and GWG (Taousani et al., 2017).

The trend of adult obesity in the United States substantially increased between 2013 and 2014 (Hales et al., 2017). Adequate GWG may help insure optimal intrauterine growth (Luke et al., 1981); however, maternal obesity and high GWG have been associated with adverse birth and pregnancy outcomes (Meng et al., 2018). This is troubling because the prevalence of obesity among women disproportionately varies by race. In 2016, the prevalence of obesity was 54.8% among AA women (Hales et al., 2017), indicating that AA women may exceed GWG recommendations and have poor birth outcomes (Meehan et al., 2014).

Johnson et al.'s (2015) study results indicated that approximately 44% of women gained above the normal amount of weight and about 20% gained below the recommended weight. Similarly, Goldstein et al. (2017) found that 47% of women experienced GWG above the recommended guidelines. These similar figures indicate that many women are gaining too much weight during pregnancy, which impacts the mother and infant. One of these impacts may include infant mortality. Infant mortality is the death of an infant before the infant's first birthday and is a growing problem (CDC, n.d.-a). In 2019 it was estimated that over 23,000 infants died in the United States (Ely & Driscoll, 2020).

A high proportion of AA women are either poor or within the low socioeconomic status category, which tends to affect safety, nutrition choices, educational attainment, well-being, access to prenatal care, and overall healthcare (Baldassari et al., 2016; Pavela et al., 2016). Although IMRs in recent years have been declining, IMRs among AA women is increasing (Lorenz et al., 2016; Mathews & Driscoll, 2017). Some researchers have suggested that racism experienced by Black women can contribute to infant mortality (Wallace et al., 2017).

Income disparities are also increasing, leading to decreased health and well-being in the United States (Elder et al., 2016; Pickett & Wilkinson, 2015). Komro et al. (2016) found that for each dollar increase above minimum wage, there was a 1%–2% decrease in lower birth weight and 4% decrease in infant mortality. Additionally, women of low socioeconomic status have been shown to have a higher chance of delivering a low-birth-weight baby in comparison to mothers of higher socioeconomic status (Kothari et al., 2016).

White mothers are more likely to have higher incomes than mothers of color. Additionally, high-income mothers have the fewest risk factors and better infant health than low-income mothers (Lin et al., 2018); this finding reveals that race and income together play a role in infant health.

Previous researchers have called for future studies to investigate the effects of GWG on infant death using the IOMs national guidelines for GWG (Bodnar et al., 2016). It is unknown whether GWG and prepregnancy BMI and income of AA women are related to infant mortality. I sought to fill that research gap by using a quantitative cross-sectional research design and collecting secondary data on AA women who were 30–47 years at the time of data collection. The next chapter provides a more thorough description of the research methods involved in the current study.

Chapter 3 details the research design rationale, study variables, the source of data, population, sampling procedures, sample size estimate based on a power analysis, and data analysis plan. In addition, the appropriate independent variables and dependent variables were examined as well as the research questions.

Chapter 3: Research Method

The first two chapters discussed the association between the independent variables (GWG and level of education), and the dependent variable (infant mortality). In this chapter, I discuss the research design and rationale, the population, and the instrumentation of the current study. In the research design and rationale section, I discuss the source of the secondary data and the research questions. I also discuss sample method, sample size and power, eligibility criteria, and characteristics of selected sample. Last, I elaborate on the data collection tool and reliability and validity of the data collection instrument.

Research Design and Rationale

The independent variables in this study were GWG and level of education and the dependent variable was infant mortality. The covariate was the income of AA women in Mississippi. I determined GWG, level of education, infant mortality, and income using secondary data, which means that all the values for the variables and the covariate were derived from previously collected and published data.

I obtained secondary data for the study from the CDC PRAMS database. I analyzed the downloaded raw data for the state of Mississippi for the AA childbearing population in Mississippi counties from 2016 to 2018. I determined this time frame based on the Mississippi state-level data available from CDC PRAMS. The population for the retrospective study was derived from maternal behaviors, experiences, and attitudes prior, during, and a few days after childbirth by AA women and their infants who died during pregnancy or immediately after delivery. The three research questions were as follows:

RQ1: What is the association between normal GWG (25–35 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds?

$H_0$1: No association exists between normal GWG (25–35 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds.

H_a1: An association exists between normal GWG (25–35 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds.

RQ2: What is the association between less than normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income?

$H_0$2: No association exists between less than less than normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi with normal body weight (25–35 lbs) who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income.

H_a2: An association exists between less than normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi with normal body weight (25–35 lbs) who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income.

RQ3: What is the association between the level of education and infant mortality among AA women with normal body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income?

$H_0$3: No association exists between the level of education and infant mortality among AA women with normal body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income.

H_a3: An association exists between the level of education and infant mortality among AA women with normal body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income.

Study Variables

I used a multiple regression design to address the study's three research questions. The CDC PRAMS released the data for this study after I received IRB approval. The names of the individuals from whom the data were derived were not be included in the files; thus, the information gathered using this approach was secured and protected. The data were secondary in nature; therefore, the individuals included in the data were not exposed to any risk or harm during the research process.

For the first research question, the independent variable was GWG of 25–35 lbs, and the dependent variable was infant mortality. For the second research question, the independent variable was GWG of 25–30 lbs, and the dependent variable was infant mortality. In the third research question, the independent variables were a GWG of ≥ 36 lbs and (b) level of education. The dependent variable for the third research question was infant mortality. I statistically controlled for income throughout the study, and I used SPSS software to conduct the descriptive statistical analysis of the population. All three research questions were answered using binary logistic regression.

Methodology

The Source of Data

I obtained data for analysis from population-based surveillance programs of CDC PRAMS. Specifically, I obtained Mississippi state-level linked birth and infant death data of AA women and their infants from 2016 to 2018 from CDC PRAMS (CDC, 2019). I used the 2016, 2017, and 2018 Mississippi PRAMS data code book to verify the study variables before downloading the datasets.

Sampling Procedures

Sampling is the process of selecting units, such as people or organizations, from a population of interest. By studying the sample, a researcher may fairly generalize the outcomes of the sample analysis from which selected units were obtained. I limited the study sample to all AA American women who had a live birth from 2016 to 2018 in the state of Mississippi. PRAMS is a population-based surveillance system focused on maternal and infant health and behaviors before, during, and after pregnancy. Maternal and infant health data were obtained through collaborative participation of counties and local health departments with the CDC. In this study, only AA women aged 30–47 years old at the time of data collection were included in the analysis. I examined the age stated in the secondary data to include eligible individuals and exclude ineligible individuals based on their stated ages.

Based on the scope of the study, I limited the study sample to all AA women who had a live birth in the state of Mississippi. I conducted a predetermined a priori power analysis to control for the type-I error probability α and type-II probability β. Thus, I completed a power analysis to determine the minimum sample size required for this study analysis.

