# THE HIDDEN ROLE OF RACIAL DISCRIMINATION ON ADVERSE BIRTH OUTCOMES: A STRATEGIC PLAN FOR DELAWARE

by

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A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Master of Arts in Urban Affairs and Public Policy

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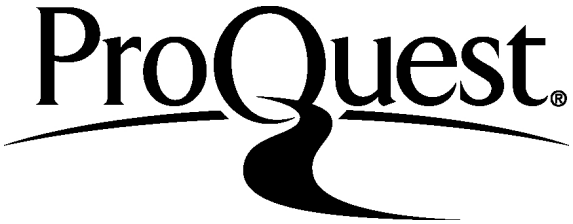

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## ABSTRACT

Black women experience an infant mortality rate more than double that of White women. The causes underlying this inequity are not well understood. Research indicates a relationship between psychological stress and adverse birth outcomes. Further, racial discrimination has been linked with psychological stress and is thought to contribute to higher rates of infant mortality among Black women. The purpose of this thesis is to explore the relationship between racial discrimination and adverse birth outcomes using a publicly available dataset, which includes characteristics of parents and birth outcomes from 2004-2009. Two approaches were used to explore racial discrimination. First, birth outcomes were assessed relative to the race of both parents. Second, birth outcomes were assessed relative to chronic hypertension. The major findings of this study were that in the college-educated population, there are persistent gaps in infant mortality between same race Black parents and biracial parents compared to same race White parents. This study also found that chronic hypertension was a contributor to adverse birth outcomes, but may not explain the effect that discrimination can have. When considered in the context of the existing literature, and a comparative institutional analysis, the findings suggest that policy interventions may need to more explicitly address the role of racial discrimination in adverse birth outcomes. Implications for Delaware's efforts to close the gap in Black-White birth outcomes are discussed. Finally, it is recommended that additional research is needed to better understand the role of racial discrimination in adverse birth outcomes, including approaches to systematically measure its effects on health.

# Chapter 1

## INTRODUCTION

Infant mortality is a key indicator of the health of a population. In order to succeed in a globalization-focused society, the health of our population has to be paramount. A decrease in infant mortality rates will not only save the lives of children, but also the amount of health problems that a child will acquire in the future.

Nationally, there is a persistent gap in the birth outcomes of Blacks compared to Whites. It has been found in studies across the board that socioeconomic status, pregnancy risk factors, and the amount of educational attainment do not eliminate the gap. Some studies have found that the adjustment for those characteristics expands rather than minimizes the gap. Thus, this thesis attempts to investigate what factors are attributing to this gap and what, if any, factors may have yet to be addressed.

This thesis begins by seeking and acknowledging the contributing factors to the Black-White gap in birth outcomes, using literature review and extensive research. These factors include but are not limited to demographics alone. The literature will extend to examining the Life Course Approach Theory to evaluate how one's life history can impact birth outcomes.

The thesis will then use publicly available national infant mortality data to assess the magnitude of this contributing factor, racial discrimination, in two ways. The first statistic analysis will explore racial discrimination at face value by looking at college-educated parents that are biracial compared to same race parents. The second

statistical analysis incorporates another variable of interest that would represent the relationship of stress from racial discrimination-- chronic hypertension.

These statistical analyses will pose the following research questions. The overarching research question: Does the experience of racial discrimination contribute to the Black-White differences in preterm deliveries, low birth weigh deliveries, and infant death? A series of two statistical analysis poses the following research question: Does the race of the father have either a protective or adverse effect on the birth outcome: preterm deliveries, low birth weight, and infant mortality, among low-risk parents? Two hypotheses are inferred: There will be a gradient effect on all three birth outcomes going from lowest to highest risk in the following order: WMWF, WMBF, BMWF, BMBF (Migone, Emanuel, Mueller, Daling & Little, 1991). Even within a low-risk population, Blacks will have more adverse birth outcomes than their White counterparts (Schoendorf, Hogue, Kleinman & Rowley, 1992). Does chronic hypertension contribute to the Black-White differences in preterm deliveries, low birth weight deliveries, and infant death? Does the inclusion of chronic hypertension reduce the racial odds ratio? Two hypotheses are inferred: Chronic hypertension, like racial discrimination, will reduce the racial odds ratio (Mustillo, Krieger, Gunderson, Sidney, McCreath & Kiefe, 2004). There will be a gradient effect on all three birth outcomes going from lowest to highest risk in the following order: WMWF, WMBF, BMWF, BMBF (Migone, Emanuel, Mueller, Daling & Little, 1991).

The thesis will then turn to a Delaware context. Delaware's infant mortality rate at 9.2 deaths per 1,000 live births is significantly higher than the average of the United States, at 6.5 deaths per live births. This high rate is greatly skewed by an outlier, as the infant mortality rate for people who are Black is 15.7 deaths per live

births. After addressing Delaware's infant mortality rate trends, an examination of the actions other states have taken to address the Black-White birth outcome gap will be performed using comparative institutional analysis. This analysis will evaluate the different alternatives each state has taken and their effectiveness in reducing infant mortality inequities. A point of study will be Boston, Massachusetts, which has nearly eliminated the inequity over the last seven years.

The alternatives will be evaluated using comparative institutional and implementation analysis. These analytical tools will provide knowledge of the various programs that each state has implemented as well as their outcomes and whether these programs could be a fit for Delaware. The tools will examine the implementation process of each alternative and the likelihood of state opposition. These tools will further ensure that the policy action taken will rectify racial discrimination. The implementation analysis will then identify strategies for Creating a Health Equity Initiative that attempts to close the Black-White birth outcome gap.

A legal and geographic information systems (GIS) analysis will be included in the Appendices to invoke a more elaborate understanding of the history of institutional racism and birth outcomes spatially. The legal analysis will be conducted to analyze how Supreme Court rulings and their definition of racial discrimination perpetuates this gap. The GIS analysis geographically pinpoints areas most at risk for infant mortality inequities in Delaware, using the most current infant mortality data. The analysis also illustrates the distribution of low birth weight and chronic hypertension to assess if the two are spatially associated.

This thesis hopes to provide a greater understanding of the contributing factors to birth outcome inequities that will be useful to an abundance of people. A mixture

of researchers and policy makers that range from the Department of Health and Social Services to Medical Legal Aid Collaborations could greatly benefit from the understanding of all confounding factors. This may be the missing piece that could improve birth outcomes significantly among all states, including Delaware. This thesis aims to change the way researchers look at the problem as well as recommend new data collection and research methods to understand the full context of the problem.

## Chapter 2

## LITERATURE REVIEW

Black women experience an infant mortality rate more than double that of White women. The causes underlying this inequity are not well understood. Results from various analyses indicate that focusing solely on the social determinants and other behavioral health characteristics show a persistent gap between Black and White birth outcomes. When infant mortality rates are stratified by race, Blacks are found to skew the rating in an upward motion the most, while Hispanics have a lower infant mortality rate than Whites. Thus, the differential between races is most shifted by Blacks alone.

Solutions purposed to close the Black-White gap in birth outcomes have yet to reach their goals. In addition, there are states that have significantly higher infant mortality rates compared to a national average. It is theorized that racial discrimination could be a potential cause that is not being readily addressed, but the magnitude of impact this cause has on the problem has yet to be quantified.

Therefore the current state of knowledge of the research problem is that the causes underlying this inequity are complicated and more potential causes may need to be explored. Researchers currently see the cause that this thesis attempts to apprehend as more theoretical, because it deems a relationship between stress and racial discrimination with no clear magnitude of its influence on the problem. Determining the effect of stress from racial discrimination is complex and does not explicitly exist within publicly available data sets. In addition, there are limits to obtaining further

knowledge on the effect of racial discrimination due to the confidentiality of data. There are many restrictions put in place that prevent a researcher from collecting the data that can be vital to their analysis. For example, the Institutional Review Board (IRB) pronounced in the Code of Federal Regulations in Subpart B that pregnant women, fetuses, and human in vitro fertilization are to be considered as a vulnerable population, which contain more than a minimal risk. Therefore, most of the IRB approved research is geared toward medical research rather than social or behavioral research, which reduces the amount of analyses performed on a social and behavioral factor like stress from racial discrimination. Overall, there are many factors that pose problems in obtaining the data to fully comprehend all elements of the Black-White gap in adverse birth outcomes.

## National Trends

Nationally, the infant mortality rates have declined dramatically over the past seven decades due in large part to public policy interventions. However, socioeconomic, geographic, racial, and ethnic inequities have persisted. The United States currently lags behind other developed countries from 12$^{th}$ lowest infant mortality rate (IMR) in 1960 to the 31$^{st}$ in 2006 (Singh & Dyck, 2010). During 1935 to 2000, infant mortality has declined at an average of 3.1% per year. However, between 2000 and 2007, the IMR has decreased slightly from 6.9 deaths per 1,000 live births in 2000 to 6.8 in 2007. When stratifying by race, from 1935 to 2000 IMR for White infants declined by 3.2% per year, while the rate for Black infants declined by 2.6%. Due to this slower decline for Black infants, the Black-White gap in birth outcomes has increased between 1935 and 2007 (Singh & Dyck, 2010) (Figure 1).

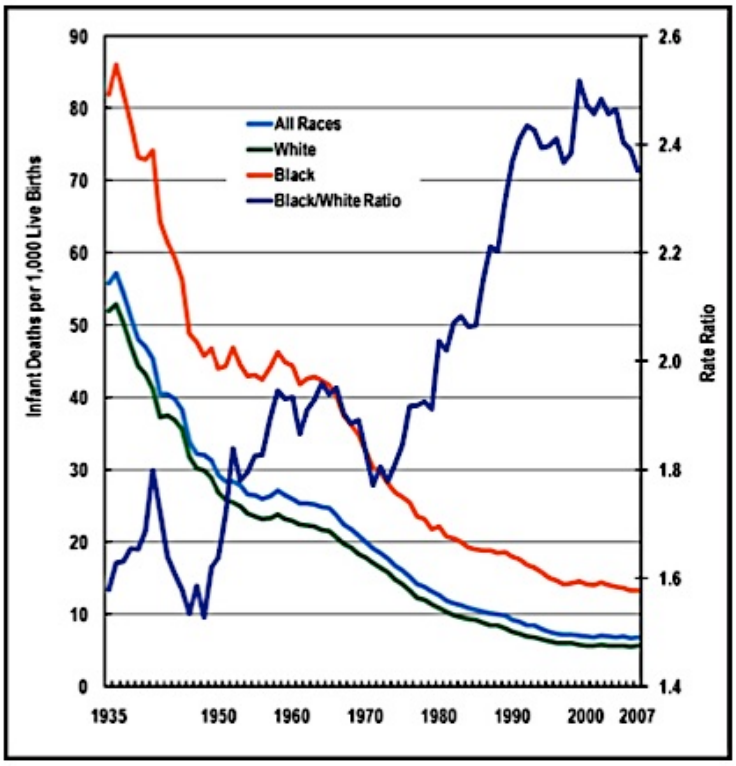


Figure 1 Line graph showing infant mortality rates by race in the United States from 1935-2007 (Singh & Dyck, 2010).

