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The Role of Stress: Low Birth Weight and Preterm Birth for African American Women

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by

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ABSTRACT

This population-based study evaluates the impact that ***psychosocial stress*** has on adverse birth outcomes of low birth weight (LBW) and pre-term birth (PTB) among African American mothers in Arkansas. The relationship between adverse birth outcomes in African American women and stress in comparison to non-Hispanic Caucasian women data was evaluated from the Pregnancy Risk Assessment Monitoring System (PRAMS) quantitative survey. Data from 2005 through 2010 was reviewed to show the impact that psychosocial stress has on adverse birth outcomes. The study sample was comprised of 14,196 participants.

Ethnic group status is the key maternal-level independent variable in this study. Of the 14,196 participants, 10,712 (75.5%) were White/Caucasian and 3,484 (24.5%) were Black/African American. In addition to examining the impacts of psychosocial stress, other key independent variables such as cigarette and alcohol use, obesity, lack of prenatal care, marital status, yearly income, and level of education were analyzed through the use of both descriptive and inferential statistics.

The findings of this study support the hypothesis in the bivariate contex that mothers who had higher levels of stress were more likely to have LBW infants as compared to mothers who had lower levels of stress. Mothers who experienced higher numbers of stressors in the past 12 months before their infants were born were significantly more likely to have LBW infants compared to mothers who experienced fewer numbers of stressors in the 12 months before their infants were born. With regard to maternal stress and gestational age status of the infant, results were not significant and did not support the hypothesis. Mothers who had experienced higher numbers of stressors in the 12 months before their infants were born were *not* significantly more

likely to have PTB compared to mothers who experienced fewer numbers of stressors in the past 12 months before their infants were born.

The findings of this study can provide insights for new and innovative healthcare strategies, interventions and support healthcare providers and policy makers in building comprehensive programs and policies aimed at reducing PTB and LBW among African American mothers.

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To my husband, Ronald J. Jenkins Jr. thanks for your continued faith and prayers. We started this journey a long time ago and you have always pushed me even when I did not think I could write another sentence or paragraph. Your words of encouragement sustained and pushed me to pursue my goal. Without your love, support, belief and understanding through this process my dream of earning a doctoral degree would not have been a reality.

To my daughters Savannah and Alexandria Jenkins, thank you for being my patient and sweet little girls, your smiling faces kept me motivated to the end. To all of my family members, close friends and professional colleagues, thank you for your continued support over the years.

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CHAPTER 1:
INTRODUCTION TO THE STUDY

Introduction

One of the most important single causes of infant mortality and neurological disabilities in children in the United States (U.S.) is ***prematurity***, that is, being born at ***low birth weight*** (less than 5 ½ pounds) or ***prior to term*** (less than 37 weeks of pregnancy) (Centers for Disease Control & Prevention, 2013 & Centers for Disease Control & Prevention, 2011). Although a combination of medical advances, expansion of coordinated health care services, and education campaigns over the past 50 years have decreased the incidence of infant mortality in the United States, the issue of disparities between African American and Caucasian infants is yet to be resolved (Rich-Edwards, J. Grizzard, T. 2005). This dissertation will focus on how ***psychosocial stress*** is associated with racial and ethnic disparities of low birth weight (LBW) and preterm birth (PTB) infants when comparing African American to non-Hispanic Caucasian mothers in Arkansas. Moreover, this dissertation will examine individual level-risk factors that may contribute to the adverse birth outcomes of PTB and LBW, such as ***smoking, alcohol consumption, body mass index (BMI), and prenatal care***.

Evaluating these important variables, takes into account the impact that both individual level risk-factors and stress-induced physiologic pathways may have on the disproportionate birth outcomes experienced by African American women in comparison to non-Hispanic Caucasian women (Dominguez, T. 2011 & Lu, M.C. et al., 2010).

African American Women and Adverse Birth Outcomes

The U.S. has made slower progress than most other industrialized countries in reducing infant mortality, stemming largely from the challenges associated with overcoming disparities among racial and ethnic groups. The U.S. infant mortality rate (IMR) has improved for all reported racial and ethnic groups, for all socioeconomic categories and for all categories of maternal education, showing a 3.0% lower rate at 6.68 infant deaths per 1,000 live births in 2006 compared to the IMR of 2005. (Rima, S., Barbara, S. 2009). Declines have continued to follow for IMR from 2005-2011 by 16 percent for non-Hispanic black women and 12 percent for non-Hispanic white women in 4 of the 5 leading causes of IMR.[1] (MacDorman, M.F., Hoyert, D.L., Matthews, T.J. 2013).

These improvements are partially due to advances made in medicine, diagnosis and reporting structures when addressing the risk factors of sudden infant death syndrome (SIDS) and congenital malformations (Mathews & MacDorman, M.F. 2008). Among these risk factors, PTB and LBW have proven to be the most challenging, especially among minority populations (MacDorman, M.F., Hoyert, D.L., Matthews, T.J. 2013).

Between 2000 and 2005, the rate of PTB infants and the rate of LBW each increased by more than 9.0 percent and during the same period, the percentage of infant deaths related to PTB rose from 34.6 percent to 36.5 percent (MacDorman, M.F., Hoyert, D.L., Matthews, T.J. 2013). In 2009, the highest rate, 12.40 per 1,000 live births, was for infants of non-Hispanic black

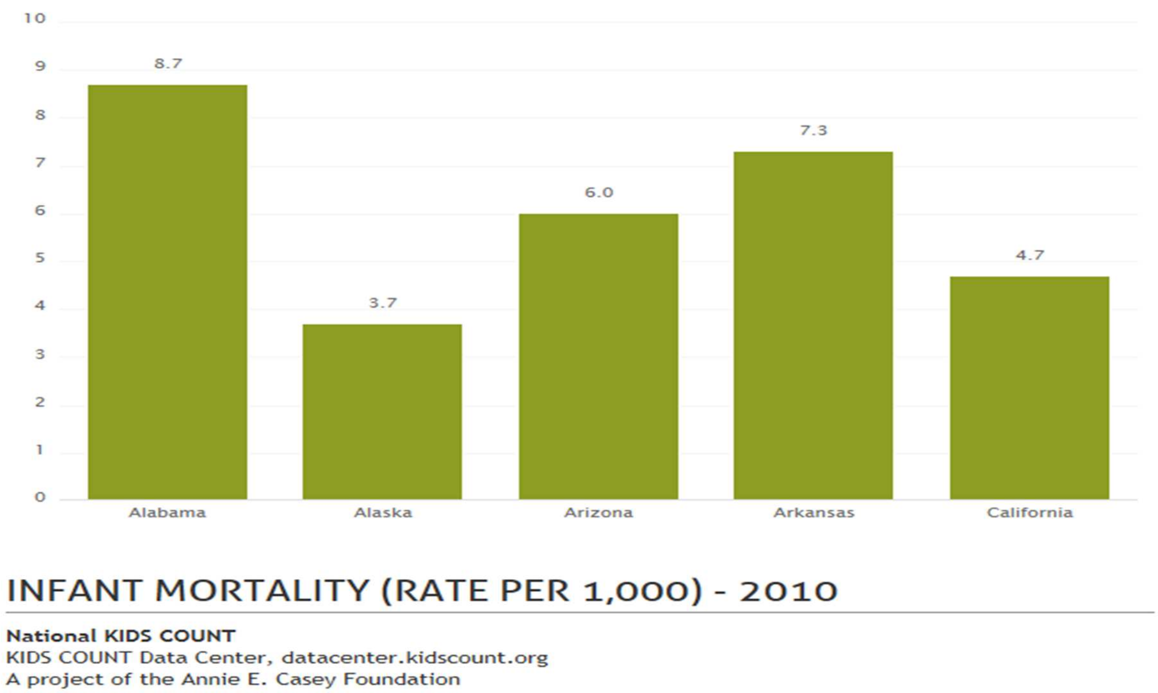
[1] Five leading causes of IMR: The leading cause of infant death in 2011 was 1). Congenital malformations, followed by 2). Short gestation/low birthweight, 3). Sudden infant death syndrome (SIDS), 4). maternal complications, and 5). Unintentional injuries. http://www.cdc.gov/nchs/data/databriefs/db120.pdf

mothers (Mathews, D.L., MacDorman, M.F. 2013). African American infants have 2.3 times the infant mortality rate as Caucasians and are three times more likely to die due to complications related to LBW when compared to non-Hispanic Caucasian infants (U.S. Department of Health & Human Services, Office of Minority Health, 2012) and are at a higher risk of delivering PTB (Ananth, C.V., Misra, D.P., Demisse, K., Smulian, J.C., 2001).

In Arkansas, infant mortality rates from 2003 to 2009 decreased slightly; with a 0.2% decrease in the percentage of infant deaths born prior to 28 weeks gestation and a 0.1% decrease of babies born weighing less than 1000 grams (Nugent, 2012). In comparison to other states, Arkansas ranked 40th place with a 7.3 rate per 1,000 with only 10 other states having a higher IMR (National Kids Count Data Center, 2013). [2]

[2] States with higher IMR than Arkansas: West Virginia, South Carolina, Louisiana, Oklahoma, Indiana, Ohio, Delaware, Tennessee, Alabama, Mississippi.

Table 1.1 Infant Mortality (Rate per 1,000) 2010



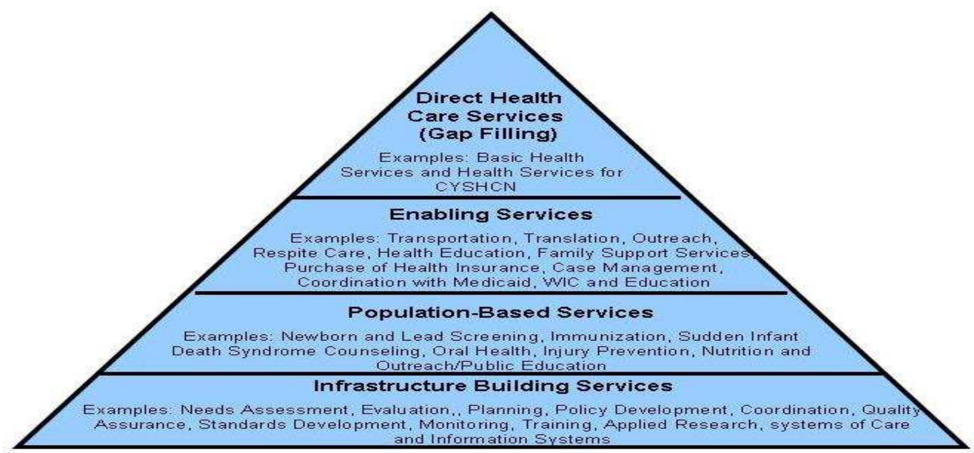
According to the March of Dimes, 2012 Premature Birth Report Card (2013), Arkansas earned the letter grade "D" with a 13.2% PTB rate and during 2008-2010 the average PTB rates in Arkansas were highest for black infants (18.1%) and LBW rates were 8.8% for all demographics (March of Dimes, 2013).

States with high IMR typically have high rates of PTB and LBW (Rauh, V.R., Andrews, H.F., Garfinkel, R.S. 2001). As reported in Table 1.1, in calendar year 2009, 290 Arkansas babies died before their first birthday, for an infant mortality rate of 7.3 deaths per 1000 live births (Nugent, 2012). Higher rates of infant mortality occurred among poor counties, especially in the Mississippi Delta, and greater rates of African American infant deaths were partially due to LBW (Nugent, 2012) and were twice as high as Caucasian birth outcomes.

To address adverse birth outcomes, the Arkansas Department of Health has taken the lead in applying the Pyramid of Maternal Child Health (MCH) Services" framework developed by the

Health Resources and Services Administration (HRSA) of the US Department of Health and Human Services (U.S. DHHS) to their existing maternal and child health practices.[3] Additionally, the importance of integrating interventions that would have an impact on stress and birth outcomes has been brought to the forefront. The Pyramid of MCH framework (Figure 1.1) provides a multi-layer approach to dealing with public health issues such as PTB and LBW.

Figure 1.1: Pyramid of MHC Framework



Which further shows Arkansas's commitment to ensuring quality and continuous service? Arkansas's commitment to decrease adverse birth outcomes such as, PTB and LBW is important; since across the United States, IMR are generally higher in the South and Midwest in comparison to other regions. It has been hypothesized that the variations in IMR between states may be explained in part by the difference in demographics of the population, health system factors and rates of PTB and LBW infants. (Mathews, D.L., MacDorman,M.F. 2010).

[3] Maternal Child Health:
U.S. Department of Health & Human Services. (2012). Health Resources and Services Administration, Maternal and Child Health. MCH Programs and Overview. http://mchb.hrsa.gov/programs/index.html.

Southern states have a high percentage of its population living in poverty and uninsured. States with a larger percentage of the population that are Caucasian have lower IMRs, whereas the opposite is true in states, such as those in the south, that have large percentages are African-Americans (Heisler, E.J. 2012). However, for the most part, the risk for PTB and LBW has been individualized and does not take into account environmental and social factors.

Although, African American women carry a disproportionate burden of individual risk factors, such as unmarried status and late entry into prenatal care, racial differences in the distribution of such risks do not explain the disparity in birth outcomes, nor are interventions based on these factors alone, likely to reduce the racial gap (Rauh, V.R., Andrews, H.F., Garfinkel, R.S. 2001).

There have been numerous studies, attempting to determine causal relationships between individual-level risk factors (e.g. ***smoking, alcohol consumption, BMI, and prenatal care)*** that would explain the disparities gap when comparing African American women and non-Hispanic Caucasian women. Among those studies include the perspectives of, (1). ***environmental influences*** (Janevic et al., 2010); (2) ***behavioral risk factors*** (Visscher, et.al 2003); Centers for Disease Control and Prevention, 2012); (3) ***social contributors*** (Torche, 2011); and (4) ***biological perspective*** (Dunkel-Schetter & Glynn, 2011; Dominguez, 2011). Although a number of these factors are known to be associated with PTB and LBW, researchers, (Collins et al, 2010; Okah et al, 2005 & Collins, Keeley et al, 2003), maintain that much of the etiologies remain inconclusive in determining the association of these factors with adverse birth outcomes in African American pregnancies.

Another factor that is often cited as a contributor to PTB and LBW is ***psychosocial stress*** (Goldstein, A., Barnett, E.S., 2008). African American women may be more susceptible to the effects of prenatal stress than European Americans (Giscombe & Lobel, 2005), which may have a possible impact on adverse birth outcomes such as PTB and LBW infants. In order to apply appropriate solutions to the problem, the consequences associated with stress, as a contributor must be taken into consideration (Torche, F., 2011 & Hobel, C.J., et al, 2008). Examining the role that psychosocial stress may have on adverse birth outcomes will position health care professionals and policymakers to develop strategic policies and programs designed to tackle the long term public health issue of PTB and LBW among African American women.

Statement and Significance of the Problem

According to the Centers for Disease Control and Prevention (CDC, 2011), PTB and LBW are among the top ten reasons for infant mortality. In the United States (U.S.) the infant mortality rate has declined throughout the 20th century, however, data show that there are still large differences in infant mortality rates among racial and ethnic groups (Mathews, D.L., MacDorman, M.F. 2009).

Increasing infant mortality rates and the persistence of racial disparities in health are one of the most widely documented problems and major concerns in the U.S. This long-term disparity is one of the many reasons why Healthy People set national goals in 2010 and 2020 that would address disparities and health equity of PTB and LBW. [4] The goals of Healthy People 2020 were expanded to focus on the social determinants of health, to achieve health equity, eliminate disparities (U.S. Department of Health & Human Services, 2010), improve the health of all groups and reduce the number of PTB and LBW and very low birth weight (VLBW)

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[4] Healthy People is a nationwide health promotion and prevention initiative where goals are set by the United States Department of Health and Human Services. Healthy People provides science-based, 10-year national objectives for improving the health of all Americans. For 3 decades, Healthy People has established benchmarks and monitored progress over time http://www.healthypeople.gov/2020/about/default.aspx

infants (U.S. Department of Health & Human Services, 2009 & The Alliance for Building Communities, 2007). [5]

Often used as an indicator of the health and well-being of the nation, infant mortality is associated with a variety of factors such as maternal health, quality and access to medical care, socioeconomic conditions, and public health practices (Alliance for Building Communities, 2007 & Center for Disease Control & Prevention, 2013). However, studies have shown that the potential benefits of maternal care for the mother and child are justified, but the efficacy of prenatal care as a whole to reduce the risk of some adverse birth outcomes is unclear (Bennett, I.M., Coco, A., Anderson, J. et al. 2009)

Additionally, the emotional toll and financial cost experienced by the mother and family may have negative outcomes when faced with the complications associated with PTB and LBW. Moreover, Behrman, R.B. (2007) as cited in Hodek et al., 2011, identified the impact that PTB and LBW may have on parents, families, and caregivers and how the overall healthcare sector strongly depends on informal care provided by families and other caregivers.