I based the established eligibility criteria for the research process on the following: (a) AA women who provided accurate and authentic birth record information of their infants to CDC PRAMS from 2016 to 2018, (b) AA women whose age at the time of the collection of data was between 30 and 47 years old, (c) prepregnancy weight, and (c) birth and death certificates of newborn babies of AA women from 2016 to 2018 in the state of Mississippi. The following birth and death records were excluded from the study: (a) records from AA women who did not provide accurate information on the birth records of their infants, (b) AA women who did carry their pregnancy to term from 2016 to 2018, and (c) AA women who were not living in the state of Mississippi from 2016 to 2018. The birth records and death records of infants and GWG of AA women obtained from CDC PRAMS must explicitly indicate their race or ethnicity as AA or Black.

Instrumentation

From the CDC PRAMS database, the essential data were as follows: the race and ethnicity of a mother, number of prenatal care visits, maternal and education status of the mother, maternal tobacco usage, maternal alcohol usage, the weight of the infant at birth, and the weight of mothers giving birth. Similarly, a typical infant death certificate contains essential data such as:

- sex of the deceased;
- age;
- time of death;
- manner of death;
- if female, is the decedent person pregnant at time of death or within past year or not pregnant at time of death;
- mailing address and zip code;
- decedent's level of education;
- race/ethnicity;
- occupation;
- marital status; and
- cause of death.

Threats to Validity

Validity is important in quantitative-based research for data integrity and accuracy. Accuracy cannot be established without consistency. Consistency is the primary element of reliability. A reliable instrument produces a consistent result or outcome (Forthofer et al., 2007). Internal validity is achieved through the reduction of systemic bias or systemic error by ensuring that the measures accurately assess the intended constructs for the population in the study (Patino & Carvalho Ferreira, 2018).

Threats to internal validity may include history, maturation, and error in the selection of participants or measurement.

The 2016, 2017, and 2018 Mississippi PRAMS data used in this study were collected using standardized tools that have been verified by the CDC. The CDC provided trainings to the interviewers on how to collect the data from participants. All data collected were verified and validated by the CDC (CDC, 2019). External validity refers to the ability to apply study findings outside of the population included in the study (Patino & Carvalho Ferreira, 2018). This study included a small sample of AA women aged 30–47 years old who were included in the 2016, 2017, and 2018 Mississippi PRAMS datasets; therefore, it is difficult to generalize the findings of this study to other populations. Additionally, I only controlled for education and income. There are other factors that could have influenced the results that were not controlled.

The secondary Mississippi state-level data obtained about pregnancy and the first few months after birth were provided by CDC PRAMS. The CDC PRAMS datasets are often used by researchers and institutions to investigate emerging health issues relating to maternal and child health (CDC, 2019). These data inform local and state leaders on the need for enhanced policies to reduce incidence and prevalence of maternal and neonatal health adverse health outcomes.

Data Analysis Plan

I used binary logistic regressions to examine the association between GWG and level of education and infant mortality among AA women aged 30–47 who reside in Mississippi and have normal and abnormal body weight. I employed a quantitative research method due to the objective nature of the research inquiry. I assessed the current research inquiry using a secondary data collection approach.

I received Walden University IRB approval before access to the data was granted (IRB Approval No. 04-27-21-0260635). The CDC has a repository of secondary databases from CDC PRAMS. The infant deaths included in this study were children birthed by AA mothers. The infant mortality cases included in the current study were infant deaths that occurred during pregnancy, before childbirth, or after child delivery. I used SPSS software for both the descriptive and inferential statistics in this study.

The 2016, 2017, and 2018 Mississippi PRAMS datasets were used for the data analysis. The personal and protected information of participants was not disclosed. I used the statistical power of 80% (0.8) with a beta value of 20% (0.2); Type II error/false negative) to estimate the minimum sample size required for this current study. In addition, I used a predetermined effect size of 1.5 for a binary logistic regression for a two-tail test for the sample size estimation. Based on these conditions computed in the G*Power software, the minimum sample size required for this study to establish a statistical power of 80% was 308. I used a predetermined alpha value of 5% (0.05), Type 1 error/false positive), and confidence level of 95% (0.95) to determine the statistical significance. I performed descriptive and inferential analyses using SPSS® 25 statistical software (IBM, 2012).

Descriptive Statistics

I conducted descriptive analysis to describe the study variables. I describe the frequencies and percentages of the categorical study variables (GWG and infant mortality) in Chapter 4. In addition, Chapter 4 also details the descriptive statistics of the confounders, education level, income, and the demographics of age, income, level of education, race (AA), BMI, infant death, and GWG.

Binary Logistic Regression

I used binary logistic regression analysis as the appropriate inferential statistical test to model relationships between dependent and independent variables in the cohorts. Binary logistic regression is an appropriate analysis to conduct when the research questions involve examining associations between one or more independent variables and a single dichotomous dependent variable (Stevens, 2009). In this study, the dependent variable (infant mortality) was dichotomous, and the study involved multiple independent variables and covariates (GWG, level of education, and income) that were both categorical and continuous. Therefore, binary logistic regression analysis was appropriate to conduct.

I examined the assumptions of binary logistic regression prior to the analysis. Binary logistic regression analysis does not require many of the assumptions of ordinary least squares linear regression. For example, binary logistic regression does not assume normality and homoscedasticity of the residuals. Binary logistic regression does require that there is no severe multicollinearity among the independent variables. I assessed multicollinearity by calculating variance inflation factors (VIFs). VIF values over 10 suggest that multicollinearity is a problem (Stevens, 2009). I removed any variables causing severe multicollinearity from the regression models.

Research Question 1

I conducted binary logistic regressions to address Research Question 1. In this binary regression analysis, the dependent variable was infant mortality, and the independent variable was GWG (25–35 lbs and >35 lbs). I based the overall statistical significance of the research inquiries on the alpha level of .05 (5%) predetermined Type 1 error limit. In other words, the null hypothesis was rejected if the estimated *p*-value was less than the .05 alpha value. However, the null hypothesis was not rejected if the estimated *p*-value was greater than .05 alpha value. I calculated the odds ratio to estimate the effect or the risk of infant mortality among women who reported GWG.

Research Question 2

Similarly, I analyzed the second research question using a binary logistic regression approach. For Research Question 2, the dependent variable was infant mortality, the independent variable was GWG (25–30 lbs and >35 lbs), and the covariate was income. Similar to the analysis for Research Question 1, the significance for Research Question 2 was evaluated using an alpha value of .05 (5%). The null hypothesis was rejected if the estimated *p*-value was less than .05 alpha value. On the other hand, the null hypothesis was not rejected if the estimated *p*-value was greater than .05 alpha value. I calculated the odds ratio to estimate the effect or the risk of infant mortality among women who reported less than normal GWG (25–30 lbs and greater than normal GWG>35 lbs).

Research Question 3

Lastly, I conducted a binary logistic regression to address the third research question. For the third research question, the independent variables were education level and GWG and the dependent variable was infant mortality. The covariate was income. Like Research Questions 1 and 2, I used an alpha value of .05 (5%) to assess the significance of the association between GWG (>35 lbs) and infant mortality.

