EFFECTS OF MARITAL STATUS AND RACIAL DISPARITIES IN LOW BIRTHWEIGHT INFANTS OF MEDICAID WOMEN

By

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ABSTRACT

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Low birthweight (less than 2500 grams) is a leading cause of death in the first 28 days of life in the United States; in 2012, eight percent of infants born in the United States were low birthweight. These infants are more likely to have long-term health sequealae or die during the first year of life than are infants of normal weight. This makes it important to further the understanding of low birthweight so prevention efforts are evidence-based and can lower the infant mortality rate in the United States; the United States has consistently higher infant mortality rates than most industrialized countries. Infant mortality is a multi-faceted problem, with poverty being a known risk factor for both infant mortality and low birthweight.

Weathering is a sociologic concept which posits that the longer one lives in poverty, the faster the aging process and onset of health conditions occur. Studies have been done applying the weathering concept to low birthweight in pregnancy, and comparisons of Black and White populations have been done; Hispanics have not been included in these studies.

Marital status has been studied for its effect on numerous health conditions, such as cardiovascular disease and cancer, and being married has been shown to frequently be

protective against disease complications and mortality. There has been very little research to date investigating the effect of being married on low birthweight.

This dissertation is a secondary analysis of the 2012 Natality Public Use Dataset, compiled annually by the Centers of Disease Control and Prevention. Black, White, and Hispanic mothers having singleton first-births in the US in 2012 were included in this study (N=499,323). Medicaid status was used as a proxy for living in poverty. The three racial/ethnic groups were analyzed for weathering by examining rates of hypertensive disorders (both chronic and pregnancy-induced). Marital status was included to investigate protective effects of being married.

Results showed that the weathering hypothesis was supported only within each racial/ethnic group. This may be due to all women in this study already being in poverty; comparison against the general population was not included.

Marital status was found to be significantly protective against LBW regardless of the presence or absence of hypertensive disorders for all three racial/ethnic groups, with Black women receiving the strongest protection. Hispanic women had the highest odds of LBW in the presence of both chronic and pregnancy-induced hypertension. These are both new findings.

Implications for healthcare providers and policymakers are discussed. In this time of rapidly evolving healthcare insurance in America, the impetus is great to make evidence-based decisions on creating healthcare agencies and policies to help lower America's infant mortality rate.

This dissertation is dedicated to the late Dr. Tom Luster. His love of teaching, collegial approach to students, and demonstration of true mentorship live on in my approach to students. He continually encouraged students to look at things differently, develop strategies to improve conditions for people at risk, and demonstrated how to think globally but act locally. You are truly missed, Dr. Luster.

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My children, Courtney (and Joe), Brandon, Morgan, and Eric, continually had faith in my ability to complete this degree. Your faith in me was more important than you will ever know. I have that same faith in each of you; follow your dreams!

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Chapter 1

INTRODUCTION

Infant mortality is often viewed as an important overall measure of the health of a nation, as it includes maternal health, public health practices, socioeconomic conditions, and the quality of and access to medical care. The world-wide infant mortality rate (number of infants who die by the age of 12 months per 1000 live births), was 42 when last reported as 2005-2010 figures by the United Nations Population Division (2013). Among the 195 countries reporting, the United States ranked 27th, with a rate of 6.1. This is a slight improvement from being ranked 33rd in 2005 with the rate of 6.8 (United Nations Population Division, 2007), but still demonstrates a continuation of the decades-long gap between the countries with the lowest infant mortality rates and the United States. This has long been a point of embarrassment and frustration for the United States, as the level of health care services available in America is far more advanced than many countries with significantly lower infant mortality rates. Access to those services and equity of services within geographic areas and sub-population groups (ethnicity/race) remains a challenge in America.

Infant mortality rates (IMR) vary widely within the United States. In the latest reported figures from 2008 births, the rate ranged from a low of 5.1 in California to a high of 11.9 in the District of Columbia (Mathews & MacDorman, 2010). This variation is due in part to the differences in high-risk population subgroups within each state (e.g., rural, urban, racial/ethnic, poverty). In addition, the disparity between the races continues. The IMR for Black infants born in the United States in 2011 was 11.4 compared to White

infants 5.1, (Black/White rate ratio [RR] = 2.2), and the IMR for Hispanics was 4.6 (Hoyert & Xu, 2012).

Disorders related to short gestation (infants born < 37 weeks gestation) and low birthweight (infants born < 2,500 grams) account for 17.0% of all infant deaths, second only to the grouping of congenital malformations, deformations, and congenital anomalies (Mathews & MacDorman, 2010). Aside from rare teratogen exposures, the congenital malformation group is largely unpreventable. This makes the category of short gestation/low birthweight the most common cause of infant deaths which may be amenable to improvement through intervention strategies.

Living in poverty is a known maternal risk factor for having a preterm or low birthweight infant (Borders, Grobman, Amsden, & Hall, 2007; Braveman et al., 2010; Collins, Wamback, David, & Rankin, 2009; DeFranco, Lian, Muglia, & Schootman, 2008; Geronimus, 1996; Goldenberg et al., 1996; Janevic et al., 2010; Kramer & Hogue, 2008; Sims, Sims, & Bruce, 2007). Mothers who live in poverty are at higher risk of having low birthweight infants because of the lack of amenities and resources available to maintain and promote preconceptual and maternal health. However, even among women living in equivalent poverty, there are significant differences in birth outcomes between races/ethnicities (Grady, 2006). One explanation of this disparity is that of "weathering," a concept first proposed by Geronimus (1996). The premise of weathering is that there is accelerated aging when living in detrimental conditions such as poverty, and the more one weathers, the higher the incidence and/or severity of premature and chronic medical conditions. These medical conditions may create secondary effects, such as adverse birth outcomes. Geronimus found that black women weathered faster than white women, which

accounted for some of the disparity in birth outcomes as maternal age increased; this has been supported by later studies (Geronimus, Bound, & Waidmann, 1999; Collins et al., 2008; Holzman et al., 2009; Love, David, Rankin, & Collins, 2010; Lu & Chen, 2004; Lu & Halfon, 2003; Rauh, Andrews, & Garfinkel, 2001).

The weathering research above was limited to Black and White populations. The exclusion of Hispanics may be due to the "epidemiologic paradox." This well-studied phenomenon states that while most Hispanics live in poverty, they have health outcomes, including infants with low birthweight, that are comparable or better than those of their White counterparts, and considerably better than their Black counterparts to whom they were more comparable from a socioeconomic viewpoint (Franzini, Ribble, & Keddie, 2001; Fuentes-Afflick, Hessol, & Perez-Stable, 1999; Markides & Coreil, 1986; Rosenberg, Raggio, & Chiasson, 2005). The lack of inclusion of Hispanics within the context of weathering is a gap in the literature.

Many health conditions affect pregnancy outcomes. Hypertension is one of the most prevalent conditions, and a known risk factor for adverse birth outcomes, including low birth weight, abruption placentae, and iatrogenic prematurity (Perry, Hockenberry, Lowdermilk & Wilson, 2010). There are two classifications of hypertensive disorders in relation to pregnancy: pre-existing and pregnancy-induced. Pre-existing (also known as chronic hypertension [CHTN]) must be diagnosed prior to pregnancy, while pregnancy-induced hypertension is first evident after 20 weeks gestation. Both conditions have the potential of having profound effects on the mother and fetus, up to and including death due to the narrowing of the vasculature, causing poor perfusion of the placenta, which subsequently causes decreased perfusion of oxygen to the fetus.

Being married also has been found to improve birth outcomes across various populations (Barrington, 2010; Hohmann-Marriott, 2009; Masho, Chapman, & Ashby, 2010; Nkansah-Amankra, Dhawain, Hussey, & Luchok, 2010). It is acknowledged that marital status is not a direct equivalent of financial and/or psychosocial support, but it is an indirect measure that is easily obtained on several demographic forms (including birth certificates), and has been found to have a positive influence on birth outcomes. Marriage is a mechanism by which mothers receive social/emotional and other types of support during and after pregnancy, and that support appears to mitigate some of the detrimental effect of living in poverty. This study will attempt to further explain the relationships between weathering and poverty with marital status, to explore racial differences in birth outcomes.

PURPOSE STATEMENT

The overall purpose of this study is to investigate racial differences (Black, White, Hispanic) in low birthweight for single mothers on Medicaid. The variables that will be studied to explain racial differences in low birthweight are hypertensive disorders to assess racial differences in "weathering" and marital status to assess racial differences in the potential of family protection.

Statement of the Problem

As the leading cause of infant mortality that is potentially preventable (or at least amenable to prevention strategies), low birthweight is an issue of great importance in the United States. Aside from mortality, the morbidity consequences of low birthweight are both immediate and long-lasting. In the best situation, the infant will have to spend a few

extra days in the hospital to ascertain the ability to properly feed and demonstrate thermoregulation. In the more severe cases, a lengthy Neonatal Intensive Care Unit (NICU) stay ensues, with likely complications and set-backs along the way. The family living in poverty may be ill-equipped to deal with the NICU stay (e.g. costs, travel), and may be overwhelmed with care of a special-needs infant upon discharge. The health concerns of these low birthweight infants do not end upon discharge, or even upon reaching one year of age; they are at high-risk for life-long morbidity (Barker, 2006). It has been shown that low birthweight is associated with increased rates of adult coronary heart disease, stroke, diabetes, and hypertension (Barker, 2006). These morbidities are thought to be due to the negative effect on the plasticity of vasculature and organs during in-utero stress.

A reduction in the rate of low birthweight infants is critical to addressing the problem, but has remained a medical mystery for decades (Berkowitz & Papiernik, 1993; Goldenberg et al., 1996; Tucker et al., 1991; Tucker & McGuire, 2004). Berkowitz and Papiernik even concluded, "It is unlikely that there will be further substantial improvement in infant survival in the United States unless a reduction in births of preterm low birth weight infants can be accomplished" (p. 414); this has yet to happen. It is critical that the underlying predisposing factors be identified to address effective reduction or prevention strategies. A holistic approach to investigation of these predisposing factors is tantamount to a solution; decades of biological studies have failed to identify an etiology for the majority of cases. While these medical studies must continue, so must they be supplemented with psychosocial evidence-based practice implications.

Racial (black vs. white) disparities in low birthweight are a well-known yet unexplained phenomenon. Even when controlling for known biological risk factors, there remains an inexplicable, very significant gap between black and white low birth weight births. This becomes a greater issue when looking at population projections, as the percentage of "white" is declining. The US Census Bureau (as cited in Martinez & Ariosto, 2011) reported that based on the 2010 Census, Hispanics accounted for more than half of the nation's expansion from the last census, making them currently the second most populous subgroup in the United States. It is crucial, therefore, to include Hispanics in this research, as they have been largely ignored in this research area.

Hypertension is one of the most common pregnancy complications, and has low birthweight and/or iatrogenic (caused by treatment) prematurity as common outcomes. In 2007, the US rate of chronic (pre-existing) hypertension (CHTN) was 11.0 per 1,000 live births. This compared to 2000 when the rate was 7.6, which is an increase of 45 percent from 2000 to 2007 (Martin et al., 2010). Conversely, the rate of pregnancy-induced hypertension (PIH; hypertension that does not occur until at least half-way through the gestation) has remained stable during that same time span, fluctuating between 37.4 (2003) and 39.9 (2005), with the latest reported rate being 38.8 in 2007.

Significance of the Study

Weathering within the context of pregnancy, although a relatively new concept, has received support in the literature (Borders et al., 2007; Collins et al., 2009; Geronimus, 1996; Holzman et al., 2009; Love et al., 2010; Lu & Chen, 2004; Lu & Halfon, 2003; Nkansah-Amankra, Luchok, et al., 2010; Sims et al., 2007). A very similar yet distinct body of literature has investigated the birthweight effects of living in poverty (Colen, 2006;

DeFranco et al., 2008; Grady, 2006; Grady & Ramirez, 2008; Janevic et al., 2010; Nkansah-Amankra, Dhawain, et al., 2010; Reagan, Salsberry, & Olsen, 2007). All of these studies except Sims et al. have looked at either solely black outcomes or black-white differences; none have included Hispanics. This is understandable, as the black population has had the worst rates for infant mortality within America, and comparison to whites has highlighted that disparity. However, as the largest growing ethnic group in the United States (Martinez & Ariosto, 2011), it is crucial to include Hispanics in this research. Additionally, as compared to other racial/ethnic groups in America, they have the highest fertility rates (Martinez & Ariosto); the obvious potential effect on overall birth outcomes is significant.

Marital status, as a measure of support, has been shown to be protective against adverse birth outcomes (Barrington, 2010; Hohmann-Marriott, 2009; Masho et al., 2010). However, it has not been included in the weathering studies to date. This study will contribute to the literature by compiling and analyzing the interplay of weathering and marital status for the three most populous (non-Hispanic black, non-Hispanic white, Hispanic) racial/ethnic groups. As aforementioned, Hispanics are the fastest growing subculture within America, and have yet to be included in major studies.

RESEARCH QUESTIONS

The following research questions are posed to gain a better understanding of the effects of weathering and marital status on the incidence of low birthweight, for non-Hispanic Black women, non-Hispanic White women, and Hispanic women who are on Medicaid in the United States. In this study Medicaid is used as a proxy for poverty. For

each of these questions, the three racial/ethnic groups will be analyzed individually; marital status and smoking will be entered as controls but racial differences in their impacts on low birthweight will also be evaluated.

1. What is the effect of increasing age on the odds of having a low birthweight infant controlling for marital status and smoking (Path A)?
2. What is the effect of increasing age on the odds of having hypertension (pre-existing [chronic] and pregnancy-induced) controlling for marital status and smoking (Path B)?
3. What is the effect of hypertensive disorders (chronic and pregnancy-induced) on the odds of having a low birthweight infant, controlling for marital status and smoking (Path C)?
4. What is the effect of increasing age on the odds of having a low birth weight infant, controlling for hypertensive disorders, marital status and smoking (Path D)?

Hypotheses

Path A:

1. The strongest effect of increasing age on the odds of having a low birthweight infant will be seen in Black women.
2. Smoking will increase the odds of low birthweight for all racial/ethnic groups.
3. Being married will decrease the odds of low birthweight for all racial/ethnic groups.

Path B:

4. The strongest effect of increasing age on the odds of having both chronic and pregnancy-induced hypertension will be seen in Black women.
5. Smoking will increase those odds for all three racial/ethnic groups.