According to the analysis, informal caregivers may experience a significant burden as well as health and well-being effects (Behrman, R.B. (2007) as cited in Hodek et al., 2011). Additionally, the mothers of PTB and LBW infants experience a greater risk of psychological distress than mothers of full-term infants. Results also indicated the infants' state of health, out of pocket expense (OOPE) and emotional distress for parents are significantly increased with decreasing gestational age. Moreover, there is some evidence for a high magnitude of reduced

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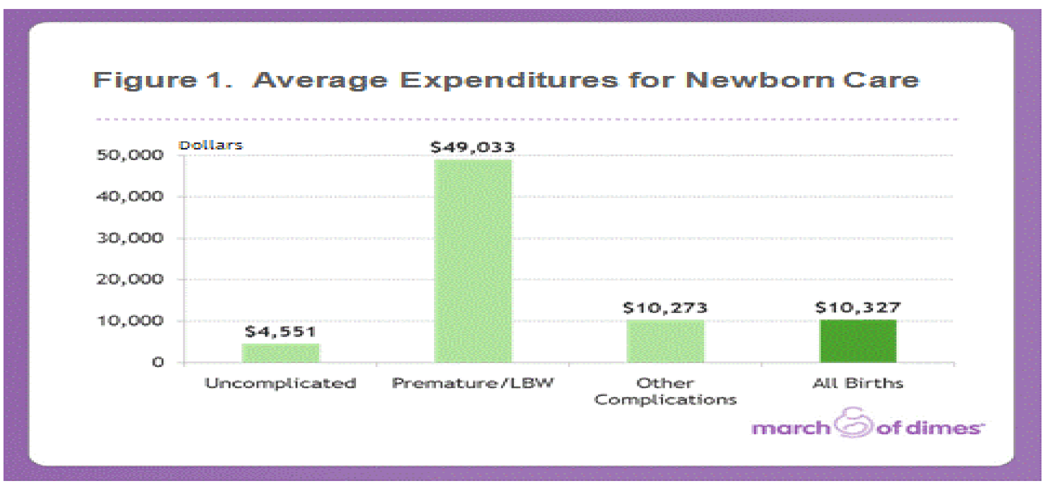
[5] Health equity is defined as the "attainment of the highest level of health for all people. Achieving health equity requires valuing everyone equally with focused and ongoing societal efforts to address avoidable inequalities, historical and contemporary injustices, and the elimination of health and health care disparities

income and missed work days of both the parents and informal caregivers (Hodek, J.M., Vonder-Schulenburg, J.M., Mittendorf, T. 2011).

The Institute of Medicine (2007), noted that in addition to the physical and emotional impact of PTB, recent estimates of the economic cost to the society is at least $26 billion each year for hospitalizations for pre-term infants. In 2008, the March of Dimes contracted Thomas Reuters to conduct a study for large employer health plans that would assess medical cost of newborns. According to the results, medical costs for newborns with complications were significantly higher than those without complications and the average expenditures for PTB and LBW infants were more than 10 times as high in comparison to uncomplicated newborns (see Figure 1).

Figure 1.2: Average Expenditures for Newborn Care (2008)
March of Dimes: The Cost of Prematurity to U.S. Employers.



Life-long challenges with health issues, mental and physical development of infants are felt and may limit potential contributions to society as an adult. Children who are born PTB or at a LBW are more likely to display cognitive deficits are more likely to perform at lower levels on measures of intelligence, language, and academic achievement, require special education, and are less likely to graduate from high school than are those who were full term or normal birth weight (Giscombe & Lobel, 2005).

Furthermore, (Giscombe & Lobel, 2005) LBW is also associated with an increased risk of preventable diseases seen in adults such as, cardiovascular disease, hypertension, non-insulin dependent diabetes mellitus (NIDDM, or Type II) and gestational diabetes, which is a significant risk factor for NIDDM.

Statement of the Purpose

The purpose of this study is to examine psychosocial stress as an possible cause of racial and ethnic disparities of low birth weight (LBW) and preterm birth (PTB) infants among African American and non-Hispanic Caucasian mothers.

Therefore, in an attempt to generate new knowledge, theory-based research will be conducted on the role that psychosocial stress plays in the birth outcomes of African American mothers who reside in Arkansas. Additional factors such as smoking, alcohol consumption, BMI and prenatal care will also be considered. And lastly, this research will examine the impact of social support systems and other relational experiences on coping with psychosocial stress experienced by African American mothers in comparison to non-Hispanic Caucasian mothers.

Research Question and Hypothesis

This research was directed by the following question and hypotheses:

> Is psychosocial stress associated with racial and ethnic disparities of low birth weight (LBW) and preterm birth (PTB) in African American mothers? The objective of this research is to determine if after controlling for several maternal-level independent variables in African American mothers, are the birth outcomes (e.g. low birth weight and pre-term births) disproportionately affected by psychosocial stress?

Hypotheses

Hypothesis 1: Mothers who smoke are more likely to have low birth weight and preterm infants.

Hypothesis 2: Mothers who drink alcohol are more likely to have low birth weight and preterm infants.

Hypothesis 3: Mothers who experience psychosocial stress are more likely to have low birth weight and preterm infants.

Hypothesis 4: Mothers who have a BMI>30 are more likely to have low birth weight and preterm infants.

Hypothesis 5: Mothers who go without prenatal care are more likely to have a low birth weight and preterm infant.

Hypothesis 6: Mothers who identify themselves as African American are more likely to have a low birth weight and preterm infant.

Hypothesis 7: Mothers who are not married are more likely to have low birth weight and preterm infants.

Hypothesis 8: Mothers who are low-income are more likely to have low birth weight and preterm infants.

Hypothesis 9: Mothers who have less than a high school diploma are more likely to have low birth weight and preterm infants.

Limitations of the Study

Several limitations exist when using the Prenatal Risk Assessment Monitoring System (PRAMS) data. First, PRAMS data is based on self-reporting and therefore is not verified by a physician or medical record. Second, recall bias is a factor, women are asked to recall incidents 3-6 months after giving birth and questions are asked regarding behavior during the perinatal period. Due to the long time frame between the birth and when the PRAMS survey was taken, this could have an impact on responses being accurate.

Third, non-response bias is a factor because the PRAMS survey is mailed to the last known address of the mother located on the birth certificate, this factor may underreport transient populations that are more difficult to reach. Additionally, follow-up attempts are only conducted via telephone surveys (i.e. land-lines) and do not include cell phones or other modes of communication in the follow-up attempts. It is possible that there may be a difference in results when comparing responses versus non-responses if non-responses are excluded.

Definitions of Terms

Adverse Birth Outcomes- Are birth outcomes that have serious health consequences across a life course, such as low birth weight or preterm birth (Blumenshine, P., Egerter S., Barclay, C.J., Cabben, C., Braman, P., 2010).

Behavioral Risk Factors- Any particular behavior or behavior pattern which strongly yet adversely affects health. It increases the chances of developing a disease, disability, or syndrome. Examples of these factors include tobacco use, alcohol consumption, smoking, obesity, physical activity, and sexual activity (Center for Disease Control and Prevention, BRFSS, 2013).

Body Mass Index (Body Mass Index)- is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2). For example, an adult who weighs 70kg and whose height is 1.75m will have a BMI of 22.9. (World Health Organization, 2015).

Chronic Stress- Can result from experiences of frequent and regular assaults, or it might result from an acute episode and have an impact on health (i.e. death, loss of job, divorce) (Jackson, F.M., 2007)

Environmental Factors- Can be defined and categorized by impact of immediate surroundings, such as living in geographical isolated areas and more specifically, deprived neighborhoods that maybe associated with adverse birth outcomes (Janevic, T. et al., 2010).

Infant Mortality Rate (IMR)- Is an estimate of the number of infant deaths for every 1,000 live births. This rate is often used as an indicator to measure the health and well-being of a nation, because factors affecting the health of entire populations can also impact the mortality rate of infants (Center for Disease Control and Prevention, Infant Mortality, 2013).

Low Birth Weight (LBW)- Is when a baby is born weighing less than 5 pounds, 8 ounces. About 1 in every 12 babies in the United States is born with low birth weight (March of Dimes, 2013).

Preterm Birth Weight (PTB)- This is birth before 37 completed weeks of pregnancy. About 7 of 10 low-birth weight babies are premature. The earlier a baby is born, the lower their birth weight may be (March of Dimes, 2013).

Preterm Delivery- This is labor that starts too soon, before 37 completed weeks of pregnancy (March of Dimes, 2013).

Social Factors- Analysis of socioeconomic factors that can be group into a few broad categories, such as individual levels of income, education, occupational class and area-based socioeconomic factors (census-derived measures) (Blumenshine, P., et al. 2010).

Psychosocial stress- Is a chronic exposure to stressful everyday hardships[6]

[6] Examples of hardships include but are not limited to; individual and family stressors such as family disruption and conflict, parents' mental health problems, and financial strain. Additionally, hardships could include dramatic short-term threats or challenges, but also the kinds of ongoing, everyday hassles that strain a person's ability to cope. (Robert Wood Johnson Foundation, Stress and Health, 2011).

which can be more damaging to health than an acute stress. Particularly early in life, psychosocial stress can result in long-term damage in multiple body organs and systems and can affect the ability to respond to stress, impairing the body's ability to appropriately "switch off" the stress response later in life (Robert Wood Johnson Foundation, Stress and Health, 2011).

Stress- Is any uncomfortable emotional experience accompanied by predictable biochemical, physiological and behavioral changes (Baum, A. 1990).

Stressor- Refers to the challenging events or conditions, including not only dramatic short-term threats or challenges, but also the kinds of ongoing, everyday hassles that strain a person's ability to cope (Robert Wood Johnson Foundation, Stress and Health, 2011).

Sudden Infant Death Syndrome (SIDS)- is the unexplained death, usually during sleep, of a seemingly healthy baby less than a year old. SIDS is sometimes known as crib death because the infants often die in their cribs (Mayo Clinic, 2014).

Pregnancy Risk Assessment Monitoring System (PRAMS)- is a surveillance project of the Centers for Disease Control and Prevention (CDC) and state health departments. PRAMS collects state-specific, population-based data on maternal attitudes and experiences before, during, and shortly after pregnancy (Center for Disease Control and Prevention, 2014).

Organization of the Study

The study is organized into five chapters. Chapter one provides an introduction to PTB, LBW and the adverse birth outcomes that are disproportionally experienced by African American women in comparison to non-Hispanic Caucasian women.

Chapter two presents literature review of PTB, LBW, and the disparities that exist when comparing African American and non-Hispanic Caucasian pregnancies. The literature includes studies that address the individual level-risk factors that may contribute to the adverse birth outcomes of PTB and LBW, such as ***smoking, alcohol consumption, BMI, and prenatal care. psychosocial stress,*** as possible causes of racial and ethnic disparities of PTB and LBW infants in Arkansas. In chapter 2, the ecological model will be discussed as the theoretical framework.

In chapter three, methods used for data collection and analysis will be examined and issues of reliability, generalization, and confidentiality will be discussed. Chapter four will discuss the results of the empirical findings utilizing psychosocial stress theory, the ecological model, and probit analysis. And lastly, chapter five will highlight the study limitations, recommendations, areas for future research and the conclusion of the findings.

CHAPTER TWO:

LITERATURE REVIEW

Introduction

Infant mortality rate (IMR), is associated with a variety of factors such as maternal health, quality and access to medical care, socioeconomic conditions, and public health practices (MacDorman, M.F. Matthews, T.J. 2008) and is often used as an indicator to measure the overall health and wellness of a nation (Centers for Disease Control and Prevention, Infant Mortality, 2013). Being defined as the number of deaths, per 1,000 live births for infants ages, less than one years of age, researchers have found that the leading cause of infant death is PTB and LBW and is more common in the United States (U.S.) than in Europe (Olson, M.E., Diekema, D., Elliott, B.A., Renier, C.M. 2010 & Heisler, E.J. 2012).

In the U.S., LBW and PTB rates, have improved slightly with PTB in 2011 being 11.72%, 2% lower than the 2010 rate of 11.99%, and the LBW in 2011 being 8.10%, which was down slightly from 2010 rate of 8.15% (Hamilton, B.E., Martin, J.D., Ventura, S.J., 2012). However, the disparities between African American and non-Hispanic Caucasians infant still exists; in comparison to non-Hispanic Caucasian infants, African American infants are more likely to die in infancy than other racial groups (Dominguez, 2011). Thus, African American infants have a higher incidence of infant deaths, therefore it is not surprising that they also have the highest rates of PTB and LBW (Dominguez, 2011).

A number of known individual level risk factors have been associated with adverse birth outcomes of PTB and LBW, however, these individual risk factors alone, have yet to fully explain the significant and persistent disparities gap between African American infants and non-Hispanic Caucasian infants (Dunkel-Schetter & Glynn, 2011 & & Jackson, F.M. 2007). In an attempt to generate new knowledge and solutions, research on PTB and LBW has turned to multidisciplinary approaches that emphasize interactions of psychosocial, sociocultural, and biomedical processes to better understand the pathways to PTB and LBW; delineate high-risk groups, and develop prevention programs (Schetter, C.D. 2009 & Wilkinson, D.S., Sable, M.R. 2000). Which leads to the question "Is psychosocial stress associated with racial and ethnic disparities of low birth weight (LBW) and preterm birth (PTB) in African American mothers?"

The effects of stress on the health of African American women remain inadequately examined (Giscombe & Lobel, 2008). Research shows that in comparison to other racial and ethnic groups, African-American women may carry a greater cumulative stress, which may be a cause of persistent disparities in birth outcomes. (Miranda, M.L., Maxson, P., Edwards, S. 2009 & Wilkinson, D.S., Sable, M.R. 2000). The theoretical framework of psychosocial stress theory, the ecological model specific to African American women, and the hypothesized causes of adverse birth outcomes will be used to draw an even deeper insight when discussing the impact of psychosocial stress.

Stress and Birth Outcomes

Pregnancy itself is stressful for some women because it affects family, work and other roles. By definition, stress can be categorized as acute, discrete events or chronic ongoing difficulties brought on by external demands that tax or exceed the adaptive capacity of an organism (Schetter, 2009). When appraised as stressful, demands result in behavioral, emotional, and cognitive and biological responses with numerous potential adverse consequences for mental and physical health (Schetter, 2009). Chronic stress can emerge from factors such as enduring economic strain, discriminatory experiences, and acute stress from severe life events such as war, natural disaster, divorce, and job loss (Torche, F., 2011). Programs that create social pregnancy centered networks for pregnant women can reduce the risk of LBW and depression (PRAMS GRAM, 2009). Support during pregnancy is inclusive of financial, family, and personal adjustments that could lead to emotional distress if not present (Lobel, 1998).

A large body of conflicting results on the research between psychosocial stress, PTB, and LBW has emerged; however, there is sufficient evidence to suggest a relationship between the two exists and that much of the variation is attributable to differing definitions and methods of assessment. For example, research by Hobel, Goldstein, and Barrett, (2008) found that during major disasters the timing of the stressor and the perception of the stressor not the number or types of stressors are most impactful on birth outcomes.

With some exception, studies show that life event stressors tend to affect birth outcomes most when they occur in the first trimester. The landmark study, "When stress Happens Matters: Effects of earthquake timing on stress responsivity in pregnancy," exploited the 1994 Northridge, California, earthquake and found an association between early pregnancy exposure to life event stressors and reduced gestational length (Glynn, L. M., Wadhwa, P. D., et.al 2001). Similar studies have also found an association where external sources of stress have impacted birth outcomes, such as the September 11, 2001 attacks in New York (Eskenazi, B., Marks, A. R et al. 2007), and the harassment in California of Arab and Arab American women after the September 11 attacks (Lauderdale, D.S. 2006). Therefore, the timing of the stressor in addition to the women's experience of event and how the experience is perceived is critically important for understanding how their bodies respond to such stressors and by extension, how their pregnancies are affected (Hobel, C., Goldstein, A., Barrett, E. 2008).

The relationship between chronic psychological stress and birth outcomes have been limited and primarily focused on the 9-month gestation period or during pregnancy and do not take into account the impact of chronic stress, over a lifetime and more specifically before conception. The growing recognition that increasing access to prenatal care and targeting high-risk behaviors during pregnancy does not adequately address the continued problem of poor birth outcomes in the U.S. has led to new paradigms with an emphasis on the health of women before they become pregnant (Living, W.C., Brady, C. et al. 2009).

This is of particular importance when addressing disparities because African American women may be at a greater risk of these adverse outcomes because they experience higher levels of stress over a lifetime (Miranda, M.L., Maxson, P. et al. 2009). According to the conceptual frameworks called "weathering", and "allostatic load" both gender and race influence the stress experiences of African American and healthcare outcomes (Woods-Giscombe, C.L. 2010). In the weathering framework, Geronimus suggest, that Blacks experience health deterioration early due to the consequences of the cumulative impact and repeated experiences with social or economic adversity and political marginalization (Geronimus, A.T., Hicken, M., Keene et al. 2006). On a physiological level, persistent, high-effort coping with acute and chronic stressors can have a profound effect on health. According to Lu and Halfon, 2010, studies have shown that the effects of allostasis have adverse healthcare outcomes on birth, including both PTB and LBW in women. The allostatic load concept has been introduced as a means for measuring and evaluating the cumulative effects of stress or "wear and tear" on the body over a lifetime with examples of stress ranging from, exposure to violence, negative life styles, behaviors, racism and lack of financial and social support (Latendresse, G. 2009).