Ethical Procedures

The Walden University IRB provides guidelines for ethical research conducted by doctoral candidates at the university, and I applied for and received IRB approval prior to conducting this study. I secured additional approval to use secondary data from the PRAMS database from the CDC before the data were accessed for this research. All requirements associated with approval, such as acknowledgment of the PRAMS Working Group and submission of the manuscript for approval prior to publication, were met.

The current study used secondary data; thus, no primary data collection involving contact with study participants took place. All data received from secondary sources, including the CDC PRAMS database, were deidentified, thus guaranteeing the anonymity of all study participants. Upon accession of the Mississippi state-level data from the CDC PRAMS, I took steps to safeguard data in accordance with ethical conventions and specific requirements from the Walden IRB and CDC. All data were kept electronically, and no paper copies of any portions of the data set were created. Data files were password-protected and stored on an external file drive, which was stored in a locked file cabinet. Only I have access to the password or to the data set. Data will be stored in this way for 5 years, after which all data will be destroyed by erasing the file and formatting the external drive to prevent retrieval.

Summary

I have described my research methodology in detail in this chapter. I used a cross-sectional study design and analyzed secondary data obtained from the CDC PRAMS database. The purpose of this study was to examine the association between GWG (25–35lbs), (25-30lbs), (> 35lbs), level of education, income, and infant mortality among AA women with normal prepregnancy body weight who were between 30 and 47 years old in the state of Mississippi from 2016 to 2018. In the current study, the independent variables were GWG and level of education and the dependent variable was infant mortality. I controlled for income to isolate the effects of the independent variables on the dependent variable. The constraints in terms of time and resources with the design choice included the protocol of obtaining IRB approval from Walden University and CDC PRAMS. CDC PRAMS is maintained by the CDC's Division of Reproductive Health, which collaborates with all the state health departments in the United States. Chapter 4 provides descriptive and inferential statistics as they pertain to the results of the current study.

Chapter 4: Results

The purpose of this study was to examine the association between GWG (25lbs–35lbs), (25-30lbs), (> 35lbs), level of education, income, and infant mortality among AA women with normal prepregnancy body weight who were between 30 and 47 years old in the state of Mississippi from 2016 to 2018. There were three research questions in this study. Infant mortality is the dependent variable for all the research questions. GWG was the independent variable for RQ1 and 2 and education was the independent variable for RQ3. The confounder accounted for in this study is maternal income. In this section, I described the data collection processes, analyzed, and discussed the descriptive and inferential analyses.

Research Questions and Hypotheses

RQ1: What is the association between normal GWG (25–35lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds?

$H_0$1: No association exists between normal GWG (25–35lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds.

H_a1: An association exists between normal GWG (25–35 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds.

RQ2: What is the association between less than normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income?

$H_0 2$: No association exists between less than normal GWG (25–30lbs) and infant mortality among AA women in Mississippi with normal prepregnancy body weight (25–35lbs) who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income.

$H_a 2$: An association exists between less than normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi with normal body weight (25–35 lbs) who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income.

RQ3: What is the association between the level of education and infant mortality among AA women with normal body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income?

$H_0 3$: No association exists between the level of education and infant mortality among AA women with normal body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income.

$H_a 3$: An association exists between the level of education and infant mortality among AA women with normal body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income.

Data Collection

The data used in this study were collected by the CDC through PRAMS, a population-based surveillance program. The PRAMS datasets that I used comprised deidentified aggregate data available in the public domain at the CDC PRAMS website. In this study, I used the Mississippi PRAMS 2016, 2017, and 2018 datasets and included only AA women aged 30–47 years who gave birth to a child. I merged the three datasets using SPSS before conducting the descriptive and inferential analyses. After merging the datasets, I cleaned and transformed the study variables as I described and operationalized in Chapter 3. The study variables I transformed and operationalized were race (AA); age (30–47 years old); GWG (25–30 lbs,(25–35 lbs), (36 lbs or greater); maternal education (primary, high school, college, higher education); BMI (normal, overweight, obese); maternal income ($0–$60,000, $60,001–$85,000, $85,0001 or greater); and infant mortality (infant death cases).

Results

I conducted descriptive analyses for GWG, infant mortality, income level, race, maternal age, and maternal BMI for AA women who lived in Mississippi and participated in the 2016, 2017, and 2018 Mississippi PRAMS. GWG was the predictor variable for both RQ1 and RQ2. Education was the predictor variable for RQ3. Income was the confounder. Infant mortality or death was the criterion for the three research questions. The descriptive analysis provided information about the distribution count and proportion of the variables implicated in the analysis. The inferential analysis provided information about the significance of the research questions and effect size of the association between the predictor and the criterion variables for the three research questions.

Descriptive Statistics

In this study, a total of 1,255 births were reported by AA women aged 30–47 years old who participated in the 2016, 2017, and 2018 Mississippi PRAMS. Of the 1,255 births, 1203 (95.9%) infants survived, and 52 (4.1%) infant deaths were reported (see Table 5). The total number of AA women included in the inferential analysis was described in detail in the inferential analysis section.

Table 5

Maternal Age and Infant Mortality Distribution of AA Women, 2016, 2017, and 2018 Mississippi PRAMS

		Infant mortality		
Maternal age		Alive	Dead	Total
30–47 years old	African American women	1203	52	1255
	Total	1203	52	1255

Gestational Weight Gain

Among AA women aged 30–47 years old, a total of 513 reported their GWG for these categories specified in the research questions: 25–30 lbs, 25–35 lbs, and 36 lbs or greater. Of 513 AA women aged 30–47 years old, 241 (47%) reported GWG between 25–30 lbs, whereas 58 (11.3%) reported GWG between 25–35 lbs. In addition, 214 (41.7%) AA women reported GWG of 36 lbs or greater (see Table 6 and Figure 2).