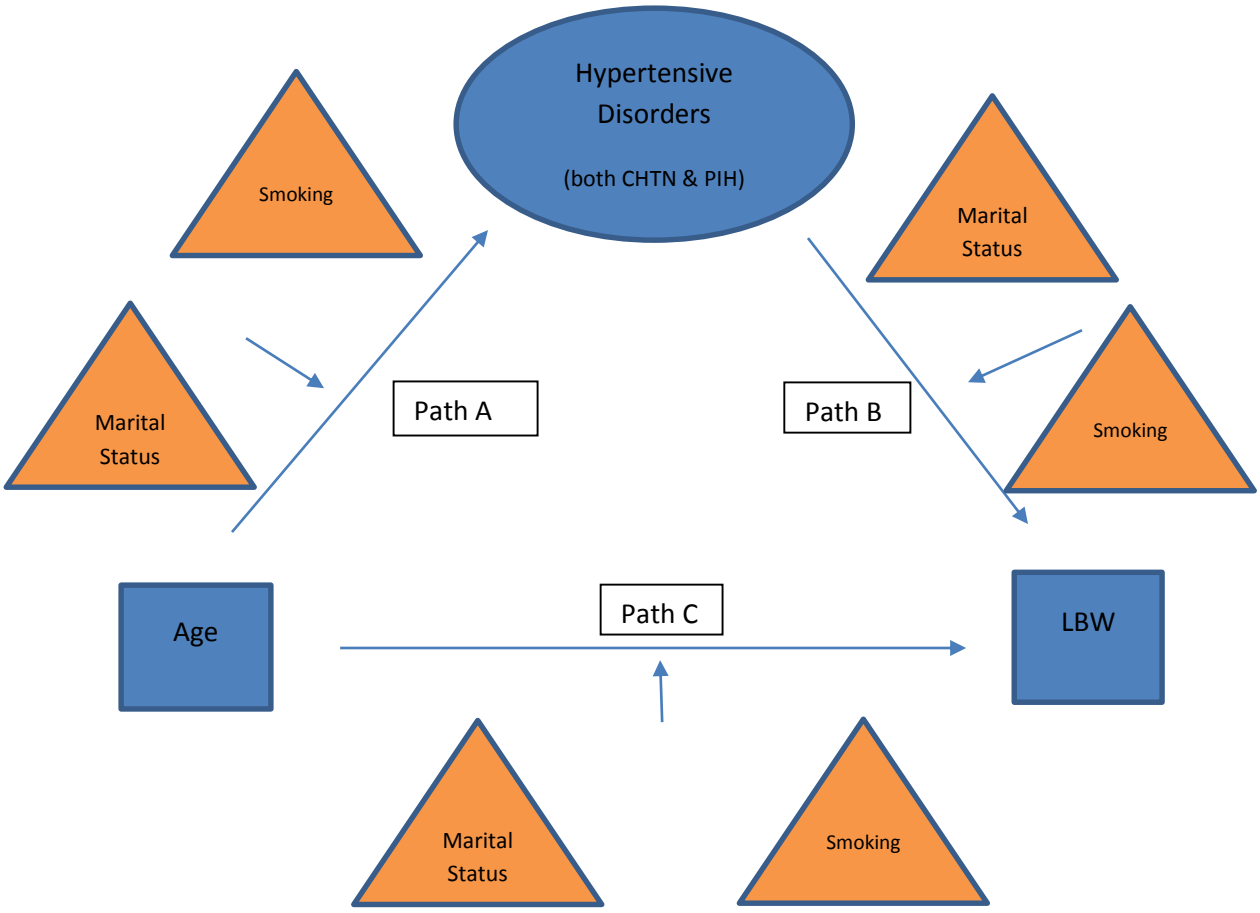
Path C:

6. The strongest effect of CHTN on the odds of having LBW will be seen in Black women.
7. Being married will decrease the odds of having low birthweight for all three racial/ethnic groups with CHTN or PIH.

Path D:

8. The strongest effect of increasing age on the odds of having low birthweight will be seen in Black women.
9. All three racial groups will have increased odds of LBW with increasing age in the presence of CHTN.
10. All three racial groups will have decreased odds of LBW if they are married.

Figure 1: Research Model



Path D: Age ⇒ LBW, controlling for hypertension, smoking, and marital status

: mediator : moderator

LBW: low birthweight

CHTN: chronic hypertension

PIH: pregnancy-induced hypertension

THEORETICAL FRAMEWORK

This study will utilize the human ecological framework, to investigate the interactions between mothers living in poverty and their environmental systems. Human ecology theory focuses on the interaction of humans, both as biological and social beings, with their environment (Bubolz & Sontag, 1993). Individuals, as well as families, are seen as dynamic and adaptive to changes within the internal and external systems with which they are interdependent (Bronfenbrenner, 1986). The framework can be used with many different populations of interest at the core (e.g., individual, family, neighborhood), as the interactions and adaptations within systems are applicable and adjustable to any core unit. For purposes of this study, the new mother and low birthweight (herein referred to as LBW) infant living in poverty will be the unit of analysis. There may or may not be others in the household, including a potential spouse.

Bronfenbrenner (1979) developed a conceptual model of the ecological environment, which is a "nested arrangement of concentric structures, each contained within the next. These structures are referred to as the micro-, meso-, and macrosystems" (p. 22). The innermost structure, the microsystem, is "a pattern of activities, roles, and interpersonal relations experienced by the developing person in a given setting with particular physical and material characteristics" (p. 22). An example of a microsystem is an individual's or family's home; the activities, roles, and relationships within that home comprise the critical components of the microsystem. Each home must be evaluated for its individual occupants, activities, roles, and relationships; similar family compositions (e.g., traditional married couple with two preschool aged children) will have both shared characteristics and unique features.

The other systems move outward from the microsystem. The next concentric layer is the mesosystem. Described by Bronfenbrenner (1979) as those settings beyond the immediate household in which the household occupants regularly interact, this would include entities such as work and school. This is followed by the exosystem, which includes those settings in which the household occupants do not directly interact, but still have a direct effect on the household. An example would be a non-live-in boyfriend's workplace; his job allows him to be able to contribute financially to the care of his child who lives in the household of interest. The most outer layer is the macrosystem. Bronfenbrenner describes this as "consistencies, in the form and content of lower-order systems (micro-, meso-, and exo-) that exist, or could exist, at the level of the subculture or the culture as a whole, along with any belief systems or ideology underlying such consistencies" (p. 26). Family and health professionals' beliefs that all pregnant women deserve access to proper prenatal care and resources, regardless of race or ethnicity, is an exemplar of a macrosystem consistency. Other examples are religion and neighborhood mores.

Bronfenbrenner (1986) later added a fifth system to his model. This is not another concentric circle, but rather an "over-lay" on the model. Labeled the "chronosystem," this refers to "time," and represents the fluidity and dynamic status of families and individuals. It can be used simplistically to represent a current snapshot of a certain timeframe in a family's life, or in more complex application, can be used to look at family life transitions over a time period. This complexity is echoed by another well-respected family scientist's statement that "Studying families isn't rocket science, it's harder. They are continually

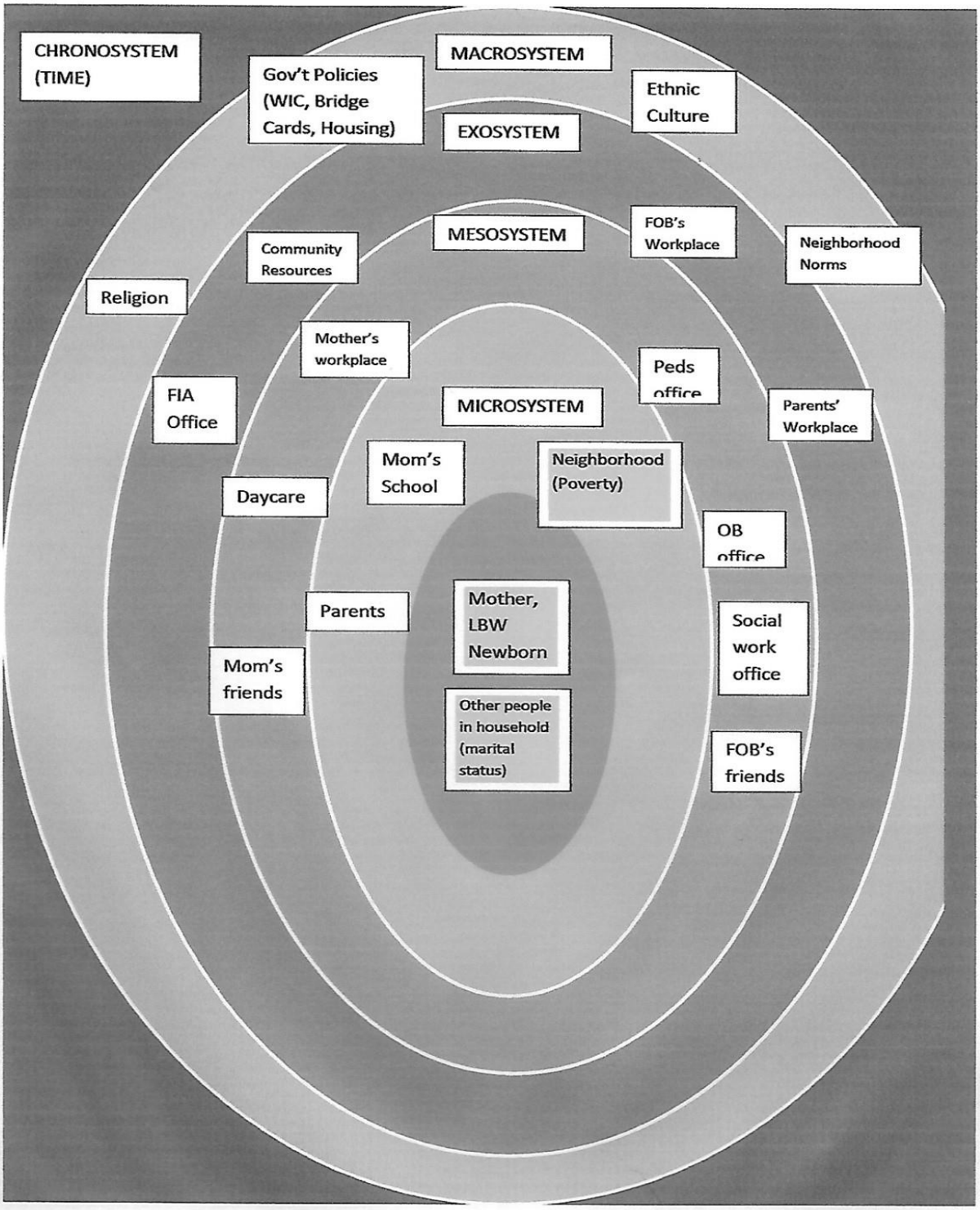
changing, day to day, and *always* fluid" (Dr. Joanne Keith, personal communication, July 2003).

In later years, Bronfenbrenner (1995) further refined his model to focus on Process-Person-Context-Time. Process refers to the interactions the person has with their environment, which is key to development; "it is by engaging in these activities and interactions that individuals come to make sense of their world and understand their place in it" (Tudge, Mokrova, Hatfield, & Karnik, 2009).

Human ecology theory supplements the concept of weathering. As women adapt and interact with their environment (ecology theory), there are simultaneous and subsequent physical adaptations occurring (weathering). Looking through the lens of human ecology allows for identification of the various factors within different levels (immediate or removed) of a mother's environment that can either directly or indirectly affect her health. A representative theoretical model is in Figure 2, with the factors contained in the research questions highlighted (page 15).

This study will focus on key factors within the microsystem, mainly, the presence of a spouse and the neighborhood of poverty. It must be understood that the many exemplars within the other systems (meso-, exo- macro-) are an ever-present influence on the mother and LBW infant (as demonstrated in Figure 2), but will not be included in this study.

Figure 2: Application of Bronfenbrenner's Model



DISSERTATION FORMAT

The following outlines the intended format of this dissertation:

Chapter One outlines the purpose and significance of this dissertation, with an overview of low birthweight, weathering, smoking, and marital status. A discussion of the ecological framework is included. Measures and variables to be extracted from the birth certificates are described.

Chapter Two is a detailed literature review of the key concepts of low birthweight, hypertension in pregnancy, weathering, and marital status.

Chapter Three describes the research questions, hypotheses, and research design, including the statistical methods that will be used.

Chapter Four lists the results of the statistical analysis.

Chapter Five is a discussion and integration of the results. This includes the contribution to the literature from these studies. Of import are implications for professionals working with families in poverty, health professionals engaged in the care of pregnant women, and policymakers who are responsible for designation of funding for health and family support programs, especially for those living in poverty.

Chapter Two

Review of the Literature

It is important to look only at singleton births when examining preterm birth rates, due to the rapid increase in the use of assisted reproduction techniques resulting in higher rates of twins and higher-order multiple gestations over the last several decades. Therefore, this dissertation is limited to singleton births, which account for approximately 96 percent of births in the US (Martin et al., 2010).

Poverty and Pregnancy

Poverty and its ill-effects have been thoroughly documented. The effects of living in poverty have special implications for pregnant women, as the repercussions for the fetus, then child, can be life-long (further discussed in the following sections).

The relationship of poverty to low birthweight has been well established in the literature, to the point where poverty is listed as a risk factor in maternity nursing textbooks (London, Ladewig, Ball, Bindler, & Cowen, 2011; Perry, Hockenberry, Lowdermilk, & Wilson, 2010). It is accepted that the connections between poverty and health are multifaceted, and include substandard housing, inadequate nutrition, lack of access to healthcare, and more environmental stressors with fewer material resources to cope with those stressors (Braveman et al., 2010). Physiologic responses to stress are well-documented, and involve many body systems, including the immune and vascular systems. These two physiologic systems are key to proper fetal development, as pregnancy already is an immunocompromised state, and the maternal vascular system must supply the placenta with all the fetal oxygen and nutritional needs.

Prenatal nutrition will affect both the mother and fetus. During pregnancy, if the body senses nutritional deficits, they will be shunted and/or pulled from the mother's nutritional stores to supply the growing fetus. These needs especially include calcium, protein, and iron. If there is inadequate maternal calcium intake, it will be pulled from maternal bones to supply the fetus, leaving the mother with increased risk of early and pronounced osteoporosis. Sources of protein tend to be expensive, and can be unattainable to those struggling economically. Red meat also is the main source of iron, which has increased demand during pregnancy. If the pregnant woman becomes anemic, it places her at high risk for extreme fatigue and hemorrhage, while placing the fetus at further risk for restricted growth and oxygen deprivation. Briley, Flanagan, and Lewis (2002) found that an in-home nutritional education program for black pregnant women living in poverty was effective in increasing iron intake, and women in the intervention group had significantly higher infant birthweights. LeBlanc and Rioux (2007) found a nutritional intervention program to be effective in lowering rates of maternal anemia for a low-income group of Caucasian women.in Canada.

Psychosocial/emotional stressors of living in poverty also are well-documented. Worry about the basic needs of survival (food, shelter, clothing, safety) cause chronic stress, which has been linked to multiple physiologic adversities, including hypertension and cancer. Stress during pregnancy (antenatal stress), however, has been studied very little as a separate entity. Associations have been found between antenatal stress and domestic violence (Curry, 1998; Dunn & Oths, 2004; Heaman, 2005), substance use (Jesse & Reed, 2004; Orr, James, & Miller, 1996), depression (Jesse & Swanson, 2007; Jesse,

Walcott-McQuigg, Mariella, & Swanson, 2005; Zuckerman, Amaro, Bauchner, & Cabral, 1989), poor weight gain (Orr et al.), and presence of a chronic medical disorder (Orr et al.).

Poverty and Hypertension

The association between poverty and hypertension is well-documented and multifactorial. Lack of access to healthcare and the inability to afford medications are common issues. Negative lifestyle choices which complicate hypertension, such as smoking and poor nutrition, also are more prevalent among lower income populations (Baumann, Chang, & Hoebeke, 2002; Kaplan et al., 2005; Nagahawatte & Goldenberg, 2008; Rothberg, Magriples, Kershaw, Rising, & Ickovics, 2011; Seligman, Laraia, & Kushel, 2010), especially if Black (Morenoff et al., 2007; Tanaka et al., 2007).