In 1935, the mortality rate for Black infants was 58% higher than the rate for White infants. The IMR in 2007 for Blacks is 135% higher of that for White infants. Furthermore this inequity translated similarly into neonatal mortality, death during the first 28 days of life, where Whites experienced faster declines at 3.3% per year than Blacks at 2.3% annually. The relative risk of Black neonatal mortality increased from 38% in 1935 to 134% in 2007 compared to Whites. These inequity trends followed when analyzing postneonatal mortality, death at which the infant is more than 27 days and less than one year of age (Singh & Dyck, 2010) (Figure 2).

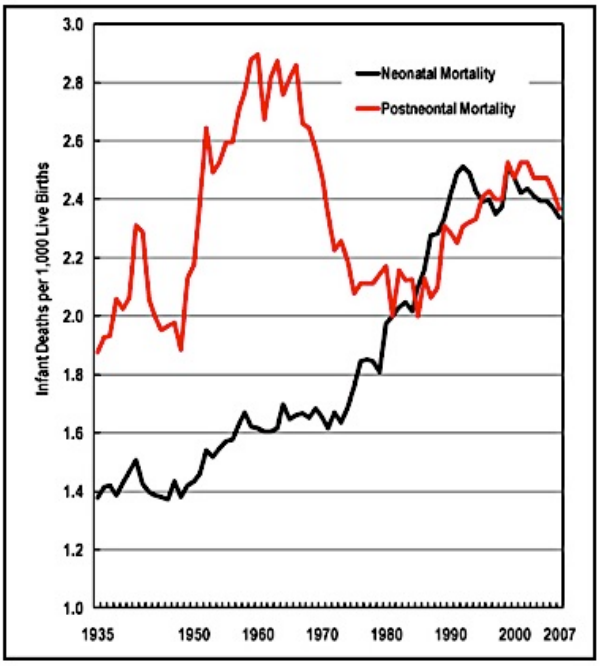


Figure 2 Line graph depicting the black to white ratio of neonatal and postneonatal mortality rates in the United States from 1935-2007 (Singh & Dyck, 2010).

The following three maps illustrate the nation's most current infant mortality rate from years 2008 to 2010. The overall United States IMR is 6.39 deaths per 1,000 live births (Figure 3) ("Infant mortality rate," n.d. ). The highest IMR is seen among non-Hispanic Blacks at 12.2 deaths per 1,000 live births (Figure 4). Non-Hispanic Whites have the lowest IMR at 5.3 deaths per 1,000 live births (Figure 5). Hispanics have an IMR of 5.4 deaths per 1,000 (not pictured). From these three groups, non-Hispanic Blacks are skewing the overall IMR while non-Hispanic Whites and Hispanics have similar IMR ("Infant mortality rate," n.d. ). For more information on spatial autocorrelations for national IMR and their statistical significance, see Appendix B.

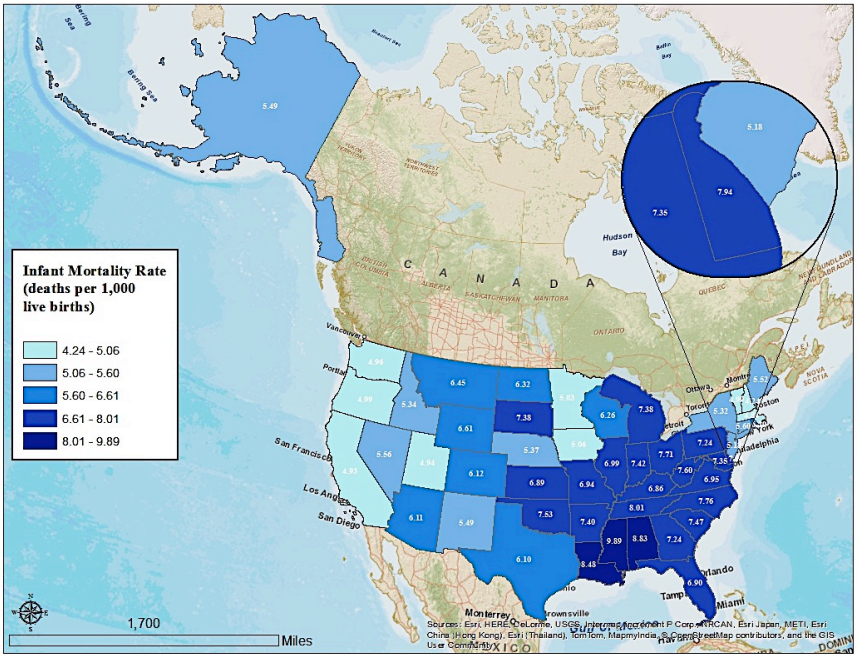


Figure 3 Overall U.S. Infant Mortality Rates, 2008-2010.

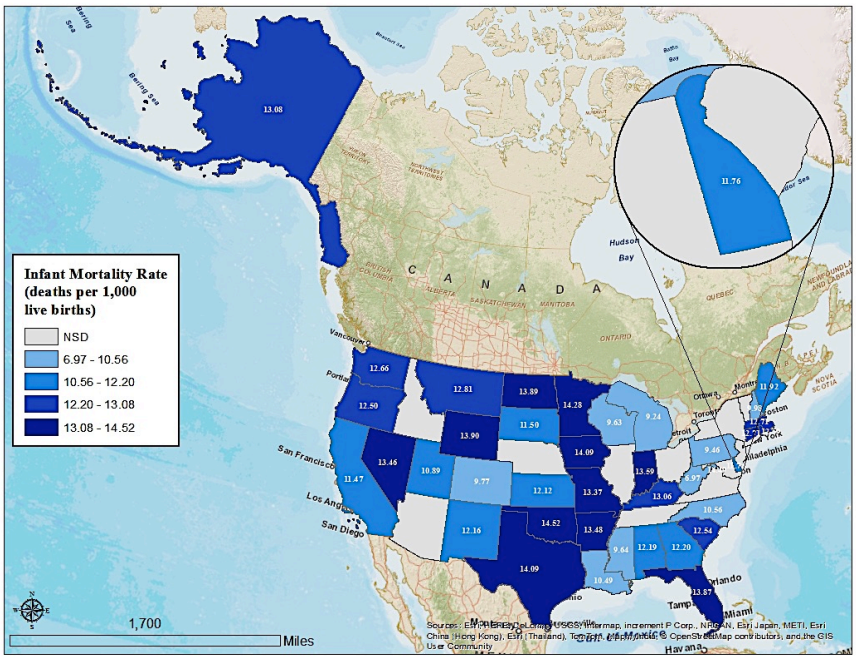


Figure 4 Infant Mortality Rates among Blacks, 2008-2010.

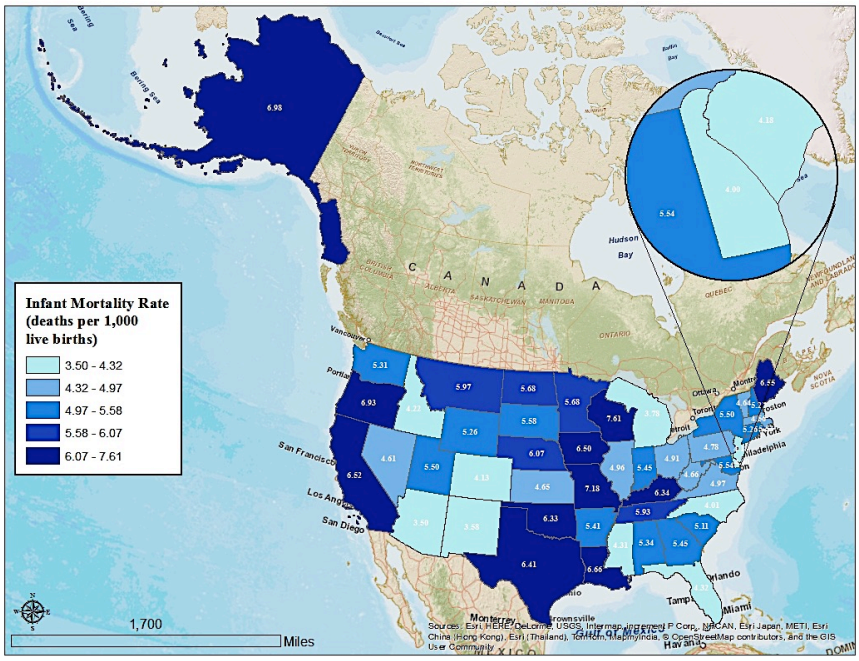


Figure 5 Infant Mortality Rates among Whites, 2008-2010.

## A Missing Link

Many credible studies establish the link between infant mortality rate and socioeconomic status and educational attainment. However, recently researchers have questioned a piece of the puzzle that seems to be missing. When socioeconomic status and educational attainment are controlled, there is a persistent Black-White gap in birth outcomes. In a match pair experiment, there are two individuals that have the same education, socioeconomic status, and occupation. Racial disparities in birth weight persist after controlling for those variables.

> "In fact, there is more of a gap between black and white mothers of higher socioeconomic position than between overall black and white rates without socioeconomic stratification" (David & Collins, 1991 , p. 236).

Studies show that if two women have college degrees, the White woman has an IMR of 4 deaths per 1,000 births whereas the Black woman has an IMR of 10 deaths per 1,000 births. In actuality, Black mothers with a college degree have worse birth outcomes than White mothers without a high school education ("When the bough," 2008).

## Must be the Lack of Income

To obtain a clearer understanding of these social inequities, a study was conducted using income incongruity rather than socioeconomic status alone (Collins, Herman & David, 1997). The study was searching for the extent to which income incongruity affects the relationship between parental races and rates of very low birth weight (VLBW), an infant weight less than 1,500 grams at birth. Negative income incongruity was defined as present when the median family income of the mother's census tract residence was one standard deviation below the mean income of non-Latino Whites with the same number of years of parental education and marital status. Positive income incongruity was defined as present when the median family income of the mother's census tract residence was one standard deviation above the mean income of non-Latino Whites with the same number of years of parental education and marital status (Collins, Herman & David, 1997).

It was found that parents of African American infants were five times as likely to experience negative income incongruity based on maternal education, paternal education, and marital status as the parents of White infants. Within each race, the distribution of selected maternal sociodemographic variables did not vary by income incongruity. In spite of this, it was concluded that negative income incongruity was not a risk factor for VLBW, because it was unrelated to race-specific VLBW. Overall,

African American infants had a greater percentage of high-risk characteristics than White infants (Collins, Herman & David, 1997).