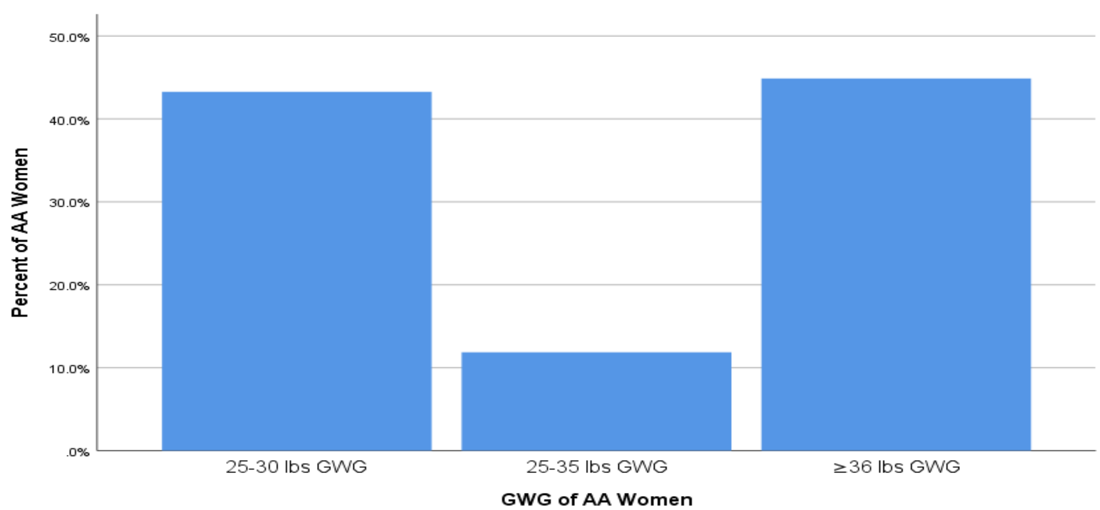
Table 6

Maternal Age (30–47 Years Old) and GWG Distribution of AA Women, 2016, 2017, and 2018 Mississippi PRAMS

Maternal age	GWG	African American Women
30–47 Years Old	25–30 lbs	241
	25–35 lbs	58
	≥36 lbs	214
	Total	513

Figure 2

Proportion of Maternal age and GWG of AA Women, 2016, 2017, and 2018 Mississippi PRAMS



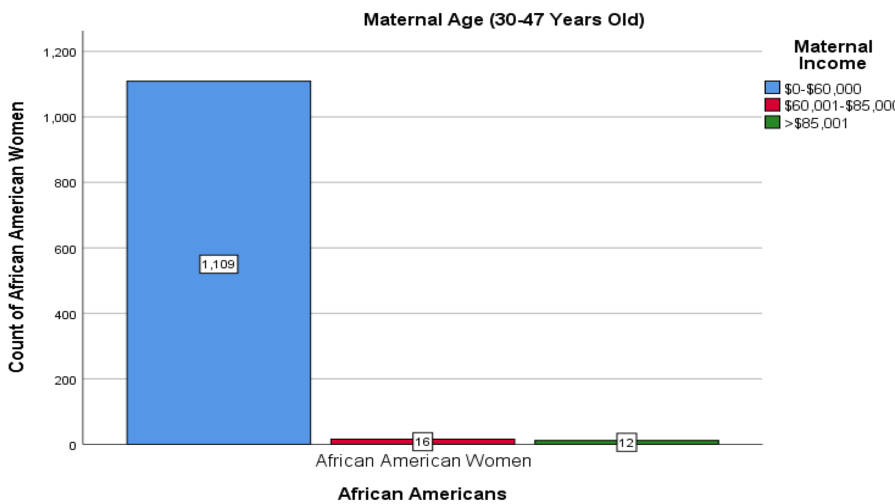
Income

Maternal income was the confounder in this study. Maternal income was grouped into three interval categories: low income ($0–$60,000), middle income ($60,001–

$85,000), and high income (>$85,001). Of 1,137 AA women aged 30–47 years old, 1,109 (97.5%) reported income between $0–$60,000. A total of 16 (1.4%) AA women reported income between $60,001–$85,000, whereas 12 (1.1%) AA women reported earned income of $85,001 or greater (see Figure 3).

Figure 3

Proportion of Maternal Income of AA Women Ages 30–47 Years Old, 2016, 2017, and 2018 Mississippi PRAMS

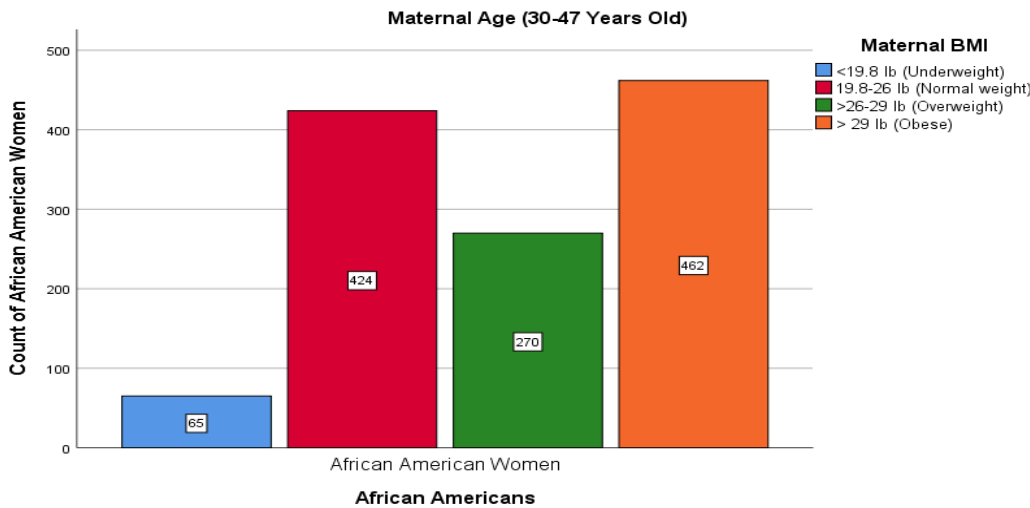


Maternal BMI

In this study, the maternal BMI of AA women was grouped into four BMI categories: <19.8 (underweight), 19.8–26 (normal weight), >26–29 (overweight), and >29 (obese). A total of 1,221 AA women reported their BMI. Of 1,221 AA women, 65 (5.3%) were underweight, 424 (34.7%) were normal weight, 270 (22.1%) were overweight, and 462 (37.8%) were obese (see Figure 4).

Figure 4

Proportion of Maternal BMI Among AA Women Ages 30–47 Years Old, 2016, 2017, and 2018 Mississippi PRAMS

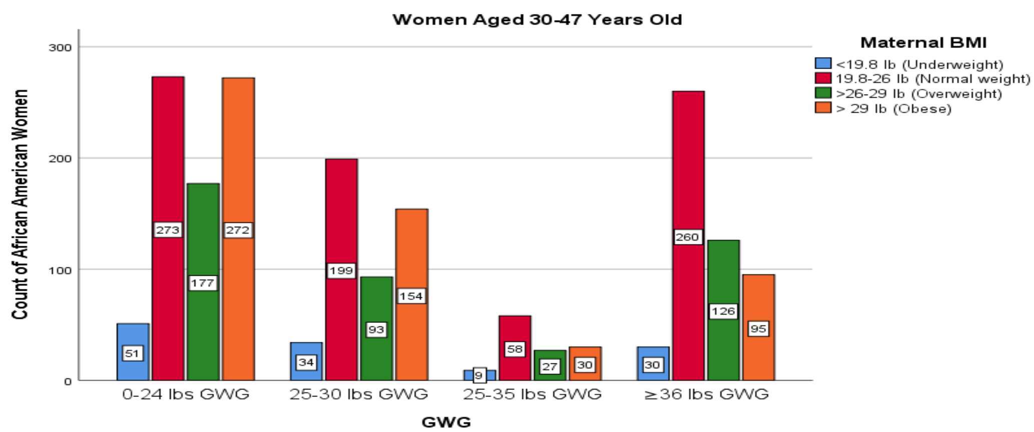


Maternal BMI Stratified by Maternal GWG

Maternal GWG categories included and addressed in this study are 25–30 lbs, 25–35 lbs, and ≥ 36 lbs. A total of 1,115 AA women aged 30–47 years old with GWG categories were included in the descriptive analysis. Of the 1,115 AA women, 480 (43.0%) reported GWG between 25–30 lbs. A total of 124 (11.1%) AA women aged 30–47 years old reported GWG between 25–35 lbs, whereas 511 (45.8%) AA women of the same age group reported a GWG of 36 or greater (see Figure 5). In each of these categories in Figure 5, the maternal BMI was also reported accordingly.