Less research has been done specific to pregnancy-associated hypertension and poverty, but studies are concordant in their findings that there is increased risk of PIH when living in poverty (Laraia, Siega-Riz, & Gundersen, 2010; Nagahawatte & Goldenberg, 2008; Tanaka et al., 2007).

Low Birthweight

Low birthweight (LBW) is defined as those infants weighing less than 2500grams at birth (5½ pounds), regardless of gestation. The US rate of LBW in 2007 was 8.2 percent, which has been on a slow but steady increase since the reported rate of 6.7 percent in 1984 (Martin et al., 2010), and data from 2012 shows the rate to be relatively stable at 8.0 (Martin et al., 2013). The increased health risks associated with LBW are well-documented. In 2006, 25 percent of all infant deaths were attributed to LBWs (Martin et al., 2010). Additionally, these infants have a multitude of chronic conditions, which will be further discussed later.

Within the LBW classification, there are two distinct groups: those who were born early and are therefore small, and those who are smaller than expected for that gestation. To be able to differentiate those infants who are smaller than expected for their given gestation, the term "SGA" (small for gestational age) is utilized. An SGA infant must be less than the 10^{th} percentile for weight at that gestation. There are typically different etiologies involved in SGA births than LBWs, as SGAs have had an issue with in-utero growth. This is different from a normally-growing fetus who is then subjected to preterm birth for whatever reason, and would then be classified as LBW, but not SGA. Conversely, it is possible to be both LBW and SGA if the infant was born early and is still smaller than expected for that gestation. Therefore, the outcome of LBW will be discussed in terms of both preterm birth (PTB) and SGA, to facilitate full understanding.

Preterm Birth

Preterm birth occurs prior to 37 weeks of gestation. It is often argued that preterm labor is the most complex, perplexing pathology within obstetrics today. There are multiple known causal factors such as trauma, infections, cocaine use, and uterine overdistention (e.g., twins), as well as iatrogenic causes. Despite all these known etiologies, approximately 45 percent of all preterm labor remains unexplained, which constitutes the largest percentage of all preterm labor causes (Goldenberg, Culhane, Iams, & Romero, 2008). Without a known cause for the majority of cases, prevention is difficult if not impossible. In fact, for decades, the question has remained as to whether it is feasible to reduce preterm birth rates with the limited knowledge of etiology. Tucker et al., as early as 1991, posited that further reduction in the preterm birth rate was not logical until further etiologies were identified; to date, these "further" etiologies remain unknown.

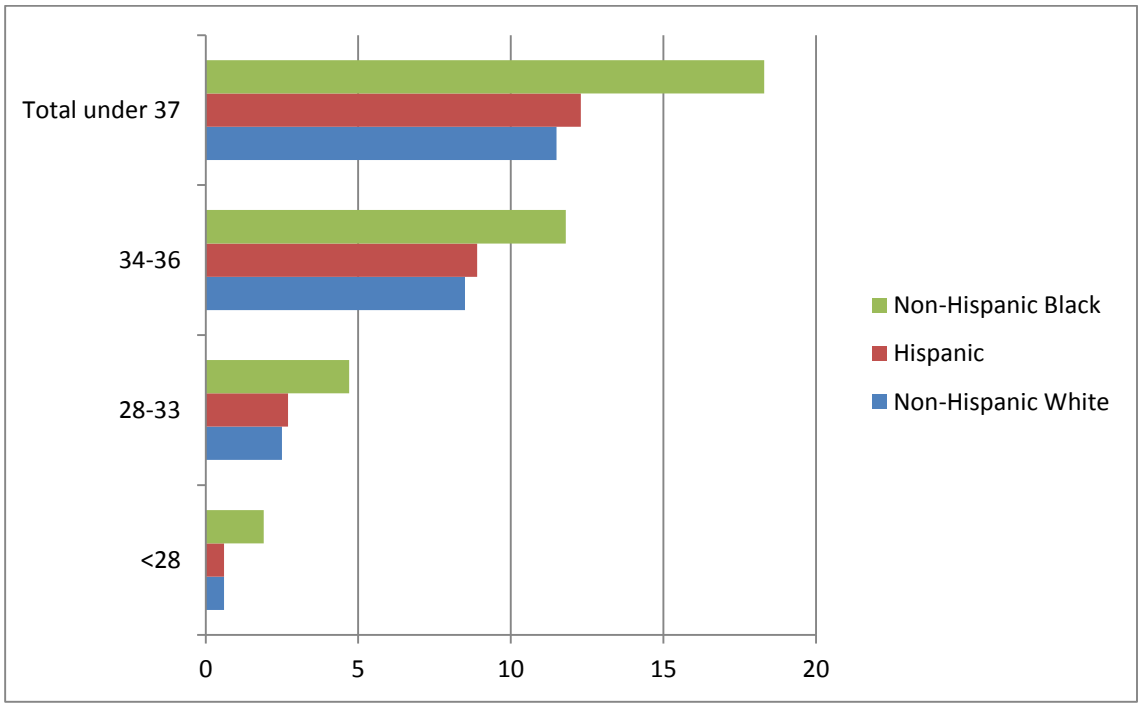
The overall rate of prematurity in America for 2012 was 11.6 percent of all births (Martin et al., 2013). Prematurity remains the leading cause of infant morbidity and mortality, with the severity of outcomes being positively correlated with the degree of prematurity. The degrees of prematurity are grouped into late preterm (34-37 weeks), preterm (28-33 weeks), and extreme preterm (<28 weeks).

The percentage of singleton births which were late preterm was 8.03 in 2007, down slightly from 8.14 in 2006; however, from 1990 (6.7 percent) to 2006 there had been a continual overall increase of 20 percent (Martin et al., 2010). Late preterm births comprise the majority (73 percent) of all preterm births (Martin et al.), and have the best outcomes of all preterm infants. However, this group still has increased rates of long-term morbidity and higher mortality than infants born at term (Mathews & MacDorman, 2010). Late-preterm infants have higher frequencies of "neonatal and postneonatal morbidities, such as respiratory distress, temperature instability, hypoglycemia, kernicterus, apnea, and feeding problems" (Reddy, Chia-Wen, Tonse, & Willinger, 2009, p. 235), and higher rates of post-neonatal rehospitalization, neonatal and post-neonatal mortality (Tomashek, Shapiro-Mendoza, Davidoff, & Petrini, 2007). Furthermore, Moster, Lie, and Markested (2008), in a study of preterm infants who were followed for over 20 years, found that late preterm infants had significantly increased rates of mental retardation, cerebral palsy, and other major disabilities as compared to term infants. These more recent findings have led to a shift in clinical practice; because of inherent errors in establishing due dates, induction of labor prior to 39 weeks must now have a medical indication (American College, 2009). Prior to that practice statement, it was common for elective inductions to occur as early as 37.5 weeks, since that was technically no longer preterm.

The remaining categories of degree of prematurity constitute the minority of all preterm births. “Preterm” accounts for 21 percent, and “extreme preterm” is 6 percent of all preterm births. The percent of all singleton births which were extreme preterm has remained essentially unchanged from 1990 (0.61 percent) to 2007 (0.62 percent) (Martin et al., 2010). These infants have the highest risk of mortality and long-term morbidity, with a first-year mortality rate of greater than 40 percent (Martin et al.).

Another complexity with the pathology of preterm labor is the significant racial disparity in rates. In 2007, the total preterm birth percent for non-Hispanic whites was 11.5, for Hispanic mothers was 12.3, but for non-Hispanic blacks was 18.3 (Martin, et al., 2010). This gap for non-Hispanic blacks continues across the subcategories of prematurity (Figure 1); and in fact is more than triple (1.9) that of non-Hispanic whites and Hispanics (0.6 each) for extreme preterm births (Figure 3). This racial gap has persisted and even widened across decades, and there is no evidence to show expectations of a narrowing of that gap. Additionally, there has been no overarching explanation for the disparity.

Figure 3: U.S. Preterm Birth percents (number per 100 births in the specified category) by Weeks Gestation and Maternal Race, 2007 (Martin et al., 2010)



In a large study by Sparks (2009), seven different racial/ethnic groups were included in an investigation of preterm birth disparities. The groups included non-Hispanic white, non-Hispanic black, US-born Mexican-origin Hispanic, foreign-born Mexican-origin Hispanic, other Hispanic, Native American, and Asian mothers. Results showed that "only non-Hispanic black mothers have a LBW disadvantage compared to non-Hispanic white mothers" (p. 769).

Small for Gestational Age

Small for gestational age (SGA) is the descriptor given to an infant who is less than the 10th percentile for weight for that gestational age. It is necessary to go as low as the 10th percentile to allow for genetic variations in size, especially bone length, which is one

of the key ultrasound determinants of fetal size. Next to prematurity, fetal growth restriction is the second leading cause of infant mortality (Baschat, Galan, Ross, & Gabbe, 2007). Unfortunately, the National Vital Statistics Reports does not record rates of SGA, but only LBW.

The etiologies of SGA are numerous, and are typically able to be identified, either pre- or post-natally. The restriction in growth can be inherent (e.g., two very short-statured parents), due to an exposure to a noxious agent during the pregnancy (e.g., cocaine, cytomegalovirus) or a maternal medical condition (e.g., chronic hypertension, severe anemia). These conditions result in a decrease in fetal growth due to an impairment at some level of oxygen and nutrient delivery to the fetus. The origin of that deficiency can be maternal (as in hypertensive disorders), placental (as in partial placenta previa), or fetal (as in chromosomal anomalies). Compared to appropriate-for-gestational age infants, "perinatal mortality rates in growth restricted neonates are 6 to 10 times greater; mortality rates as high as 120 per 1000 for all cases of (SGA)… have been reported" (Baschat et al., 2007, p. 771).

Barker (2006) published an oft-cited study in which adults who had been SGA were identified and assessed for medical conditions. Barker found that these adults had increased incidence of coronary heart disease, stroke, hypertension, and Type 2 diabetes. The study also found that "slow growth during infancy and rapid weight gain after the age of two years exacerbated the effect of slow fetal growth…The associations are thought to reflect the body's plasticity during development, by which its structure and function can be permanently changed by the intrauterine and early postnatal environment" (p. 270). The profound life-long effects of SGA are clear.

Hypertension

Hypertension is the constriction of blood vessels from any of numerous causes, resulting in higher intravascular pressure and decreased blood flow due to the narrowed diameter of the blood vessels. Overtime, this causes intravascular damage from the increased pressure, and end-organ damage from decreased delivery of oxygen and other nutrients.

The degree of perinatal risk is directly proportionate to the duration of the hypertension and the degree of hypertension; i.e., the woman who has had hypertension the longest with the highest blood pressures is the most at risk for poor outcomes. This is mainly due to vascular and organ damage from the elevated intravascular pressures. Vascular damage compromises placental perfusion; the woman's arteries provide suboptimal perfusion to the placenta, which directly affects fetal oxygenation and nutritional status. Maternal organ damage is found mainly in the kidneys and liver. The kidneys are an integral part of maintaining normal hydration and fluid/electrolyte balances, both of which are crucial to pregnancy outcomes. The liver is responsible for maintenance and/or conversion of multiple metabolic compounds, including bilirubin, amino acids, carbohydrates, fats, and thyroid hormones, all of which are necessary to achieve optimal pregnancy outcomes. Hypertensive damage to the kidneys and/or the liver will initially be temporary, but will become permanent with continued exposure to the elevated intravascular pressure. The central nervous system (CNS) also is affected, especially in pregnancy. In the presence of elevated blood pressures, the CNS becomes irritable and hypersensitive to stimuli; this can lead to seizures (also known as "eclampsia" during

pregnancy). Seizures during pregnancy are of major concern, not only for the trauma potential (falling, striking the abdomen/head), but also due to the lack of breathing during an eclamptic episode which can cause hypoxia in the fetus and premature labor.

Smoking

Use of cigarettes during pregnancy has long been established as a cause of poor pregnancy and postnatal outcomes. In the US in 2002, prenatal cigarette use was accountable for 5 to 8 percent of preterm deliveries, 5 to 7 percent of preterm-related deaths, 13 to 19 percent of term infants with growth restriction, and 23 to 34 percent of sudden infant death syndrome (Tong et al., 2013). It also increases the risk of placenta previa, placental abruption, and premature rupture of the membranes (Centers for Disease Control and Prevention, 2010).

There are over 7000 chemicals in cigarette smoke (Centers for Disease Control and Prevention, 2010), many of which cause inflammation and cellular damage to lung and vascular tissue. This creates reduced blood flow to the placenta, which is then exacerbated by intra-placental damage from the chemicals, further reducing blood flow and nutrient delivery to the fetus. These chemicals make the mother more at risk for hypertensive disorders from vascular damage, and lung damage from the direct exposure to inhaled chemicals; the outcome of each damaged system results in decreased blood flow and oxygen delivery to the fetus.

Weathering

The concept of weathering was first introduced by Geronimus, and was described as "the effects of social inequality on the health of populations [that] may compound with age, leading to growing gaps in health status through young and middle adulthood that can

affect fetal health" (Geronimus, 1996, p. 590). In her research on birth outcomes among blacks and whites living in poverty, increasing maternal age (from 15 years old forward) was significantly positively related to the rates of LBW for black women, but not for whites. It also was found that a "notable share of this interaction effect [is] explained by the measured maternal health characteristics…consistent with the theoretical perspective that among the socioeconomically disadvantaged, black women's health deteriorates more rapidly over the young adult ages" (Geronimus, p. 594). These same findings have been replicated by several subsequent studies (Collins et al., 2008; Geronimus, Bound, & Waidmann, 1999; Holzman et al., 2009; Lu & Halfon, 2003; Rauh, Andrews, & Garfinkel, 2001). However, all of these studies have investigated the application of the weathering concept to only black and white populations; Hispanics have not been included.

Goldenberg et al. (1996) studied almost 1500 singleton pregnancies in black and white women with lower socioeconomic status, analyzing multiple medical, psychosocial, and behavioral risk factors and their association with the LBW racial disparity. This study found that "many of the risk factors for low birth weight were more common among white women than black women. Nevertheless, black women had more infants born preterm, with growth restriction, and with low birthweight than did white women" (p. 1317). The concept of weathering, although not discussed in the study, could easily be applied and tested to help explain these findings.

Support of a racial difference in weathering is not universal. Borders, Bryant, Grobman, Amsden, and Holl (2007), in a study of chronic psychosocial stress and LBW in a low-income population, found the only demographic factor which was associated with LBW was increasing maternal age, regardless of race. They also found multiple

psychosocial factors (food insecurity, a child with chronic illness in the home, increased crowding in the home, unemployment, poor coping skills) were all significantly associated with LBW even after adjusting for maternal age.

Marital Status

The presence of a support system is a desired entity for anyone, especially a pregnant woman. While marital status has not been extensively studied, there are research findings which support its importance in birth outcomes.

Marital status can be used as a measure of parental relationship; it is not as descriptive as qualitative data, but has been used to infer a support system. Unmarried women are less likely than married women to report they and their partner both desired the pregnancy (Williams, 1994), and are more likely to be lower-income, lower-educated, have their relationship with their significant other dissolve, (Carlson, McLanahan, & England, 2004; Smock, 2000), and have low birthweight infants (Barrington, 2010; Bird, Chandra, Bennett, & Harvey, 2000; Hohmann-Marriott, 2009; Masho et al., 2010; Sullivan, Raley, Hummer, & Schiefelbein, 2012). Women who reported their pregnancy as unintended also were more likely to have inadequate prenatal care (Hohmann-Marriott).