Many sources of stress are unequally distributed along socioeconomic and racial lines, so that the poorest nations and individuals within nations are at higher risk of exposure (Pearlin et al. 2005; Turner et al. 1995; Wisner et al. 2004 as cited in Torche 2011). Hence, African

American women may be more susceptible to the effects of prenatal stress than European Americans (Giscombe & Lobel, 2005). Among the perspectives that have attempted to explain the disparities gap in birth outcomes and why African American women may experience higher levels of stress than non-Hispanic Caucasian women include, (1). ***environmental influences*** (Janevic et al., 2010), (2). ***behavioral risk factors*** (Visscher, et.al 2003; Centers for Disease Control and Prevention, 2012), (3). ***social contributors*** (Torche, 2011) and (4). ***biological perspective*** (Dunkel-Schetter & Glynn, 2011; Dominguez, 2011).

However, birth outcome disparities are not fully explained by the perspectives that are interconnected with socioeconomic status, maternal risk factor behaviors, genetic or prenatal care (Dunkel-Schetter & Glynn, 2011). And in order to understand the causes of racial and ethnic disparities as they relate to PTB and LBW, the consequences of ***stress as a contributor*** to adverse birth outcomes must be taken into consideration. (Hogan & Ferre, 2001) The research indicates that African American women experience higher rates of PTB and LBW due to ***psychosocial stress***. A handful of studies have reported associations between maternal race, ethnicity and placental cortiocotropin releasing hormone (CRH) levels among black women compared with white women (Rich-Edwards, 2005). Stress response triggers the production of placental corticotrophin releasing hormone (CRH), which in turn results in reduced gestational age, PTB and LBW (Torche, 2011).

For example, a study of 472 low-income African American women found that specific types of life events such as the loss of a family member, were associated with earlier delivery (PTB), but the total number of life events was not (Barbosa, 2000 as cited in Giscombe'C.L., Lobel, M. 2005). Another study, found African American women's unfavorable perceptions of their communities (e.g. safety, delivery of municipal services, cleanliness, quality of schools) were associated with higher rates of very low birth weight (VLBW), and this association was independent of the adverse impact of stressful life event on birth weight (Giscombe C.L., Lobel, M. 2005).

And lastly, a study that investigated 282 pregnant women analyzed the effects of maternal prenatal anxiety and corticotropin-releasing hormone (CRH) on the length of gestation, finding suggests that women with higher levels of CRH and high prenatal maternal anxiety at 28 to 30 weeks gestation delivered earlier than women with lower CRH levels and maternal prenatal anxiety (Mancuso, R.A., Dunkel-Schetter, C. 2004). Out of the 282 the sample consisted of 43% African-American, 32% Latinas, 24% European-American and two-women of unspecified ethnicity. The women were assessed using a pregnancy specific anxiety test that assessed sample participants level of anxiety about being pregnant. It could be that factors in the environment of black women may increase individual susceptibility and inflammatory reaction to infection and psychosocial stressors are a prime candidate (Rich-Edwards, 2005).

Behavioral Ecological Model

The ecological framework proposes two key concepts: (1) that individual behavior affects and is affected by the social environment and (2) that behavior both shapes and is shaped by multiple levels of influence (Rowland-Hogue & Hargraves, C.J., 1995). The ecological model (Figure 2.1), recognize that examining the ecological niche-the family, the community, the political and social environments in which the person lives is essential in helping to understand and to prevent health problems. The ecological model views a problem like disparities in birth outcomes among African American women and non-Hispanic Caucasian women as a result of many different factors in the environment that could possibly contribute to the problem of PTB and LBW.

Furthermore, the ecological model considers the complex interplay between individual, relationship, community, and societal factors and how these levels affect individual health behaviors and outcomes (Centers for Disease Control and Prevention, 2009 & See Figure 1). With regard to pregnancy and birth outcomes, the ecological model recognizes that the individual health behaviors and outcomes are strongly influenced by multiple levels of intrapersonal and interpersonal relationships, institutional, community and existing policy frameworks (Grzywacz & Fuqua, 2000; Sallis & Owen, 2002).

This model is consistent with the bio-ecological theory (Bronfenbrenner's, 1979), which consists of five systems of interaction, four of which are relevant in relation to infant mortality and disparities; the microsystem, which in this case would include the individual pregnant woman and any other contextual factors (e.g. immediate surroundings, health care systems, family members, etc.). Variables to be considered at the microsystem level (individual) would include (stress, smoking status and alcohol consumption). The microsystem factors would be inclusive of (number of years of education, income, stress).

The mesosystem, would be the setting in which the most interaction for the pregnant woman would take place. The mesosystem, helps to move us beyond the dyad or two-party relation, and helps to connect two or more systems in which the pregnant woman lives (Bronfenbrenner's 1979). This setting would include relationships or a circle of peers. Variables to be considered at the mesosystem are external entities, the larger community, churches, family and spousal support (e.g. emotional and financial support systems).

The next level, would be the exosystem, wherein, the pregnant woman, would not have to be involved in any capacity, however, individually she will be affected by the structures immediately around her. Exosystems are the contexts we experience vicariously, and yet, they have a direct impact on us (Swick, J. & Williams, R. 2006).

The last and final level is the macrosystem which involves the societal factors that influence all other systems, and includes cultural values, race and ethnicity identity, safety of your residence, economic patterns, and social conditions. In the macrosystem, the effects on the mother are not within the control of the individual pregnant woman. The macrosystems we live in influence what, how, when, and where we carry out our relations (Bronfenbrenner, 2005 as cited in Swick, J. & Williams, R. 2006). All of the systems have the ability to positively or negatively affect the health of the mother and birth outcomes. How the systems, collectively integrate together helps to form the social context that the pregnant mother will experience.

The central role of relationships and their associated effects upon maternal and infant well-being have generated a new understanding of the infant mortality challenge. The new approach is grounded in social determinants of health theory; women and their babies must be viewed not only as individuals, but as members of families, communities, and larger systems that have either positive or negative impacts upon their psychological and physical states (Jackson, F.M., 2007).

The economic and social conditions, opportunities, environmental influences, as well as risk and protective factors within their places of work, life, and play, must be considered (Jackson, F.M., 2007). A woman brings to the role her own experiences, expectations, and fears concerning pregnancy and parenthood, as well as her appraisal of her own circumstances and how they fit in with the social norms of her primary reference group (Peacock, et al., 2001).

The social nature of pregnancy and its discovery cannot be overemphasized. When a woman conceives outside of circumstances that are considered unacceptable within her social context, and particularly without an adequate support network she may perceive pregnancy as a situation too threatening to contemplate (Peacock, et al., 2001).

Figure: 2.1: A graphic depiction of the ecological model and bio-ecological theory

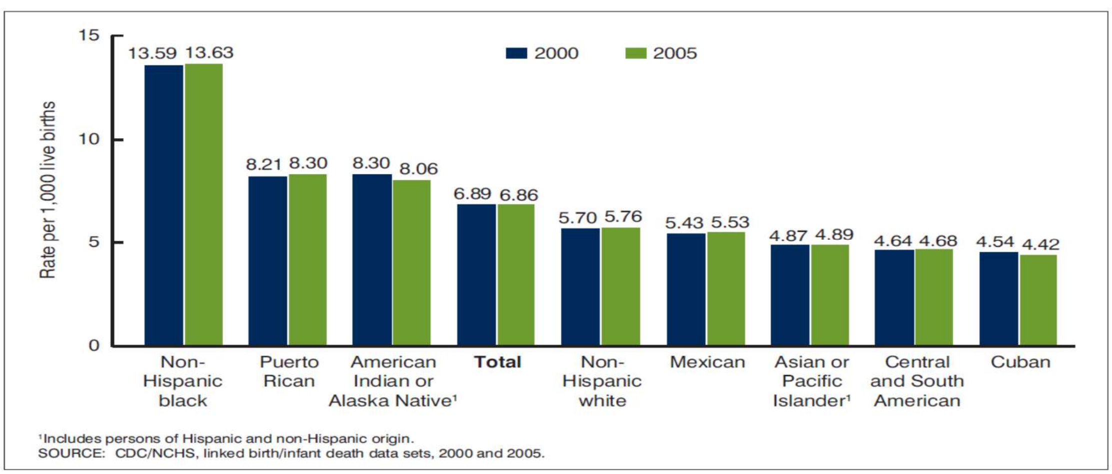
Low Birth Weight and Preterm Birth among African American Women

In the United States, black women are approximately twice as likely as women from most other racial or ethnic groups (Dole, et al., 2004) to have a preterm birth and are 3 to 4 times as likely to have a very early preterm birth. In 2009, the rate of LBW was much higher among infants born to non-Hispanic Black women (13.6 percent) than infants born to mothers of other racial/ethnic groups (Child USA, U.S. Department of Health and Human Services, 2011).

A study conducted by the Centers for Disease Control and Prevention (2009) found African American women have consistently experienced higher rates of PTB, LBW, and infant mortality than all other racial/ethnic groups. And Blacks had higher rates of infant mortality than any other race or ethnicity in both 2000 and 2005 (MacDorman & Matthews, 2008 & Table 2.1), the rate per 1,000 live births for infant mortality by race and ethnicity differed significantly. [7]

In comparison, non-Hispanic black and non-Hispanic white rates per 1,000 live births were 13.59 to 5.70 in 2000 and 13.63 to 5.76 in 2005 (See Table 2.1). More recently, according to the U.S. Department of Health and Human Services, Office of Minority Health (2009) African American infants are four times more likely than non-Hispanic Caucasian infants to die as infants due to complications related to LBW.

Table 2.1: Infant Mortality Rates by Race and Ethnicity: United States 2000 and 2005



[7] The literature on adverse birth outcomes inconsistently uses the terms African American, black and non-Hispanic Black to describe this population. Thus, in this prospectus, I use the terms Black and African American interchangeably.

The state of Arkansas has highlighted infant mortality as a priority and the interventions listed in the recently published report, Natural Wonders: The State of Children's Health in Arkansas (2011), focus on increasing access to Medicaid as well as assuring access to prenatal health services. However, to no avail, the rate of infant mortality within minority communities, specifically African American women still indicates high racial disparities.

In 2006, 14.9 of every 1000 African American infants in Arkansas died; this rate is 12.5 percent higher than the national average of 13.2 for African Americans (Arkansas Department of Health: The Current Birth Data by State, Region and County 2010 & Center for Disease Control Fast Stats: Death and Mortality, 2008 as cited in Natural Wonders: The State of Children's Health in Arkansas, 2011). Listed in the same report, the top causes of neonatal death in 2006 were birth defects and low birth weight, while the leading causes of infant deaths were Sudden Infant Death Syndrome (SIDS) and birth defects.

Many studies have researched the underlying causes of racial and ethnic disparities. However these approaches and solutions are based on an analysis of individual and behavioral risk factors alone. Thus, the epidemiological and intervention literature suffers from several limitations and fails to fully explain racial disparities in birth outcomes for African American women.

The research on ***environmental risk factors*** as causes for PTB and LBW propose that living in geographically isolated areas and more specifically, deprived neighborhoods have been associated with adverse birth outcomes (Janevic, T. et al., 2010). Hospital and birth data from 1998-2002 from the New York State Department of Health was linked to census track data and found that women living in deprived neighborhoods were at a higher risk of PTB and LBW relative to those living in the least deprived neighborhoods (Janevic, et al. 2010). Of the 591,983 births, 517,994 included information on the mother's census tract of residence and residents of New York City. The categories of race and ethnicity ancestry were self-reported.

The outcome was determined by women who lived in deprived neighborhoods and at a higher risk of LBW and PTB. Logistic regression was performed to estimate the ratio of relative risks, also interpreted as the odds ratio, for each quartile of neighborhood deprivation relative to the lowest for the 3-level outcome of preterm birth (birth <32 weeks, birth 33–36 weeks, ≥ 37 weeks) (Janevic, et al., 2010).

The neighborhood factors consisted of twenty-one variables from the U.S census; the domains of maternal education, housing, employment, occupation, poverty, and residential stability. Additionally, the study highlighted the association from a previous study conducted between the years of 1987-1993 on the city of New York with consistent findings. (Rauh, Andrews, Garfinkel, 2001).

Ethnic and racial segregation was not taken into account, which is an important pre-existing factor for neighborhood deprivation. The majority of the women in the studies were foreign-born (e.g. Hispanic Caribbean, Puerto Rican and Dominican women), which may explain some of the diversity in the results.

Self-reported ethnicity ancestry and race, may also be a limitation when it comes to accuracy of those particular categories. And lastly, the studies did not account for the neighborhood effects on health, or neighborhood characteristics of workplace, length of time at the residence, and the characteristics of near-by neighborhoods.

Additional literature on the ***environmental risk factor perspective*** also includes studies on the effects of ambient air pollutants on birth outcomes. Ritz, Wilhelm, Hoggatt & Ghosh (2007) conducted a case control survey of 2,543 of 6,374 women sampled from a cohort of

58,316 eligible births in 2003 in Los Angeles County, California. Risk factors included, maternal age, race, ethnicity, parity, education, when the infants were born and/or maternal smoking, alcohol consumption, living with a smoker, and marital status during pregnancy.

The results indicated exposure to the traffic-related pollutants—carbon monoxide and fine particles—mostly during the first trimester and possibly high exposures prior to delivery, are associated with preterm birth in the Los Angeles metropolitan area (Ritz, et al., 2007). However, the results were confounded by well-known risk factors and a low response rate of participants was a limitation of the study.

Research indicates that the ***behavior*** in which a mother participates can greatly affect the birth outcomes of the infant. Although there is a higher probability of adverse birth outcomes, if a woman participates in risky behaviors over a life course, these risk factors do not account for the disparities (Lu & Halfon, 2010). Established risk factors are inclusive of, but not limited to, cigarette smoking, alcohol consumption, illicit drug usage, and minimal or no prenatal car and have been found to have negligible impact on the racial gap (Collins, et al., 2004).

The impact of maternal smoking and other drug use during pregnancy on infant birth weight was demonstrated in a sample of data collected on 766 urban women in a Washington, D.C. Metropolitan Area drug study who delivered live births. Results showed that although a woman's use of cigarettes, marijuana, and heroin during pregnancy was related to infant birth weight, the use of alcohol and cocaine during pregnancy was not significantly related to or associated with infant birth weight (Visschera, et al., 2003).

A noted limitation in the study was that the women were interviewed in person and asked to recall verbally any complications as well as their use of cigarettes, alcohol, and illicit drugs during pregnancy. The study relied on memory, which introduces the possibility of recall bias.

According to the study, mothers that smoked during the pregnancy decreased the birth weight of the infant by 130 grams and mothers who were heroin users decreased the birth weight of the infant by 450 grams, on average. No effect was seen on birth weight in the model for mothers who used alcohol or cocaine.

When reviewing the disparities gap, findings on the impact of smoking differs. Several self-reported studies found that Black women are less likely to smoke cigarettes and drink alcohol during pregnancy than are white women (Centers for Disease Control and Prevention, 2008 & PRAMS GRAM, 2008). Moreover, African American women who did not smoke cigarettes during pregnancy still had higher rates of infant mortality than non-Hispanic White women who did (Matthew, T.J., MacDorman, 1999 as cited in Lu, M.C., Halfon, N. 2010).

A prospective cohort study, found that smoking was not related to preterm birth overall when comparing birth outcomes between African American women and non-Hispanic Caucasian women, but cotinine measured at the time of delivery was (Savits, D.A. et al., 2001).[8] Whether smoking occurred before or during pregnancy, the results were negligible or inconsistent in association with preterm birth.

Only the postpartum cotinine measure suggested that women with the highest levels were at increased risk for preterm birth. According to the study, metabolism of nicotine differed by race with the highest level seen in African-American women. African American women tended to smoke mentholated cigarettes, while non-Hispanic Caucasian women tended to that smoke non-mentholated.

This study suggested that the high levels of methanol in cigarettes may be the cause for the high percentages of preterm birth seen in African American mothers and not necessarily the

[8] Definition of cotinine: Metabolite of nicotine (a component of tobacco smoke). http://www.cdc.gov/biomonitoring/Cotinine_BiomonitoringSummary.html

mere fact that the mother smokes. However, this suggestion was not conclusive and the study suggested more research on the effects of methanol and birth outcomes would be necessary.