On the other hand, the position of African Americans relative to Whites was essentially unaffected by the type and direction of income incongruity. Even in a logistic regression, which controlled for racial differences in maternal age, education, marital status, and parity (the interaction of live birth order and mother's age), the odds ratio of VLBW for African Americans compared to white infants in negative income incongruity, no income incongruity, and positive income incongruity were 2.4, 2.6, and 2.1, respectively. These odd ratios depict the uniformity of persistently higher African American IMR among the three types of income incongruity. Furthermore, positive income incongruity was found to be associated with lower race specific rates of VLBW, but overall did not eliminate the racial disparity in birth weight (Collins, Herman & David, 1997). The researchers provided one possible explanation for the persistence of the gap even when an African American mother has positive income incongruity stating that,

> "African American women in this small subgroup are likely to suffer more psychophysiological stress related to discrimination and social isolation than their White counterparts" (Collins, Herman & David, 1997, p. 416).

**Must be the Lack of Educational Attainment**

Since the income incongruity does not close the gap, researchers have turned to the parent's educational attainment. A study was conducted to understand the impact of educational attainment on Black-White infant mortality inequities. The sample contained only infants who mothers were 20 years of age or older, whose parents had

both completed at least 16 years of education, and the parents were of the same race (Schoendorf, Hogue, Kleinman & Rowley, 1992).

The IMR in the college-educated Black population was found to be 10.2 deaths per 1,000 live births, whereas the college-educated White population rate was 5.4 deaths per 1,000 live births. After being adjusted for age, parity, when prenatal care was initiated, and marital status the likelihood of death for a Black infant was 1.82 times higher than that of a White infant (Schoendorf, Hogue, Kleinman & Rowley, 1992).

The risk of low birth weight (LBW), an infant weighting less than 2,500 grams at birth, was more than twice as high among Blacks compared to Whites. Furthermore, the risk of VLBW was found to be three times as high for Black infants as for White infants (Schoendorf, Hogue, Kleinman & Rowley, 1992). In order to understand the magnitude of VLBW, a report from Health Resources and Services Administration's Secretary's Advisory Committee on Infant Mortality, stated that approximately 1% of births occurring at VLBW accounts for approximately two-thirds of the racial gap in infant mortality ("Eliminating health disparities," 2006).

In addition, Black infants were three times as likely as White infants to die of causes attributable to prenatal events, which include prematurity. Aside from the Black infants in the general population, Black infants born to college-educated parents have a higher mortality rate than similar White infants largely due to the higher rates of LBW. It was found that for this population of Black and White infants born at a normal birth weight (NBW), weighting in at more than 2500 grams, have equivalent mortality rates. For that reason, the predominance of LBW among college-educated

Blacks was the contributing factor to this disparity (Schoendorf, Hogue, Kleinman & Rowley, 1992).

The study noted that controlling for age, parity, marital status, prenatal care and education does not eliminate the gap between Black and White infant mortality inequities. As a matter of fact, the Black-White differential was far greater for infants born to mothers with few risk factors than for those infants born to mother in the high-risk groups (Schoendorf, Hogue, Kleinman & Rowley, 1992). The researchers concluded their report expressing that

> "the persistently increased risk of low birth weight and very low birth weight among black infants in this selected population suggests a basic lack of understanding the determinants of premature birth and an inability to prevent premature delivery, even in an educated population" (Schoendorf, Hogue, Kleinman & Rowley, 1992, p. 1526).

**Must be Genetic**

Studies in search for a "preterm gene" to explain the Black-White birth outcome gap fell short as well. Researchers hypothesized that the preterm gene would have originated in African populations (David & Collins, 2007). Therefore a study was conducted with the comparison of three groups of women delivering in Illinois over a fifteen-year period: U.S.-born White women, U.S.-born Black women, and African-born Black women (David & Collins, 2007).

The results showed that the overall birth weight distributions for infants of U.S.-born White women and African-born women were almost identical (David & Collins, 2007) (Figure 6). However, Black women born in the United States experienced higher rates of VLBW, than either the White or African-born women once appropriate confounders were controlled. This study further proves that it is not

race that is creating this problem, but rather a factor that is contained within the United States borders (David & Collins, 2007).

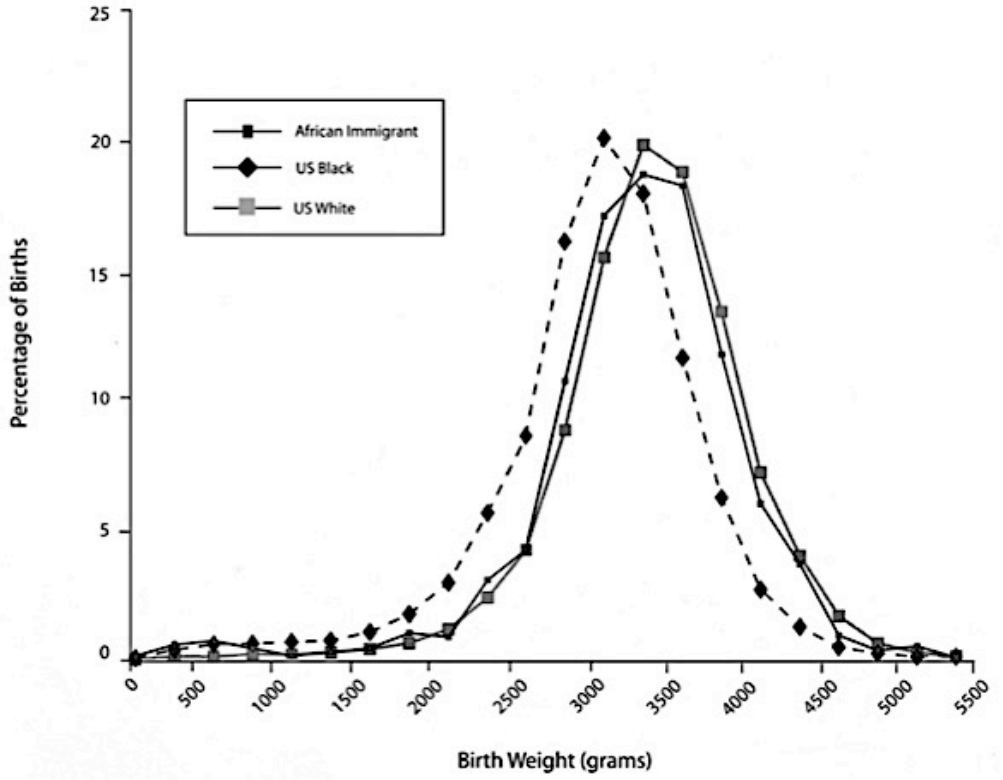


Figure 6 Line graph illustrating the similarity between African immigrant and U.S. Black birth weight and their contrast to the U.S. Black birth weight (David & Collins, 2007.)

The study also confirmed that African immigrants who gave birth to girls were heavier than the girls born into established Black American families. Yet, when these first-generation Black girls grew up in the U.S. and went to have daughters of their own, their children's birth weights were lower on average than their own weights had

been at birth (David & Collins, 2007). This leads to a conclusion that an African gene is not the answer, but the United States itself is creating these health inequities.

### Stress from Racial Discrimination: Another Cause to Consider

Researchers have turned to a new explanation for the growing gap: racism. Racism is the attitudes and beliefs that result in "differential and/or unfair treatment of individuals on the basis of race" (Barnes-Josiah & Fitzgerald, 2004, p. 2). Furthermore, racism is "organized system, based on an ideology of inferiority, that disadvantages groups designed to be inferior compared to those presumed to be superior" (Williams & Neighbors, 2001, p. 801.) The United States adopted this system when segregating Blacks and Whites, creating a hierarchy and superiority of one race to another. Even as time and Civil Rights events occurred, the ill health effects are continuously passed down from generation to generation with no sign of disappearing.

This is explained through the notion of institutional racism, meaning the "differential access to the good, services, and opportunities of society by race" (Barnes-Josiah & Fitzgerald, 2004, p.3). Institutional racism limits the socioeconomic attainment of Blacks, which can lead to an overall group difference in socioeconomic status that thereby indirectly affects health. Racial residential segregation has played a central role in building a system that determines Blacks access to education, employment, and health opportunities, which widens the education, income, occupation, and wealth differences seen between Blacks and Whites. However, controlling for these socioeconomic characteristics does not eliminate the Black-White gap in birth outcomes (Williams & Neighbors, 2001). Understanding institutional racism on the basis of access to goods and services sets the foundation for the

magnitude of the inequity, but does not reveal the psychological effects of this phenomenon (Barnes-Josiah & Fitzgerald, 2004).

Out of all ethnicities, Blacks were and are the most racially stigmatized (David & Collins, 2007). When Williams *et al.* (2001) analyzed public opinion surveys and found that most Americans knowledge this social stigmatism. He found that Blacks were the group most discriminated against followed by Hispanics, American Indians, Asians, and Jews. The survey revealed that 66 percent of Americans believe that Blacks endure "a lot" or "a tremendous amount" of discrimination and 88 percent believe that Blacks face at least "some" discrimination. In a 1995 survey, he found that over 40 percent of Americans believe that the level of discrimination over the past ten years has not changed or gotten substantiality worst (Williams & Neighbors, 2001). This stigmatization is now contributing to the gaps in health experienced today (David & Collins, 2007).

Due to racism, Black women suffer from chronic stress and that stress starts the day they are born ("When the bough," 2008). In fact, there was a study of 334 midlife women, which examined the links between different kinds of stress and risk factors for heart disease and stroke. Black women who stated that racism was a source of stress in their lives developed more plaque in their carotid arteries than Black women who did not. The excess plaque is an early sign of heart disease (Drexler, 2007). Thus this research suggests that the prevalence of racism throughout America's history, even after the Civil Rights Movement, is still affecting Blacks today and contributing to adverse birth outcomes.

American society and the associated racial profiling have also been found to affect pregnant women in California. Pregnant women with Arabic names were

suddenly more likely than any other group to deliver LBW babies in the six months following the tragic 9/11 events. After this time span, their low birth regained regularity, meanwhile Blacks continue to suffer from an increasing gap of birth outcome inequities (Drexler, 2007).

Furthermore, the compilation of these studies indicates genetic, biomedical, education, income, and perceived risk factors, such as smoking, maternal age, live birth order, cannot close the gap alone. In addition, every study concluded with the researcher announcing either the lack of understanding to combat infant mortality or that other research pertaining to racial discrimination should be conducted (David & Collins, 1991), (Schoendorf, Hogue, Kleinman & Rowley, 1992), (Collins, Herman & David, 1997), (David & Collins, 2007). In no way are the traditional social determinants of health to be devalued through this analysis. Rather, this research is aims enhance the understanding of an additional determinant of health that could potentially, if treated correctly, close the gap.