None of these studies included the combination of race/ethnicity, maternal age, and poverty status to investigate variations in the above findings. This is a gap in the literature.

Marriage has been shown to be associated with improved overall physical and mental health (Koball, Moiduddin, Henderson, Goesling, & Besculides, 2010; Schoenborn, 2004; Wood, Goesling, & Avellar, 2007). Higher rates of cancer survival (Baine et al., 2011; Mahdi et al., 2013; Wang, Wilson, Stewart, & Hollenbeak, 2011), and better control of diabetes (Lister, Fox, & Wilson, 2013; Seidel, Franks, Stephens, & Rook, 2012) are

examples of health benefits experienced by people who are married. Specifically of import to this study, being married has been shown to be protective against cardiovascular complications (Baker et al., 1999; Floud et al., 2014: Idler, Boulifard, & Contrada, 2012; Kiecolt-Glaser & Newton, 2001; King & Reis, 2012; Robles & Kiecolt-Glaser, 2003; Zhang & Hayward, 2006). King and Reis also included marital satisfaction for those who were married, and found those who were not only married, but in a highly satisfying marriage, had the best long-term survival rates after cardiac surgery. They cited the combination of spousal support and motivation to adopt healthy lifestyle behaviors as key factors in this improved outcome.

Without qualitative data to describe the level of support in any relationship, marital status is used in many studies as a measure of support. Marriage may be another mechanism by which mothers receive social/emotional and other types of support during and after the pregnancy, and that support may mitigate some of the detrimental effects of living in concentrated poverty. Marriage rates are changing rapidly in America, making timely application of research findings difficult.

Chapter Three

Research Design

Data Set

The data set being used for this secondary analysis is the 2012 Natality Public Use Dataset, compiled annually by the Centers for Disease Control and Prevention (CDC) from recorded birth certificate data from all 50 states and the District of Columbia. Each state's registration area transmits those data electronically to the CDC's National Center for Health Statistics.

The data are limited to those US residents who give birth within the 50 states and the District of Columbia. Data from US residents who give birth outside the US are not included.

Inclusion criteria for this study are first-time live birth mothers, who are having a singleton birth (i.e., no twins, triplets, or higher order multiples). They are listed as having Medicaid as their primary payment source, and are between the ages of 15-44 years. Their race/ethnicity is listed as non-Hispanic Black, non-Hispanic White, and Hispanic. From that pool, any listed fetal anomaly or birth defect was cause for exclusion, due to altered growth issues.

Application for approval from Michigan State University's IRB was submitted. The IRB application #i043927 was determined to be exempt from human subject research criteria.

Definitions

Low birthweight (LBW): infant whose birthweight is <2500grams (5 pounds 8 oz.), regardless of gestation

Mother's Age: 15-44 years of age included in this study

Pre-existing hypertension (chronic hypertension): hypertension which has been diagnosed prior to conception of this pregnancy

Pregnancy-induced hypertension (also known as pre-eclampsia): a condition which is newly diagnosed during this pregnancy and is due to pregnancy.

Marital Status: data classified into "married" or "not married"

Smoking: use of cigarettes at any time during the pregnancy

Poverty: for this study, those mothers receiving Medicaid insurance

This dissertation is a secondary analysis of birth certificate data from the fifty states and the District of Columbia. Birth certificates are required for every infant born alive, regardless of gestation. Since the vast majority of births in America occur within hospitals, the completion of the birth certificate occurs in the hospital prior to discharge. There are two parts to the completed birth certificate: the abbreviated form and the complete form. The mother (and father, if present) are given the abbreviated form to complete, which lists parental birth dates, ethnicity/race, and the name for the newborn. The birth attendant completes the remaining portions, which include pertinent maternal medical history, and specific birth information (e.g., complications with labor and/or delivery, newborn complications). The hospital then files the completed birth certificate with the state, where

it is normally housed by the state's Department of Community Health, Division for Vital Records and Health Statistics. Each state then electronically transmits that data to the CDC, where it is compiled into a national data set.

This study will include only first-time births, since a history of preterm labor, preterm birth, or LBW is the largest single predictor of recurrence. The racial/ethnic groups to be included are non-Hispanic black, non-Hispanic white, and Hispanic. Multiple gestations will be excluded as preterm labor is expected as well as the subsequent LBW, and those infants with congenital anomalies or malformations. Maternal hypertension will be divided into those conditions which were present prior to the pregnancy, and those conditions which developed during the pregnancy or are classified as pregnancy-related. Chronic hypertension places pregnancies at risk for alterations in placental perfusion due to damage to the maternal vascular system prior to conception, while pregnancy-induced hypertension is a serious acute condition which can cause sudden and severe alterations in blood flow to the placenta and subsequently to the fetus. Hypertensive conditions will be analyzed with increasing age, to test the concept of weathering.

Marital status will be included. Birth certificates list single, married, divorced, and unknown as options. This study sorted those options into "married" and "not married" for purposes of statistical analyses.

Descriptive statistics will be compiled separately for Blacks, Whites and Hispanics. SPSS programming will be used for the descriptive and statistical analyses. Binary logistic regression will be utilized to study racial disparities in LBW. Confidence intervals will be set at 95 percent.

Chapter Four

STATISTICAL ANALYSIS

This chapter starts with the discussion of the descriptive statistics of the study participants. The second part describes the results of the statistical analysis of the five research questions.

Descriptive Statistics

The 2012 Natality File, found on the CDC website (http://www.cdc.gov/nchs/data_access/VitalStatsOnline.htm), contains the records on all birth certificates from the year 2012 that were filed in the fifty states and the District of Columbia. From that entire database (N= 1,569,943), cases were initially narrowed to those of mothers between the ages of 15-44 who were having their first live birth, and were using Medicaid as their primary payment source (N=542,455) (Table 1). The cases were then narrowed to include the races/ethnicities Non-Hispanic White (hereafter referred to as "White"), Non-Hispanic Black ("Black"), and Hispanic, as the three target groups in this study. Additional eliminations were then done for plurality (a pregnancy with more than one fetus) and those birth defects which are listed on the birth certificate. It is necessary to exclude plurality due to the high risk of premature labor and premature delivery, thus resulting in a low birth weight infant which may have nothing to do with the effects of living in poverty. Similarly, birth defects and chromosomal anomalies often result in overall lack of normal growth, resulting in a low birth weight infant regardless of environmental resources. This left a final N of 499,323 for inclusion in this study. These final cases included Blacks (N= 116,732), Whites (N= 222,938), and Hispanics

(N=159,653) (Table 2), which are self-designated by the mother when she completes the birth certificate after the birth of her child.

Table 1: Birth Certificate Variables Excluded in Study

BIRTH CERTIFICATE VARIABLE	N
Total Births in US, 2012	1,569,943
Eliminate other than Maternal Age 15-44, First Live Birth, On Medicaid	-1,027,488
Eliminate other than Non-Hispanic White, Non-Hispanic Black, Hispanic	-34,004
Eliminate Plurality	-6450
Eliminate Spina Bifida & Anencephaly	-1671
Eliminate Oomphalocele & Gastroschisis	-426
Eliminate Cleft Lip &/Or Palate	-357
Eliminate Diaphragmatic Hernia	-71
Eliminate Down Syndrome	-153
FINAL N OF CASES TO BE INCLUDED	499,323

Table 2: Frequency of Racial/Ethnic Groups Included in Study

RACIAL/ETHNIC CATEGORY	N	%
Non-Hispanic White	222,938	44.6%
Hispanic	159,653	32.0%
Non-Hispanic Black	116,732	23.4%
TOTAL	499,323	100%

The overall rate of LBW for women in this study is consistent with national birth data, which has consistently shown Black women to have higher rates (12.5 per 100 live births) than either Whites (7.3) or Hispanics (7.0). True to the epidemiologic paradox, Hispanics have the lowest rate of LBW in this study despite living in increased poverty.

Table 3: Rate of LBW by Racial/Ethnic Group (Rate per 100 live births)

GROUP	LBW
Black	12.5
White	7.3
Hispanic	7.0

For all mothers, the age range was 15-44 years, and the mean, median, and mode for each group were very similar, with Whites having just a slightly higher average age at first birth (approximately 5 months older than the Hispanic average age, and 6 months older than the Black average age).

Table 4: Descriptive Statistics on Maternal Age in Years by Racial/Ethnic Group

GROUP	MEAN	MEDIAN	MODE
Black	22.10	21	20
White	22.74	22	20
Hispanic	22.20	21	19

However, the other key variables in this study, marital status and smoking, showed large discrepancies between groups. Specifically, Blacks were far less likely (9.6%) to be married than either Whites (26.0%) or Hispanics (24.0%). Also, Whites were substantially more likely to be smokers (23.1%) than either Blacks (5.4%) or Hispanics (2.1%).

Table 5: Descriptive Statistics of Marital Status and Smoking by Racial/Ethnic Group

GROUP	MARRIED	SMOKER
Black	9.6%	5.4%
White	26.0%	23.1%
Hispanic	24.0%	2.1%

Chronic hypertension (CHTN) (hypertension which is diagnosed and present prior to pregnancy) and pregnancy-induced hypertension (PIH) (high blood pressure first diagnosed during pregnancy) are both important complications of pregnancy. Blacks are more likely than either Whites or Hispanics to have CHTN or PIH (Table 6). True again to the epidemiologic paradox, Hispanics have the lowest pre-existing hypertension when becoming pregnant, and are still less likely than either Whites or Blacks to have PIH.

Table 6: Percentage of Births with CHTN and PIH by Racial/Ethnic Group

GROUP	% with CHTN	% with PIH
Black	1.9	7.2
White	1.1	6.4
Hispanic	0.6	4.6

Smoking is a well-known risk factor for hypertensive disorders. To analyze the number of women in this study who smoked and the frequency of having either CHTN or PIH, a cross-tabulation was run. Within the CHTN variable (Table 7), White women who smoked were the most likely to have CHTN; approximately 6 times more likely than Hispanics who smoked, and approximately 3 times more likely than Black women who smoked. These percentages are similar to the results in Table 4, which showed the much higher frequency of smoking amongst White women in this study when compared to

Blacks and Hispanics. Smoking was more apt to be associated with the presence of CHTN in all three racial/ethnic groups.

Table 7: Cross Tabulation of Frequency of Presence/Absence of CHTN and Smoking Within CHTN Variable

WITHIN CHTN		% NON-SMOKER	% SMOKER
BLACK	CHTN	91.3	8.7
	NO CHTN	94.3	5.7
WHITE	CHTN	74.2	25.8
	NO CHTN	75.3	24.7
HISPANIC	CHTN	95.6	4.4
	NO CHTN	97.9	2.1

When looking within the smoking variable (Table 8), racial/ethnic differences were seen. Of all women who smoked, Black women had the highest percentage of CHTN (almost 3%), more than double that of Whites (1.2%) and Hispanics (1.3%). Among the non-smoking women, Hispanics had the lowest percentage of CHTN (0.6%), compared to non-smoking Whites (1.1%) and non-smoking Blacks (1.9%).

Table 8: Cross Tabulation of Frequency of Presence/Absence of CHTN and Smoking Within Smoking Variable

WITHIN SMOKE		% NON-SMOKER	% SMOKER
BLACK	CHTN	1.9	2.9
	NO CHTN	98.1	97.1
WHITE	CHTN	1.1	1.2
	NO CHTN	98.9	98.8
HISPANIC	CHTN	0.6	1.3
	NO CHTN	99.4	98.7

When cross-tabulation was utilized to look within the PIH variable for frequencies of smoking, similar results were obtained. White women were the most likely to be smokers, whether PIH was present (21.7%) or not (25.0%), which is more than three times higher than rates of smoking amongst Blacks, and approximately 10 times higher than rates of smoking amongst Hispanic women.

Table 9: Cross Tabulation of Frequency of Presence/Absence of PIH and Smoking Within PIH Variable

WITHIN PIH		% NON-SMOKER	% SMOKER
BLACK	PIH	93.7	6.3
	NO PIH	94.3	5.7
WHITE	PIH	78.3	21.7
	NO PIH	75.0	25.0
HISPANIC	PIH	97.7	2.3
	NO PIH	97.9	2.1

Within the smoking variable, smoking Black women had the highest percentage of PIH (7.9%), compared to smoking White women (5.7%) and smoking Hispanic women (5.1%). Interestingly, PIH was less common among White women who smoked (5.7%) vs. White women who did not smoke (6.7%).

Table 10: Cross Tabulation of Frequency of Presence/Absence of PIH and Smoking Within Smoking Variable

WITHIN SMOKING		% NON-SMOKER	% SMOKER
BLACK	PIH	7.3	7.9
	NO PIH	92.7	92.1
WHITE	PIH	6.7	5.7
	NO PIH	93.3	94.3
HISPANIC	PIH	4.6	5.1
	NO PIH	95.4	94.9

RESULTS OF THE LOGISTIC REGRESSION

(Application of the Research Model)

Logistic regression was used to analyze the research questions. The models estimated (Paths A, B, C, and D) are described below. To reiterate, only first time singleton births for Black, White, and Hispanic women on Medicaid are included in this study, and each racial/ethnic group were run as a separate model.

Question #1: What is the effect of increasing maternal age on the odds of having a LBW infant controlling for marital status and smoking (Path A)?

The results from the first research question are presented in Table 11. Interestingly, the odds of having an LBW infant with every year of age increase was almost the same for Blacks (OR 1.025, 95% CI 1.021-1.029) and for Whites (OR 1.024, 95% CI 1.021-1.028) controlling for marital status and smoking. This finding does not support the weathering hypothesis, but will be discussed in Chapter Five. Hispanic women showed a significant but lower risk (OR 1.018, 95% CI 1.014-1.022). This finding corresponds to the epidemiologic paradox for Hispanics. Being married was protective for all racial/ethnic groups with Black mothers receiving the greatest protection (OR .774, 95% CI .724-.827). For all three groups, smoking also significantly increased the odds of having a LBW infant with White mothers having the highest odds (OR 1.807, 95% CI 1.745-1.872). All findings were significant at p=.000.

Table 11: Effect of Increasing Age on the Odds of Having LBW

Controlling for Marital Status and Smoking

		BLACK	WHITE	HISPANIC
	OR	1.025	1.024	1.018
AGE	CI	1.021, 1.029	1.021, 1.028	1.014, 1.022
	p	.000	.000	.000
	OR	1.606	1.807	1.749
SMOKING	CI	1.503, 1.716	1.745, 1.872	1.568, 1.952
	p	.000	.000	.000
	OR	.774	.911	.896
MARITAL	CI	.724, .827	.875, .948	.854, .940
	p	.000	.000	.000

Hypothesis #1: Black women will have the strongest effect of increasing age on the odds of having a LBW infant. This hypothesis is rejected, as there is almost no difference between Black and White women.

Hypothesis #2: Smoking will increase the odds of LBW for all racial/ethnic groups. This hypothesis is accepted.

Hypothesis #3: Being married will decrease the odds of LBW for all racial/ethnic groups. This hypothesis is accepted.

Question #2: What is the effect of increasing maternal age on the odds of having hypertension (CHTN or PIH) while controlling for marital status and smoking (Path B)?