Research highlighting ***social contributors*** is another perspective that has attempted to explain the disparities gap between African American women and non-Hispanic Caucasian women as it pertains to LBW and PTB. Most studies that analyze socioeconomic factors are measured and grouped into a few broad categories, such as individual levels of income, education, occupational class, and area-based socioeconomic factors (census-derived measures) (Blumenshine, P., et al. 2010).[9]

In a systematic review of the literature from (1999-2007) out of 106 studies, 93 reported a significant association between at least one socioeconomic measure and one birth outcome (LBW or PTB), either in the overall study population or in a racial/ethnic subgroup (Blumenshine, P., et al. 2010). Research has implied that social factors influence a woman's health, behaviors, and access to quality health care services (Hogan & Ferre, 2001). Others state that social contributors alone do not account for the disparity that exist (Jackson, F.M., 2007).

Some socioeconomic measures—in particular occupational class, were more frequently associated with adverse birth outcomes than others (Blumenshine, P., et al. 2010). However, this particular finding was more common in European settings in North American studies, and was not the same for African Americans and Hispanic women. When socioeconomic effects are viewed across racial lines, the findings in the literature review vary and are inconsistent. From 1997-2007 when the literature examined individual-level socioeconomic measure, there are limitations. The measures were stratified by race/ethnicity and focused on education rather than

[9] Census-Derived Measures: poverty, income, education, unemployment, occupation, wealth.

income or occupational class (which was examined primarily in European studies that typically lacked data on race/ethnicity) (Blumenshine, P., et al. 2010).

Although poverty and the economic uncertainty may play a major role in adverse birth outcomes, researchers for over a decade at the Centers for Disease Control and Prevention, have shown that college-educated African American women's birth outcomes are more closely aligned with non-college educated, unemployed, uninsured white women than they were with college-educated, employed, insured white women (Rowley, D.L. 2001). The assumption was that college-educated African American women's birth outcomes would be more closely aligned with college-educated, employed, insured white women.

Similar findings are seen in a cohort study that linked North Carolina birth and infant death files from 1988-1993. African Americans women were at higher risk for infant mortality at every level of education, and the disparity on a multiplicative scale increased as educational achievement increased (Din-Dzietham & Hertz-Picciotto, 1998).

Studies have also found that despite the fact that many well-educated black women obtain prenatal care beginning in the first trimester, the relative risk of death among their offspring has increased over time, amounting to a 2.9-fold excess risk among infants who were born in 2001 (Matthews, T.J. 2003 as cited in Hogue, C.J. & Bremner J.D. 2005). Most of the differential mortality rate is owing to excess risk of preterm and very low birth weight deliveries (Hogue, C.J. & Bremner J.D. 2005). Additionally, Vintzileos et al. (2002) looked at pregnancy outcomes by receipt of prenatal care. They found that neonatal deaths were higher for African American infants in both the presence and absence of prenatal care (Vintzileos et al., 2002).

This finding is consistent with other studies that analyze pregnancy outcomes of women that have had prenatal care and show, despite first-trimester initiation of prenatal care, minority pregnancies experienced more perinatal mortality when compared with pregnancies in the white population.

According to the Guttmacher Institute, in a large multicenter study of women who received care during their first trimester, perinatal mortality occurred in 10.0 pregnancies per 1,000 among white women, 15.9 per 1,000 among Hispanics, and 42.1 per 1,000 among blacks. The racial disparities remained even after adjusting for a wide range of variables associated with pregnancy outcomes (Healy, A.J. et al., 2006).

Other studies have examined the link between marital status and birth outcomes. In a recent systematic review of research from twenty-one studies, two reviewers independently, reviewed the risk of an infant being born with LBW, PTB, or small for gestational age (SGA) among married and unmarried women. Meta-analysis was performed using a random effects model for both unadjusted and adjusted data, odd ratio (OR) and a 96% confidence interval (CI) was calculated. The results showed that maternal unmarried status is associated with an increased risk of of LBW, PTB and SGA births. Current theories linking marital status and birth outcomes include lack or reduced level of psychosocial support and relationship stability for unmarried women, increased exposure to risky behaviors by unmarried mothers such as alcohol/drug abuse, and sexual activities (Shar, P.S., Alis, S., 2010).

Studies have shown that there is a relationship between mothers who are overweight/obese and adverse birth outcomes. In a systematic review of the literature from both developing and developed countries, meta-analyses examined this relationship in 84 studies, totaling 1,095, 834 women with single pregnancies. Results showed that overall risk of preterm birth was similar in overweight/obese women and women versus normal weight; the risk of induced preterm birth was increased in overweight and obese women. (McDonald, S.D., Han, Z., Mulla, S., Beyene, J., 2010).

These results are consistent with a study that analyzed pre-pregnancy body mass index (BMI) and birth outcomes. Results showed that of the 167,750 nulliparous women examined, the odds ratio for late fetal deaths and PTB, was increased among women with higher BMI. However, the risk of delivering a small-for-gestational-age infant decreased more with increasing body-mass index among parous than among nulliparous women (Cnattingrus, S., Bergstorm, R. et al., 1998).

The ***biological perspective*** tends to focus on infections during pregnancy, maternal age, and genetic predisposition as major factors in LBW and PTB. Many sources link preterm birth to symptomatic infections such as urinary or respiratory tracts, and in the last decade, great interest has been generated to support the hypothesis that subclinical infection is an important cause of preterm labor (Gibbs, R.S. 2001).

Evidence of this is in four broad categories; (1) intrauterine infection or systemic administration; (2) extrauterine maternal infections such as malaria, pyelonephritis, pneumonia, and periodontal disease have been associated with premature parturition; (3) subclinical intrauterine infections are associated with preterm labor and delivery, and (4) patients with intraamniotic infection or intrauterine inflammation (defined as an elevation of amniotic fluid concentrations of cytokines and matrix-degrading enzymes in the mid-trimester are at risk for subsequent preterm delivery (Romero, R., et al., 2007).

Findings show that the relationship between preterm birth and infection are inconsistent through gestation. Infection is rare in late preterm deliveries (at 34-36 weeks), but is present in most cases in which the birth is less than 30 weeks as shown by the histological examination by the fetal membrane at delivery (Goldenberg, R.L., et al. 2000). The role that psychosocial stress plays in adverse outcomes is strongly linked with increasing the susceptibility to intrauterine and fetal infection-inflammatory process and thereby promotes parturition through pro-inflammatory mechanisms (Wadhwa, E.D., Culhane, J.F., et al. 2001).

Studies that look at maternal age as a risk factor tend to observe these adverse birth outcomes in girls and women between the ages of 15-19 and 35 years and older (Graham, J., Zhang, L., & Schwalberg, R. 2007, Friede, A., Baldwin, W., et al. 1987, U.S. Department of Health and Human Services, Maternal and Child Health Bureau, 2011).

In one study that examined North Carolina birth outcome measures for non-Hispanic African Americans and whites for the maternal age groups of 15-19, 20-34 and 35 years and older, the results showed adverse birth outcomes for African Americans when there was an increase with maternal age, and racial disparities increased with increasing maternal age (Buescher, P.A., Manjoo, M., 2006).

Preterm delivery, very low birth weight, and the neonatal death rates were most associated with the largest disparities at the older ages. Additionally, the study used the "weathering hypothesis" as a framework to explain the pattern of why African American women have higher rates of LBW and PTB infants. [10]

The hypothesis suggests that the preconception health of the woman is crucial not only to the mother's health, too that of the infant as well. Therefore, high levels of chronic stress may have negative effects on health, and stress can affect maternal behaviors such as smoking, nutrition, and substance use (Hogan, V.K. as cited in Buescher, P.A., Manjoo, M., 2006).

[10] Weathering Hypothesis: The weathering hypothesis proposes that the health of African American women may begin to deteriorate in early adulthood as a physical consequence of cumulative socioeconomic disadvantage.

In a study conducted to understand social and genetic factors three groups were examined, U.S born blacks, African born blacks and U.S. born whites. Vital records from 1980 through 1995 from Chicago, Illinois were used to determine birth weights among infants. The results showed that African born black and U.S. born white infant birth weights were more closely related to each other than U.S. born blacks (David, R.J., & Collins, J.W., 1997). According the study it is an assumption that U.S. born black women differ genetically from white women, and thus, this affects the ability to bear normal or large infants (Hulsey, T.C., Levkoff, A.H., et al. & Amini, s.B., Catalano, P.M., et al., as cited in David, R.J., & Collins, J.W., 1997). The expectation was that women of "pure" West African origin would bear smaller children than U.S. born blacks, considering that U.S. born blacks have a genetic admixture with European Americans. However, this was not the case, and an opposite finding was discovered in that regardless of socioeconomic status, the infants of black women born in Africa weighed more than the infants of comparable black women born in the United States.

David, R.J., & Collins, J.W., (1997) maintain that additional studies of groups of women from New York, Boston, and multiple states have had concordant results; black women born outside the United States have heavier infants than those born inside the United States, even after adjustment for cigarette smoking, alcohol intake, and illicit-drug use.

Similar findings occur with other ethnicities/races that are foreign born. Women who are foreign born, white, black, and Hispanic women are less likely to have LBW infants than their U.S. born counterparts. Immigrant women exhibit lower rates of known risk factors for LBW (e.g. low education, single motherhood, smoking, and drinking during pregnancy) than their US-born counterparts (Garcia, D., Soobader-Mah, J., Berkman, L.F. 2005 & Gennaro, S. 2005).

Traditional birth outcome studies often are limited in their ability to determine causation and ignore how factors act together, as well as how they are shaped by the social structural context in which they occur, over time and before pregnancy. Research on how the effects of ***psychosocial stress*** may play a role in adverse birth outcomes, such as LBW and PTB, could add more insight into the birth outcomes disparities gap between African American and non-Hispanic Caucasian mothers.

Evidence suggests that there are three physiological pathways in which prenatal maternal stress may affect birth outcomes. These include a *neuroendocrine pathway*, which is the major physiological marker to explain prenatal maternal stress on birth outcomes (Lockwood, 1999), a *maternal vascular disease pathway*, and an *immune–inflammatory pathway* (Hobel et al., 1999; Holzman, Bullen, et al., 2001, Lockwood, 1999; Wadhwa, Culhane, Rauh, & Barve, 2001; Wadhwa, Culhane, Rauh, Barve, et al., 2001 as cited in Giscombe & Lobel, 2005).

Several researchers have examined factors other than the established risk factors to explain adverse birth outcomes for African American women. These factors include, social support, high level of stress, experiences of racism, place of residence, neighborhood violence, and dynamics (Collins et al. 1998). Wadhwa et al. show that a chronic maternal cardiovascular, immune/inflammatory, and neuroendocrine process is detrimental to infant birth weight (Wadhwa, et al. 2001).

Moreover, through the *neuroendocrine pathway*, psychophysiological stress is likely to accelerate the release of corticotrophin-releasing hormone (CRH), which initiates a cascade of events leading to preterm delivery (Rich-Edwards, et al., 2001; Wadhwa, et al., 2001; Entringer, et al., 2010; Broders, A.E. et al., 2007).

In a study , Stancil, Hertz-Piccotto, Schrammn & Morse, (2000), several sources of stress were evaluated, which included life events, neighborhood safety, sexual and racial discrimination from a sample of 94 pregnant women in the Pittsburg, Pennsylvania area. Pregnant women were excluded from the study if they were under 18 years of age, past 13 weeks pregnancy, had pre-existing medical conditions, such as hypertension and diabetes, or had previous pregnancies that put them at high-risk.

The study found that higher perceived stress was not related to objective stimuli (e.g. life events), but it was found in multiple regression models, to be related to younger age, higher income, lower educational attainment, and higher score for reported experiences of sexual discrimination. (Stancil, Hertz-Piccotto, Schrammn & Morse, 2000). However, researchers interested in measuring the effects of chronic stress as a result of life events may examine a range of related exposures, such as distress, anxiety, household strain, job stress, daily hassle, depression, and pregnancy-related anxiety, which do seem to be associated with increased risk of PTB. (Paarlberg 1995 as cited in Hobel, Goldstein & Barrett, 2008).

Summary

In this chapter, literature was presented on PTB and LBW among African American women and how psychosocial stress may play a role in adverse birth outcomes. The paradigm shift from examining individual-level risk factors to including psychosocial stress and its effects on African American women pregnancies could be instrumental in providing in depth knowledge about the underlying causes of adverse birth outcomes. Research on environmental influences, behavioral risk factors, social contributors, and the biological perspective has supported individual-level risk factors as one of the primary reasons why adverse birth outcomes are disproportionately higher among African-American women. However, these individual-level risk factors have not been able to fully explain the disparities gap that still exists (Dunkel-Schetter & Glynn, 2011 & Jackson, F.M. 2007). Because the effects of stress on the health of African American women remains inadequately examined (Giscombe & Lobel, 2008), a new perspective and analysis on PTB and LBW is warranted.

CHAPTER 3:

RESEARCH DESIGN AND DATA COLLECTION

Introduction

The premise of this study was driven by prior research (Collins et al., 2010; MacDornan, Hovert, & Matthews, 2013; Okah et al., 2005) pertaining to low birth weight (LBW) and pre-term birth (PTB), infant status. Previous research has shown that despite the many medical advances and interventions to decrease the incidence and prevalence of LBW and PTB, adverse birth outcomes continue to disproportionally impact African American women (MacDorman, Hoyert, & Matthews, 2013). Studies have examined individual-level risk factors as a means to identify relationships that could explain the disparities between African birth outcomes of American women and non-Hispanic White women, however, these etiologies remain inconclusive (Collins et. al., 2010; Okah et. al., 2005).

In chapter 1, the study topics of LBW and PTB infant status were introduced. The first chapter continued with an overview of the study argument, including the alternative hypothesis. The alternative hypothesis is that psychosocial stressors differentially influence LBW and PTB infant status in African American and non-Hispanic White mothers. In chapter 2, the theoretical and empirical work pertinent to the study were reviewed and discussed.

Chapter 3 focuses on research design. The chapter opens with the research question. An examination of the proposed research design follows. As this study utilized data from the Centers for Disease Control's (2005-2010) Arkansas Pregnancy Risk Assessment Monitoring System (PRAMS), this data and its utilization are addressed in this section and in the data analysis sections. Chapter 4 presents the empirical findings, the research tool and measured variables.

Chapter 5 present the interpretation of the findings, future areas of research and concludes with a summary of the study.

Research Question

This study evaluates the impact that ***psychosocial stress*** has on adverse birth outcomes of LBW and PTB among African American mothers in Arkansas. The research addresses the following question:

Is psychosocial stress associated with racial and ethnic disparities of LBW and PTB in African American mothers in comparison to non-Hispanic Caucasian mothers? The objective of this research is to determine if, after controlling for several maternal-level independent variables, the births outcomes (e.g. low birth weight and pre-term births) among African American were disproportionately affected by psychosocial stress.

Research Design and Data

Secondary data for this population-based study was collected from a quantitative survey to evaluate the relationship between adverse birth outcomes in African American women and stress in comparison to non-Hispanic Caucasian women. Data from the 2005-2010 Arkansas Pregnancy Risk Assessment Monitoring System (PRAMS) is utilized to address the research question. PRAMS is a surveillance project of the Centers for Disease Control and Prevention (CDC) and state health departments, that collects state-specific, population-based data on maternal attitudes and experiences before, during, and shortly after pregnancy (Centers for Disease Control and Prevention, 2014), that can affect the health of the baby. Through this joint effort, PRAMS provides data for state health officials to use to improve the health of mothers and infants and monitor changes in maternal and child health indicators (Centers for Disease Control and Prevention, 2014).

The data generated was population-based and the collection methods were the same across all states. The data was thus derived from a general representation of the entire state's population of women delivering live births and can be used to compare data across other states. Each participating state samples between 1,300 and 3,400 women per year (2005-2010) (Centers for Disease Control and Prevention, 2014).

The 2005-2010 Arkansas PRAMS data was primarily collected through a questionnaire, which was mailed to women who delivered babies who were two to six months old. Women who did not return the questionnaire received a follow-up phone call. In this study, data from only African American and non-Hispanic Caucasian women were used. The final data set for the study was comprised of 14, 196 participants, 10, 712 (75%) of whom were White/non-Hispanic Caucasian and 3,484 (24.5%) of whom were Black/African American.

Variables and Measures

Dependent variables- There are two dependent variables in this study. Both pertain to infant status. The first dependent variable was low birth weight infant status and the second dependent variable is preterm infant status.

Low birth weight infant status-Low birth weight is measured by the weight of the infant in grams. This variable is dichotomous with coding where 0=birth weight equal to or less than 2,500 grams and 1=birth weight greater than 2,500 grams (Centers for Disease Control and Prevention, Birth Weight & Gestation, 2014).

Preterm infant status-Preterm infant status is measured by the length of the gestational period. This was re-coded to be dichotomous where 0=preterm/less than 37 weeks gestational age and 1=not preterm/equal to or greater than 37 weeks gestation.

<u>Maternal level independent variables-</u> There were four measures of maternal level independent variables all of which were dichomotously coded. They are cigarette use, alcohol use, pre-pregnancy body mass index (BMI) and psychosocial stress.