**Race as a Social Construct: Another Determinant of Health**

This determinant of health, race, is put forth to invoke a new realm of thinking. Instead of viewing the correlations with education and socioeconomic status or blaming a gene that does not exist, the root of those correlations should be viewed on an individualized basis. If the populations associated with these correlations were understood, then the diagnosis prescribed would not be the same for all. African Americans who have suffered from lifelong minority status would have different interventions to help them personally. Both Schoendorf *et al.* (1992) and Collins *et al*. (1997) have given insight on how more education or money is not solving the problem

within that population. Those remedies show substantial improvements among Whites, but that doesn't mean the outcomes will be as substantial among all races.

When attempting to fix the problem, the White cure becomes the only remedy valued. However, Americans have to move away from old habits to understand the history and the society that remains after a time of brutal enslavement. Even if the action or phase is innocent or trivial from a White person's perspective, it may be perceived as major and profound to many Blacks from the perceptual predisposition that Blacks have internalized through the pervasiveness of racial incidents (Williams & Neighbors, 2001). As neonatologists Dr. David and Dr. Collins expressed their concern that the, "reluctance to use the word racism and to acknowledge that discriminatory patterns and practices persist has held back meaningful research in this area" (David & Collins, 1991, p. 240). If the gap is to be closed, Americans cannot afford to be colorblind. Americans must come to understand race as the social context that it was constructed upon. The long history of this social context is further elaborated in Appendix A.

## A New Way to Conduct Health Disparities Research

In searching for new ways to tackle the Black-White birth outcome gap, researchers have continued to analyze variables such as socioeconomic status (SES), but in a way that is applicable to each subset of the population. A team of researchers conducted a study on how the mother's job strain can impact the birth weight of their infants (Oths, Dunn & Palmer, 2001). Again, this study does not discount socioeconomic status, but rather provides a new insight into psychosocial effects of their job on pregnancy outcome, instead of the occupation itself.

There was an eligibility criterion for the interview process to eliminate high-risk patients. This criteria selected only patients between the ages 20 and 34, receiving early prenatal care, and did not have chronic hypertension, chronic diabetes mellitus, cardiopathy, actively treated epilepsy, or thyroid disease. The interview consisted of various questions on demographics, social support, relationships, stressful life events, pregnancy history, illegal substance use, income, work schedule, job history, and job conditions. There was also a focus on determining if the individual's job was high in psychosocial demands and low in control as well as high in physical demand. This measure of psychosocial and physical demands was found through a series of questions that were coded to represent the various conditions. If a person was found to have high demand and low controls, then they were classified as having job strain (Oths, Dunn & Palmer, 2001).

The study discovered that women with job strain had babies with lower birth weights than either women with no strain or unemployed women. The difference in birth weight between mothers in a high strain job compared to no strain was 190 grams. It was also found that the effect of job strain on adjusted birth weight was greater for Blacks than Whites, 273 versus 88 grams, respectively (Oths, Dunn & Palmer, 2001).

The study confirmed that in a sample of healthy adult women there was a clear effect of job strain on birth weight. However, the gap in birth weight by ethnicity was still evident under the no strain condition at 220 grams, but it was only about half of that found in the presence of job strain at 405 grams. In addition, women who felt discrimination within their workplace were nearly three times as likely to be under job strain than those who were not. So the effect of job strain does not close the gap, but

helps explain how job strain and racial discrimination can widen the gap and that an intervention at the occupational level might have positive effects on the infant mortality disparity (Oths, Dunn & Palmer, 2001).

### Understanding the Affects of Interpersonal Racial Discrimination

Another study was performed to obtain a better understanding of the extent to which women's reported lifetime and pregnancy exposure to interpersonal racial discrimination is associated with VLBW infants (Collins, David, Handler, Wall & Andes, 2004). The study contained only African American women that were divided into one case subject and two control subjects: case subjects were restricted to mothers of singleton VLBW preterm, less than 37 weeks, infants; one control subject contained critically ill non-low birth weight (NLBW) term infants that were admitted to the neonatal intensive care unit for ventilator management; the other control subject contained healthy NLBW infants that were admitted to the normal newborn nursery (Collins, David, Handler, Wall & Andes, 2004).

Trained African American interviewers collected data on the mother's demographics, risk factors and education as well as asked questions on lifetime and pregnancy exposure to interpersonal racial discrimination in five domains: at work, getting a job, at school, getting medical care, and getting service at a restaurant or a store (Collins, David, Handler, Wall & Andes, 2004). It is found that the distribution of sociodemographic, biomedical, and behavioral characteristics did not vary between the critically ill and healthy control subjects. However, there was a slightly higher percentage of case subjects that were found to be older, more educated, and cigarette smokers (Collins, David, Handler, Wall & Andes, 2004).

Collins *et al.* (2004) discovered the magnitude of association between racial discrimination and VLBW was strongest in the finding a job and at work domains. The association between maternal exposure to interpersonal racial discrimination and VLBW was also found to be the strongest among women with more than 12 years of formal education. This association was confirmed by the odds ratio that the risk of having a VLBW infant for college-educated women, who reported racial discrimination in 1 or more and 3 or more domains were 2.8 and 7.3, respectively. The odds ratio of VLBW infant for maternal lifetime exposure to interpersonal racial discrimination in 1 or more domains and 3 or more domains was 1.9 and 3.2, respectively. However, there was no association of VLBW with incidents of perceived discrimination during pregnancy itself. This can be explained by the notion that pregnancy is only nine months whereas discrimination throughout a mother's lifetime would have a greater impact (Collins, David, Handler, Wall & Andes, 2004).

The case and control subjects were compared to determine if there was difference between the outcome of the infant and the presence of discrimination. When case subjects were compared only with the critically ill control subjects, the odds ratio for exposure to racial discrimination in 1 or more domains and 3 or more domains was 1.9 and 3.4, respectively. Taking those same case subjects and comparing them only with the healthy control subject the odds ratio was 1.9 and 3.0, respectively. These findings explain that no matter the outcome, a healthy or critically ill baby, that racial discrimination still creates the same level of risk. It was concluded that the lifelong accumulated experiences of interpersonal racial discrimination by African American women would constitute an independent risk factor for VLBW infants (Collins, David, Handler, Wall & Andes, 2004).

The researchers also stated that the,

> "conventional investigative approach to the racial disparity in the rates of very low birth weight births has been based on the implicit assumption that there is a set of risk factors that differ in quantity between the races but exert similar effects on African American and white women", but an " extensive literature has shown that established risk factors have minimal impact on the rate of VLBW for African Americans" (Collins, David, Handler, Wall & Andes, 2004, p. 2135).

Therefore the newly established risk factor, racial discrimination, has to be accounted for in further research and policy solutions.

## New Considerations

Throughout this analysis it is evident that the social determinants of health need to be viewed in their true form. Americans have to move away from old habits as neonatologists have stated that,

> "the persistent use of the biologic concept of race in medicine and epidemiology is more a result of habit and a reflection of existing power relationships than a product of critical scientific thought" (David & Collins, 1991, p. 237-238).

> Furthermore that, "discrimination and black disadvantage are so pervasive and multilayered in American society, it is not surprising that studies comparing blacks and whites can rarely, if ever, truly 'control for socioeconomic status'" (David & Collins, 1991, p. 238).

Society needs to understand the severity of overlooking the past and treating the future like nothing happened. If this is not achieved, the gap in infant mortality as well as other health risks will continue and Blacks will face persistently worse outcomes since the traditional response is not eliminating the problem.

As stated above, racism affects health through chronic stress. Stress is "a complex phenomenon that encompasses exposures to psychosocial, environmental, and physical changes and the body's response to those experiences" (Jackson, 2007).

Every person encounters stress at some point whether it is through the loss of a job or the death of a friend or family member. Yet the stress that is felt occasionally does not compare to the everyday, every minute stress of Blacks in America. Due to severe racism in the United States, most Blacks have internalized racism, meaning collectively they have accepted the "negative messages about their own abilities and intrinsic worth" (Barnes-Josiah & Fitzgerald, 2004, p. 2). This is a pressure that builds and never lets up. A further explanation of the types of racial discrimination is seen in Figure 7.

| Internalized | Interpersonal | Institutional | Structural |
|---|---|---|---|
| A set of private beliefs, prejudices and ideas that individuals have about the superiority of Whites and the inferiority of people of color. Among people of color, it manifests as internalized racial oppression. Among Whites, it manifests as internalized racial superiority. | The expression of racism between individuals. These are interactions occurring between individuals that often take place in the form of harassing, racial slurs, or telling of racial jokes. | Discriminatory treatment, unfair policies and practices, inequitable opportunities and impacts within organizations and institutions, based on race. | Racial bias across institutions and society. It's the cumulative and compounded effects of an array of factors such as public policies, institutional practices, cultural representations, and other norms that work in various, often reinforcing, ways to perpetuate racial inequity. |

Figure 7 This figure describes the multiple types of racial discrimination (Clark, Huisingh, Ommerborn & Grooms, n.d.).

The manifestation of this problem does not lie only in the realm of infant mortality, but also in other health inequities, such as diabetes. In order to close the gaps in inequities of IMR and diabetes, there can no longer be a one cure fits all mentality that Americans, researchers, physicians have become accustomed to. There has to be a realization that different segments of the population, in this case those who have internalized race-related stress, have disproportionally negative health outcomes including adverse reproductive outcomes.

# Chapter 3

# METHODOLOGY FOR TWO STATISTCAL ANALYSES

## Conceptual Model

The above discussion paints a picture of relationships between maternal education, parental education, income incongruity, socioeconomic position, racial genetic markers, and other influences on birth weight, premature deliveries, and infant mortality that fail to reduce the racial gap in birth outcomes. Here, this series of analyses attempts to explain the racial gap among same race and biracial parents as well as reduce the racial gap in birth outcomes in two ways. The first analysis will explore racial discrimination at face value by looking at college-educated parents that are biracial compared to same race parents. The second analysis incorporates another variable of interest that attempts to represent the relationship of stress from racial discrimination-- chronic hypertension.

The first analysis attempts to determine the effects of racial discrimination on birth outcomes by analyzing not just the mother's race, but also the father's race. A biracial couple may experience more or less racial discrimination depending on the race of the father. The race of the father may provide either a protective or adverse effect on their partner's birth outcome. It is thought that if the father is Black and his partner is White, there will be racial discrimination imposed on not only him, but the couple as a whole. The stress from this unfamiliar discrimination may increase the risk of low birth weight, preterm deliveries, and infant mortality among White Mother-Black Father (WMBF) infants. The reverse phenomenon is hypothesized for

Black Mother-White Father (BMWF) infants. If the race of the father is White and his partner is Black, there could a protective effect on the mother. The Black mother will still suffer from lifelong racial discrimination, but the White father could shield some of that effect decreasing the risk of low birth weight, preterm deliveries, and infant mortality. Black Mother-Black Father (BMBF) infants will still fare the worst among birth outcomes and White Mother-White Father (WMWF) infants will fare the most optimal.