Figure 5

Proportion of GWG Among AA Women Ages 30–47 Years Old, 2016, 2017, and 2018 Mississippi PRAMS

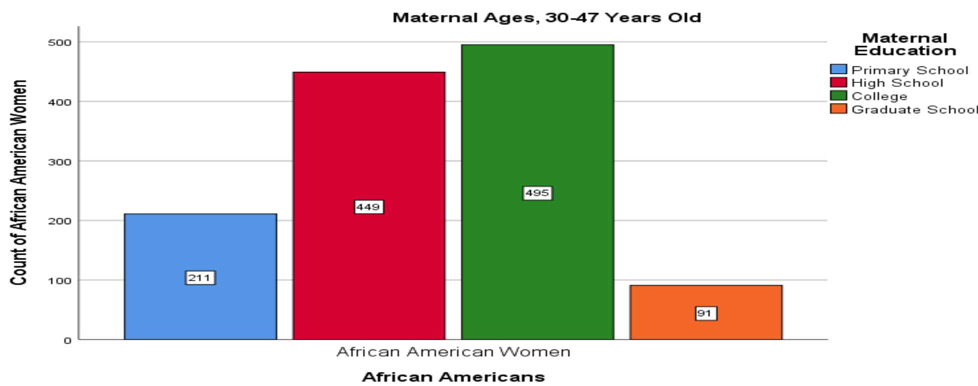


African Americans Stratified by Maternal Education

Among AA women aged 30–47 years old, a total of 1,246 reported their education status. Of these 1,246 AA women, a total of 211(16.9%) had a primary education. A total of 449 (36.0%) AA women had a high school education. A total of 495 (39.7%) of AA women had a college education and 91 (7.3%) AA women had a graduate education (see Figure 6).

Figure 6

Proportion of AA Women Aged 30–47 Years Old with Education status, 2016, 2017, and 2018 Mississippi PRAMS



Inferential Analysis

I used the inferential statistics described in this analysis to explain the significance, magnitude of the effect of the association, and direction of the correlation between the predictor variables (GWG and education) and criterion variable (infant mortality/death) among AA women aged 30–47 years old in Mississippi. The confounder controlled in the analysis was income (low, middle, and high level). The following are the three research questions analyzed in the study.

Research Question 1

RQ1: What is the association between normal GWG (25–35 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds?

$H_0$1: No association exists between normal GWG (25–35 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds.

H_a1: An association exists between normal GWG (25–35 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds.

In this model summary analysis, the model summary estimates predicted the difference in variance observed between GWG and infant mortality after controlling for maternal income. Based on the Cox and Snell model, 0.0% of the variance in the infant mortality or death can be explained by GWG, whereas the Nagelkerke model suggested that 0.1% of infant mortality variance can be explained by GWG (see Table 7).

Table 7

Model Summary Analysis of GWG and Infant Mortality Among AA Women Aged 30–47 Years

Step	−2Log likelihood	Cox & Snell *R* Square	Nagelkerke *R* Square
1	233.999a	.000	.001

Note. a. Estimation terminated at iteration number 7 because parameter estimates changed by less than .001.

In this analysis, of 1669 infants born by AA women aged 30–47 years old who reported their GWG, 1647 (98.7%) infants survived and 22 (1.3%) died (see Table 8).

Table 8

Classification Table of GWG and Infant Mortality Among AA Women Aged 30–47 Years Old

			Predicted		
			Infant mortality		
	Observed		Alive	Dead	Percentage correct
Step 1	Infant mortality	Alive	1647	0	100.0
		Dead	22	0	0.0
	Overall percentage				98.7

Note. a. The cut value is .500.

In this analysis, the association between AA women aged 30–47 years old with GWG between 25–35 lbs and infant mortality was analyzed. AA women of the same age group with GWG ≥36 lbs was the reference category. Based on the analysis, AA women with GWG (25–35 lbs) did not significantly (p = 0.717, OR = 0.754) predict infant mortality compared to AA women with GWG (≥36 lbs). Based on the findings, the null hypothesis was not rejected. Thus, there was no association between GWG (25–35 lbs) and infant mortality among AA women aged 30–47 years old in Mississippi compared to AA women with GWG greater than 35 pounds. For the odds ratio analysis, children of AA women aged 30–47 years old with GWG (25–35 lbs) were 0.25 times less likely to experience infant mortality (see Table 9).

Table 9

GWG and Infant Mortality Parameter Estimate Among AA Women Aged 30–47 Years Old

	Variable	*B*	*S.E.*	Wald	*df*	Sig.	Odds ratio	95% C.I. for odds ratio	
								Lower	Upper
Step 1[a]	GWG (≥ 36 lbs)			.170	2	.919			
	GWG (25–30 lbs)	.037	.450	.007	1	.934	1.038	.429	2.509
	GWG (25–35 lbs)	−.282	.779	.131	1	.717	.754	.164	3.470
	Constant	−4.303	.318	182.662	1	.000	.014		

Note. A. Variable(s) entered on Step 1: GWG.

Research Question 2

RQ2: What is the association between normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income?

> $H_0$2: No association exists between less than normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi with normal body weight (25–35 lbs) who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income.

> H_a2: An association exists between less than normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi with normal body weight (25–35

lbs.) who are between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income.

In this model summary analysis, the model summary estimates predicted the difference in variance observed between GWG and infant mortality after controlling for maternal income. Based on the Cox and Snell model, 0.4% of the variance in the infant mortality or death can be explained by GWG, while the Nagelkerke model suggested that 2.8% of infant mortality variance can be explained by GWG (see Table 10).

Table 10

GWG, Infant mortality, and Maternal Income Model Summary of AA Women Aged 30–47 Years

Step	−2Log likelihood	Cox & Snell *R* Square	Nagelkerke *R* Square
1	226.420a	.004	.028

Note. a. Estimation terminated at iteration number 20 because maximum iterations has been reached.

In this analysis, of 1610 infants born by AA women aged 30–47 years old who reported their GWG and maternal income, a total of 1588 (98.6%) infants survived and 22 (1.4%) died (see Table 11).