1. **Cigarette use**- In the PRAMS survey, cigarette use is based on smoking within the past two years. The coding of this variable is 0=have not smoked cigarettes in the past two years and 1=have smoked cigarettes in the past two years.
2. **Alcohol use-** In the PRAMS survey, alcohol use is based on drinking within the past two years. The coding of this variable is 0=did not drink alcohol in the past two years and 1=did drink alcohol in the past two years.
3. **Pre-pregnancy body mass index (BMI)-** BMI was calculated based on the mother's self-reported weight and height without shoes, prior to pregnancy. Coding of the dichotomous BMI variable is 0=BMI is less than 30 and 1=BMI is equal to or greater than 30 (Masho, S.W., Bishop, D.L., Munn, M., 2013 &McDonald, S.D., Hanz, Mulla, S. Beyene, J., 2010).
4. **Psychosocial Stress-** Maternal stress is assessed based on the mother's report of stressful life events based on things that may have happened before and during their most recent pregnancy. The life events that serve as indicators for maternal stress are *family illness, separation or divorce, moving to a new home, homelessness, husband or partner lost his job, personal loss of job, arguing with husband or partner, inability to pay bills, in a physical fight, husband or partner went to jail, someone close had a problem with drinking or drugs, someone close died, husband or partner pushed, hit, slapped, kicked, choked or physically hurt you during the pregnancy, ex-husband or ex-partner, hit, slapped, kicked, choked*

or physically hurt you and did anyone else physically hurt you in any way?

Coding of dichotomous psychosocial stress variable is 0=Experienced 0-1 psychosocial stressors and 1=Experienced 2 or more psychosocial stressors.

Maternal-level control variables- There are five maternal level control variables in this study. All of these variables were dichotomously coded.

1. **Total household yearly income** was reported from the PRAMS survey. In the PRAMS survey income was categorized were 0=less than 10,000, 1= $10,000-$14,999, 2= $15,000 to $19,999, 3= $20,000 to $24,999, 4= $25,000 to $34,999, 5= $35,000 to $49,000 and 6= $50,000 or more. In this study, income was coded where 0=income is equal to or less than $20,000 a year and 1=income is greater than $20,000 a year (United States Census Bureau, 2012 & Orr, St, Blackmore-P.C., et al., 2000 & DeFranco, E., Lian, M., Muglia, L., Schootman, M. 2008)
2. **Race-** The PRAMS survey is conducted with women of all races. The categories for race in the PRAMS survey were 1=Asian, 2=American Indian, 3=Black/African American, 4=Chinese, 5=Filipino, 6=Japanese, 7=Hawaiian, 8=White and 9=Other race. However, only African American and non-Hispanic Caucasian/White women were used in this study. The variable was dichotomized to create a comparison group where 1=African American and 0=non-Hispanic White.
3. **Marital status-** The PRAMS survey inquired about marital status and used the response codes of married and not married. In this study, marital status of the respondents was coded where 0=not married and 1=married.
4. **Maternal education**- Maternal education was obtained from the PRAMS survey with coding of this variable reported as 1= 0-8 years, 2= 9-11 years, 3= 12 years, 4=13-15

years, and 5= greater than 16 years. In this study, the variable was dichotomized where 0=(less than 12 years of education or less than a high school degree) and 1=equal to or greater than 12 years of education (or a high school degree or higher).

5. **Pre-natal visits-**Mothers who went without adequate prenatal care by the time of their first scheduled prenatal care visit is included on the PRAMS survey by self-report. The coding for this variable was 0=without prenatal care for the first two trimesters (27 weeks) and 1=with prenatal care for the first two trimesters (27 weeks).

Data Management and Analysis

This study utilized secondary data from the PRAMS. The permission to use PRAMS data from 2005-2010 was obtained by the Arkansas Department of Health (see Appendix B for agreement). In addition, the data was downloaded, cleaned and files from 2005-2010 were merged to be in one file. Cleaning the data consisted of reviewing the data for missing cases, removing those cases that had missing responses and conducting descriptive statistics for each variable.

In this study, it is posited that specific psychosocial stressors were the underlying factors of racial and ethnic disparities with regard to low birth weight (LBW) and preterm birth (PTB) infants among African American and non-Hispanic Caucasian mothers. In addition to the primary independent variable of race are eight other variables, marital status, yearly income, education level, cigarette use, alcohol use, stress level, BMI, and prenatal care. There are two dependent variables: LBW and PTB infant status. The analysis examines the individual effects of each variable alone and in combination with the other independent variables. This approach requires the use of two types of statistical analyses: (a) chi-square (χ^2) tests and (b) binary logistic regression.

Chi-square (χ^2) tests of independence. Chi-square (χ^2) tests are conducted to determine significant associations between the independent and dependent variables, all of which were coded as dichotomous. A chi-square test of independence is a nonparametric statistic that "compares the frequencies of one nominal variable for different values of another nominal variable" (Bolboacă, Jäntschi, Sestraş, Sestraş, & Pamfil, 2011, p. 531). The use of chi-square (χ^2) tests of independence was selected for its appropriateness in examining associations between each dichotomously-coded psychosocial stressor variable and the dichotomously coded LBW and PTB outcome *variables, respectively (Bolboacă et al., 2011; McHugh, 2013). Significance of the chi-*square (χ^2) tests of independence was determined by the χ^2 value with its corresponding significance (p) value, with significance set at $p < .05$. Two measures of association, lambda (λ) and Kendall's tau (τ)–b were used to determine the amount of variance in the dependent variable explained by the independent variable. Lambda (λ) was used as a "reduction in error approach" measure of association for the dichotomous independent variables that were nominal (e.g., ethnicity, receipt of prenatal care) (Agresti & Wackerly, 1977, p. 120). Kendall's tau (τ)–b was used as a measure of association for those dichotomous independent variables that were ordinal (e.g., pre-pregnancy BMI, life stressors) (Agresti & Wackerly, 1977).

Binary logistic regression. Binary logistic regression, a parametric statistic used to determine "the relation between a categorical outcome variable and one or more predictor variables" was the second analysis used in this study to test the hypotheses (Peng & So, 2002, p. 33). In binary logistic regression, the dependent variable must be a dichotomously coded variable, while the independent variables can be coded as dichotomous, categorical, or continuous variables (Peng & So, 2002; Saha, 2011). Logistic regression examines the probabilities (as opposed to linear relationships) between variables and estimates the logit, defined as the logarithm of ratio of the probability of presence of a study characteristic to the probability of its absence (Peng & So, 2002; Saha, 2011).

The binary logistic regression analyses allows for examination of (a) the overall logistic regression model effects on the respective dependent variables and (b) the unique contribution of each predictor variable on the respective dependent variables (Peng & So, 2002; Saha, 2011).

The overall model fit, inclusive of all predictor variables, is determined by the model chi-square, with significance of the model set at $p < .05$. Goodness of model fit is further validated by the Hosmer & Lemeshow chi-square test; a *non-significant* Hosmer & Lemeshow chi-square test statistic indicates that the data fit the proposed model well (Saha, 2011). Results from the classification table are utilized to report the percentage of cases correctly classified into their respective dependent variable groups as determined by the model predictors (Saha, 2011). The significance of each predictor on the respective dependent variables is determined by the Wald chi-square statistic and its corresponding significance value, set at $p < .05$ (Saha, 2011). The logs odds ratio, which denotes "the change in the average value of Y from one unit change in X" is also reported for each predictor and outcome relationship (Peng & So, 2002, p. 42).

Summary

The purpose of this study is to examine if psychosocial stressors play a role in adverse outcomes of LBW and PTB infant status among African American and non-Hispanic Caucasian mothers who resided in Arkansas between 2005 and 2010. This chapter presented information on the study methodology, with emphasis placed on (a) the use of PRAMS 2005-2010 data; (b) the identification and operationalization of study variables; and (c) the two-fold approach to the methods of data analysis (e.g. chi-square [χ^2] tests of independence and binary logistic regression). The next chapter reports the bivariate and multivariate findings.

Chapter 4: Empirical Findings

Introduction

The purpose and aim of this study is to examine the impact of psychosocial stressors as the underlying factor of racial and ethnic disparities as it relates to low birth weight (LBW) and preterm birth (PTB) infants among African American and non-Hispanic Caucasian mothers. Ethnicity (i.e., Black/African American and White/Caucasian) is a key independent variable. The psychosocial stressors utilized as maternal-level independent variables are cigarette and alcohol use in the past two years, maternal experiences of stress, obesity, and lack of prenatal care. Maternal-control independent variables are marital status, yearly income, and level of education. The dependent variables are LBW infant status and PTB infant status. All study variables were dichotomous.

The data is from the Pregnancy Risk Assessment and Monitoring System (PRAMS) data set from the Centers for Disease Control (CDC) (CDC, 2014). PRAMS is a six-year population-based state-specific research project conducted by the CDC in conjunction with state departments of health (CDC, 2014). The primary goal of the PRAMS data is to utilize pre- to post-pregnancy attitudes, experiences, behaviors, and risk factors among mothers who had recently given birth to improve the health and well-being of mothers and infants (CDC, 2014). From the data, 14,196 Black/African American and White/Caucasian women who (a) resided in Arkansas, and (b) had a live birth between the years of 2005 and 2010, Table 4.1 presents the frequency and percentage of participants per year.

Table 4.1

Frequencies and Percentages of Participants by Data Collection Year (N = 14196)

Variable Categories	*Frequency*	*Percentage*
Data Collection Year		
2005	2724	19.2
2006	2824	19.9
2007	2488	17.5
2008	2319	16.3
2009	1673	11.8
2010	2168	15.3

Arkansas PRAMS 2005-2010

To ensure that data collection year did not confound study results, two chi-square (χ^2) tests of independence were conducted to determine if differences in LBW and PTB outcome existed across data collection years. In these analyses, the independent variable was data collection year and the two dependent variables were LBW and PTB infant status. Results showed that neither LWB nor PTB infant status significantly differed across data collection years, $\chi^2(5) = 7.26$, $p = .202$ and $\chi^2(5) = 3.42$, $p = .636$, respectively.

Study Sample

The study sample was comprised of 14,196 participants. Ethnic group status is the key maternal-level independent variable in this study. Of the 14,196 participants, 10,712 (75.5%) were White/Caucasian and 3,484 (24.5%) were Black/African American. The participants' mean age was 36.85 years (*SD* = 3.60, *Md* = 38.00).

LBW and PTB. The two dependent variables in this study are LBW and PTB infant status. A small majority (*n* = 8091, 57%) of mothers had normal birth weight infants while 6,098 (43.0%) had low birth weight infants. Seven participants (0.001%) did not provide this information. Over one-third of participants (*n* = 4432, 31.2%) had a pre-term infant (i.e., born less than 37 weeks of gestation). In contrast, the majority (*n* = 9713, 68.4%) of participants had infants at the normal gestational age (i.e., born at 37 weeks or more). See Table 4.2 for LBW and PTB infant status frequencies and percentages.

Table 4.2

Frequencies and Percentages of Infant Birth Weight Status and Gestational Age Status (N = 14196)

Variable Categories	*Frequencies*	*Percentages*
Birth Weight of Infant		
Low Birth Weight (< 2500 g)	6098	43.0
Normal Birth Weight (>= 2500 g)	8091	57.0
Missing	7	0.001
Gestational Age Status		
Pre-Term (< 37 weeks)	4432	31.2
Normal Term (>= 37 weeks)	9713	68.4
Missing	51	0.4

(N = 14196)

A chi-square (χ^2) test of independence was conducted to examine if LBW infants were more likely to be born pre-term. Results from the chi-square (χ^2) test of independence showed that the majority of pre-term infants (n = 4014, 90.6%) were of low birth weight when they were born, $\chi^2(1) = 5985.15$, $p < .001$.

Two maternal-level control variables in this study were yearly family income and having/not having received a high school degree. Over one-third (31.9%) of participants did not answer the question inquiring about their yearly family income. Of those participants who did, 5,347 (37.7% of entire sample) reported a yearly income of less than $20,000, and 4,315 (30.4% of entire sample) reported a yearly income of $20,000 or more per year. With regard to highest level of education, 3,144 (22.1% of) participants did not receive a high school degree while 10,910 (76.9% of) participants did. A small group (n = 142, 1.0%) of participants did not provide their highest level of education. See Table 4.3 for frequencies and percentages for these variables.

Table 4.3

Frequencies and Percentages of Participant Race, Yearly Income, and High School Degree Variables (N = 14196)

Variable Categories	*Frequency*	*Percentage*
Race		
White/Caucasian	10712	75.5
Black/African American	3484	24.5
Yearly Income		
Less than $20,000	5347	37.7
Greater than or Equal to $20,000	4315	30.4
Missing	4534	31.9
High School Degree		
No	3144	22.1
Yes	10910	76.9
Missing	142	1.0

(N = 14196)

Pre-pregnancy BMI, prenatal care, and stress level statuses. Pre-pregnancy BMI, prenatal care during pregnancy, and stress level are three maternal-level independent variables (see Table 4.4 for frequencies and percentages of these variables). Over half (*n* = 7998, 56.4%) of the participants did not provide either pre-pregnancy weight or height information required to calculate their BMI. Of the participants who did, slightly over a third (n = 4663, 32.8% of entire sample) of participants were of normal weight (i.e., had a BMI less than 30) before their pregnancy. In contrast, slightly over a tenth (*n* = 1535, 10.8% of entire sample) of participants had BMIs equal to or greater than 30, which placed them in the obese category, prior to their pregnancy.

Table 4.4

Frequencies and Percentages of Pre-pregnancy BMI, Prenatal Care during Pregnancy, and Stress Level (N = 14196)

Variable Categories	*Frequencies*	*Percentages*
Pre-Pregnancy BMI		
Less than 30	4663	32.8
Greater than or Equal to 30	1535	10.8
Missing	7998	56.4
Prenatal Care During Pregnancy		
No	295	2.0
Yes	9748	68.7
Missing	4153	29.3
Stress Level		
Low Stress (0-1 Stressors)	3854	27.1
High Stress (2+ stressors)	6221	43.8
Missing	4121	29.0

(N = 14196)

Participants were asked if they received prenatal care during their pregnancy. Almost one-third (*n* = 4153, 29.3%) of participants did not answer this question. Among those participants who did, a very small group of participants (*n* = 295, 2.0% of entire sample) reported having not received prenatal care during their pregnancy. Nine thousand seven hundred and forty-eight (68.7% of entire sample of) participants reported receiving prenatal care while pregnant.

Stress levels of mothers were calculated by summing the number of "yes" responses mothers provided to questions asking about 23 types of stressors. Of the 23 types of stressors, mothers most frequently reported (a) moving to a new address (*n* = 4357, 30.7%), (b) arguing with husband or partner more than usual (*n* = 3537, 24.9%), (c) having many bills that could not be paid (*n* = 3186, 22.4%), and (d) having a family member with a serious illness (*n* = 3039, 21.4%). Mothers who reported no greater than one stressor during the 12 months before their infants were born were placed in the low-stress category (*n* = 3854, 27.1%). Mothers who reported two or more stressors during the 12 months before their infants were born were placed in the high-stress category (*n* = 6221, 43.8%). Almost one-third (n = 4121, 29.0%) of the stressor questions did not have responses.

Cigarette and alcohol use in the past two years. Two additional maternal-level independent variables for this study were maternal cigarette and alcohol use in the past two years. Almost one-third of participants (n = 4099, 28.9%) did not answer the question about their cigarette use in the past two years. Of the remaining participants, 6,192 (43.6% of) reported that they had not smoked cigarettes in the past two years whereas 3,905 (27.5% of) of participants reported that they had smoked cigarettes in the past two years.

Almost one-third of participants (*n* = 4091, 28.8%) did not answer the question about their alcohol use in the past two years. Of the remaining participants, 3,907 (27.5%) reported that they had *not* consumed alcohol in the past two years. In contrast, 6,198 (43.7%) of participants reported that they *had* drunk alcohol in the past two years. See Table 4.5 for these frequencies and percentages.

Table 4.5

Frequencies and Percentages of Cigarette and Alcohol Use in Past Two Years (N = 14196)

Variable Categories	*Frequencies*	*Percentages*
Cigarette Use in Past Two Years		
No	6192	43.6
Yes	3905	27.5
Missing	4099	28.9
Alcohol Use in Past Two Years		
No	3907	27.5
Yes	6198	43.7
Missing	4091	28.8

(N = 14196)

A chi-square (χ^2) test of independence was conducted to examine if mothers who drank alcohol in the past two years also smoked cigarettes in the past two years. Results from the chi-square (χ^2) test of independence were significant, $\chi^2(1) = 761.76$, $p < .001$. Results showed that 3,046 (78.2% of) mothers who drank alcohol also smoked cigarettes in the past two years.