Previous analyses, Migone *et al.* (1991), Parker (2000), and Srinivasjois *et al.* (2012), have found gradients in adverse birth outcomes, with maternal race contributing more than paternal race. Adams *et al.* (1993) performed a retrospective cohort study to examine the Black-White difference in preterm delivery among United States Army enlisted women, who had unrestricted access to prenatal care as well as good health status. The study found that unlimited prenatal care and the elimination of recreational drug use did not eliminate the Black-White gap in preterm deliveries. An unexpected finding in their analysis was when the mother was White and the father was Black, there was a 31% higher risk of preterm delivery than when both parents were White. This risk increased to 2.2 times higher when both parents were Black than when both parents were White (Adams, Read, Rawlings, Harlass, Sarno & Rhodes, 1993). Parker (2000) introduced the theory of the protective effect that White fathers have on Black mothers. In explaining how the demographically lower-risk group BMWF infants had consistently higher risks of both VLBW and LBW than WMBF, she identified the persistent effects of racial discrimination throughout the life of Black women, regardless of the father's race as a profound contributor. She also

stated that the exposure to racial discrimination among White mothers with Black fathers is likely more limited (Parker, 2000).

This analysis extends the previous analyses to assess whether this gradient exists among college-educated parents. Schoendorf *et al.* (1992) performed a cross-sectional analysis to calculate infant mortality rates for children born to college-educated parents, as well as assessing the effect of birth weight by examining mortality rates before and after the exclusion of infants weighting less than 2,500 grams at birth (Schoendorf, Hogue, Kleinman & Rowley, 1992). The methods of Schoendorf's analysis were used as a reference point for this analysis. All methods were replicated to provide a comparative analysis of the two studies. However, the birth cohort linked birth-infant death data files used in this analysis did not include the father's education level. Thus, the mother's education was relied on as the representation of education for the couple. Schoendorf's analysis also included the National Center for Health Statistics' 61 infant-death codes to evaluate the underlying cause of death (ICD-9-CM). Since 1992, the 10$^{th}$ revision of the *International Classification of diseases, 10$^{th}$ Revision, Clinical Modification* (ICD-10-CM) was released in 1999 replacing the 61 infant-death codes with 130 list of infant-death codes ("ICD-9* recodes of," n.d.). Thus, the 130 recodes were used in this analysis to maintain continuity.

This analysis provides an additional extension to the past analyses by taking the recommendations for further analysis described in Adams *et al.* (1993) and Srinivasjois *et al.* (2012). Both analyses refer to the contribution of racism and racial discrimination on the outcome of the pregnancy and calls for an examination of psychosocial stress, social, and environmental factors that pertain to biracial couples.

The first analysis does not explicitly analyze these factors, but rather explores Parker's protective effect theory and whether her theory persists among college educated parents. The second analysis attempts to bring previous analyses to the next level by analyzing the psychological stress that pertains to biracial and Black couples.

Stereotypically, it is perceived that Blacks have higher infant mortality rates due to lower levels of educational attainment, socioeconomic status and higher rates of teenage pregnancy, lack of marital status, and live births. Past studies performed by David *et al.* (1991), Schoendorf *et al.* (1992), Collins *et al.* (1997), and David *et al.* (2007) have contested these beliefs providing evidence that even those with the highest level of socioeconomic status share the same birth outcome as their racial counterpart with lower socioeconomic status. Those researchers have also noted that there is a lack of understanding the determinants of adverse birth outcomes and an inability to prevent them even in a low risk population. Researchers, like Adams *et al.* (1993), Parker (2000), Mustillo *et al.* (2004), and Srinivasjois *et al.* (2012), have hypothesized that racial discrimination, a psychosocial stressor, may be increasing these adverse birth outcomes. This analysis intends to extend their work by analyzing if there is a racial discrimination effect on adverse birth outcomes occur low-risk population in a gradient effect among same race and biracial parents.

For the second statistical analysis, a variable to represent race-related stress was selected to depict the impact of racial discrimination on birth outcomes. Chronic hypertension was used as a proxy for stress from racial discrimination. In synthesizing the current literature surrounding the relationship between chronic stress and hypertension, Spruill (2010) explains that the

> "impact of stress on the development of hypertension is believed to involve a sympathetic nervous system response, in which release of

> catecholamines leads to increased heart rate, cardiac out, and BP" (Spruill, 2010, p. 13).

Exposure to chronic stress, such as race-related discrimination, leads to allostatic load (wear-and -tear on the body). This wear and tear leads to impaired immunity, atherosclerosis, obesity, bone demineralization, and atrophy of nerve cells in the brain. Thus, the body can no longer function properly producing a series of poor health outcomes (McEwen, 2006). The presence of chronic hypertension is thought to be related to the existence of chronic stress. Furthermore, racial discrimination is an everyday stressor; so chronic hypertension was selected as the proxy for race-related stress.

Williams *et al.* (2001) analyzed the association of racism and hypertension. He suggested that the stress from racism is a contributing factor to the elevated rates of hypertension among Blacks. Williams and colleagues acknowledged that chronic mental stress, that could be from racial discrimination, was linked to the heighten risk of hypertension. He provided a summary of studies that consistently found a positive association between stress and the elevation of blood pressure. Most studies reported either baseline cardiovascular reactivity and/or cardiovascular reactivity to stress was higher in Blacks compared to Whites. When assessing family history of hypertension, family history was found to be related to cardiovascular reactivity for Whites, but was found to be unrelated to the reactivity for Blacks. These studies concluded that the mechanism responsible for these differences in cardiovascular reactivity was the greater constriction of peripheral blood vessels, which elevated blood pressure among Blacks compared to Whites. Williams and colleagues also documented a community sample from Pitt County North Carolina that measured stress as to what degree life is dominated by worries, aggravation, and uncontrollable events within eight domains.

The study found that perceived stress was positively associated with diastolic and systolic blood pressure (Williams & Neighbors, 2001).

Williams *et al.* (2001) also analyzed the association of racial discrimination and hypertension. In laboratory studies of cardiovascular reactivity, it was found that Black women who scored higher on the perceived racism scale or everyday racism scale had increased diastolic blood pressure response to speech tasks, which could be interpreted as an incident of racial basis. In community based studies analyzing the association of racial discrimination and hypertension, there seemed to be an overall "U" shape pattern among respondents that reported none and three or more experiences of racial discrimination had elevated systolic and diastolic blood pressure compared to respondents who reported one or two experiences of racial discrimination. The findings in the community-based study were not always statistically significant (Williams & Neighbors, 2001).

Collins *et al.* (1991) provided additional insight to William's "U" shaped pattern through an assessment of a study of 51 Black and 50 White women that were interviewed about experiences of race and gender biased treatment and their responses to that treatment.

> "The incidence of self-reported hypertension in black women who were exposed to what they perceived as racial bias and who stated they 'usually accepted and kept quiet about unfair treatment' was 4.4 times higher than among those who said they 'took action or talk to others'" (David & Collins, 1991, p. 239).

Thus, the experience and internalization of racial discrimination could be the cause of these increased rates of hypertension. There was no association found among White women, since only a smaller number of them reported experiencing race-biased treatment (David & Collins, 1991).

Chronic hypertension is not solely due to racial discrimination. Hypertension accounts for stress generally. However this data set does not contain a variable that quantifies the stress of strictly racial discrimination. Other stressors, such as financial or occupational stress could also contribute to the presence of chronic hypertension. Any association with hypertension may then overstate the racial component. This analysis attempts to eliminate other stressors by using chronic hypertension rather than pregnancy associated hypertension. The prevalence of chronic hypertension is a lifelong disease much like the stress from racial discrimination. Again, the presence of chronic hypertension can be caused by more confounding factors, then exclusively race-related stress, but the data set does not allow for a better way to distinguish the type of stress associated with the chronic hypertension.

The selection of the data set was specific to the needs of this analysis. This data set included all births as well as births that were linked to their corresponding death certificate. Thus the data set provided an array of options to be able to see the prevalence of low birth weight and preterm deliveries among all infants as well as the amount of those infants who died thereafter. This analysis is interested in the Black-White gap in birth outcomes. This gap is measured by the comparison of infant mortality rates between the two races. Typically, when studying infant mortality, birth weight and gestation in weeks are the dependent variables of choice. Low birth weight and preterm deliveries have a greater risk of suffering from infant mortality. Therefore this analysis will analyze the prevalence of low birth weight and preterm deliveries as well as infants who suffered from infant mortality. The goal of this analysis is to analyze the Black-White gap in low birth weight, preterm deliveries, and infant mortality and determine if chronic hypertension, a proxy for stress from racial

discrimination, would reduce the gap between the four parental groups. The publicly available infant mortality data from Vital Statistics indicates every infant that was born in the United States of America that died within 364 days. This data includes these infants' birth weight, gestation in weeks, live birth order, plurality (whether the birth was single or multiple birth) as well as their mother's demographics.

The premise of this analysis will include the traditional maternal risk factors (maternal education, marital status, parity, maternal age, trimester prenatal care was initiated, pregnancy smoking status). While maintaining conventional wisdom, a variable for stress-related exposure to prolonged and internalized racial discrimination will be included to analyze an expected increase, if any, in the probability of low birth weight, preterm delivery, and infant death. To examine the variable of interest, chronic hypertension, a progression of models similar to those used by Mustillo *et al.* (2004) will be employed. This will be analyzed for Black and White mothers as well as same race and biracial parents.

## Research Questions

The overarching research question is: Does the experience of racial discrimination contribute to the Black-White differences in preterm deliveries, low birth weigh deliveries, and infant death?

The first analysis poses the following research question: Does the race of the father have either a protective or adverse effect on the birth outcome: preterm deliveries, low birth weight, and infant mortality, among low-risk parents? Two hypotheses are inferred: There will be a gradient effect on all three birth outcomes going from lowest to highest risk in the following order: WMWF, WMBF, BMWF, BMBF (Migone, Emanuel, Mueller, Daling & Little, 1991). Even within a low-risk

population, Blacks will have more adverse birth outcomes than their White counterparts (Schoendorf, Hogue, Kleinman & Rowley, 1992).

The second analysis poses the following research question: Does chronic hypertension contribute to the Black-White differences in preterm deliveries, low birth weight deliveries, and infant death? Does the inclusion of chronic hypertension reduce the racial odds ratio? Two hypotheses are inferred: Chronic hypertension, like racial discrimination, will reduce the racial odds ratio (Mustillo, Krieger, Gunderson, Sidney, McCreath & Kiefe, 2004). There will be a gradient effect on all three birth outcomes going from lowest to highest risk in the following order: WMWF, WMBF, BMWF, BMBF (Migone, Emanuel, Mueller, Daling & Little, 1991).