Table 11

Classification Table of GWG, Infant Mortality, and Maternal Income of AA Women Aged 30–47 Years Old

			Predicted		
			Infant mortality		
Observed			Alive	Dead	Percentage correct
Step 1	Infant mortality	Alive	1588	0	100.0
		Dead	22	0	0.0
	Overall percentage				98.6

Note. a. The cut value is .500.

In this analysis, the association between GWG and infant mortality after controlling for income was analyzed. AA women aged 30–47 with GWG 36 lbs or greater was the reference group for the GWG category. Also, AA women aged 30–47 years old with an earned income greater than $85,001 was the reference for the maternal income category. Based on the analysis, AA women aged 30–47 years old with a GWG of 25–30 lbs did not significantly (p = 0.987, *OR* = 1.008) predict infant mortality compared to AA women of the same age group with GWG 36 lbs or greater. Furthermore, maternal income ($0–$60,000 and $60,001–$85,000) were not statistically significant (p = 0.081, *OR* = 0.429; p = 996*, OR* = 0.0, respectively). Based on the findings, the null hypothesis for Research Question 2 was not rejected. For the odds ratio analysis, AA women aged 30–47 years old with GWG between 25–30 lbs were 1.008 times more likely to have infant mortality compared to those with GWG 36 lbs or greater after accounting for maternal income (see Table 12).

Table 12

GWG, Infant Mortality, and Income Parameter Estimate Among AA Women Aged 30–47 Years Old

	Variable	*B*	*S.E.*	Wald	*df*	Sig.	Odds ratio	95% C.I. for odds ratio	
								Lower	Upper
Step 1[a]	GWG (≥ 36 lbs)			0.171	2	0.918			
	GWG (25–30 lbs)	0.01	0.45	0.000	1	0.987	1.008	0.416	2.439
	GWG (25–35 lbs)	−0.31	0.78	0.152	1	0.696	0.737	0.159	3.411
	Income (>$85,001)			3.039	2	0.219			
	Income ($0–$60,000	-.085	0.49	3.039	1	0.081	0.429	0.166	1.111
	Income ($60,001–$85,000)	-17.66	3681.9	0.000	1	0.996	0.000	0.000	0.000
	Constant	−3.50	0.48	52.844	1	0.000	0.030		

Note. a. Variable(s) entered on Step 1: GWG, maternal income.

Research Question 3

RQ3: What is the association between the level of education and infant mortality among AA women with normal body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income?

$H_0$3: No association exists between the level of education and infant mortality among AA women with normal body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income.

*H*a3: An association exists between the level of education and infant mortality among AA women with normal body weight who are between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income.

In this model summary analysis, I analyzed the difference in variance observed between education level and infant mortality among AA women with normal GWG after controlling for maternal income. Based on the Cox and Snell model, 0.4% of the variance in the infant mortality or death can be explained by education level, while the Nagelkerke model suggested that 3.3% of infant mortality variance can be explained by education level (see Table 13).

Table 13

Model Summary for Maternal Education, Infant Mortality, GWG, and Maternal Income Among AA Women Aged 30–47 Years Old

Step	−2Log likelihood	Cox & Snell *R* Square	Nagelkerke *R* Square
1	225.291a	.004	.033

Note. a. Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

For the Research Question 3 analysis, a total of 1,605 infants were born by AA women aged 30–47 years old. Of the 1,605 infants, 1,583 (98.65) survived and 22 (1.4%) infants died (see Table 14).

Table 14

Classification Table for Maternal Education, Infant Mortality, GWG, and Maternal Income Among AA Women Aged 30–47 Years Old

			Predicted		
			Infant mortality		
Observed			Alive	Dead	Percentage correct
Step 1	Infant mortality	Alive	1583	0	100.0
		Dead	22	0	0.0
	Overall percentage				98.6

Based on the analysis, the recommended GWG of 25–30 lbs did not significantly (p = 0.971, *OR* = 1.02) predict infant mortality compared to a GWG of ≥36 lbs. Also, GWG (25–35 lbs) was not statistically significant (p = 0.699, *OR* = 0.74) in predicting infant mortality compared to GWG ≥36 lbs. Furthermore, primary school, high school, and college were not statistically significant (p = 0.747, *OR* = 1.36; p = 0.709, *OR* = 1.34; p = 0.362, *OR* = 1.83, respectively) in predicting infant mortality among AA women aged 30–47 years old. In addition, the maternal income range of $0–$60,000 was not statistically significant (p = 0.079, *OR* = 0.34) in predicting infant mortality among AA women aged 30–47 years old compared to those with income $85,001 or greater. Similarly, $60,001–$85,000 was not statistically significant (p = 0.996) in predicting infant mortality among AA women aged 30–47 years old compared to those with income $85,001 or greater.

Based on the findings, the null hypothesis was not rejected, thus suggesting that there was no association between education level and infant mortality among AA women with GWG of 25–30 pounds when compared to AA women with GWG greater than 35 pounds. Nonetheless, respectively, AA women aged 30–47 years old with a college education or high school or primary education were 1.83 or 1.34 or 1.36 times more likely than women with graduate education to have infant mortality cases (see Table 15).

Table 15

Maternal Education Level, Infant Mortality, GWG, and Maternal Income Parameter Estimates

								95% C.I. for odds ratio	
	Variable	*B*	*S.E.*	Wald	*df*	Sig.	Odds ratio	Lower	Upper
Step 1[a]	Maternal education (higher)			1.02	3	0.798			
	Primary school	0.31	0.96	0.10	1	0.747	1.36	0.209	8.885
	High school	0.29	0.78	0.14	1	0.709	1.34	0.288	6.236
	College	0.61	0.67	0.83	1	0.362	1.83	0.498	6.750
	GWG (≥ 36 lbs)			0.17	2	0.917			
	GWG (25–30 lbs)	0.02	0.45	0.001	1	0.971	1.02	0.420	2.464
	GWG (25–35 lbs)	−0.30	0.78	0.15	1	0.699	0.74	0.160	3.424
	Maternal income >$85,001			3.08	2	0.215			
	$0–$60,000	−1.09	0.62	3.08	1	0.079	0.34	0.099	1.137
	$60,001–$85,000	−17.77	3664.25	0.00	1	0.996	0.00	0.000	0.000
	Constant	−3.67	0.54	46.75	1	0.000	0.03		

Note. a. Variable(s) entered on Step 1: Maternal education, GWG, maternal income.

Summary

Three research questions and corresponding hypotheses were analyzed in this study for AA women aged 30–47 years old. The first research question, which focused on association between GWG (25–35 lbs) and infant death, did not significantly ($p = 0.717$, $OR = 0.754$) predict infant mortality compared to AA with GWG greater than 35 lbs. Therefore, I failed to reject the null hypothesis. In this study, there was no association between normal GWG (25–35 lbs) and infant mortality among AA women aged 30–47 years old in Mississippi when compared to women with GWG greater than 35 pounds. For the estimated odds ratio, AA women with normal weight and normal GWG were 0.25 times less likely to have infant mortality compared to those with GWG 36 lbs or greater.