The results (Table 12) show that for all three groups, as age increased, so did the odds of CHTN, controlling for marital status and smoking. The greatest odds were for Blacks to develop CHTN with increasing age (OR 1.133, 95% CI 1.124-1.141). In other words, for every year of age increase, Black women were 13 percent more likely to have chronic hypertension, Hispanic women were 12 percent more likely, and White women were 10 percent more likely. Being married was significantly protective against CHTN for every year of increasing age for both Black (p=.000) and White (p=.013) mothers. Again Black mothers were the most protected by being married. Being married does not significantly protect Hispanic women from CHTN. This may be due to the epidemiologic paradox. Smoking was found to be significantly associated with CHTN for Hispanic and Black mothers at p=.000, and still significant for Whites but slightly less so at p=.010.

Table 12: Effect of Increasing Age on the Odds of CHTN

Controlling Marital Status and Smoking

CHTN		BLACK	WHITE	HISPANIC
	OR	1.133	1.101	1.122
AGE	CI	1.124, 1.141	1.093, 1.108	1.111, 1.133
	p	.000	.000	.000
	OR	1.404	1.132	2.251
SMOKING	CI	1.203, 1.639	1.030, 1.243	1.652, 3.067
	p	.000	.010	.000
	OR	.710	1.120	.953
MARITAL	CI	.620, .813	1.024, 1.225	.827, 1.098
	p	.000	.013	NS

For PIH, the results (Table 13) show that for all three groups, as age increased, so did the odds of PIH, controlling for marital status and smoking. The greatest odds were for Blacks (OR 1.023, 95% CI 1.017-1.028) and Hispanics (OR 1.024, 95% CI 1.019-1.029) to develop PIH with increasing age, with slightly lower odds for Whites (OR 1.017, 95% CI 1.013-1.021). In other words, for every year of age increase, Black and Hispanic mothers were more than 2 percent more likely to have PIH, while Whites were slightly more than 1.5 percent more likely. Importantly, being married was protective of PIH for Black mothers only. Smoking was significantly associated with increased odds of PIH for White mothers only. This finding needs further investigation, as physiologically, smoking is a known risk factor for vasoconstriction and hypertensive disorders including CHTN as above.

Table 13: Effect of Increasing Age on the Odds of Development of PIH

Controlling for Marital Status and Smoking

PIH		BLACK	WHITE	HISPANIC
	OR	1.023	1.017	1.024
AGE	CI	1.017, 1.028	1.013, 1.021	1.019, 1.029
	p	.000	.000	.000
	OR	1.076	.841	1.126
SMOKING	CI	.979, 1.183	.806, .878	.961, 1.321
	p	NS	.000	NS
	OR	.885	1.039	1.017
MARITAL	CI	.815, .960	.998, 1.082	.961, 1.077
	p	.003	NS	NS

Hypothesis #4: Black women will have the strongest effect of increasing age on the odds of having both chronic and pregnancy-induced hypertension. This hypothesis is rejected.

Hypothesis #5: Smoking will increase the odds of having LBW for all racial/ethnic groups for both CHTN and PIH. This hypothesis is accepted for the CHTN model, and rejected for the PIH model.

Question 3: What is the effect of hypertensive disorders on the odds of having LBW, controlling for smoking and marital status (Path C)?

Not unexpectedly, these results showed a significant increase in having a LBW infant in the presence of CHTN for all three groups (Table 14). Both Blacks (OR 2.566, 95% CI 2.326-2.831) and Whites (OR 2.611, 95% CI 2.339-2.913) had greater than a 2.5 increase in odds of having a LBW infant in the presence of CHTN; Hispanics (OR 3.456, 95% CI 2.956-4.041) had more than a three-fold increase. Marital status was significantly protective against LBW in the presence of CHTN for Blacks (OR .871, 95% CI .817-.928; *p*=.000) and Hispanics (OR .940, 95% CI .897-.985; *p*=.009), and still significant but less so for Whites (OR .962, 95% CI .925-1.000; *p*=.050). When CHTN was present, smoking significantly (*p* = .000) increased the odds of LBW across all three racial/ethnic groups.

Table 14: Effect of CHTN on the Odds of Having LBW Controlling for Marital Status and Smoking

CHTN		BLACK	WHITE	HISPANIC
	OR	2.566	2.611	3.456
CHTN	CI	2.326, 2.831	2.339, 2.913	2.956, 4.041
	p	.000	.000	.000
	OR	1.625	1.807	1.728
SMOKING	CI	1.521, 1.737	1.744, 1.871	1.548, 1.930
	p	.000	.000	.000
	OR	.871	.962	.940
MARITAL	CI	.817, .928	.925, 1.000	.897, .985
	p	.000	.050	.009

In the PIH path (Table 15), all three groups were statistically significantly at increased odds for having a LBW infant when PIH was present. Blacks (OR 2.807, 95% CI 2.660-2.962) had increased odds of more than 2.5; Whites (OR 2.818, 95% CI 2.682-

2.961) had almost the same odds as Blacks. Hispanics (OR 3.469, 95% CI 3.257-3.694) had the largest risk, with increased odds of 3.5 of having an LBW infant when PIH was present. Being married was protective for Blacks (*p*=.000) and Hispanics (*p*=.005), but less significant for Whites (*p*=.035). Smoking was again shown to have significant (*p* = .000) effect on the odds of LBW when PIH was present for all three groups, demonstrating the importance of smoking reduction interventions.

Table 15: Effect of PIH on the Odds of Having LBW Controlling for Marital Status and Smoking

PIH		BLACK	WHITE	HISPANIC
	OR	2.807	2.818	3.469
PIH	CI	2.660, 2.962	2.682, 2.961	3.257, 3.694
	p	.000	.000	.000
	OR	1.642	1.845	1.745
SMOKING	CI	1.535, 1.756	1.781, 1.912	1.562, 1.950
	p	.000	.000	.000
	OR	.879	.958	.936
MARITAL	CI	.825, .937	.921, .997	.893, .981
	p	.000	.035	.005

Hypothesis #6: Black women with CHTN will have the strongest effect of CHTN on the odds of having LBW. This hypothesis is rejected.

Hypothesis #7: Being married will decrease the odds of having low birthweight for all three racial/ethnic groups with CHTN or PIH. This hypothesis is accepted.

Question #4: What is the effect of increasing maternal age on the odds of having LBW, controlling for hypertensive disorder, marital status and smoking (Path D)?

When Path A was re-analyzed by adding the presence of a hypertensive disorder (CHTN or PIH) to the controls, there were only very slight changes in the odds of increasing age on LBW (Tables 16 and 17) suggesting that hypertensive disorders are not strong mediators in the age and LBW relationship for Black, White and Hispanic mothers on Medicaid. Hispanic women had the least increase with each year of increasing age, which supports the epidemiologic paradox. As expected, the presence of CHTN or PIH increased the odds of LBW with every year of increase in maternal age. Hispanic women had the highest odds of LBW with the presence of CHTN (Hispanic OR 3.265, 95% CI 2.790-3.820; Black OR 2.393, 95% CI 2.167-2.643; White OR 2.460, 95% CI 2.203-2.747) or with the presence of PIH (Hispanic OR 3.439, 95% CI 3.229-3.663; Black OR 2.782, 95% CI 2.636-2.936; White OR 2.794, 95% CI 2.660-2.936). In other words, for every increased year of age, Hispanic women who had CHTN or PIH had more than a three-fold increase in the odds of having LBW, which are higher odds than Black or White women with either hypertensive disorder.

Being married did continue to significantly decrease the odds of having a LBW infant in every group when CHTN was present (Black OR .781, 95% CI .730-.835; White OR .909, 95% CI .873-.946; Hispanic OR .898, 95% CI .856-.942) as well as when PIH was present (Black OR .779, 95% CI .728-.833; White OR .905, 95% CI .869-.942; Hispanic OR .894, 95% CI .856-.942). These are new findings, which have not been reported in the literature.

Smoking remained significantly associated with increased odds of LBW in both CHTN and PIH models. All findings were significant at *p*=.000.

Table 16: Effect of Increasing Age on the Odds of Having LBW,

Controlling for CHTN, Marital Status, and Smoking

CHTN		BLACK	WHITE	HISPANIC
	OR	1.021	1.022	1.015
AGE	CI	1.017, 1.025	1.019, , 1.026	1.011, 1.019
	p	.000	.000	.000
	OR	1.592	1.805	1.723
SMOKING	CI	1.489, 1.702	1.743, 1.870	1.543, 1.924
	p	.000	.000	.000
	OR	.781	.909	.898
MARITAL	CI	.730, .835	.873, .946	.856, .942
	p	.000	.000	.000
	OR	2.393	2.460	3.265
CHTN	CI	2.167, 2.643	2.203, 2.747	2.790, 3.820
	p	.000	.000	.000

Table 17: Effect of Increasing Age on the Odds of Having LBW,

Controlling for PIH, Marital Status, and Smoking

PIH		BLACK	WHITE	HISPANIC
	OR	1.023	1.023	1.015
AGE	CI	1.019, 1.027	1.019, 1.026	1.011, 1.019
	p	.000	.000	.000
	OR	1.603	1.842	1.740
SMOKING	CI	1.499, 1.714	1.778, 1.909	1.557, 1.944
	p	.000	.000	.000
	OR	.779	.905	.894
MARITAL	CI	.728, .833	.869, .942	.856, .942
	p	.000	.000	.000
	OR	2.782	2.794	3.439
PIH	CI	2.636, 2.936	2.660, 2.936	3.229, 3.663
	p	.000	.000	.000

Hypothesis #8: All three racial/ethnic groups will have increased odds of LBW with increasing age in the presence of chronic hypertension. This hypothesis is accepted.

Hypothesis #9: Black women with CHTN will have the strongest effect of increasing age on the odds of having low birthweight. This hypothesis is rejected.

Hypothesis #10: All three racial groups will have decreased odds of LBW if they are married. This hypothesis is accepted.

There were both expected findings (e.g., the increased odds of LBW in the presence of CHTN) and unexpected findings (e.g., Black women not having higher odds of LBW than White women) in these results. It is important to note that the findings on marital status and the results on Hispanics are both are contributions to the literature which have not yet been reported in this subject area. All findings are further discussed in the following chapter.

CHAPTER FIVE

CONCLUSIONS

This chapter includes the discussion and implications of the research findings, theoretical applications, limitations of this study, and implications for future research. It also includes implications for health care professionals and legislative officials who control budgets and make policies regarding health care.

This study sought to explore the relationship of living in poverty –i.e., being on Medicaid, and the odds of having a LBW infant, through a secondary analysis of all birth certificates filed in the United States in 2012 and correlated into a public data set owned by the CDC (http://www.cdc.gov/nchs/data_access/VitalStatsOnline.htm). Included in this research were first-time mothers living in poverty (as defined by having Medicaid for insurance) who were non-Hispanic White (45% of total N in this study), non-Hispanic Black (23%), and Hispanic (32%). There are multiple confounding factors listed on birth certificates which raise the risk of having an LBW infant that have nothing to do with living in poverty per se; these factors (e.g., congenital anomalies, twins, chromosomal abnormalities) were cause for elimination from the study. The final number of cases included in this study was just under one-half million (N=499,323), which allows for generalizability based on the large sample size.

The frequency of LBW was highest in the Black women (13% of Black women in this study, vs. 7% of included White and Hispanic women), which corresponds to national statistics and speaks to the disturbing continued disparity in Black and White birth outcomes. These LBW infants face increased odds of poor outcomes such as death in the first year of life and adult co-morbidities such as diabetes and heart disease. The need for further understanding and prevention of LBW has obvious significance for not only these

infants as individuals, but also for healthcare costs and budgetary considerations for America in general. A significant reduction in the rate of hypertension and diabetes would cause a profound reduction in healthcare costs in America.

Weathering, as a sociologic construct, is defined as a more rapid aging process brought on by the chronic stress of living in poverty. Decreased access to amenities (e.g., heat, proper nutrition, clean water), as well as limited access to health care (geographic and financial availability) can cause exacerbation of current health issues, failure to recognize the onset of new health conditions, and lack of treatment for diagnosed conditions. Work by previous researchers has shown that Black women weathered faster than White women living in similar poverty, and that there were disparate pregnancy outcomes related to that weathering process. To date, Hispanic women had not been included in any of that research. As the fastest growing racial/ethnic group in America, it is important to include Hispanics in such comparative research.

Human ecology theory studies the interaction of humans and their environment. Family ecology, then, looks specifically at families as the unit of interest. In this study, the family was defined as the mother, her newborn infant, and a potential spouse (if listed on the birth certificate). The environment included in this study was that of living in poverty. Having Medicaid insurance was used as the proxy for living in poverty, since there are no income data on a birth certificate.

Marriage has been shown to be associated with better health in the literature. This study included marital status as a variable, to see if it provided a protective effect against the risk of having a LBW infant for these women living in poverty. Of the women in this

study, 10 percent of Blacks, 26 percent of Whites, and 24 percent of Hispanic women were listed as "married" on the birth certificate.

With the increase in acceptance of inter-racial/mixed ethnicity marriages, the issue of racial/ethnic homogenicity becomes complex. Some of the women in this study, are no doubt not homogeneously Black or White or Hispanic; but that is a limitation of the data available on the birth certificates currently used. The implications, then, for interpretation of racial/ethnic results and comparisons becomes blurred, and will become more so with increased societal acceptance and frequency of heterogeneous couples.

In the descriptive statistics, it was found that the average age at first birth was only slighter (approximately six months) older for Whites than for Blacks or Hispanics. This defies public perception of many conservatives that low SES Blacks are having babies at a much younger age than similar SES Whites. Instead, it speaks directly to the need to have pregnancy and women's health services universally available to all women, especially those living in poverty.

There is a striking difference in the large percentage of White mothers (23%) vs. Black (5%) or Hispanic (2%) who smoke. Smoking has been shown repeatedly, for decades, to have deleterious effects on a fetus and newborn, not to mention the woman herself. Qualitative research could help here, to investigate why this large disparity exists, and to see why Black and Hispanic women have lower rates. Did they smoke prior to the pregnancy and quit with the affirmation of pregnancy- and if so, what influenced them to stop smoking? Are cessation programs and therapies being equally offered and made available to these women? The American College of Obstetricians and Gynecologists (American College, 2010) recommends that all pregnant women be extensively counseled

regarding the dangers of smoking during pregnancy and that on-going assessment and encouragement be given throughout the pregnancy and post-partum period, since 50-60% of those women who quit smoking during pregnancy will resume smoking within the first year post-partum (American College). This has implications for the next pregnancy, and the goal of being smoke-free prior to becoming pregnant the next time. Women must be effectively counseled, encouraged, and coached in order to increase the success of cessation programs. Too often, in a busy obstetric practice, the lengthy time necessary to counsel women on smoking is not available, and the opportunity to effect change is lost. "Patient Education" within the context of an office visit is not a reimbursable event. If patient education is done as a separate event, such as a class on smoking cessation, it can then be billed but it is rare to receive third-party reimbursement for such a class. Typically, these type of classes are funded by the patient having to pay cash to be able to enroll, which automatically eliminates this as an option for women living in poverty. Insurance companies must place more value on this preventative teaching, and develop reimbursements specific to smoking cessations to allow healthcare providers the fiscal availability of time spent on this educational efforts.