Assumptions for Chi-Square (χ^2) Tests of Independence

One benefit of using chi-square (χ^2) tests of independence to test hypotheses is that this statistical test has few assumptions, and those that do exist are often easily met (Howell, 2010). The first assumption is that each observation is independent of all others (Howell, 2010). In this study, participants responded to their own PRAMS surveys, thus there existed only one observation per participant. This assumption was met. The second assumption for chi-square (χ^2) tests of independence is that cells should have at a minimum10 responses (Howell, 2010). In this study, the sample size of 14,196 participants allowed for more than 10 observations per cell. This assumption was met.

Hypotheses

This study tests nine hypotheses, six of which pertain to maternal-level independent variables and three of which pertain to maternal-level control variables. For all hypotheses, the dependent variables are (1) LBW or (2) PTB infant status, thus requiring one set of chi-square (χ^2) tests for each dependent variable. In this section, the six hypotheses related to maternal-level independent variables and the corresponding chi-square (χ^2) tests of independence results are presented. In the following section, the three hypotheses related to maternal-level control variables and the corresponding chi-square (χ^2) tests of independence results are presented. Due to the number and complexity of the hypotheses, the overall results for the nine study hypotheses are summarized in the final section of this chapter.

Hypotheses and Results: Maternal-Level Independent Variables

Hypothesis 1. The first hypothesis is that mothers who used cigarettes in the past two years were more likely to have LBW and preterm infants as compared to mothers who did not smoke cigarettes in the past two years. Results from the two chi-square (χ^2) tests of independence are presented in Tables 6.1 and 7.1 As hypothesized, with regard to smoking status and infant birth weight status, results were significant, $\chi^2(1) = 25.71$, $p < .001$, $\lambda=0.064$. Mothers who smoked cigarettes in the past two years were significantly more likely to have LBW infants (n = 1734, 44.4%) compared to mothers who did not smoke cigarettes in the past two years (n = 2435, 39.3%). With regard to smoking status and gestational age status, results -- contrary to the hypothesis -- were not significant, $\chi^2(1) = 0.04$, $p = .842$. Mothers who smoked cigarettes in the past two years were *not* significantly more likely to have pre-term babies (n = 1187, 30.5%) compared to mothers who did not smoke cigarettes in the past two years (n = 1897, 30.7%).

Table 4.6

Chi-Square (χ^2) Tests of Independence of Maternal Cigarette Use and Infant Birth Weight Status

Birth weight	Did not smoke (0)	Smoked (1)	Total
Low Birth Weight (0)	2435 (39.3%)	1734 (44.4%)	4169
Normal Birth Weight (1)	3757 (61%)	2169 (55.6%)	5926
Total	6192	3903	10,095

Note. $\chi^2(1) = 25.71$, $p < .001$, $\lambda=0.064$

Table 4.7

Chi-Square (χ^2) Tests of Independence of Maternal Cigarette Use and Infant Gestational Age Status

Gestational Age	Did not smoke (0)	Smoked (1)	Total
Preterm (0)	1897 (30.7%)	1187 (30.5%)	3084
Fullterm (1)	4283 (69.3%)	2704 (69.5%)	6987
Total	6180	3891	10071

Note. $\chi^2(1) = 0.04$, p = .841

Hypothesis 2. The second hypothesis is that mothers who drank alcohol in the past two years were more likely to have LBW and preterm infants than mothers who did not drink alcohol in the past two years. Results from the two chi-square (χ^2) tests conducted to answer this hypothesis are presented in Tables 4.8 and 4.9. With regard to maternal alcohol use and infant birth weight status, the first chi-square (χ^2) test of independence result was significant, $\chi^2(1) = 8.24$, p = .004, $\lambda = 0.063$ but the relationship is contrary to the hypothesis.

Mothers who drank alcohol were significantly *less* likely to have LBW infants (*n* = 2488, 40.3%) compared to mothers who did not drink alcohol (*n* = 1681, 43.0%).

With regard to maternal alcohol use and gestational age status of the infant, results from the chi-square analysis were not significant, $\chi^2(1) = 1.97$, p = .165. While not significant, the percentages for maternal alcohol use and infant pre-term status followed the same trend as the percentages for maternal alcohol use and LBW infants, with slightly more mothers (i.e., 1.3%) who *did not* drink during the past two years having pre-term infants than mothers who *did* drink in the past two years.

Table 4.8

Chi-Square (χ^2) Tests of Independence of Maternal Alcohol Use and Infant Birth Weight Status

Birth weight	Did not drank alcohol (0)	Drank Alcohol (1)	Total
Low Birth Weight (0)	1681 (43.0%)	2488 (40.3%)	4169
Normal Birth Weight (1)	2225 (57.0%)	3709 (59.9%)	5934
Total	3906	6197	10,103

Note. $\chi^2(1) = 8.24$, $p < .001$, λ=0.0631

Table 4.9

Chi-Square (χ^2) Tests of Independence of Maternal Alcohol Use and Infant Gestational Age Status

Gestational Age	Did not drink alcohol (0)	Drink Alcohol (1)	Total
Preterm (0)	1224 (31.4%)	1860 (30.1%)	3084
Full Term (1)	2674 (68.6%)	4321 (69.9%)	6995
Total	3898	6181	10079

Note. $\chi^2(1) = 1.97$, $p = .165$

Hypothesis 3. The third study hypothesis is that mothers who had higher levels of stress were more likely to have LBW and preterm infants compared to mothers who had lower levels of stress. Stress was categorized as higher stress = experiencing 2 or more psychosocial stressors during the 12 months before their infants were born and low stress = experiencing 0 to 1 psychosocial stressors during the 12 months before their infants were born. Results from the two chi-square (χ^2) tests of independence conducted to answer this hypothesis are presented in Tables 4.10 and 4.11

Table 4.10

Chi-Square (χ^2) Tests of Independence of Maternal Stress Level and Infant Birth Weight Status

Birth weight	Stress=0-1 (0)	Stress=2+1 (1)	Total
Low Birth Weight (0)	1483 (38.5%)	2675 (43.0%)	4158
Normal Birth Weight (1)	2371 (61.5%)	3544 (57.0%)	5915
Total	3854	6219	10,073

Note. $\chi^2(1) = 20.18$, $p < .001$, tau-b = -0.45

Table 4.11

Chi-Square (χ²) Tests of Independence of Maternal Stress Level and Infant Gestational Age Status

Gestational Age	Stress=0-1 (0)	Stress=2+1 (1)	Total
Preterm (0)	1146 (29.8%)	1925 (31%)	3071
Full Term (1)	2700 (70%)	4278 (69.0)	6978
Total	3846	6203	10,049

Note. $\chi^2(1) = 1.71$, $p = .191$

With regard to maternal stress and infant birth weight status, results were significant, and they supported the hypothesis, $\chi^2(1) = 20.18$, $p < .001$, tau-b = -0.45. Mothers who experienced higher numbers of stressors in the past 12 months before their infants were born were significantly more likely to have LBW infants ($n = 2675$, 43.0%) compared to mothers who had had experienced fewer numbers of stressors in the past 12 months before their infants were born ($n = 1483$, 38.5%). With regard to maternal stress and gestational age status of the infant, results were not significant, contrary to the hypothesis $\chi^2(1) = 1.71$, $p = .191$. Mothers who had experienced higher numbers of stressors in the past 12 months before their infants were born were *not* significantly more likely to have pre-term babies ($n = 1925$, 31.0%) compared to mothers had experienced fewer numbers of stressors in the past 12 months before their infants were born ($n = 1146$, 29.8%).

Hypothesis 4. The fourth hypothesis is that mothers with pre-pregnancy BMIs equal to or greater than 30 were more likely to have LBW and preterm infants. That is, mothers who, based on their pre-pregnancy BMIs being greater than or equal to 30, were categorized as obese, were more likely than mothers who, based on their pre-pregnancy BMIs being less than 30, were categorized as being of normal weight, were more likely to have low birth weight and preterm infants. Results from the two chi-square (χ^2) tests of independence conducted to address this hypothesis are presented in Tables 4.12 and 4.13.

Table 4.12

Chi-Square (χ^2) Tests of Independence of Maternal Pre-pregnancy BMI and Infant Birth Weight Status

Birth weight	BMI =<30 (0)	BMI=30+ (1)	Total
Low Birth Weight (0)	1847 (39.6%)	608 (39.6%)	2455
Normal Birth Weight (1)	2816 (60.4%)	927 (60.4%)	3743
Total	4663	1535	6198

Note. $\chi^2(1) = 0.00$, $p = 1.00$

Table 4.13

Chi-Square (χ^2) Tests of Independence: Maternal Pre-pregnancy BMI and Infant Gestational Age Status

Gestational Age	BMI=<30 (0)	BMI=30+ (1)	Total
Preterm (0)	1385 (29.7)	496 (32.4%)	1881
Full Term (1)	3272 (70.3%)	1037 (67.6%)	4309
Total	4657	1533	6,109

Note. $\chi^2(1) = 3.73$, $p = .054$, *tau-b* = -0.250

Regarding maternal pre-pregnancy BMI and infant birth weight status, results were not significant, and they did not support the hypothesis, $\chi^2(1) = 0.00$ p =1.00. In fact, the same percentages of LBW infants (i.e., 39.6%) were found for mothers with BMIs greater than or equal to 30 (n = 608) and mothers with BMIs less than 30 (n = 1847). The results for the chi-square (χ^2) test of independence examining maternal pre-pregnancy BMI and gestational age status of the infant were significant p<.10 and supported the hypothesis $\chi^2(1) = 3.73$, $p = .054$, τ-b = -.250. Mothers who had BMIs greater than or equal to 30 were significantly more likely to have pre-term infants (n = 496, 32.4%) compared to mothers with BMIs less than 30 (n = 1385, 29.7%).

Hypothesis 5. The fifth hypothesis is that mothers who went without prenatal care during their pregnancy were more likely to have LBW and preterm infants in comparison to mothers who received prenatal care during their pregnancy. Results from the two chi-square (χ^2) tests of independence conducted to address this hypothesis are presented in Tables 4.14 and 4.15. Results from the first chi-square (χ^2) test of independence examining maternal prenatal care status and infant birth weight status are significant, and they support the hypothesis, $\chi^2(1) = 15.90$, $p < .001$, $\lambda = 0.929$. Mothers who had not received prenatal care during their pregnancy were significantly more likely to have LBW infants ($n = 155$, 52.5%) compared to mothers who had received prenatal care during their pregnancy ($n = 3990$, 40.9%). The results for the second chi-square (χ^2) test of independence examining prenatal care status and gestational age status of the infant were also significant and supported the hypothesis $\chi^2(1) = 10.29$, $p = .001$, $\lambda = 0.906$. Mothers who had not received prenatal care during their pregnancy were significantly more likely to have pre-term infants ($n = 113$, 39.2%) compared to mothers who had received prenatal care during their pregnancy ($n = 2957$, 30.4%).

Table 4.14

Chi-Square (χ^2) Tests of Independence of Maternal Prenatal Care and Infant Birth Weight Status

Birth weight	No Prenatal Care (0)	Prenatal Care Services (1)	Total
Low Birth Weight (0)	155 (52.5%)	3990 (40.9%)	4145
Normal Birth Weight (1)	140 (47.5%)	5756 (59.1%)	5896
Total	295	9746	10041

Note. $\chi^2(1) = 15.90$, $p < .001$, $\lambda = 0.929$

Table 4.15

Chi-Square (χ^2) Tests of Independence of Maternal Prenatal Care and Infant Gestational Age Status

Gestational Age	No Prenatal Care (0)	Prenatal Care Services (1)	Total
Preterm (0)	113(39.2%)	2957 (30.4%)	3070
Full Term (1)	175 (60.8%)	6772 (69.6%)	6947
Total	288	9729	10017

Note. $\chi^2(1) = 10.29$, $p = .001$, $\lambda = 0.906$

Hypothesis 6. The sixth hypothesis is that mothers who were Black/African American were more likely to have LBW and preterm infants than White/Caucasian mothers. The two chi-square (χ^2) tests of independence conducted to address this hypothesis are presented in Tables 14.4 and 14.5 Results from the first chi-square (χ^2) test of independence examining ethnic group status and infant birth weight status are significant, supporting the hypothesis, $\chi^2(1) = 356.42$, $p < .001$, $\lambda = 0.478$. Mothers who are Black/African American were significantly more likely to have LBW infants ($n = 1976$, 56.7%) compared to White/Caucasian mothers ($n = 4122$, 38.5%). With regard to ethnic group status and gestational age status of the infant, the results for the chi-square (χ^2) test of independence are also significant, thus supporting the hypothesis $\chi^2(1) = 127.60$, $p < .001$, $\lambda = 0.219$. Black/African American mothers were significantly more likely to have preterm infants ($n = 1353$, 39.1%) compared to White/Caucasian mothers ($n = 3079$, 28.8%).

Table 4.16

Chi-Square (χ²) Tests of Independence of Maternal Ethnic Group and Infant Birth Weight Status

Birth weight	African American	Caucasian	Total
Low Birth Weight (0)	1976 (56.7%)	4122 (38.56%)	6098
Normal Birth Weight (1)	1507 (43.3%)	6584 (61.5%)	8091
Total	3483	10706	14189

Note. $\chi^2(1) = 356.42$, $p < .001$, $\lambda = 0.478$

Table 4.17

Chi-Square (χ²) Tests of Independence: Maternal Ethnic Group and Infant Gestational Age Status

Gestational Age	African American	Caucasian	Total
Preterm (0)	1353 (39.1%)	3079 (28.8%)	4432
Full Term (1)	2110 (60.9%)	7603 (71.2%)	9713
Total	3463	10682	14145

Note. $\chi^2(1) = 127.60$ $p < .001$, $\lambda = 0.219$

Hypotheses and Results: Maternal-Level Control Variables

Hypothesis 7. The seventh hypothesis is that mothers who were not married are more likely to have LBW and preterm infants than are married mothers. Results from the two chi-square (χ^2) tests of independence are presented in Tables 4. 18 and 4.19. With regard to maternal marital status and infant birth weight status, results from the first chi-square (χ^2) test of independence are significant, supporting the hypothesis, $\chi^2(1) = 217.41$, $p < .001$, $\lambda = 0.429$. Mothers who were not married were significantly more likely to have LBW infants (n = 3348, 49.4%) than mothers who were married (n = 2744, 37.1%). With regard to maternal marital status and gestational age status of the infant, as hypothesized, the results for the chi-square (χ^2) test of independence are significant, $\chi^2(1) = 42.63$, $p < .001$, $\lambda = 0.240$. Mothers who were not married were significantly more likely to have pre-term infants (n = 2294, 34.0%) compared to mothers who were married (n = 2132, 28.9%).

Table 4.18

Chi-Square (χ²) Tests of Independence of Maternal Marital Status and Infant Birth Weight Status

Birth weight	Not Married (0)	Married (1)	Total
Low Birth Weight (0)	3348 (49.4%)	2744 (37.1%)	6092
Normal Birth Weight (1)	3433 (50.6%)	4652 (62.9%)	8085
Total	6781	7396	14177

Note. $\chi^2(1) = 217.41$, $p < .001$, $\lambda = 0.429$

Table 4.19

Chi-Square (χ²) Tests of Independence of Maternal Marital Status and Infant Gestational Age Status

Gestational Age	Not Married (0)	Married (1)	Total
Preterm (0)	2294 (34.0%)	2132 (28.9%)	4426
Full Term (1)	4457 (66.0%)	5250 (71.1%)	9707
Total	6751	7382	14133

Note. $\chi^2(1) = 42.63$, $p < .001$, $\lambda = 0.240$

Hypothesis 8. The eighth hypothesis is that mothers who are of lower household income status are more likely to have LBW and preterm infants than are mothers of higher income status. Low-income status was defined as having a yearly household income of less than $20,000, and any income greater than or equal to $20,000 was considered higher income status. Results from the two chi-square (χ^2) tests of independence conducted to address this hypothesis are presented in Tables 4.20 and 4.21.

Table 4.20

Chi-Square (χ²) Tests of Independence of Maternal Income Status and Infant Birth Weight Status

Birth weight	Less than 20K (0)	More than 20K + (1)	Total
Low Birth Weight (0)	2428 (45.4%)	1539 (35.7%)	3967
Normal Birth Weight (1)	2917 (54.6%)	2776 (64.3%)	5693
Total	5345	4315	9660

Note. $\chi^2(1) = 93.96$, $p < .001$, tau-b = 0.099

Table 4.21

Chi-Square (χ^2) Tests of Independence of Maternal Income Status and Infant Gestational Age Status

Gestational Age	Less than 20K (0)	More than 20K (1)	Total
Preterm (0)	1728 (32.4%)	1218 (28.3%)	2946
Full Term (1)	3602 (67.6%)	3090 (71.7%)	6692
Total	5330	4308	9638

Note. $\chi^2(1) = 19.31$, $p < .001$, tau-b = 0.450

With regard to maternal income status and infant birth weight status, results from the chi-square (χ^2) test of independence were significant, $\chi^2(1) = 93.96$, $p < .001$, tau-b = 0.099, thus supporting the hypothesis. Mothers who were of lower-income status are significantly more likely to have LBW infants (n = 2428, 45.4%) compared to mothers who were of higher-income status (n = 1539, 35.7%). With regard to yearly income status and gestational age status of the infant, as hypothesized, the results for the chi-square (χ^2) test of independence were significant, $\chi^2(1) = 19.31$, $p < .001$, τ-b = 0.450. Mother who were of low-income status were significantly more likely to have pre-term infants (n = 1728, 32.4%) compared to mothers who were of higher income status (n = 1218, 28.3%).