The second research question focused on the association between GWG of 25–30 lbs and infant mortality among AA in Mississippi when compared to AA women with GWG greater than 35 pounds after controlling for income. In this analysis, GWG (25–30 lbs) did not significantly ($p = 0.987$, $OR = 1.008$) predict infant mortality. In addition, maternal income was not statistically significant ($p = 0.079$ [$0–$60,000]; $p = 0.996$ [$60,001–$85,000]) in predicting infant mortality in this analysis. The null hypothesis was rejected for Research Question 2. Therefore, there was no association between normal GWG (25–30 lbs) and infant mortality among AA women when compared to AA women with GWG greater than 35 pounds.

In addition, the association between education level and infant mortality among AA women after controlling for maternal income was examined. In this analysis, GWG (25–30 lbs or 25–35 lbs) did not significantly ($p = 0.971$, $OR = 1.02$; $p = 0.699$, $OR =$

0.74, respectively) predict infant mortality compared to those with GWG of 36 lbs or greater. Furthermore, primary school, high school, and college were not statistically significant ($p = 0.747$, $OR = 1.36$; $p = 0.709$, $OR = 1.34$; $p = 0.362$, $OR = 1.83$, respectively) in predicting infant mortality among AA women explored in this study conditions. In addition, maternal income was not statistically significant ($p = 0.079$ [$0–$60,000]; $p = 0.996$ [$60,001–$85,000]) in predicting infant mortality. Therefore, I also rejected the null hypothesis. Thus, there was no association between education level and infant mortality among AA women in Mississippi when compared to AA women with GWG greater than 35 pounds after controlling for income.

In Chapter 5, I further explain how the study results inform maternal and infant health and public health discipline. I also provide recommendations on how to improve and promote effective public health structures to increase awareness on maternal and infant health to further reduce infant mortality in Mississippi. Additionally, I discuss how to address the barriers and limitations observed in this study and explain how the study can be improved. Other recommendations that I provide focus on the need to increase the sample size of AA women aged 30–47 in PRAMS in Mississippi to ensure accurate representation of the population with cases of infant mortality in that state.

Chapter 5: Discussion, Conclusions, and Recommendations

In this study, I examined the association between different levels of GWG (25–30 lbs, 25–35 lbs, and 36 lbs or greater), level of education, and infant mortality among AA women aged 30 and 47 years old in Mississippi after controlling for income. In Mississippi, infant mortality among AA women is a public health concern and has led to public health and medical interventions. In addition, maternal GWG is also a risk factor for adverse maternal and infant health (Bodnar et al., 2016). The study findings suggest that GWG, education, and income among AA women included in the 2016, 2017, and 2018 PRAMS datasets did not significantly predict infant mortality for AA women aged 30 and 47 years old in Mississippi.

Interpretation of the Findings

Three research questions and their corresponding hypotheses were analyzed in this study. In the first research question, I examined the association between normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi who were between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds. Based on the analysis, AA women with normal GWG (25–35 lbs) did not significantly ($p = 0.717$, $OR = 0.754$) predict infant mortality compared to AA women with above the recommended GWG (≥36 lbs). Therefore, the null hypothesis was not rejected for this research question. This finding did not align with Meng et al.'s (2018) and Meehan et al.'s (2014) prior study findings. Meng et al. found that maternal obesity and high GWG were health risks associated with adverse birth and pregnancy outcomes. Similarly, Meehan et al. suggested that the odds of infant deaths are higher among obese mothers; obesity is a risk factor likely to increase in women with greater maternal weight or BMI during pregnancy.

For the second research question, I examined the association between less than normal GWG (25–30 lbs) and infant mortality among AA women in Mississippi who were between the ages of 30 to 47 years old when compared to women with GWG greater than 35 pounds after accounting for income. Based on the study analysis, AA women aged 30–47 years old with GWG of 25–30 lbs did not significantly (p = 0.987, OR =1.008) predict infant mortality compared to AA women of the same age group with a GWG of 36 lbs or greater after accounting for income. In addition, maternal income ($0–$60,000 and $60,001–$85,000) did not significantly (p = 0.081, OR = 0.429; p = 996, OR = 0.0, respectively) predict infant mortality. Therefore, the null hypothesis was rejected as well for this research question. This finding did not support Goldstein et al.'s (2017) study results, which suggested that GWG above the recommended weight was related to greater risk of adverse health impact for the mother and infant. In the current study, the adverse outcomes of infant mortality investigated were not significantly different for mothers with GWG of 25–30 lbs and 36 lbs or greater.

For the third research question, I examined the association between the level of education and infant mortality among AA women with normal body weight who were between the ages of 30 to 47 years old in Mississippi when compared to women with GWG greater than 35 pounds after accounting for income. Primary school, high school, and college were not statistically significant (p = 0.747, OR = 1.36; p = 0.709, OR = 1.34; and p = 0.362, OR = 1.83, respectively) in predicting infant mortality among AA women aged 30–47 years old compared those with higher education. Also, AA women aged 30–47 years old with GWG of 25–30 lbs did not significantly (p = 0.987, OR = 1.008) predict infant mortality compared to AA women of the same age group with a GWG of 36 lbs or greater after accounting for income. In addition, none of the maternal incomes ($0–$60,000 and $60,001–$85,000) significantly (p = 0.081, OR = 0.429; p = 996, OR = 0.0, respectively) predicted infant mortality. Therefore, the null hypothesis was rejected as well for this research question. This current finding did not support Kiross et al. (2019) and many other authors. Many experts have suggested that a lower education level is a risk factor for infant death (Agüero & Bharadwaj, 2014; Kiross et al., 2019; Weldearegawi et al., 2015). These experts suggest that lack of basic knowledge on maintaining a healthy pregnancy leads to high IMRs (Agüero & Bharadwaj, 2014; Kiross et al., 2019; Weldearegawi et al., 2015).

The current study findings suggest no association between various levels of GWG (25–30 lbs and 25–35 lbs), education, and infant mortality among AA women aged 30–47 years old in Mississippi compared to those with GWG greater than 35 lbs. The ecosocial constructs and BPS theoretical model constructs may have influenced the findings because the two theories suggest that biological, sociological, and psychological factors influence health-related outcomes such as infant mortality. Thus, it is possible that the improved biological, sociological, and psychological factors, along with some policies, may have reduced adverse infant health outcomes among AA women in Mississippi.