DISCUSSION OF THE RESULTS OF THE RESEARCH QUESTIONS

This study looked at first-time mothers living in poverty and the relationships between increasing maternal age, hypertensive disorders, smoking, and marital status, and how those factors affected the odds of having an LBW infant. The results are discussed in order of the research questions.

Question #1: What is the effect of increasing maternal age on the odds of having LBW, controlling for marital status and smoking (Path A)?

The effect of increasing maternal age on the odds of having a LBW infant were consistent with current literature. While controlling for marital status and smoking, increasing age did increase the odds of LBW in each racial/ethnic group. This supports the weathering theory in general; women living in poverty (even younger women of reproductive age) have higher odds of health issues for every year they age, and that would include higher odds of having a LBW infant. What was unexpected was the lack of difference between those increased odds for Black and White women. According to the weathering research, Blacks have been found to weather faster, and therefore it was unexpected to find that Blacks had a 2.5 percent increase in LBW for every year they aged when compared to Whites who had a 2.4 percent increase. Hispanics had an expected result of lower odds than either Whites or Blacks, with a 1.8 percent increase in LBW for every year of increased maternal age. While the Hispanic finding is supported by the epidemiologic paradox, the lack of difference between White and Black is not supported by the weathering concept and is unexplained. This may be due to all women in the study already being in poverty, and not compared to the general population rates of LBW for each specific race/ethnicity. Further investigation is warranted to explore this finding.

Smoking was significantly associated with increased odds of LBW for all three racial/ethnic groups. This is an expected finding based on the physiologic effects of smoking, causing potent vasoconstriction and resulting in decreased maternal blood supply to the placenta, thereby reducing oxygenation and nutritional supply to the fetus. The combination of increasing maternal age (aging causes increased chance for

vasoconstriction due to loss of elasticity in the blood vessels) in the presence of smoking should increase odds of LBW, and that was shown in these results. It is important to re-iterate the profound difference in rates of smoking amongst the three groups; White women were more than four times more likely than Black women, and more than ten times more likely than Hispanic women to smoke during the pregnancy. Targeting smoking cessation strategies for areas with higher White populations would be most cost-effective based on these results, but is important for all women of childbearing age.

Being married was significantly protective against having a LBW for all three racial/ethnic groups. Within the limitations of secondary analyses, no further details can be gleaned from what benefit "married" is truly providing. This is congruent with prior research which has shown decreased rates of health issues such as hypertension and cardiovascular diseases for married people (see Chapter 2). It is postulated here that the benefits obtained from being married are multifactorial- financial, emotional, and logistic (e.g., having someone to help with errands, care of the home), all of which would lower stress, thereby decreasing the risk for high blood pressure and other stress-mediated illnesses. However, qualitative research is needed to go beyond the legal label of "married" and further define what is truly gained from that relationship. Certainly there are many couples who co-habitate without legal coupling and receive those same benefits, but without qualitative research or other designations in a research model, they are still considered "single" in studies bound by data which does not include some type of "supportive relationship" designation as an option.

Question #2: What is the effect of increasing maternal age on the odds of having hypertension (CHTN or PIH) controlling for marital status and smoking (Path B)?

Aging, as a physiologic process, increases the risk of hypertension. Overall, Blacks have higher risks than Whites and Hispanics (National Heart, Lung, and Blood Institute, 2012). This model showed that for women in this study (15-44 years of age), every year of increased age was significantly associated with increased odds of having CHTN or developing PIH regardless of race/ethnicity, when controlling for smoking and no prenatal care. Comparatively, Blacks had a slightly higher chance of CHTN (13%) than Hispanics (12%) or Whites (10%) for every year of increasing age. These results are supportive of the weathering hypothesis when comparing Blacks and Whites, showing that over multiple years, Blacks are developing CHTN at faster rates than Whites.

The fact that Hispanics had almost the same odds as Blacks needs further investigation. In this study, Hispanics were classified as a single group (as coded by the CDC in this data set). The birth certificate does list different ethnicities within this group that were not used in this study (e.g., Mexican, Puerto Rican). There are known differences in these Hispanic ethnicities in regards to hypertensive disorders. For instance, Puerto Ricans have higher death rates from hypertension than either Whites or Blacks, but Cubans have lower death rates than either Whites or Blacks (National Heart, Lung, and Blood Institute, 2012). The constitution of "Hispanics" in this study, as a group, is not known, but it is acknowledged that it is a multi-ethnic group which confounds these findings and their interpretation.

Smoking was significantly associated with increased odds of CHTN with increasing age for all three groups as well. This corresponds to general population risk of

smoking and developing hypertensive disorders. As previously discussed, the chemicals in cigarettes are potent vasoconstrictors; for anyone with a proclivity toward hypertension, or in the presence of overt hypertension, smoking will exacerbate the narrowing of the blood vessels and any outcomes of that constriction.

Being married conveyed significant protection against CHTN for Black mothers, and only mild protection for White mothers. It was not a significant factor for Hispanic mothers. This may be influenced by the much lower rate of marriage among Black women when compared to White and Hispanic women. Again, many Black women receive benefits from being in committed relationships without being able to check the "married" box on the birth certificate.

In the PIH arm of this model, chances of developing PIH were almost equal across the three groups. With every year of increased age, Blacks had a 2.3 percent higher chance of PIH; Whites had a 1.7 percent higher chance, and Hispanics had a 2.4 percent increase. An interesting finding in this PIH model, however, is that smoking was only a significant finding for every year of increasing age in White women. This may be related to the much higher rate of smoking amongst the White women in this study (23% were smokers) vs. the Black (5%) and Hispanic (2%) women. In light of the much higher rate of smoking, it is surprising that White women did not have higher odds of PIH than their counterparts. More research is needed here which would include identification of additional factors influencing these outcomes, as well as including quantification and timing of smoking in the pregnancy. There are certain to be outcome differences between those that smoke 1-2 cigarettes per day than those that use 1 pack (20 cigarettes) per day, and between those that quit in early pregnancy vs. those that smoke throughout the pregnancy.

Question 3: What is the effect of hypertensive disorders on the odds of having LBW, controlling for marital status and smoking (Path C)?

This question was posed to assess the odds of having LBW when hypertensive disorders were present, regardless of age. Results are consistent with healthcare literature. When CHTN was present, Blacks and Whites were more than 2.5 times more likely to have LBW than when CHTN was not present in their same racial group; Hispanics were more than 3 times more likely than non-hypertensive Hispanics. Physiologically, this makes sense since chronic hypertension has been present prior to the pregnancy, and vascular damage has been ongoing for an undetermined amount of time prior to the added physiologic stress of pregnancy. Once vascular damage becomes severe enough to cause decreased oxygen delivery to tissues, a process known as shunting occurs. The body recognizes the tissue hypoxia, and diverts a higher percentage of blood to what are considered "vital" organs- the brain, heart, and kidneys. The uterus then becomes even more depleted of available oxygen and nutrients to transfer to the fetus, resulting in LBW.

The occurrence of PIH also was significantly associated with higher odds of LBW. When PIH was present, Black and White women were more than 2.5 times more likely to have LBW (than Black or White women without PIH), and Hispanic women had the largest increase at almost 3.5 times more likely (than Hispanic women without PIH). These findings again do not support the weathering hypothesis, since White women with PIH were equally apt to have LBW than Black women with PIH. This may be due to the aforementioned situation of all women in this study already being in poverty, and not comparing to the general population for each race/ethnicity. And for PIH, the

epidemiologic paradox for Hispanic women was not protective, as they had the highest risk of LBW in this situation.

For both the CHTN and the PIH arm, smoking was significantly associated with increased odds of LBW. This is congruent with healthcare literature, where the association between smoking and having a LBW infant are well-publicized. Further study which includes quantification and duration of smoking in pregnancy could lend further insight into critical levels of smoking which trigger the LBW outcome.

Being married was protective against CHTN and PIH for all three racial/ethnic groups. However, Black women received the largest protection. This is a new finding, and important enough to warrant further investigation to identify the true benefits these women are receiving from being married.

Question 4: What is the effect of increasing maternal age on the odds of having LBW when controlling for marital status, smoking, and hypertensive disorder, (Path D)?

In the final question, all the variables included in the research questions were included as controls to assess the effect of increasing maternal age on the odds of LBW.

This question was analyzed once controlling for CHTN along with the other controls (smoking and marital status), and then re-analyzed substituting CHTN with PIH. For each racial/ethnic group, there was essentially no difference in odds of LBW with increasing maternal age whether CHTN or PIH was in the model.

All the variables used as controls were found to have significance in both the CHTN and the PIH model. The presence of a hypertensive disorder and smoking were both individually significantly (p=.000) associated with increased odds of LBW. And in both

the CHTN and PIH model, marriage was significantly (p=.000) protective against the odds of LBW. This is an important finding, which has not been previously reported in the literature.

Comparing the three racial/ethnic groups, marriage made the largest difference for Black women (OR .781 in the CHTN model, .779 in the PIH model; White OR .909 CHTN model, .905 PIH model; Hispanic OR .898 CHTN model, .894 PIH model). This is an important finding, especially in view of the low percentage of Black women in this study who were married (9.6%) vs the percentage of White (26.0%) and Hispanic (24%) women who were married. This lower rate of marriage among Black women may be partially explained by the higher rates of incarceration, joblessness, and mortality among Black men when compared to the general population (Koball et al., 2010). This creates a higher ratio of Black women to Black men during reproductive years, limiting the availability of available partners. Another limitation to be considered is the fact that healthy people are more desirable as a spouse (Koball et al., 2010; Wood et al., 2007), and therefore those women who have risk factors for having LBW (such as CHTN) may be less likely to be married.

Without further research into what benefits it is that marriage offers which conveys this protection, it can only be postulated that the largest benefit is gained through increased household income. This would offer potentially more access to food (quantity and quality), better housing, and neighborhoods with more resources. The primary advice to women with known LBW pregnancies is to increase their protein intake; however, the largest source of protein is meat, which is very expensive and quickly decimates a food budget.

The benefit of emotional support, however, cannot be dismissed or minimized. Studies have shown decreased rates of hypertension and cardiovascular disease for those who are married, citing the benefit of emotional support as well as increased resources.

In this study, there was essentially no difference in odds of LBW with increasing maternal age as compared to the results from Path A (effect of increasing maternal age on LBW, controlling for smoking and marital status). The addition of hypertensive disorder to the controls did not substantially change the effect of increasing age on LBW, for any of the racial/ethnic groups. This finding suggests that CHTN and PIH have an independent effect on increasing odds of LBW independent of the mother's age.

SUMMARY AND IMPLICATIONS

The weathering hypothesis was not universally supported in this study. It was found to be applicable to increased odds of LBW with increasing maternal age for all three groups who were living in poverty, but did not show the racial difference between Blacks and Whites found in previous studies. For the odds of hypertension with increasing age, the weathering hypothesis again was applicable to all groups but did not show differences between groups. This may be due to all women in this study living in poverty (using Medicaid as a proxy for poverty), and not being compared to the general population.

Hypertensive disorders (CHTN, PIH) were shown to be significantly associated with increased odds of LBW, consistent with healthcare literature. There were racial/ethnic differences found here, with Hispanics having the highest odds of LBW when either hypertensive disorder was present (approximately 3.5 times more likely), compared to Blacks and Whites (each were more than 2.5 times more likely). This is an unexpected finding, as Hispanics typically have better outcomes (i.e., the epidemiologic paradox).

Smoking was found to be associated with hypertensive disorders and LBW for all groups except in one question. When assessing the effect of increasing maternal age on PIH, smoking was not found to be a significant variable for the Black women and Hispanic women; it was a significant variable for White women. This needs further investigation into quantification and duration of smoking, which was not included in this study.

Being married was found to be significantly associated with lowering the odds of LBW, for all three racial/ethnic groups but was especially true for Black women. These are new findings to add to the literature, and need confirmatory testing as well as qualitative investigation to get to the true benefits that marriage provides for these women. Further exploration into the racial/ethnic differences for marital health benefits is also needed.

The interaction of families with their environment has been the focus of many family scientists. As a dynamic, and ever-changing species, amid a continually evolving environment, such study is challenging and difficult at best. The "environment" (i.e., poverty) and "family" (pregnant woman and presence of a spouse) have evolved even since this study began. With the new healthcare system in America (the Affordable Care Act) requiring every person to have some type of health insurance, the indicator for poverty used in this study (Medicaid) would need to be modified to replicate the design. And the current definition of "married" is changing by the minute, as more and more states amend laws to recognize same-sex marriages. Human ecology theory has the ability to guide research based on the interaction of families with their complex environment. This study used an earlier version of Bronfenbrenner's model, with limited inclusion of environmental factors. Expanding that model in future research to include more of the process and context

of Bronfenbrenner's later models may yield further insight into the potential importance of environmental factors which were not included in this study.

Healthcare professionals can utilize these findings not only to direct future research, but to emphasize the importance of education for low SES pregnant women. While smoking education is not a reimbursable event, the ethical impetus is present to implement and follow up on cessation therapies in these women. Similarly, since the presence of a spouse in this study was protective against LBW in all racial/ethnic groups, the designation and inclusion of a significant support person could easily be integrated into prenatal care. Once designated, that primary support person should not only be encouraged to participate in prenatal visits, but welcomed and included by the healthcare staff. Older guidelines and policies that only include the father of the baby as a designated visitor or able to participate in visits are not only outdated, but potentially increasing the odds of a poor outcome (such as LBW). Integrating the support from the healthcare team and the support from her significant others will optimize the positive effects of each woman's care. A perfect example of such integration would be the development of a smoking cessation program for pregnant women which includes their significant other. The presence of the significant other would lend the support, especially if they smoked also, and they could encourage each other in the cessation therapy.

Allocation of funding for such programs is typically under the direction of agency officials and extrapolates to legislators who set state and national budgets. With the new national healthcare insurance program (i.e., the Affordable Care Act) beginning its implementation, it is an opportunity for legislators to implement evidence-based funding. The literature continues to show improved outcomes when women receive prenatal care,

and racial disparities in LBW continue to exist as shown in this study. Developing culturally sensitive AND accessible health clinics which deliver prenatal care are necessary to improve rates of prenatal care, but funding must be allocated for such programs. Simply requiring Americans to have health insurance, without an acceptable and culturally sensitive health center to utilize that insurance, is a waste of valuable funding and a lost opportunity to improve health for many Americans. Additional funding to provide smoking cessation programs is another example of where budgets could practice evidence-based funding.

It is important to revise outdated policies for these pregnant women which restrict benefits and access to the historical role of "husband." This study, concordant with other research, has shown the improved health outcomes when a person is "married." Current policies should be updated to allow each woman to designate who her significant other is, regardless of legal marital status and gender. This will need to extend to legislative policies for insurance and financial benefits, visitation policies, and legal designation as "next of kin."

LIMITATIONS

Due to the constrains of a secondary analysis of a pre-existing data set, it is not possible to get any other indicator of poverty than "Medicaid" as the mother's source of payment at the time of delivery. There are multiple limitations with use of this variable as a poverty indicator. Many states will automatically qualify uninsured women who are lower and middle class for Medicaid when they become pregnant, to encourage them to seek prenatal care and hospital/facility- based births to avoid the need to have an unattended pregnancy and birth. Also previously (prior to implementation of the Affordable Care Act

in 2014) included in eligibility for Medicaid were females who were in college but had "aged-out" of their parents' insurance, despite their income level. These young women do not live in poverty; in fact, many of them were higher income families. These are examples of women who received Medicaid but do not live in poverty, and therefore may skew these statistics. Using additional research methodologies, such as GIS to tie birth certificate addresses to neighborhoods can refine the sample to include only those truly living in impoverished neighborhoods and those living in segregated poverty.