Hypothesis 9. The ninth hypothesis is that mothers who had not received a high school degree are more likely to have LBW and preterm infants than mothers who had received a high school degree or higher. Results from the two chi-square (χ^2) tests of independence conducted to address this hypothesis are presented in Tables 4.22 and

4. 23. With regard to maternal level of education and infant birth weight status, as hypothesized, results from the chi-square (χ^2) test of independence were significant, $\chi^2(1) = 21.51$, $p < .001$, tau-b = 0.039. Mothers who had less than a high school degree were significantly more likely to have LBW infants (n = 1469, 46.5%) than to mothers who had at least a high school degree (n =

4559, 41.8%). Regarding maternal education level and gestational age status of the infants, the results for the chi-square (χ^2) test of independence are not significant, $\chi^2(1) = 0.92$, $p = .338$, thus not supporting the hypothesis. Mothers who did not have a high school degree were *not* more likely to have pre-term infants (n = 996, 31.9%) than to mothers who had a high school degree or higher (n = 3371, 31.0%).

Table 4.22

Chi-Square (χ^2) Tests of Independence of Maternal Education Level and Infant Birth Weight Status

Birth weight	12 Years Educ. (0)	12 Years Educ. (1)	Total
Low Birth Weight (0)	1460 (46.5%)	4559 (41.8%)	6019
Normal Birth Weight (1)	1683 (53.5%)	6346 (58.2%)	8029
Total	3143	10905	14048

Note. $\chi^2(1) = 21.51$, $p < .001$, tau-b = 0.039

Table 4.23

Chi-Square (χ^2) Tests of Independence of Maternal Education Level and Infant Gestational Age Status

Gestational Age	12 Years Educ. (0)	12 Years Educ. (1)	Total
Preterm (0)	996 (31.9%)	3371 (31.0%)	4367
Full Term (1)	2128 (68.1%)	7510 (69.0%)	9638
Total	3124	10881	14005

Note. $\chi^2(1) = 0.92$, $p = .338$

Summary of Results: Maternal-level Independent Variables and Infant Status Outcomes

Results for the first twelve chi-square (χ^2) tests of independence for the first six hypotheses are summarized in this section and are presented in Table 4.24. The results for the cigarette use and the outcomes of infant low birth weight and pre-term status were not easily understood. Although mothers who smoked cigarettes in the past two years were more likely to have low birth weight infants, they were not more likely to have pre-term infants, when compared to mothers who did not smoke cigarettes in the past two years. The results for the alcohol use are intriguing. Significance was found for alcohol use and low birth weight, but opposite of the expected direction. Mothers who did not drink alcohol in the past two years were more likely to have low birth weight infants compared to mothers who did drink alcohol in the past two years. While the results were not significant for the dependent variable of infant pre-term status, the percentages showed the same pattern.

Table 4.24

Summary of Results of Maternal-level Independent Variables and Infant Status Outcomes

Infant Dependent Variables	*Maternal Independent Variables*		*Research Hypothesis Supported*	
			Yes	*No*
	Cigarette Use			
	No	Yes		
Low birth weight	39.3%	44.4%	X	
Pre-term	30.7%	30.5%		X
	Alcohol Use			
	No	Yes		
Low birth weight	43.0%	40.1%		X[a]
Pre-term	31.4%	30.1%		X
	Stress Level			
	Low	High		
Low birth weight	38.5%	43.0%	X	
Pre-term	29.8%	31.0%		X
	Pre-pregnancy BMI			
	BMI < 30	BMI >= 30		
Low birth weight	39.6%	39.6%		X
Pre-term	29.7%	32.4%	X	
	Prenatal Care			
	Yes	No		
Low birth weight	40.9%	52.5%	X	
Pre-term	30.4%	39.2%	X	

	Ethnic Group		
	White	Black	
Low birth weight	38.5%	56.7%	X
Pre-term	28.8%	39.1%	X

Note. a : Results were significant but in the opposite direction

Equivocal results were found for stress and BMI status for both dependent variables. Mothers who had high stress levels were more likely to have low birth weight infants, but were not more likely to have infants who were pre-term. The opposite results were found for BMI status. Mothers who had BMIs greater to or equal than 30 were not more likely to have low birth weight infants, but were more likely to have pre-term infants, as compared to mothers who had BMIs less than 30.

The last two hypotheses were supported for both dependent variables, and the percentage differences were quite distinct. Mothers who had no prenatal care during their pregnancy were significantly more likely to have both low birth weight and pre-term infants than mothers who did. Furthermore, Black/African American mothers were significantly more likely to have low birth weight and pre-term infants as compared to White/Caucasian mothers.

Summary of Results

Maternal-level Control Variables and Infant Status Outcomes

Three sets of chi-square (χ^2) tests of independence were conducted to evaluate the three hypotheses that pertaining to the maternal-level control variables of marital status, yearly income status, and education. Results for the last three hypotheses are reviewed in this section and are summarized in Table 4.25.

Table 4.25

Summary of Results of Maternal-level Control Variables and Infant Status Outcomes

Infant Dependent Variables	*Maternal Independent Variables*		*Research Hypothesis Supported*	
			Yes	*No*
	Marital Status			
	Married	Not Married		
Low birth weight	37.1%	49.4%	X	
Pre-term	28.9%	34.0%	X	
	Yearly Income			
	Higher Income	Lower Income		
Low birth weight	35.7%	45.4%	X	
Pre-term	28.3%	32.4%	X	
	Education Level			
	HS Degree-Yes	HS Degree-No		
Low birth weight	41.8%	46.5%	X	
Pre-term	31.0%	31.9%		X

Marital status and yearly income status were significant for both dependent variables. Mothers who were not married were significantly more likely to have both low birth weight and pre-term infants as compared to mothers who were married. In addition, mothers who were of lower income status were significantly more likely to have low birth weight and pre-term infants as compared to mothers who were of higher income status.

Results for high school degree status and low birth weight status were significant. Mothers who did not have a high school degree were significantly more likely to have low birth weight infants as compared to mothers who had at least a high school degree. In contrast, mothers who did not have a high school degree were *not* more likely to have pre-term infants than mothers who had at least a high school degree.

Binary Logistic Regression

Binary logistic regression analysis is conducted for each dependent variable, infant birth weight and infant gestational age. As the dependent variables are dichotomous, binary logistic regression is the appropriate method (Klugh, 2013). The control variables, maternal marital status, yearly income, and education level are entered first in the logistic regression model, followed by the six independent variables, cigarette use, alcohol use, stress level, BMI, prenatal care, and maternal ethnicity. Results from the logistic regression analyses are reported by dependent variable.

Binary logistic regression: Maternal variables and infant birth weight status.

The logistic regression results for birth weight status show that the model chi-square was significant, $\chi^2(6) = 73.53$, $p < 0.001$ (see Table 4.26). The non-significance of the Hosmer and Lemeshow chi-square test confirmed that the model was a good fit to the data, $\chi^2(6) = 9.51$, $p = .301$. Results from the classification table showed that 62.4% of the infant birth weight categories were correctly classified into their respective category based on the predictor variables. The Nagelkerke R^2 for this model was .04, a small effect size (Cohen, 1992).

Table 4.26

Binary Logistic Regression of Predicting Infant Birth Weight Status (N = 14196)

Predictors	*B*	*SE*	*Wald* χ^2	*Df*	*p*	*Odds Ratio*	*95% CI for Odds Ratio*	
							Lower	Upper
Marital Status	*.210*	*.068*	*9.55*	*1*	*.002*	*1.23*	*1.08*	*1.41*
Yearly Income	*-.153*	*.066*	*5.42*	*1*	*.020*	*0.86*	*0.76*	*0.98*
Education Level	-.059	.085	0.48	1	.487	0.94	0.80	1.11
Cigarette Use	*.253*	*.062*	*16.87*	*1*	*<.001*	*1.29*	*1.14*	*1.45*
Alcohol Use	-.034	.060	0.31	1	.575	0.97	0.86	1.09
Stress Level	.033	.060	0.30	1	.581	1.03	.092	1.16
BMI	-.038	.063	0.37	1	.546	0.96	0.85	1.09
Prenatal Care	-.173	.371	0.22	1	.640	0.84	0.41	1.74

Ethnicity	*.643*	*.080*	*64.07*	*1*	*<.001*	*1.90*	*1.63*	*2.23*

Note. Significant results are italicized
(N = 14196)

Four maternal variables drove the significance of the binary logistic model: (a) maternal marital status, (b) maternal yearly income, (c) maternal cigarette use, and (d) maternal ethnicity. Mothers who were not married were 1.23 times more likely to have LBW infants as compared to mothers who were married, Wald $\chi^2(1) = 9.55$, $p = .002$. Mothers who had a yearly income of less than $20,000 had a 14.2% higher probability of having LBW infants as compared to mothers who were had yearly incomes that were at least $20,000, Wald $\chi^2(1) = 5.42$, $p = .020$. Both cigarette use and being of Black/African American ethnicity produced the strongest associations with infant birth weight status. Results showed that mothers who smoked during the past two years were 1.29 times more likely to have LBW infants as compared to mothers who did not smoke in the past two years, Wald $\chi^2(1) = 16.87$, $p < .001$. Mothers who were Black/African American were almost twice as likely (with an odds ratio of 1.90) to have LBW infants in comparison to White/Caucasian mothers.

Binary logistic regression: Maternal variables and infant gestational age status.

Results from the logistic regression on infant gestational age status showed that the model chi-square was significant, $\chi^2(6) = 25.58$, $p < 0.001$ (see Table 4.27). The non-significance of the Hosmer and Lemeshow chi-square test confirmed that the model was a good fit to the data, $\chi^2(6) = 13.17$, $p = .106$. Results from the classification table showed that 69.7% of the two infant gestational age categories were correctly classified into their respective category based on the predictor variables. The Nagelkerke R^2 for this model was .011, a small effect size (Klugh, 2013).

Table 4.27

Binary Logistic Regression of Predicting Infant Gestational Age (N = 14196)

Predictors	*B*	*SE*	*Wald* χ^2	*Df*	*p*	*Odds Ratio*	*95% CI for Odds Ratio*	
							Lower	Upper
Marital Status	.137	.072	3.61	1	.057	1.15	1.00	1.32
Yearly Income	-.029	.069	0.17	1	.679	0.97	0.85	1.11
Education Level	.079	.089	0.77	1	.380	1.08	0.91	1.29
Cigarette Use	-.002	.065	0.00	1	.977	1.00	0.88	1.13
Alcohol Use	.006	.063	0.01	1	.927	1.01	0.89	1.14
Stress Level	-.008	.063	0.01	1	.905	1.00	0.88	1.12
BMI	.098	.066	2.24	1	.135	1.10	0.97	1.26
Prenatal Care	.216	.416	0.27	1	.604	1.24	0.55	2.80
Ethnicity	*.377*	*.083*	*20.74*	*1*	*<.001*	*1.50*	*1.24*	*1.72*

Note. Significant results are italicized
(N = 14196)

Only one variable, maternal ethnicity, emerged as a significant predictor of infant preterm status, Wald $\chi^2(1) = 20.74$, $p < .001$, and drove the significance of the binary logistic regression model. Results showed mothers who were Black/African American were 1.50 times more likely to have preterm infants in comparison to White/Caucasian mothers.

Summary of Logistic Regression Results

Two binary logistic regressions were conducted to examine the predictive value of maternal demographic, cigarette and alcohol use, stress level, BMI, and prenatal care variables on the two dependent variables of infant birth weight status and infant gestational age status (preterm status). The first binary logistic regression, with infant birth weight status as the dependent variable, was significant, $\chi^2(6) = 73.53$, $p < 0.001$. The significant predictors of low birth weight status were (a) maternal single status, (b) maternal low-income status, (c) maternal cigarette use in the past two years, and (d) maternal African American ethnicity. The second logistic regression model, with the dependent variable of infant gestational age status (preterm status), was significant, $\chi^2(6) = 25.58$, $p < 0.001$. The only predictor of infant preterm status was maternal African American ethnicity.

CHAPTER 5:

SUMMARY AND DISCUSSION

This chapter ties the findings to the extant literature, discusses the limitations of this study and presents ideas for future research. The purpose of the research was to explore the relationship between stress and adverse birth outcomes of African American women. The findings reported in Chapter 4 build on previous research that focuses on environmental, behavioral risk, social and biological factors as contributors to adverse birth outcomes.

This study utilized survey data (2005-2010) from the Arkansas Pregnancy Risk Assessment and Monitoring System (PRAMS) national database. PRAMS is a public health surveillance project that is supported by the Centers for Disease Control and Prevention (CDC) in coordination with state health departments. The PRAMS research project collects state-specific, population-based data on maternal attitudes and experiences before, during, and shortly after pregnancy. CDC and Arkansas Department of Health researchers collect data yearly. They select randomly a sample of over 2,000 women who meet study criteria and send them the study packet by mail (Arkansas Department of Health, PRAMS, 2014). The mothers are asked to complete and return the PRAMS survey via mail. Follow-up of participants is done via phones if there no response from the mailed survey (Arkansas Department of Health, PRAMS, 2014). The study analyzed data from 14,196 participants using 2005-2010 PRAMS data. Of the 14,196 participants, 10,712 (75.5%) were White/Caucasian and 3,484 (24.5%) were Black/African American.

Interpretation of the Findings and Previous Research

This study examined relationships between maternal stressors and adverse infant birth outcomes of LBW and PTB using Arkansas PRAMS data from 2005-2010. In this study, the variables included the maternal behavioral risk factors of smoking and alcohol use, the maternal biological risk factors of ethnicity and BMI, the maternal social risk factors of receiving no prenatal care within the first two trimesters of pregnancy, not being married, not graduating from high school, being of low-income (i.e., making less than $20,000 a year), and experiencing two or more social stressors within the past year. Few studies have examined specific maternal risk factors as they relate to LBW or PTB. This was done to enhance knowledge on ethnic disparities and adverse infant birth outcomes resulting from maternal behavioral, biological, and social stressors (Hogan & Ferre, 2001).

The significant findings in this study align with results found in previous studies (e.g., Blumenshine et al., 2010; Din-Dzietham & Hertz-Picciotto, 1998; Shar & Alis, 2010; Vintzileos et al., 2002). Results from this study did show that mothers with less than an annual income of $20,000 were more likely to have LBW and/or PTB infants as compared to mothers having an annual income of over $20,000. Blumenshine et al. (2010) posited that the inconsistent findings in the literature with regard to socioeconomic status and adverse infant birth outcomes was likely a result of the use of maternal education as an indicator of income. Results in this study show that both income and education play important roles in influencing adverse infant birth outcomes. The measurement of these variables was defined as low income and education attainment. Low income was defined as making less than $20,000 a year and low maternal education was defined as not having a high school degree. This specificity in measurement is somewhat lacking in previous studies, which may have play a role in the inconsistency in findings from previous studies. As stated in Blumenshine et al. (2010), studies that have examined the effects of income on LBW and PTB have tended to use just maternal education as a measure of poverty. Measuring both income and education in this study helps to parse out the differences between income an education effects. The validity in measurement is important, as results from such measurement can be used to inform the development of public health initiatives directed toward specific groups of mothers at risk as a result or income and/or education levels.

Results in this study showed that alcohol use and BMI were not significantly associated with LBW nor PTB. Smoking during pregnancy was only significantly associated with LBW, but not with PTB. The lack of significance for alcohol use and adverse infant birth outcomes may have resulted from lack of validity with regard to (a) the cessation of alcohol use once pregnant and/or (b) the number of alcohol drinks consumed on a daily or weekly bias. Results from the study by O'Leary, Nassar, Kurinczuk, and Bower (2009) showed that mothers who drank heavily prior to their pregnancy and ceased drinking during their pregnancy were more at risk for having LBW and PTB infants than were mothers who drank in moderation throughout their pregnancy. Minimal alcohol use during pregnancy was not associated with increased odds of having infants who were of LBW or of PTB (O'Leary et al., 2009). This finding from O'Leary et al.'s (2009) study was supported in a review of literature by Odendaal, Steyn, Elliott, and Burd (2009), who found that the odds of having a LBW or PTB infant was not associated with moderate drinking (i.e., one to two alcohol drinks per day) and increased only when mothers drank three or more drinks per day. Futhermore, Patra, Bakker, Irving, Jaddoe, Malini, and Rehm (2011), in their meta-analysis of 36 studies showed that moderate alcohol use (defined as one drink per day) was associated with reduced odds of LBW or PTB.