Limitations of the Study

Several limitations were identified in different areas of the study, including research design, secondary data use, sample size, and data collection and analysis. In this study, the research design applied was cross-sectional; as a result, the findings inferred were not causal, but correlational. Only an experimental or quasi-experimental design finding can be used to infer causality. The 2016, 2017, 2018 PRAMS datasets used for the data analysis were collected by the CDC as surveillance data and were not tailored or intended for this specific study. Therefore, there was no enhanced effort to target AA women aged 30–47 years old and those with GWG between 25–30 lbs, 25–35 lbs, and 36 lbs or greater when the data were collected. In other words, the information used in this analysis was not designed purposely for this study. The sample of AA women aged 30–47 years old with infant deaths used in this study was comprised of combined data from the 2016, 2017, and 2018 Mississippi PRAMS datasets. Even with 3 years of Mississippi PRAMS datasets, the overall sample with the inclusion criteria was still small. Small sample sizes inherently distort research findings through a Type II or Type I error. In addition, it is difficult to generalize the findings outside of the target population because the sample size was very small. In addition, the study was not a multisite study.

Recommendations

Though no statistically significant findings emerged in this study, the purpose of the study and the rationale for which the study was conducted was reasonable and necessary. Based on the findings of the study, important observations were noted. In maternal or infant health settings, several factors can influence infant mortality cases

(Grépin & Bharadwaj, 2015; Keats, 2018; Makate, 2016; Makate & Makate, 2016). Therefore, based on the findings of this study, future studies should be designed to target AA women aged 30–47 with GWG between 25–30 lbs, 25–35 lbs, and 36 lbs or greater to minimize a Type I or Type II error. For instance, with Mississippi PRAMS data collection, AA women who lost a baby or an infant during pregnancy, delivery, or postdelivery should be targeted and included in future PRAMS. In future studies, infant mortality among AA women should be compared to those of other races or ethnic groups (White, Asian, Latino, Native American, Native Hawaiian/Pacific Islanders), as this current study only explored IMRs among AA women.

In addition, it is important to explore infant mortality using the 2016, 2017, and 2018 PRAMS datasets among AA women aged 30–47 years old in other states with a focus on the variables examined in this study. Such comparisons in other states will provide important information on how the variables (GWG, income, education) explored in this study influence infant mortality in other states. Similarly, future studies can also explore the impact of GWG with other local or regional credible data sources on infant mortality, GWG, income, education, and other demographic factors. Mississippi public health departments and medical centers should continue to explore enhanced interventions to further minimize infant deaths among pregnant women in the state.

Social Implications

In many studies, abnormal GWG has been linked to adverse health outcomes such as preterm birth and infant mortality. The status of maternal and infant health predicts the level of well-being of a nation. Improved life expectancy and the quality of life within a population are social determinants of health and social well-being. The findings from the three research questions analyzed were not statistically significant in predicting infant mortality among AA women aged 30–47 years old; however, several social implications surfaced from the study findings. For example, the study findings suggest quantifiable evidence of return of investment on public health and medical intervention efforts, thus reinforcing the impact of public health and medical efforts that are ongoing in the state of Mississippi. Specifically, in Mississippi, current public health programs such as the Golden Hour Neonatal Care (GHNC), Fetal-Infant Mortality Review (FIMR), and Mississippi Perinatal Quality Collaborative (MPQC) offer interventions designed to improve infant and maternal health and reduce preterm birth and infant mortality (MSDH, 2018). Based on the findings of this study, it is possible that these programs had positive social and public health implications in reducing infant mortality among AA women in all BMI and GWG statuses. In addition, Mississippi public health departments can conduct additional assessments to explore whether the infant mortality gaps among AA women or other minority racial groups and Whites have been reduced as well. Programs such as GHNC, FIMR, and MPQC can be empowered by the findings of this study to continue to promote active participation in the programs. The following paragraphs provide a summary of these programs and describe how they benefit mothers and infants in the state of Mississippi.

GHNC is an evidence-based multifaceted stakeholder partnership known to improve birth outcomes and clinical quality improvement initiatives in the state of

Mississippi. GHNC provides a clinical care intervention to preterm infants upon birth or delivery to reduce the risk of complications and death (MSDH, 2018).

The FIMR program is also designed to reduce fetal and infant deaths in Mississippi. The basic operation processes of FIMR are to support maternal or infant health-related reviews, interviews, bereavement support systems, grief, and case review and community action. FIMR teams in Mississippi receive referrals from the hospitals, health systems, clinics, office of Vital Registry, case management programs, and other related perinatal providers. Fetal and infant mortality review includes a multidisciplinary community-based team with a common goal of reducing infant and fetal deaths. The FIMR team is well-trained and understands the ramification of individual cases. The team considers the life-course perspectives and the personal experiences of families, including the impact of racism and other social determinants of health on how the factors affect infant and maternal outcomes.

The MPQC is a multiple stakeholder partnership created to improve birth outcomes using evidence-based clinical quality improvement initiatives (MSDH, 2018). MPQC team is a network of multidisciplinary professionals who work together with many stakeholders in the community to improve the quality of care for babies and mothers. The MPQC and hospital teams in Mississippi implement protocols to support best practices in the care of vulnerable or at-risk neonates and infants. In Mississippi, the MPQC program supports and implements the use of patient safety bundles, which consist of systematic management of severe venous thromboembolism, obstetric hemorrhage, and maternal hypertension in birthing facilities in the state of Mississippi. Patient safety bundles are evidence-based best practices effective in improving patient outcomes. Each provider in the state of Mississippi tailors patient safety bundles that are appropriate for their patient population and needs.

In addition to the GHNC, FIMR, and MPQC, the Alliance for Innovation in Maternal Healthcare (AIM) will also substantially benefit from the findings of this study (MSDH, 2018). AIM was created in the state of Mississippi to address hypertension and heart initiatives. Often, pregnant women have pregnancy-induced hypertension that can lead to adverse health outcomes if not addressed. In Mississippi, the AIM program has been supporting and implementing perinatal quality efforts to improve management and control of hypertension, heart disease, related deaths, and morbidities. AIM will be informed of the study findings, which suggest that infant deaths among AA with normal GWG is not statistically significant in comparison to those with abnormal GWG. The finding may also advance the need for the Cross-Cultural Health Care Program to maintain the momentum of their public health efforts related to maternal and infant health measures.

Conclusions

The purpose of this study was to examine the association between GWG, (25-35lbs), level of education, income and infant mortality among AA women with normal prepregnancy body weight who were between 30 and 47 years old in the state of Mississippi from 2016 to 2018. These associations were examined using the 2016, 2017, and 2018 Mississippi PRAMS datasets. In this study, GWG, education, and income did not significantly predict infant mortality among AA women aged 30–47 years old in

Mississippi. In all three research questions analyzed, there was no statistically significant association between GWG, infant mortality, education, or income. In all three research questions, I failed to reject the null hypotheses.

The findings of this study provide assurance to local, state agencies, and programs currently engaging in enhanced cultural competence training on the importance of application of evidence-based interventions in public health efforts. Additionally, these findings indicate a positive return on investment in the application of evidence-based interventions that address public health needs. Finally, these findings send a strong message that the public health efforts promoted, implemented, and adopted by multidisciplinary public health stakeholders and programs are making noticeable social change in the reduction of infant mortality in Mississippi. Nonetheless, additional studies including a larger sample size of AA women are necessary to further explore the findings of this study.

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