Low birthweight and small for gestational age (SGA) infants can have very different pathologies. Any infant born prematurely will be LBW (birthweight less than 2500g); this includes those infants who are delivered early purposefully due to a deteriorating maternal or infant condition, as well as those infants of mothers with premature labor with no known etiology. The lower birthweight is then not a result of restricted growth, but simply earlier-than-expected birth. However, SGA applies only to those infants who are smaller than expected based on what week of gestation they are born. These SGA infants are sometimes constitutionally small, but very often are smaller than expected due to either serology insults (e.g., bacterial or viral infections) or decreased blood flow due to conditions such as hypertension or smoking. Ideally, this study would have looked at SGA infants, but birth certificates do not list SGA, only birthweight.

Being married has been shown in the literature to be protective against complications from numerous health conditions, including cardiovascular disease, cancer, and diabetes, as well as lower rates of LBW. There are obvious limitations to using the basic "married" classification on the birth certificate. Qualitative research, to determine the true presence of a supportive relationship, would yield results more indicative of the

advantage of an emotionally and financially supportive relationship with a significant other, regardless of marital status. This also would be inclusive of gay women, who may or may not be able to be legally married in their specific state as of the date of this study.

While the exact components of standard prenatal care are debatable, as is the ideal number and timing of visits, the evidence supports the necessity of prenatal care in improving perinatal outcomes. Identification and reduction and/or elimination of risks, along with early detection and treatment of abnormalities, lowers the rates of undesirable events. Research has shown the link between no prenatal care and higher rates of LBW (Cox, et al., 2011; Krans & Davis, 2012; Partridge, et al., 2012; Taylor, et al., 2005; Willems Van Dijk, et al., 2010), prematurity (Cox, et al., 2011; Taylor, et al., 2005; & . Willems Van Dijk, et al., 2010), early and late neonatal death (Partridge, et al., 2012), as well as stillbirth and infant death (Partridge, et al., 2012). In specific research related to hypertension, prenatal care was found to be essential in proper identification and treatment of the disorder (Hadwen, 2011). However, the interplay between not receiving prenatal care and being diagnosed with either CHTN or PIH is complex, and will have irregularities in reporting on the birth certificate. This is due to the definition of both CHTN and PIH. In order to accurately diagnose either condition, it must be determined when the blood pressure elevated in relationship to the pregnancy. Chronic hypertension must be diagnosed prior to the beginning of the pregnancy, and PIH can only be diagnosed after 20 weeks gestation (half-way through the pregnancy). In the presence of not receiving prenatal care, the only way either of these can accurately be diagnosed is the presence of other medical records which have recorded the maternal blood pressure prior to or during the first half of the pregnancy. Therefore, there may be substantially more cases of both

CHTN and PIH which have not been officially labeled as such on the birth certificate for those women who did not receive prenatal care. As with any data set, the data are only as reliable as the person inputting/classifying the data. In a hectic labor and delivery unit, taking the extra time to truly reflect on each birth certificate's questions, and ascertain an accurate response, is often not seen as a necessity by the busy delivery attendant. Due to these complicating factors, and the low frequency of not receiving prenatal care (less than 1.8% for all racial/ethnic groups), it was not included in this study.

Quantification and duration of smoking during pregnancy were not included in this study. This is an important limitation of the results. As previously discussed, differentiating the number of cigarettes smoked daily, along with segregating those who quit in early pregnancy would no doubt provide more detailed information on the true effects on LBW.

This study was the first to include Hispanics when utilizing the weathering concept, but all "Hispanic" cultures were grouped together as a homogenous variable. As there are differences in hypertension within different Hispanic sub-cultures, these groups need to be included as distinct groups in future research. Separation of these sub-cultures will produce more accurate, and perhaps different, results.

While this study benefitted from the large number of cases available in using national level data, it is acknowledged that there are very different geographical environments within the United States, and those areas can also contain very different community cultures which can affect rates of smoking and marriage. Using state or even neighborhood/community-level data may provide more accurate results which can be utilized to build studies with more homogenous data to better infer meaning of results.

This novice researcher chose to use an earlier model of Bronfenbrenner's work, and limit the systems included to those in the microsystem. Utilization of his later models, along with a more inclusive use of his process-person-context-time components may yield different and more comprehensive results.

FUTURE RESEARCH

In addition to the limitations aforementioned, and their implications for future study design, there are additional areas for future research. Emphasis should be on qualitative components to further explore the effect of a supportive relationship related to birth outcomes as a high priority, especially in light of the quickly growing married lesbian population here in America. Differences between lesbian and heterosexual couples could be investigated using a modified replication of this study.

For further investigation into application of the weathering concept, more ethnicities and racial groups need to be included. There are many areas within America of concentrated ethnic/racial communities, where GIS software and birth certificate linkage could provide valuable insight into differences in birth outcomes for these populations. Cultural-specific research could lead to insights as to how to best provide educational, financial, and healthcare resources which are sensitive to and appropriate for a range of cultures and ethnicities. Studies which compare and contrast these same issues for women who do and do not live in poverty will give further insight into poverty-related conditions versus genetic or cultural issues in regards to health.

REFERENCES

REFERENCES

American College of Obstetrics and Gynecology. (2009). ACOG Practice Bulletin Number 107: Induction of Labor. *Obstetrics & Gynecology, 114*(2), 386-397.

Ayoola, A.B., Netleman, M.D., Stommel, M., & Canady, R.B. (2010). Time of pregnancy recognition and prenatal care use: a population-based study in the United States. *Birth, 37*(1), 37-43.

Baine, M., Sahak, F., Lin, C., Chakraborty, S., & Lyden, E. (2011). Marital Status and Survival in Pancreatic Cancer Patients. Retrieved on April 15, 2014, from www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0021052#pone-0021052-g004

Baker, B., Helmers, K., O'Kelly, B., Sakinofsky, I., Abelsohn, A., & Tobe, S. (1999). Marital Cohesion and ambulatory blood pressure in early hypertension. *American Journal of Hypertension, 12*(2), 227-230.

Barker, D.J. (2006). Adult consequences of Fetal Growth Restriction. *Clinical Obstetrics & Gynecology, 49*(2), 270-283.

Barrington, S. (2010). The Increasing Protection of Marriage on Infant Low Birth Weight Across Two Generations of African American Women. *Journal of Family Issues, 31*(8), 1041-1064.

Baschat, A.A., Galan, H.L., Ross, M.G., & Gabbe, S.G. (2007). Intrauterine Growth Restriction. In S.G. Gabbe, J.R. Niebyl, & J.L. Simpson (Eds.), *Obstetrics: Normal and Problem Pregnancies* (pp. 771-814). Elsevier: Philadelphia.

Bird, S.T., Chandra, A., Bennett, T., & Harvey, S.M. (2000). Beyond marital status: Relationship type and duration and the risk of low birth weight. *Family Planning Perspectives, 32*, 281-287.

Borders, A.E.B., Grobman, W.A., Amsden, L.B., & Holl, J.L. (2007). Chronic Stress and Low Birth Weight Neonates in a Low-Income Population of Women. *Obstetrics & Gynecology, 109*(2), 331-338.

Braveman, P., Marchi, K., Egerter, S., Kim, S., Metzler, M., Stancil, T., & Libet, M. (2010). Poverty, Near-Poverty, and Hardship Around the Time of Pregnancy. *Maternal Child Health Journal, 14*, 20-35.

Briley, C., Flanagan, N.L., & Lewis, N.M. (2002). In-home prenatal nutrition intervention increased dietary iron intakes and reduced low birthweight in low-income African-American women. *Journal of the American Dietetic Association, 102*(7), 984-987.

Bronfenbrenner, U. (1979). *The Ecology of Human Development.* Cambridge, MA: Harvard University Press.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology, 22*(6), 723-742.

Bronfenbrenner, U. (1995). Developmental ecology through space and time: A future perspective. In P. Moen, G.H. Elder, Jr., & K. Luscher (Eds.), *Examining lives in context: Perspectives on the ecology of human development* (pp.617-647). Washington, DC: American Psychological Association.

Bubolz, M.M., & Sontag, M.S. (1993). Human Ecology Theory. In P.G. Boss, W.J. Doherty, R. LaRossa, W.R. Schumm, & S.K. Steinmetz (Eds.), *Sourcebook of Family Theories and Methods: A Contextual Approach* (pp. 419-435). New York: Plenum Press.

Byrd, D.R., Katcher, M.L., Peppard, P., Durkin, M., & Remington, P.L. (2007). Infant Mortality: Explaining Black/White Disparities in Wisconsin. *Maternal Child Health Journal, 11,* 319-326.

Cai, J., Hoff, G.L., Dew, P.C., Guillory, V.J., & Manning, J. (2005). Perinatal Periods of Risk: Analysis of Fetal-Infant Mortality Rates in Kansas City, Missouri. *Maternal and Child Health Journal, 9*(2), 199-205.

Carlson, M., McLanahan, S., & England, P. (2004). Union formation in fragile families. *Demography, 41,* 237-261.

Centers for Disease Control and Prevention. (2010). How tobacco smoke causes disease: a report of the Surgeon General. US Department of Health and Human Services, Atlanta, GA.

Colen, C.G., Geronimus, A.T., Bound, J., & James, S.A. (2006). Maternal Upward Socioeconomic Mobility and Black-White Disparities in Infant Birthweight. *American Journal of Public Health, 96*(11), 2032-2039.

Collins, J.W., Wamback, J., David, R.J., & Rankin, K.M. (2009). Women's Lifelong Exposure to Neighborhood Poverty and Low Birth Weight: A Population-Based Study. *Maternal and Child Health Journal, 13,* 326-333.

Cox, R.G., Zhang, L., Zotti, M.E., & Graham, J. (2011). Prenatal Care Utilization In Mississippi: Racial Disparities and Implications for Unfavorable Birth Outcomes. *Maternal and Child Health Journal, 15,* 931-942.

Curry, M.A. (1998). The interrelationships between abuse, substance use, and psychosocial stress during pregnancy. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 27,* 692-699.

David, R.J., & Collins, J.W. (1997). Differing Birth Weight Among Infants of U.S.-Born Blacks, African-Born Blacks, and U.S.-Born Whites. *The New England Journal of Medicine, 337*(17), 1209-1214.

DeFranco, E.A., Lian, M., Muglia, L.J., & Schootman, M. (2008). Area-level poverty and preterm birth risk: A population-based multilevel analysis. *BMC Public Health, 8,* 316-325.

Dunn, L.L., & Oths, K.S. (2004). Prenatal predictors of intimate partner abuse. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 33,* 54-63.

El-Sayed, A.M., & Galea, S. (2012). Temporal Changes in Socioeconomic Influences on Health: Maternal Education and Preterm Birth. *American Journal of Public Health, 102*(9), 1715-1721.

Finer, L.B., & Kost, K. (2011). Unintended Pregnancy Rates at the State Level. *Perspectives on Sexual and Reproductive Health, 43*(2), 78-87.

Floud, S., Balkwill, A., Canoy, D., Wright F.L., Reeves, G.K., Green, J., …& Cairns, B.J. (2014). Marital Status and Ischemic Heart Disease incidence and Mortality in Women: A Large Prospective Study. *BMC Medicine, 12*(1), 42-45.

Geronimus, A.T. (1996). Black/White differences in the relationship of maternal age to birthweight: a population-based test of the weathering hypothesis. *Social Science & Medicine, 42*(4), 589-97.

Geronimus, A.T., Bound, J., & Waidmann, T.A. (1999). Health inequality and population variation in fertility-timing. *Social Science & Medicine, 49,* 1623-1636.

Geronimus, A.T., Hicken, M., Keene, D., & Bound, J. (2006). "Weathering" and Age Patterns of Allostatic Load Scores Among Blacks and Whites in the United States. *American Journal of Public Health, 96*(5), 826-833.

Geronimus, A.T., Hicken, M.T., Pearson, J.A., Seashols, S.J., Brown, K.L., & Cruz, T.D. (2010). Do US Black Women Experience Stress-Related Accelerated Biological Aging? *Human Nature: An Interdisciplinary Biosocial Perspective, 21*(1), 19-38.

Goldenberg, R.L., Cliver, S.P., Mulvihill, F.X., Hickey, C.A., Hoffman, H.J., Klerman, L.V., & Johnson, M.J. (1996). Medical, psychosocial, and behavioral risk factors do not explain the increased risk for low birthweight among black women. *American Journal of Obstetrics & Gynecology, 175,* 1317-1324.

Goldenberg, R.L., Culhane, J.F., Iams, J.D., & Romero, R. (2008). Epidemiology and causes of preterm birth. *The Lancet, 371,* 75-84.

Goza, F.W., Stockwell, E.G., & Balistreri, K.S. (2007). Racial Differences in the Relationship Between Infant Mortality and Socioeconomic Status. *Journal of Biosocial Science, 39,* 517-529.

Grady, S. (2006). Racial disparities in low birthweight and the contribution of residential segregation: a multilevel analysis. *Social Science & Medicine, 63*(12), 3013-3029.

Grady, S., & Ramirez, I. (2008). Mediating medical risk factors in the residential segregation and low birthweight relationship by race in New York City. *Health & Place, 14*(4), 661-677.

Hadwin, G. (2011). Antenatal: Blood Pressure: Evidence Summaries. *Joanna Briggs Institute, 2011-04-13.*

Hamilton, B.E., Martin, J.A., & Ventura, S.J. (2011). Births: Preliminary Data for 2010. *National Vital Statistics Report, 58*(24). Hyattsville, MD: National Center for Health Statistics.

Heaman, M.I. (2005). Relationships between physical abuse during pregnancy and risk factors for preterm birth among women in Manitoba. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 34,* 21-731.

Hillemeier, M.M., Lynch, D., Harper, S., Raghunathan, T., & Kaplan, G.A. (2003). Relative or Absolute Standards for Child Poverty: A State-Level Analysis of Infant and Child Mortality. *American Journal of Public Health, 93*(4), 652-657.

Hohmann-Marriott, B. (2009). The Couple Context of Pregnancy and its Effects on Prenatal Care and Birth Outcomes. *Maternal and Child Health Journal, 13*(6), 745-754.

Holzman, C., Eyster, J., Kleyn, M., Messer, L.C., Kaufman, J.S., Laraia, B.A., O'Campo, P., … & Elo, I.T. (2009). Maternal Weathering and Risk of Preterm Delivery. *American Journal of Public Health, 99*(10), 1864-1871.

Hoyert, D.L., & Xu, J.Q. (2012). Deaths: Preliminary data for 2011. *National Vital Statistics Report, 61*(6). Hyattsville, MD: National Center for Health Statistics.

Idler, E.L., Boulifard, D.A., & Contrada, R.J. (2012). Mending Broken Hearts: Marriage and Survival Following Cardiac Surgery. *Journal of Health and Social Behavior, 53*(1), 33-49.

Janevic, T., Stein, C.R., Savitz, D.A., Jaufman, J.S., Mason, S.M., & Herring, A.H. (2010). Neighborhood Deprivation and Adverse Birth Outcomes among Diverse Ethnic Groups. *Annals of Epidemiology, 20*(6), 445-451.