## Data

Both statistical analyses draw on publicly available infant mortality data for the most recent six years of data. This data was extracted from the Centers for Disease Control and Prevention, which encompasses data from Vital Statistics on Birth Cohort Linked Birth-Infant Death Data for years 2004 to 2009. The data set consists of all individual births and a linked death certificate if the infant suffered from infant mortality through that time period ("Vital statistics data," 2015). A total of 25,255,139 individual cases were available in datasets from 2004 to 2009. 25,089,004 of those cases lived past their first birthday. A total of 166,135 cases make up the infant deaths over the six-year span. The six-year time period data files were chosen for several reasons. First, the college-educated biracial parents analysis had a low sample size after exclusions. To ensure at least a sample size of 100 for all four parental groups six years of data was needed. Second, the prevalence of chronic hypertension is low among all births. Therefore the use of the same six-year time span increased the

number of cases of chronic hypertension among Black and White mothers as well as the four parental groups. The overarching goal of these analyses is to illustrate the probability of adverse birth outcomes among college educated biracial parents and how that racial odds ratio can be reduced with addition of a proxy for racial discrimination.

## Sample

Both analyses for the birth cohort linked birth-infant death files focused on individuals who were identified as Black or African American and White. If an individual did not identify as Black or White, then the case was excluded from the analysis. Multiple infant births were also excluded from the analyses in order to control for outliers and to contain the skewness of the data. There is an increased risk of VLBW among multiple birth infants, because they are often premature (born under 37 weeks). VLBW is prevalent among 10% of twins and 33% of triplets; thus they were excluded (Trevino, n.d.).

The first analysis only included cases that the father's race was known and either Black or White, the mother had completed at least 16 years of education, and the birth weight was known. All other cases were excluded. After these exclusions, the first statistical analysis contained a total of 3,364,037 cases. 3,353,832 of those cases lived past their first birthday. A total of 10,205 cases made up the infant deaths for the six-year time span.

The second analysis excluded cases with a gestational age that was less than 20 weeks. Those infants are not viable. Thus, those cases were excluded to control for outliers and to contain the skewness of the data. After these exclusions, the second statistical analysis contained 22,694,584. 22,567,323 of those cases lived past their

first birthday. A total of 127,261 cases made up the infant deaths for the six-year time span.

## Measures

### Birth Outcomes

For the purposes of the first statistical analysis, VLBW infants were defined as those who weighted less than 1,500 grams at birth. LBW infants were defined as weighting less than 2,500 grams at birth. NBW infants were defined as those who weighted more than 2,500 grams at birth. Infant mortality rate was defined as the number of deaths of children younger than 1 year of age per 1,000 live births (Schoendorf, Hogue, Kleinman & Rowley, 1992).

For the purposes of the second statistical analysis, preterm deliveries were defined as those infants with a gestational age less than 37 weeks. LBW infants were defined as those who weighted less than 2,500 grams at birth (Mustillo, Krieger, Gunderson, Sidney, McCreath & Kiefe, 2004). Infant mortality rate was defined as the number of deaths of children younger than 1 year of age per 1,000 live births

### Chronic Hypertension

Chronic hypertension was exclusively used in the second statistical analysis as a proxy for stress from racial discrimination. Chronic Hypertension was coded as 1, if the mother's medical file stated the presence of chronic hypertension, 0 otherwise.

### Maternal Risk Factors

*Parental Race*. Both statistical analyses use parental race in their analysis. Parental race only includes cases for individuals that identified as Black or White.

The father's race had to be present to be included in the analysis. The analyses include BMWF, WMBF, and BMBF as dichotomous variables in comparison to WMWF.

*Maternal Race*. The second statistical analysis included cases for individuals that identified as Black or White. The models include Black as a dichotomous variable in comparison to White mothers.

*Maternal Education*. The first statistical analysis only included mothers who completed at least 16 years of education.

In the second statistical analysis, maternal education categorized education levels as less than 4 years of college and 4 or more years of education (Mustillo, Krieger, Gunderson, Sidney, McCreath & Kiefe, 2004).

Due to missing cases over the six-year time span, two similar education variables with different names were used.

*Maternal Age & Parity*. Two variables used by Collins *et al.* (1997) as well as Schoendorf *et al.* (1992) were created to account for the interaction between maternal age and parity. The first variable divided maternal age into 5 year intervals from 20 years to greater than 35 years of age. Those age groups were arranged to whether the mother was primiparas, first pregnancy, to multiparas, second pregnancy or more. The second interaction variable defined high parity when the mother was under 25 years of age with parity greater than 2 and women over the age of 25 with parity greater than 3. All other mothers were categorized a low parity.

For the second statistical analysis, an additional age interval was included, mothers less than 20 years of age that were categorized depending on whether the mother was primipara or multipara.

*Marital Status*. Marital status was coded as 1 if the mother identified as being married at delivery. Unmarried responses were coded as 0.

*Prenatal Care*. Prenatal care was defined as early if it was initiated within the first trimester. Prenatal care initiated in the second and third trimester or not at all was defined as late or none prenatal care.

Due to missing cases over the six-year time span, two similar prenatal care variables with different names were used.

*Pregnancy Smoking Status.* Smoking status was created into a dummy variable where smoker during pregnancy was coded as 1, otherwise 0. This variable was only included in the second statistical analysis.

## Analyses

The first statistical analysis starts with a univariate distribution using previously described risk factors for infant mortality of each variable among BMBF, BMWF, WMBF, and WMWF parents (Kleinman & Kessel, 1987) (Schoendorf, Hogue, Kleinman & Rowley, 1992). On the basis of these preliminary analyses, a logistic regression analysis was conducted to examine the determinants of infant mortality among infants born to college-educated parents. The risk ratio of birth-weight distributions as well as the mortality rate associated with those birth weights were computed. The risk ratio of the underlying cause of death was also calculated (Schoendorf, Hogue, Kleinman & Rowley, 1992).

The second statistical analysis begins with a univariate distribution using two additional risk factors described in the first statistical analysis among Black and White mothers and the four parental groups, as well as the distribution after stratification according to preterm deliveries, LBW, and infant mortality. On the basis of these

preliminary analyses, a logistic regression analysis was performed examining associations between the outcomes of interest and maternal risk factors. A progression of models is employed to determine whether chronic hypertension, a proxy for stress from racial discrimination, reduces the racial odds ratio when it is included in the analysis. These models will be administered on three birth outcomes: preterm deliveries, low birth weight, and infant mortality. The first model includes only race to quantify the magnitude of the Black-White gap in the three birth outcomes. The second model adds the variable of interest, chronic hypertension. The third model adjusts for maternal risk factors in the first model. The fourth model adjusts for maternal risk factors in the second model (Mustillo, Krieger, Gunderson, Sidney, McCreath & Kiefe, 2004). The same series of models were conducted for the four parental groups. Risk ratios were then calculated for the prevalence of chronic hypertension, as well as the risk ratio of the presence of chronic hypertension on the three birth outcomes.

## Chapter 4

## STATISTIAL ANALYSIS: INFANT MORTALITY AMONG SAME RACE & BIRACIAL COLLEGE-EDUCATED PARENTS

### Results

In the six years studied, 18 percent of Black Mothers with Black Fathers, 22 percent of Black Mothers with White Fathers, 15 percent of White Mothers with Black Fathers, and 31 percent of White Mothers with White Fathers reported completing at least 16 years of education. Information of the father's level of education was not given in the data set, leaving the mother's education as the sole representation of educational attainment for the couple.

A total of 25,255,139 births occurred within this six-year span. Individuals that identified as Black or White, contained information on the father's race, had a singleton infant, completed at least 16 years of education and their infants birth weight was known made up 13 percent of the births and 6 percent of deaths studied in this analysis. The final study population included 237,073 BMBF, 21,444 BMWF, 46,065 WMBF, and 3,059,455 WMWF infants, .8 percent, .5 percent, .4 percent, and .3 died respectively.

Among college-educated mothers whose infants died before their first birthday, WMWF were less likely to be having a child of all 20 to 24 year olds (Table 1). BMWF were least likely to have a child among 25 to 29 year old multiparas. Among multiparas over the age of 35, WMBF were least likely to be having a child. Most mothers among all parental groups were more likely to have a child as the 5 year

age intervals increased with a drop in births occurring in the over 35 years of age category. WMWF were more likely to be having their first child than BMBF counterparts. However, mothers in a biracial relationship were more likely than both same race parents to be having their first child and less likely to have high parity. The gradient of outcomes was similar to the gradient of distributions going from lowest to highest risk in the following order: WMWF, WMBF, BMWF, BMBF. WMBF were least likely to be married and then the reverse gradient was maintained. The percentage of prenatal care followed the gradient except that BMWF obtained the highest percentage among the four parental groups.

Table 1 Characteristics of College –Educated Mothers whose Infants Died Stratified by the Race of the Father, 2004-2009.

| CHARACTERISITIC | WMWF (N=8,100) | WMBF (N=162) | BMWF (N=100) | BMBF (N=1,843) |
|---|---|---|---|---|
| | | *percent* | | |
| Parity and Age Group | | | | |
| Primiparas | | | | |
| 20-24 yr | 4.4 | 8.6 | 11.0 | 6.7 |
| 25-29 yr | 17.3 | 17.9 | 15.0 | 15.7 |
| 30-34 yr | 14.7 | 18.0 | 18.2 | 15.2 |
| ≥35 yr | 9.7 | 10.5 | 11.0 | 12.5 |
| Multiparas | | | | |
| 20-24 yr | 1.1 | 3.1 | 2.0 | 2.8 |
| 25-29 yr | 12.2 | 9.9 | 4.0 | 11.0 |
| 30-34 yr | 20.7 | 18.6 | 17.2 | 16.0 |
| ≥35 yr | 19.5 | 13.0 | 21.0 | 19.2 |
| Parity Category | | | | |
| Low | 92.3 | 93.2 | 93.9 | 91.8 |
| High | 7.7 | 6.8 | 6.1 | 8.2 |

| Table 1 continued | | | | |
|---|---|---|---|---|
| Martial Status | | | | |
| Married | 94.0 | 63.6 | 77.0 | 72.5 |
| Unmarried | 6.0 | 36.4 | 23.0 | 27.5 |
| Prenatal Care | | | | |
| Early | 89.8 | 88.7 | 90.1 | 86.8 |
| Late or None | 10.2 | 11.3 | 9.9 | 13.2 |

[a] Low parity is defined as mothers under 25 years of age with parity less than 2 and mothers over the age of 25 with parity less than 3.

[b] Early prenatal care is defined as case initiated within the first trimester of pregnancy.