Studies (e.g., Collins et al., 2004; Dietz et al., 2010; McCowan & Logan, 2009; Odendaal et al., 2009) have consistently shown associations between smoking and pre-pregnancy obesity and the increased risk of LBW or PTB. It is surprising that neither maternal smoking nor maternal BMI is associated with LBW or PTB. One reason for lack of significance with regard to smoking for PTB could be a low rate of cigarette smoking in general among African American mothers (Centers for Disease Control, 2008). Yerushalmy (2014), who found paradoxical results report that the group of low weight infants who were the healthiest had a mother who smoked and a father who did not smoke. This finding suggest, that other behavioral, environmental, and social factors may interact with maternal smoking. The combined use of both alcohol and cigarette smoking -- a common occurrence during pregnancy was not examined in the Yerushalmy, (2014). Odendaal et al. (2009) in their review of the literature, found that PTB that was highest in women who drank alcohol and smoked cigarettes. This result suggests that "the combined exposure" of the infant to both alcohol and nicotine is related to increases in LBW and PTB (Odendaal et al., 2009, p. 1).

Maternal pre-pregnancy obesity has been significantly linked to both infant LBW and PTB (Cedergren, 2004; Cnattingrus et al., 1998; McDonald et al, 2010; Siega-Riz et al., 2009). In this study, BMI was not associated with infant LBW and was not ($p < .135$) associated with PTB. The lack of significant results with regard to obesity may have resulted from the small percentage of mothers -- 10% -- who were obese, or, in relation, be a result of the lack of inclusion of women who were overweight (i.e., >= BMI of 25). Additionally, the BMI variable is prone to measurement error due because it is self- reported. Moreover, the lack of significant associations between maternal BMI and LBW can possibly be explained by the literature that has shown significant associations between maternal BMI and infants who were "*large* for gestational age" (Athukorala, Rumbold, Willson, & Crowther, 2010, p. 1).

The lack of significant influence of maternal social stress on adverse infant outcomes may be reflective of concerns related to the measurement of stress and other methodological issues (DiPietro, 2012). DiPietro (2012) argues that numerous inconsistent findings exist in the literature as they relate to maternal stress and adverse infant outcomes, and that methodological and measurement issues may be the cause of these empirical contradictions. DiPietro (2012) noted use of various and diverse self-report measures of stress across studies and advocated the use of physiological measurements of stress (e.g., stress hormone levels) versus maternal self-reports of perceived stress. This argument is supported in studies (e.g., Christian, 2012; Davis, Glynn, Waffarn, & Sandman, 2011; Douglas, 2010; Kramer et al., 2009) that have shown direct links between increased levels of cortisol and corticotrophin-releasing hormone and increased risk for having a PTB infant.

DiPietro (2012) further argued that inconsistent results in studies examining linkages between maternal stress and adverse child outcomes may be due to (a) lack of examination as to the timing of specific stressors; (b) the length, type, and severity of stress; and (c) “difficulties in distinguishing maternal stress from more ubiquitous aspects of maternal personality” (p. s3). These arguments have been supported in prior research. Davis and Sandman (2010) found that PTB depended upon the timing of exposure to maternal cortisol levels, with exposure to maternal cortisol levels during the first trimester significantly increasing PTB (as opposed to exposure during the second and third trimester). Other studies have shown that PTB is more likely to occur in mothers who have experienced prolonged exposure to stress as compared to mothers experiencing episodic stress events, with African American mothers experiencing chronic stressors being most at risk (Collins, Simon, Jackson, & Drolet, 2005; Hogue & Bremner, 2005; Love, David, Rankin, & Collins, 2010). Since the PRAMS survey was mailed to women who recently gave birth 2-4 months ago, there is the potential opportunity to explore in more detail the timing of exposure, particular in the first trimester of pregnancy or prolonged exposure to stress and measure the impact on birth outcomes.

There is an increasing awareness among public health researchers with regard to the relevance of racism as an important maternal stressor Schetter (2010). This argument is supported by Schetter (2010), who found that, of all of the studies that were reviewed, "race-related stressors prospectively predicted PTB and LBW, especially in African American women" (p. 536). Studies have furthermore supported DiPietro's (2012) contention that the effect of maternal stress on PTB is complicated by personality covariates. For example, research studies have shown that maternal stress covaries with maternal depression, anxiety, and perceived health to influence infant birth outcomes (Chatzi et al., 2013; Christian, 2012; Douglas, 2010; Hosseini et al., 2009).

While the results from this study did not support all hypotheses, the majority of findings was significant and aligned with previous research findings (Chatzi et al., 20143; Christian, 2012; Douglas, 2010; Hosseini et al., 2009). Some unexpected findings emerged. The behavioral risk factor of alcohol use and the biological risk factor of BMI were not significantly associated with LBW or PTB. The lack of significant associations between alcohol use and adverse infant birth outcomes is consistent with research showing no relationship between moderate use of alcohol (defined as 1 drink a day) and adverse infant birth outcomes.

The results further showed that smoking and having 2 or more major stressors in the past year were significantly associated with infant LBW, but not infant PTB (Table 4.24). It is unclear as to why a lack of significance with regard to smoking and adverse infant birth outcomes was found, as this relationship has been consistently supported in the literature. The lack of significant findings with regard to maternal stress and adverse infant birth outcomes was also unexpected. These non-significant results, although unexpected, may relate to limitations of the study; however, they can inform suggestions for future studies.

Limitations

There were strengths and limitations of this study. Strengths of the study were its strong external validity due to the use of the Arkansas PRAMS population-based data set (2005-2010) and the use of population-based data, which precluded the need to test for covariates and provided a substantially large sample size. These strengths allow the results to be generalized to Arkansas women who have given birth within the past few months. There were limitations of this study. Recall bias was a factor for this study. As women were asked to recall their experiences 2 to 4 months after giving live birth to an infant, their current psychological and emotional states, attitudes, and behaviors may have influenced their responses. A woman may recall her pregnancy and her experiences during the pregnancy differently based on the outcome of the pregnancy. For example, mothers with infants that were LBW or PTB may experience higher levels of stress than mothers of infants who were not LBW or PTB. Other limitations include how the PRAMS questions were posed and the question response format. For example, single item questions and the dichotomous measurement of the variables required the use of nonparametric statistics and prevented an examination of the stressors' degree of impact on the mother.

Future Areas of Research

Numerous avenues of new empirical investigation can result from this study. Despite the numerous years of PRAMS data, few studies have utilized PRAMS data to examine cohort differences with regard to maternal stressors and adverse infant birth outcomes. While the PRAMS study is cross-sectional, thus preventing longitudinal research, cohort studies can provide information on cohort differences and variable changes (e.g., changes across years with regard to alcohol use). Research is needed to untangle the effects of socioeconomic status (SES) by assessing how maternal education and income -- as well as other indicators of SES -- influence LBW and PTB. Studies that examine the combined use of alcohol and smoking on adverse infant birth outcomes are needed, as are studies that investigate the potential interplay between alcohol and drug use and obesity on LBW and PTB. Important areas of future investigation are those studies that examine mediation and moderation effects of social stressors on adverse infant birth outcomes. Suggestions for these types of future studies include the examination of how stressors influence BMI alcohol or cigarette use. This in turn influences LBW and/or PTB outcomes. Additional studies include how maternal socioeconomic status or ethnicity may moderate between perceived stress and adverse infant birth outcomes.

There is much room in the public health literature for studies on stress and maternal and infant outcomes. Future research should address and examine the exact type, timing, length, and severity of stressors and whether the stress was experienced before, during, or after the pregnancy. A gap in the literature remains with regard to the examination of racism as a stressor for African American women; studies are needed to examine the role that racism in general and different types of racism (e.g., institutional, interpersonal) may play in influencing infant birth outcomes in African American women. Studies that require participants to track specific stressors on a weekly or daily basis could reduce recall bias and enhance the measurement of stress. And lastly, the evaluation of interventions for women at risk for LBW or PTB is a necessity and could provide solutions about what works when developing programs and policy for targeted populations.

Policy Implications

Other than the Infant and Child Death Review Program: Infant Action and Mortality Group (2012) according to the Arkansas Department of Health (2012), there is currently no formal public policy to address infant mortality in Arkansas.[11] In the report, From Data to Action: A Background Paper on Infant Mortality in Arkansas (Arkansas Department of Health, 2012), recommendations are listed to address infant mortality and include improving direct services, enabling services, enhancing population-based services, expanding community-based services and increasing public awareness campaigns. Although African American births contribute disproportionately to PTB, there is no direct policy or current recommendation that would encompass addressing the effects of psychosocial stress on adverse birth outcomes for African-American women, PTB or LBW. Moreover, the intersectionality of how race, gender and socio-economic status may affect African American women's health and adverse birth outcomes is not included in the report discussion or recommendations.

According to the ecological model (Rowland-Hogue & Hargraves, C.J., 1995) when approaching issues such as PTB and LBW among African American women, there is a need to use intersectionality as a public health framework to further understand how these factors may interplay with health outcomes. Most public health approaches, systems and research typically examine each system or factor independently, thus impairing efforts to understand the health of people whose lives cut across these diverse realisms of experiences (Bowleg, L. 2012).

Policy options and recommendations that could influence PTB and LBW in African American women would include:

[11]Arkansas Infant and Child Death Review (ICDR) Program is to improve the response to infant and child fatalities, provide accurate information on how and why Arkansas children are dying, and ultimately reduce the number of preventable infant and child deaths by establishing an effective review and standardized data collection system for all unexpected infant and child deaths.

- Support and increase funding for research, education, and demonstration projects specifically targeted for African American women and that address PTB, LBW and psychosocial stress.
- Enhance public education about how to reduce PTB and LBW among caregivers and clinicians of the mother and integrate the ecological model as a framework.
- Acquire and sustain adequate funding and technical assistance for innovative grass root approaches that will address systems change in education, economic and social justice disparities and personal challenges experienced by the African American mothers.
- Increase access to perinatal intensive care services in NICUs (Neonatal Intensive Care Units).

Conclusion

The primary aim of this study was to assess whether ***psychosocial stress*** was associated with racial and ethnic disparities of low birth weight (LBW) and preterm birth (PTB). In the bivariate context, the findings support the hypothesis that mothers who had higher levels of stress were more likely to have LBW infants than mothers with lower levels of stress. However, in the multivariate models there is no relationship between stress and birth outcomes. Both LBW and PTB were significantly associated with (a) no prenatal care during the first two trimesters of the pregnancy; (b) not being married, (c) low socioeconomic status ; (d) lack of a high school degree; and (e) African American ethnicity. Mothers who smoked and/or who had experienced higher numbers of stressors in the 12 months before their infants were born were *not* significantly more likely to have a PTB compared to mothers who did not smoke and/or experienced fewer numbers of stressors in the 12 months before their infants were born. Alcohol use and BMI were not significantly associated (at $p < .05$) with either LBW or PTB. Results from this study can inform public health initiatives for women at risk for LBW and PTB and offer suggestions for new areas of research.

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APPENDICES

September 9, 2014

MEMORANDUM

TO:	Tionna Jenkins Brinck Kerr
FROM:	Ro Windwalker IRB Coordinator
RE:	PROJECT CONTINUATION
IRB Protocol #:	13-09-089
Protocol Title:	*The Role of Stress: Low Birth Weight and Preterm Birth for African American Women*
Review Type:	☒ EXEMPT ☐ EXPEDITED ☐ FULL IRB
Previous Approval Period:	Start Date: 09/17/2013 Expiration Date: 09/16/2014
New Expiration Date:	09/16/2015

Your request to extend the referenced protocol has been approved by the IRB. If at the end of this period you wish to continue the project, you must submit a request using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. Failure to obtain approval for a continuation on or prior to this new expiration date will result in termination of the protocol and you will be required to submit a new protocol to the IRB before continuing the project. Data collected past the protocol expiration date may need to be eliminated from the dataset should you wish to publish. Only data collected under a currently approved protocol can be certified by the IRB for any purpose.

This protocol has been approved for 14,196 total participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

APPENDIX B

AGREEMENT FOR SHARING ARKANSAS PRAMS DATA WITH EXTERNAL RESEARCHERS

I, ______________________________, as principal investigator on this proposed analysis of Arkansas Pregnancy Risk Assessment Monitoring System (PRAMS) data, agree to the following requirements for the use of Arkansas PRAMS data and assure compliance with the requirements.

1. I will not use nor permit others to use these data except for statistical analysis and reporting.
2. I will not use nor permit others to use these data to conduct analyses other than those for the research/project titled The Role of Stress: LBW and PTB for A. A. Women
3. I will not release nor permit others to release the data set or any part of it to any person others than those listed as collaborators in the attached proposal.
4. I will not attempt or permit others to use the data set to attempt to learn the identity of any participant. If the identity of a respondent should be inadvertently discovered, I will make no use of this knowledge, nor will I permit others to use the knowledge. I will inform the Arkansas PRAMS staff of the discovery, so they can prevent future discoveries. I pledge that neither I nor other members of my team will inform anyone else of this knowledge.
5. All oral or written presentations of the results of the analyses will include an acknowledgment of the Arkansas PRAMS and the Centers for Disease Control and Prevention.
6. All oral or written presentations of the results of the analyses will be submitted to the Arkansas PRAMS staff for review.
7. When the proposed analyses are completed, all copies of these data will be destroyed or returned to Arkansas PRAMS.

My signature indicates my agreement to comply with these requirements.

Name: ______________________________

Title: University of Arkansas – The Role of Stress: LBW and PTB for A. A. Women

Organization: University of Arkansas

Signature: ______________________________

Date: 6/17/2013

APPENDIX C

Smoking

1. Have you smoked cigarettes in the past 2 years?

   No=1, Yes=0

Alcohol

2. Have you had any alcoholic drinks in the past 2 years?

   No=1, Yes=0

BMI

3. Just before you got pregnant with your new baby, how much did you weigh?

   _______Pounds **OR** ______Kilos

4. How tall are you without shoes?

   _______Feet ______ Inches

Prenatal Care

The questions are about the prenatal care received during the most recent pregnancy. Prenatal care includes visits to a doctor, nurse, or other health care worker before the baby was born to get checkups and advice about pregnancy.

How many weeks or months pregnant were you when you had your first visit for prenatal care? Do not count a visit that was only for a pregnancy test or only for WIC (the Special Supplemental Nutrition Program for Women, Infants, and Children).

_____ Weeks **OR** ______ Months

___I didn't go for prenatal care

Psychosocial Stress: No=1, Yes=0

These questions are about things that may have happened during the 12 months before the new baby was born

a. A close family member was very sick and had to go into the hospital
b. I got separated or divorced from my husband or partner
c. I moved to a new address

d. I was homeless
e. My husband or partner lost his job
f. I lost my job even though I wanted to go on working
g. I argued with my husband or partner more than usual
h. My husband or partner said he didn't want me to be pregnant
i. I had a lot of bills I couldn't pay
j. I was in a physical fight
k. My husband or partner or I went to jail
l. Someone very close to me had a problem with drinking or drugs
m. Someone very close to me died

Psychosocial Stress (Traumatic): No=1, Yes=2

These questions are about things that may have happened during the 12 months before the new baby was born

1. During the 12 months before you got pregnant with your new baby, did your husband or partner push, hit, slap, kick, choke, or physically hurt you in any other way?
   No=1, Yes=2
2. During the 12 months before you got pregnant with your new baby, did an ex-husband or ex-partner push, hit, slap, kick, choke or physically hurt you in any other way?
   No=1, Yes=2
3. During the 12 months before you got pregnant with your new baby, did anyone else physically hurt you in any way?
   No=1, Yes=2
4. During your most recent pregnancy, did your husband or partner push, hit, slap, kick, choke, or physically hurt you in any other way?
   No=1, Yes=2
5. During your most recent pregnancy, did an ex-husband or ex-partner push, hit, slap, kick, choke, or physically hurt you in any other way?
   No=1, Yes=2
6. During your most recent pregnancy, did anyone else physically hurt you in any way?
   No=1, Yes=2

Psychosocial Stress (Traumatic) No=1, Yes=2

These questions are about things that may have happened during the most recent pregnancy

1. Your husband or partner threatened you or made you feel unsafe in some way
   No=1, Yes=2
2. You were frightened for the safety of yourself or your family because of the anger or threats of your husband or partner
   No=1, Yes=2
3. Your husband or partner tried to control your daily activities, for example, controlling who you could talk to or where you could go
   No=1, Yes=2
4. Your husband or partner forced you to take part in touching or any sexual activity when you did not want to
   No=1, Yes=2

Income

During the 12 months before your new baby was born, what was your yearly total household income before taxes?

a. Less than $10,000
b. $10,000 to $14,000
c. $15,000 to $19,999
d. $20,000 to $24,999
e. $25,000 to $34,999
f. $35,000 to $49,000
g. $50,000 or more

Education

1. Less than high school diploma
2. High school or GED
3. More than high school

Race

African American=0, Non-Hispanic Caucasian=1