Jesse, D.E., & Reed, P.G. (2004). Effects of spirituality and psychosocial well-being on health risk behaviors in Appalachian pregnant women. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 33,* 739-747.

Jesse, D.E., & Swanson, M.S. (2007). Risks and resources associated with antepartum risk for depression among rural southern women. *Nursing Research, 56,* 378-386.

Jesse, D.E., Swanson, M.S., Newton, E.R., & Morrow, E.R. (2009). Racial Disparities in Biopsychosocial Factors and Spontaneous Preterm Birth Among Rural Low-Income Women. *Journal of Midwifery & Women's Health, 54,* 35-42.

Jesse, D.E., Walcott-McQuigg, J., Mariella, A., & Swanson, M.S. (2005). Risks and protective factors associated with symptoms of depression in low-income African American and Caucasian women during pregnancy. *Journal of Midwifery & Women's Health, 50,* 405-410.

Kiecolt-Glaser, J.K. & Newton, T. (2001). Marriage and health: His and Hers. *Psychological Bulletin, 127*(4), 472-503.

King, K.B. & Reis, H.T. (2012). Marriage and Long-Term Survival after Coronary Artery Bypass Grafting. *Health Psychology, 31*(1), 55-62.

Koball, H.L., Moiduddin, E., Henderson, J., Goesling, B., & Besculides, M. (2010). What Do We Know About the Link Between Marriage and Health? *Journal of Family Issues, 31*(8), 1019-1040.

Kramer, M.R., & Hogue, C.R. (2008). Place Matters: Variation in the Black/White Very Preterm Birth Rate Across U.S. Metropolitan Areas, 2002-2004. *Public Health Reports, 123*(5), 576-585.

Krans, E.E., & Davis, M.M. (2012). Preventing Low Birthweight: 25 years, prenatal risk, and the failure to reinvent prenatal care. *American Journal of Obstetrics & Gynecology, 206*(5), 398-403.

Laughon, S.K., Reddy, U.M., Sun, L., & Zhang, J. (2010). Precursors for Late Preterm birth in Singleton Gestations. *Obstetrics & Gynecology, 116*(5), 1047-1055.

LeBlanc, C.P., & Rioux, F.M. (2007). Iron Deficiency Anemia following Prenatal Nutrition Interventions. *Canadian Journal of Dietetic Practice and Research, 68*(4), 222-225.

Leslie, J., Galvin, S., Diehl, S., Bennett, T., & Buescher, P. (2003). Infant mortality, low birth weight, and prematurity among Hispanic, white, and African American women in North Carolina. *American Journal of Obstetrics & Gynecology, 188*(5), 1238-1240.

Lister, Z., Fox, C., & Wilson, C.M. (2013). Couples and Diabetes: A 30-Year Narrative Review of Dyadic Relational Research. *Contemporary Family Therapy, 35*(4), 613-638.

London, M.L., Ladewig, P.A.W., Ball, J.W., Bindler, R.C.M., & Cowen, K.J. (2011). *Maternal & Child Nursing Care* (3rd Ed.). Pearson: Upper Saddle River, NJ.

Love, C., David, R.J., Rankin, K.M., & Collins, J.W. (2010). Exploring Weathering: Effects of Lifelong Economic Environment and Maternal Age on Low Birth Weight, Small for Gestational Age, and Preterm Birth in African-American and White Women. *American Journal of Epidemiology, 172*(2), 127-134.

Lu, M.C. & Chen, B. (2004). Racial and ethnic disparities in preterm birth: the role of stressful life events. *American Journal of Obstetrics & Gynecology, 191*(3), 691-699.

Lu**,** M.C, & Halfon, N. (2003). Racial and ethnic disparities in birth outcomes: a life-course perspective. *Maternal & Child Health Journal, 7*(1), 13-30.

MacDorman, M.F., Hoyert, D.L., & Mathews, T.J. (2013). Recent declines in infant mortality in the United States, 2005-2011. *NCHS Data Brief,* 120. Hyattsville, MD: National Center for Health Statistics.

MacDorman, M.F., & Mathews, T.J. (2009). Behind international rankings of infant mortality: How the United States compares with Europe. *NCHS Data Brief*, 23. Hyattsville, MD: National Center for Health Statistics.

Mahdi, H., Kumar, S., Munkarah, A.R., Adalamir, M., Doherty, M. & Swensen, R. (2013). Prognostic impact of marital status on survival of women with epithelial ovarian cancer. *PsychoOncology, 22*(1), 83-88.

Martin, J.A., Hamilton, B.E., Sutton, P.D., Ventura, M.A., Mathews, T.J., Kirmeyer, S., & Osterman, M.J.K. (2010). Births: Final Data for 2007. *National Vital Statistics Report, 58*(24). Hyattsville, MD: National Center for Health Statistics.

Martin, J.A., Hamilton, B.E., Ventura, M.A., Osterman, M.J.K., Wilson, E.C., & Mathews, T.J. (2010). Births: Final Data for 2010. *National Vital Statistics Report, 61*(1). Hyattsville, MD: National Center for Health Statistics.

Martinez, M., & Ariosto, D. (2011, March 24). Hispanic population exceeds 50 million, firmly nation's No. 2 group. *CNN*. Retrieved from http://articles.cnn.com/2011-03-24/us/census.hispanics_1_hispanic-population-illegal-immigration-foreign-born?_s=PM:US

Masho, S.W., Chapman, D., & Ashby, M. (2010). The Impact of Paternity and Marital Status on Low Birth Weight and Preterm Births. *Marriage & Family Review, 46(*4), 243-256.

Mathews, T.J., & MacDorman, M.F. (2010). Infant Mortality Statistics From the 2006 Period Linked Birth/Infant Death Data Set. *National Vital Statistics Report, 58*(17). Hyattsville, MD: National Center for Health Statistics.

McArthur, A. (2010). Antenatal: Routine Care: Evidence Summaries. *Joanna Briggs Institute, 2010-09-14.*

Michigan Department of Community Health. (2009). *Michigan Resident Birth File* [Data set]. Retrieved from http://www.michigan.gov/mdch/0,1607,7-132-2944_4669_4681---,00.html

Moster, D., Lie, R.T., Markestad, T. (2008). Long-term medical and social consequences of preterm birth. *New England Journal of Medicine, 359*(3), 262-273.

Nkansah-Amankra, S. (2010). Neighborhood Contextual Factors, Maternal Smoking, and Birth Outcomes: Multilevel Analysis of the South Carolina PRAMS Survey, 2000-2003. *Journal of Women's Health, 19*(8), 1543-1552.

Nkansah-Amankra, S., Dhawain, A., Hussey, J.R., & Luchok, K.J. (2010). Maternal Social Support and Neighborhood Income Inequality as Predictors of Low Birth Weight and Preterm Birth Outcome Disparities: Analysis of South Carolina Pregnancy Risk Assessment and Monitoring System Survey, 2000-2003. *Maternal Child Health Journal, 14,* 774-785.

Nkansah-Amankra, S., Luchok, K.J., Hussey, J.R., Watkins, K., & Liu, X. (2010). Effects of Maternal Stress on Low Birth Weight and Preterm Birth Outcomes Across Neighborhoods of South Carolina, 2000-2003. *Maternal Child Health Journal, 14,* 215-226.

Olson, M.E., Diekema, D., Elliott, B.A., & Renier, C.M. (2010). Impact of Income and Income Inequality on Infant Health Outcomes in the United States. *Pediatrics, 126*(6), 1165-1173.

Orr, S.T., James, S.A., & Miller, C.A. (1996). Psychosocial stressors and low birthweight in an urban population. *American Journal of Preventative Medicine, 12*, 459-466.

Osborne, C., Berger, L.M., & Magnuson, K. (2012). Family Structure Transitions and Changes in Maternal Resources and Well-being. *Demography, 49*, 23-47.

Papacek, E.M., Collins, J.W., Schulte, N.F., Goergen, C., & Drolet, A. (2002). Differing Postneonatal Mortality Rates of African-American and White Infants in Chicago: An Ecologic Study. *Maternal and Child Health Journal, 6*(2), 99-105.

Partridge, S., Balayla, J., Holcroft, C.A., & Abenhaim, H.A. (2012). Inadequate Prenatal Care Utilization and Risks of Infant Mortality and Poor Birth Outcome: A Retrospective Analysis of 28,729,765 U.S. Deliveries over 8 Years. *American Journal of Perinatology, 29*(10), 787-794.

Perry, S.E., Hockenberry, M.J., Lowdermilk, D.L., & Wilson, D. (2010). *Maternal Child Nursing Care* (4th. Ed). Mosby Elsevier: Maryland Heights, MO.

Rauh, V.A., Andrews, H.F., & Garfinkel, R.S. (2001). The Contribution of Maternal Age to Racial Disparities in Birthweight: A Multilevel Perspective. *American Journal of Public Health, (91)*11, 1815-1824.

Reagan, P.B., Salsberry, P.J., & Olsen, R.J. (2007). Does the measure of economic disadvantage matter? Exploring the effect of individual and relative deprivation on intrauterine growth restriction. *Social Science and Medicine, 64*, 2016-2029.

Reddy, U.M., Chia-Wen, K., Tonse, N.K.R., & Willinger, M. (2009). Delivery Indications at Late-Preterm Gestations and Infant Mortality Rates in the United States. *Pediatrics, 124*(1), 234-240.

Reichman, N.E., Hamilton, E.R., Hummer, R.A., & Padilla, Y.C. (2008). Racial and Ethnic Disparities in Low Birthweight Among Urban Unmarried Mothers. *Maternal Child Health Journal, 12,* 204-215.

Robles, T.F. & Kiecolt-Glaser, J.K. (2003). The physiology of marriage: pathways to health. *Physiology & Behavior, 79*(3), 409-416.

Rosenthal, M.B., Li, Z., Robertson, A.D., & Milstein, A. (2009). Impact of Financial Incentives for Prenatal Care on Birth Outcomes and Spending. *Health Research and Educational Trust, 44*(5), 1465-1479.

Schoenborn, C.A. (2004). Marital status and health: United States, 199-2002. *Advance Data,* No. 351.

Shapiro-Mendoza, C.K., Tomashek, K.M., Kotelchuk, M., Barfield, W., Nannini, A., Weiss, J., & Declercq, E. (2008). Effect of late-preterm birth and maternal medical conditions on newborn morbidity risk. *Pediatrics, 121*(2), e223-232.

Seidel, A.J., Franks, M.M., Stephens, M.A., & Rook, K.S. (2012). Spouse Control and Type 2 Diabetes Management: Moderating Effects of Dyadic Expectations for Spouse Involvement. *Family Relations, 61*(4), 698-709.

Sims, M., Sims, T.L., & Bruce, M.A. (2007). Urban Poverty and Infant Mortality Rate Disparities. *Journal of the National Medical Association, 99*(4), 349-357.

Smock, P.J. (2000). Cohabitation in the United States: An appraisal of research themes, findings, and implications. *Annual Review of Sociology, 26,* 1-20.

Sparks, P.J. (2009). One Size Does Not Fit All: An Examination of Low Birthweight Disparities Among A Diverse Set of Racial/Ethnic Groups. *Maternal Child Health Journal, 13,* 769-779.

Sullivan, K., Raley, R.K., Hummer, R.A., & Schiefelbein, E. (2012). The Potential Contribution of Marital-Cohabitation Status to Racial, Ethnic, and Nativity Differentials in Birth Outcomes in Texas. *Maternal and Child Health Journal, 16,* 775-784.

Taylor, C.R., Alexander, G.R., & Hepworth, J.T. (2005). Clustering of U.S. Women Receiving No Prenatal Care: Differences in Pregnancy Outcomes and Implications for Targeting Interventions. *Maternal and Child Health Journal, 9*(2), 125-133.

Tomashek, K.M., Shapiro-Mendoza, C.K., Davidoff, M.J., & Petrini, J.R. (2007). Differences in mortality between late-preterm and term singleton infants in the United States, 1995-2002. *Journal of Pediatrics, 151*(5), 450-456.

Tong, V.T., Dietz, P.M., Morrow, B., D'Angelo, D.V., Farr, S.L., Rockhill, K.M., & England, L.J. (2013). Trends in Smoking Before, During, and After Pregnancy-Pregnancy Risk Assessment Monitoring System, United States, 40 Sites, 2000-2010. *MMWR, 62,* 1-19.

Torche, F. (2011). The Effect of Maternal Stress on Birth Outcomes: Exploiting a Natural Experiment. *Demography, 48,* 1473-1491.

Tucker, J.M., Goldenberg, R.L., Davis, R.O., Copper, R.L., Winkler, C.L., & Hauth, J.C. (1991). Etiologies of Preterm Birth in an Indigent Population: Is Prevention a Logical Expectation? *Obstetrics & Gynecology, 77*(3), 343-347.

Tudge, J.R.H., Mokrova, I., Hatfield, B.E., & Karnik R.B. (2009). Uses and Misuses of Bronfenbrenner's Bioecological Theory of Human Development. *Journal of Family Theory & Review, 1*(4), 198-210.

United Nations, Department of Economic and Social Affairs, Population Division (2013). World Population Prospects: The 2012 Revision.

United Nations, Department of Economic and Social Affairs, Population Division (2007). World Population Prospects: The 2006 Revision, Highlights, Working Paper No. ESA/P/WP.202.

Vespa, J., & Painter II, M.A. (2011). Cohabitation History, Marriage, and Wealth Accumulation. *Demography, 48,* 983-1004.

Victoria, C.G., Wagstaff, A., Schellenberg, J.A., & Gwatkin, D. (2003). Applying an equity lens to child health and mortality: More of the same is not enough. *The Lancet, 362*(9379), 233-245.

Wang, L., Wilson, S.E., Stewart, D.B., & Hollenbeak, C.S. (2011). Marital status and colon cancer outcomes in US Surveillance, Epidemiology and End Results Registries: Does marriage affect cancer survival by gender and stage? *Cancer Epidemiology, 35*(5), 417-422.

Willems Van Dijk, J.A., Anderko, L., & Stetzer, F. (2011). The Impact of Prenatal Care Coordination on Birth Outcomes. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 40*(1), 98-108.

Williams, L.B. (1994). Determinants of couple agreement in US fertility decisions. *Family Planning Perspectives, 26,* 169-173.

Wood, R.G., Goesling, B., & Avellar, S. (2007). The Effects of Marriage on Health: A Synthesis of Recent Research Evidence. *Mathematica Policy Research Inc.,* Washington, D.C.

Woods, S.M., Melville, J.L., Guo, Y., Fan, M.-Y., & Gavin, A. (2009). Psychosocial Stress during Pregnancy. *American Journal of Obstetrics & Gynecology, 202*(1), 61.e1-61.e7.

Zachariah, R. (2004). Attachment, Social Support, Life Stress, and Psychological Well-Being in Pregnant Low-Income Women: A Pilot Study. *Clinical Excellence for Nurse Practitioners, 8*(2), 60-67.

Zhang, Z. & Hayward, M.D. (2006). Gender, the Marital Course, and Cardiovascular Disease in Late Midlife. *Journal of Marriage and Family, 68*(3), 639-657.

Zuckerman, B., Amaro, H., Bauchner, H., & Cabral, H. Depressive symptoms during pregnancy: relationship to poor health behaviors. *American Journal of Obstetrics & Gynecology, 160*, 1107-1111.