The infant mortality rate among BMBF college-educated population was 7.8 deaths per 1,000 live births whereas the infant mortality rate among WMWF college-educated population was 2.7 deaths per 1,000 live births. Among biracial parents, BMWF had an infant mortality rate of 4.7 per 1,000 live births whereas WMBF had an infant mortality rate of 3.5 deaths per 1,000 live births. After the adjustment for age and parity, marital status, and when prenatal care was initiated, the likelihood of death among BMBF infants was 2.75 times that for a WMWF infant (2.60-2.90) (Table 2). The likelihood of death among BMWF infants was 1.61 times that for a WMWF infant (1.31-1.99). The likelihood of death among WMBF infants was 1.22 times that for a WMWF infant (1.04-1.44). These odds ratios were all valid at the 95 percent confidence interval.

Table 2 Adjusted Odds Ratio for Death among Infants Born to College-Educated Parents, 2004-2009.[a]

| MATERNAL CHARACTERISTIC STRATIFIED BY PATERNAL RACE | ODDS RATIO (95% CI) |
|---|---|
| Race | |

Table 2 continued

| | |
|---|---|
| White Mother-White Father§ | 1.00 |
| White Mother-Black Father | 1.22 (1.04-1.44)*** |
| Black Mother-White Father | 1.61 (1.31-1.99)*** |
| Black Mother-Black Father | 2.75 (2.60-2.90)*** |
| Parity and Age Group | |
| Primiparas | |
| 20-24 yr | 1.13 (1.02-1.26)** |
| 25-29 yr | 1.02 (0.95-1.10) |
| 30-34 yr | 1.07 (0.99-1.16)* |
| ≥35 yr | 1.48 (1.36-1.62)*** |
| Multiparas | |
| 20-24 yr | 1.06 (0.89-1.27) |
| 25-29 yr§ | 1.00 |
| 30-34 yr | 0.87 (0.81-0.94)*** |
| ≥35 yr | 1.10 (1.02-1.19)*** |
| Parity Category[b] | |
| Low§ | 1.00 |
| High | 1.34 (1.24-1.46)*** |
| Marital Status | |
| Married§ | 1.00 |
| Unmarried | 1.27 (1.18-1.36)*** |
| Prenatal Care[c] | |
| Early§ | 1.00 |
| Late or None | 1.12 (1.05-1.20)*** |

§ Reference category.

[a] The odds ratios were adjusted for age and parity, marital status, and when prenatal care was initiated. CI defines the confidence interval.

[b] Low parity is defined as mothers under 25 years of age with parity less than 2 and mothers over the age of 25 with parity less than 3.

[c] Early prenatal care is defined as case initiated within the first trimester of pregnancy.

* Significant at p<.10

** Significant at p<.05

*** Significant at p<.01

Two age and parity groups, primiparas 25 to 29 years of age and mulitparas 20 to 24 years of age, were not a significant predictor of infant mortality. Primiparas

within the 30 to 34 age category were significant only at the 90% confidence interval. Primiparas aged 20 to 24 years old were significant at the 95% confidence interval, whereas all other variables were significant at the 99% confidence interval. This insignificance could be attributed to the small number of muiltparas aged 20 to 24 and the variation of percent distributions among the four parental groups. Infants born to primipara and mulitparas over the age of 35 had the highest, significant risk of death. High parity was associated with a 34 percent increased risk of death. Infants born to unmarried mothers had a 27 percent increased risk of death. Late or no prenatal care was associated with a 12 percent increase in the risk of infant death.

A commonly used determinant of infant mortality, birth-weight distributions, was analyzed in attempt explain the higher death rate among all parental groups in comparison to WMWF even after adjusting for maternal risk factors (Table 3). The percentage of births in the VLBW and LBW increased in a gradient effect. The reverse gradient was seen among NBW infants.

Table 3 Distribution of Birth Weights among Infants Born to College-Educated Parents, 2004-2009.

| BIRTH WEIGHT (g) | PERCENTAGE OF BIRTHS | | | |
|---|---|---|---|---|
| | WMWF | WMBF | BMWF | BMBF |
| <1500 | 0.57 | 0.91 | 1.57 | 2.29 |
| 1500-2499 | 3.18 | 4.06 | 5.22 | 6.65 |
| ≥2500 | 96.25 | 95.04 | 93.21 | 91.07 |

The infants of BMBF college-educated parents were more than four times as likely and more than 2 times as likely to have a VLBW and LBW infant as the WMWF college-educated parents, respectively (Table 4). BMWF parents were 2.76 times more likely to have a VLBW infant and 1.64 times more likely to have a LBW infant than WMWF parents. Infants among WMBF college-educated parents were 1.60 times more likely to have a VLBW infant and 1.27 times more likely to have a LBW infant than WMWF college-educated parents.

Table 4 Risk Ratios Associated with Birth Weight Distribution among Infants Born to College-Educated Parents, 2004-2009.[a]

| BIRTH WEIGHT (g) | RISK RATIO (95% CI) | | | |
|---|---|---|---|---|
| | WMWF | WMBF | BMWF | BMBF |
| <1500 | 1.00 | 1.60*** (1.45-1.76) | 2.76*** (2.48-3.08) | 4.03*** (3.91-4.16) |
| 1500-2499 | 1.00 | 1.27*** (1.22-1.33) | 1.64*** (1.55-1.74) | 2.09*** (2.06-2.12) |
| ≥2500 | 1.00 | 0.99*** (0.99-0.99) | 0.97*** (0.97-0.97) | 0.95*** (0.94-0.95) |

[a] Risk ratio indicates the relative risk for BMBF, BMWF, and WMBF as compared with WMWF, and CI represents the confidence interval.
*** Significant at p<.01

BMWF and BMBF college-educated parents had the highest mortality rates for infants weighting less than 1,500 grams (Table 5). White mothers had the lowest mortality rate among infants weighting less than 1,500 grams at birth, regardless of the father's race. WMWF college-educated parents had the highest mortality rate among

infants weighting from 1,500 to 2,499 grams. Infants born to BMWF college-educated parents had the lowest NBW mortality rate.

Table 5 Mortality Rates among Infants Born to College-Educated Parents, 2004-2009, According to Birth Weight.

| BIRTH WEIGHT (g) | MORTALITY RATE§ (95% CI)[a] | | | |
|---|---|---|---|---|
| | WMWF | WMBF | BMWF | BMBF |
| <1500 | 198.64 (192.00-205.26) | 174.64 (134.56-214.67) | 214.29 (164.79-263.78) | 238.01 (255.02-250.99) |
| 1500-2499 | 14.88 (14.10-15.64) | 11.24 (6.43-15.52) | 11.62 (5.30-17.94) | 12.06 (10.47-13.77) |
| ≥2500 | 1.09 (1.05-1.13) | 1.55 (1.02-1.92) | 0.75 (0.37-1.13) | 1.68 (1.51-1.85) |
| Total | 2.65 (2.61-2.73) | 3.53 (2.98-4.06) | 4.66 (3.75-5.58) | 7.77 (7.42-8.13) |

[a] CI represents the confidence interval.
§Per 1,000 live births.

Although BMBF college-educated parents had the highest percentage of births and the second highest infant mortality rate within the 1,500 to 2,499 grams birth weight category, BMBF had a 19 percent lower risk of death than among comparable WMWF infants (Table 6). Schoendorf *et al.* (1992) found no excess infant mortality among Black infants with birth weights of at least 2,500 grams. However, this analysis reports that BMBF have a 1.54 greater risk of infant death among NBW infants than it's WMWF counterparts. Many of the risk ratios were found to be insignificant. This could be due to the low number of infant death cases among

biracial parents. The only birth weight risk ratio that was significant for biracial parents was among WMBF college-educated parents with an infant weighting more than 2,500 grams at birth. Those parents were 1.43 times more likely to have an infant weighting over 2,500 grams at birth die before their first birthday.

Table 6 Risk Ratios Associated with Mortality Rates Among College-Educated Parents, 2004-2009, According to Birth Weight.[a]

| BIRTH WEIGHT (g) | RISK RATIO (95% CI) | | | |
|---|---|---|---|---|
| | WMWF | WMBF | BMWF | BMBF |
| <1500 | 1.00 | 0.88 (0.71-1.09) | 1.08 (0.88-1.33) | 1.20*** (1.13-1.27) |
| 1500-2499 | 1.00 | 0.76 (0.49-1.16) | 0.78 (0.45-1.34) | 0.81*** (0.70-0.94) |
| ≥2500 | 1.00 | 1.43*** (1.12-1.81) | 0.69 (0.42-1.14) | 1.54*** (1.39-1.72) |
| Total | 1.00 | 1.33*** (1.14-1.55) | 1.76*** (1.45-2.14) | 2.94*** (2.79-3.09) |

[a] Risk ratio indicates the relative risk for BMBF, BMWF, and WMBF as compared with WMWF, and CI represents the confidence interval.
*** Significant at p<.01

Among the infants born to BMBF college-educated parents, LBW infants accounted for 80 percent of infant deaths and only 9 percent of births (Table 3 & 7). LBW infants accounted for 85 percent of infant deaths among infants born to BMWF college-educated parents and only 7 percent of births. Among infants born to WMBF college-educated parents, LBW infants accounted for 58 percent of infant deaths and only 5 percent of all births. LBW infants accounted for 60 percent of infant deaths

among infants born to WMWF college-educated parents and only 4 percent of births. The impact of birth weight on infant mortality was greatest among VLBW infants. Among the infants born to BMBF college-educated parents, VLBW infants accounted for 70 percent of infant deaths and only 3 percent of births. VLBW infants accounted for 72 percent of infant deaths among infants born to BMWF college-educated parents and only 1.6 percent of births. Among infants born to WMBF college-educated parents, LBW infants accounted for 45 percent of infant deaths and only .9 percent of all births. LBW infants accounted for 43 percent of infant deaths among infants born to WMWF college-educated parents and only .6 percent of births.

Table 7 Percent Birth Weight Distribution of Infant Deaths among College-Educated Parents, 2004-2009.

| BIRTH WEIGHT (g) | WMWF (N=8,100) | WMBF (N=162) | BMWF (N=100) | BMBF (N=1,843) |
|---|---|---|---|---|
| <1500 | 42.5 | 45.1 | 72 | 70 |
| 1500-2499 | 17.9 | 13 | 13 | 10.3 |
| ≥2500 | 39.6 | 42 | 15 | 19.7 |

Among all college-educated parents, conditions originating in the prenatal period accounted for the most frequent cause of death (Table 8). Of the conditions originating in the prenatal period, prematurity accounted for the highest underlying cause of death. The frequencies of death by premature deliveries followed the gradient for birth outcomes with WMWF at the lowest risk and BMBF with the highest risk. The second most frequent underlying cause of death fluctuated between congenital anomalies and other causes between the four parental groups. Among other

causes, the occurrence of sudden death syndrome was most frequent among the other specified categories. Infants born to WMBF college-educated parents had the greatest frequency of sudden death syndrome.

Table 8 Mortality Rates among Infants Born to College-Educated Parents, 2004-2009, According to Underlying Cause of Death.

| CAUSE OF DEATH | WMWF | | WMBF | |
|---|---|---|---|---|
| | NUMBER OF DEATHS | IMR§ | NUMBER OF DEATHS | IMR§ |
| Congenital Anomaly | 2,780 | 0.91 | 34 | 0.74 |
| Perinatal Causes | 3,361 | 1.10 | 83 | 1.80 |
| Maternal Factors | 422 | 0.14 | 8 | 0.17 |
| Factors During Labor and Delivery | 319 | 0.10 | 11 | 0.24 |
| Prematurity | 872 | 0.29 | 23 | 0.50 |
| Respiratory Distress Syndrome | 172 | 0.06 | 4 | 0.09 |
| Other Neonatal Respiratory Causes | 483 | 0.16 | 6 | 0.13 |
| Other Neonatal Causes | 1,093 | 0.36 | 31 | 0.67 |
| Other Causes | 1,959 | 0.64 | 45 | 0.98 |
| Sudden Infant Death Syndrome | 422 | 0.14 | 14 | 0.30 |
| Injury | 0 | 0.00 | 0 | 0.00 |
| Infection | 129 | 0.04 | 4 | 0.09 |
| Respiratory Disease | 129 | 0.04 | 0 | 0.00 |
| All Other Causes | 1,279 | 0.42 | 27 | 0.59 |

| CAUSE OF DEATH | BMWF | | BMBF | |
|---|---|---|---|---|
| | NUMBER OF DEATHS | IMR§ | NUMBER OF DEATHS | IMR§ |
| Congenital Anomaly | 16 | 0.75 | 303 | 1.28 |
| Perinatal Causes | 67 | 3.12 | 1,170 | 4.94 |

Table 8 continued

| | | | | |
|---|---|---|---|---|
| Maternal Factors | 8 | 0.37 | 166 | 0.70 |
| Factors During Labor and Delivery | 5 | 0.23 | 90 | 0.38 |
| Prematurity | 23 | 1.07 | 426 | 1.80 |
| Respiratory Distress Syndrome | 3 | 0.14 | 62 | 0.26 |
| Other Neonatal Respiratory Causes | 5 | 0.23 | 122 | 0.51 |
| Other Neonatal Causes | 23 | 1.07 | 304 | 1.28 |
| Other Causes | 17 | 0.79 | 370 | 1.56 |
| Sudden Infant Death Syndrome | 2 | 0.09 | 68 | 0.29 |
| Injury | 0 | 0.00 | 0 | 0.00 |
| Infection | 2 | 0.09 | 34 | 0.14 |
| Respiratory Disease | 1 | 0.04 | 42 | 0.18 |
| All Other Causes | 12 | 0.56 | 226 | 0.95 |

§IMR denotes the infant mortality rate per 1,000 live births.

BMBF infants were 4.49 times more likely as WMWF infants to die of conditions originating in the perinatal period (Table 9). BMWF and WMBF were 2.84 and 1.64 times more likely to die from these conditions than WMWF infants. Of the conditions originating in the perinatal period, prematurity accounted for the highest risk of infant mortality. BMBF, BMWF, and WMBF infants were 6.30, 3.76, and 1.75 times more likely to die due to prematurity than WMWF infants, respectively. Among congenital anomalies infants born to BMBF college-educated parents were 1.41 times more likely to die from these abnormalities than WMWF counterparts. Within the other causes category, respiratory disease increased the risk of death for BMBF infants by over a fourfold compared to WMWF infants. The relative risk of sudden death syndrome was over two times as likely to occur in an infant death among BMBF and WMBF compared to WMWF infants. Many of the risk ratios were found to be insignificant. This could be due to the low number of infant death cases among biracial parents.

Table 9 Risk Ratios Associated with the Underlying Cause of Death among Infants Born to College-Educated Parents, 2004-2009.[a]

| CAUSE OF DEATH | RISK RATIO (95% CI) | | | |
|---|---|---|---|---|
| | WMWF | WMBF | BMWF | BMBF |
| Congenital Anomaly | 1.00 | 0.81 (0.58-1.14) | 0.82 (0.50-1.34) | 1.41*** (1.25-1.58) |
| Perinatal Causes | 1.00 | 1.64*** (1.32-2.04) | 2.84*** (2.23-3.62) | 4.49*** (4.20-4.80) |
| Maternal Factors | 1.00 | 1.26 (0.63-2.53) | 2.70*** (1.34-5.44) | 5.08*** (4.24-6.07) |
| Factors During Labor and Delivery | 1.00 | 2.29*** (1.26-4.18) | 2.24* (0.92-5.41) | 3.64*** (2.88-4.60) |
| Prematurity | 1.00 | 1.75*** (1.16-2.65) | 3.76*** (2.49-5.69) | 6.30*** (5.62-7.08) |
| Respiratory Distress Syndrome | 1.00 | 1.54 (0.57-4.16) | 2.49 (0.79-7.79) | 4.65*** (3.48-6.22) |
| Other Neonatal Respiratory Causes | 1.00 | 0.83 (0.37-1.85) | 1.48 (0.61-3.56) | 3.26*** (2.67-3.98) |
| Other Neonatal Causes | 1.00 | 1.88*** (1.32-2.69) | 3.00*** (1.99-4.54) | 3.59*** (3.16-4.08) |
| Other Causes | 1.00 | 1.53*** (1.14-2.05) | 1.24 (0.77-2.00) | 2.44*** (2.18-2.72) |
| Sudden Infant Death Syndrome | 1.00 | 2.20*** (1.29-3.75) | 0.68 (0.17-2.71) | 2.08*** (1.61-2.69) |
| Injury | 1.00 | - - | - - | - - |
| Infection | 1.00 | 2.06 (0.76-5.57) | 2.21 (0.55-8.94) | 3.40*** (2.33-4.96) |
| Respiratory Disease | 1.00 | - - | 1.11 (0.15-7.91) | 4.20*** (2.97-5.95) |

Table 9 continued

| | | | | |
|---|---|---|---|---|
| All Other Causes | 1.00 | 1.40* (0.96-2.05) | 1.34 (0.76-2.36) | 2.28*** (1.98-2.63) |

[a] Risk ratio indicates the relative risk for BMBF, BMWF, and WMBF as compared with WMWF, and CI represents the confidence interval.

* Significant at p<.10

*** Significant at p<.01

## Discussion

The results of this analysis are consistent with previous analysis, Schoendorf *et al.* (1992), reporting that even within a low-risk population (at least 16 years of education completed) BMBF infants have the most adverse birth outcomes and a higher death rate than WMWF infants. These results are also consistent with past analysis, Migone *et al.* (1991), on biracial parents demonstrating that a gradient of low to high risk (WMWF-WMBF-BMWF-BMBF) or lower death rate to higher death rate. This gradient was maintained within this low-risk population.

The excess of deaths among BMBF and biracial infants compared to WMWF infants was attributed to the increased prevalence of VLBW and LBW infants. The increased risk of prematurity as the underlying cause of death was higher for all infants compared to WMWF infants. However prematurity was more prevalent among Black mothers, regardless of the father's race. On the other hand, the occurrence of a Black father with a White mother increased her risk of delivering a LBW infant as well as the risk of premature death.

An excess of deaths for BMBF infants were found in each birth weight category except for an infant weighting more than 1,500 grams and less than 2,500 grams. This implies that the higher infant mortality rates among BMBF infants are due to VLBW as opposed to the inclusion of LBW (1,500 to 2,499 grams). This was

only seen among BMBF since other parental groups did not significantly vary from WMWF. The excess of VLBW among BMBF infants could be due the stress associated with racial discrimination. When the mother has high urinary cortisol levels, the quantification of stress, their fetuses are found to have smaller head circumference, abdominal circumference, biparietal diameter, and fetal weight. Those infants were shorter gestation age and lower birth weight (Field, Hernandez-Reif, Diego, Figueiredo, Schanberg & Kuhn, 2006). Thus, the persistence of stress endured by Black mothers compared to White mothers, regardless of the father's race is producing more preterm infants and/or infants with a substantially lower birth weight. Further analysis should analyze the incidence of stress associated with racial discrimination in terms of cortisol levels and the infant's birth outcome, especially within the VLBW range.

For the purposes of this analysis, the inclusion of biracial college-educated parents was to see if the low to high risk gradient was maintained among a low-risk population. Since the gradient was maintained for the risk of delivering a VLBW infant, a LBW infant, increased total mortality rate, increased premature death all after the adjustments for age and parity, initiation of prenatal care, and marital status some explanation has to be provided for the changes in birth outcomes with the addition of the father's race.

One possible explanation is that the discrimination or lack thereof for a person who is either Black or White is causing a psychological stress on their partner. The adverse impact of psychological stress is more likely to affect Black and biracial parents due to life long racial discrimination (Adams, Read, Rawlings, Harlass, Sarno & Rhodes, 1993).

Black mothers are at the highest risk for elevated levels of stress, because racial discrimination is reoccurring as a nonstop stressor throughout her lifetime. This stress seems to be mitigated by the addition of a White father. Since the White father did not suffer from this lifelong stressor it seems as though there is a protective effect enforced on the Black mother's level of stress. The addition of a White father to a Black mother does not eliminate the high risk of LBW and infant mortality, however the risk is reduced.

The reverse effect is seen among WMBF couples. A White mother, like a White father, does not suffer from race-related psychological stressor and thereby has a lower risk for LBW and infant mortality. However, when a White mother is pregnant by a Black father, the risk for LBW and infant mortality increases. A new, unfamiliar psychological stressor in her life could explain this increase in adverse birth outcomes among White mothers with Black fathers. The White mother of his child could be adversely affected by the Black father's experience of racial discrimination. Together as a couple they could experience a race-related psychological stressor and thereby produce an infant with an increased risk of adverse birth outcomes. The increase in risk for LBW and infant mortality among WMBF infants does not amount to the high risk of BMBF infants, but the increase in risk is still significant.

Results were consistent with Parker (2000) in that demographically BMWF were a low risk group having higher rates of marriage and early prenatal care compared to WMBF. However, this low risk group had consistently higher risks of VLBW, LBW, and infant death. Parker explained this deferential through the effect of exposure to racial discrimination that is unique to Black mothers, regardless of the father's race (Parker, 2000).

Overall, the race of the mother does contribute more to birth outcomes than the race of the father. However, the races of both parents significantly affect the infant's birth outcome. This affect is seen even in low-risk populations with high levels of educational attainment. Therefore another cause is mediating these adverse birth outcomes. Moving from a genetic to psychological effect could explain how the race of each parent is playing a role in the overall birth outcome.

Previous studies such as Migone *et al.* (1991) believe that the mother contributes more to the probability of birth outcomes due to sociodemographic variables, health-related behaviour, and environmental factors. However, the father's race was deemed to contribute less than that of the mother's race. Migone believes that there are genetic and/or non-genetic factors associated with the father's race affecting his partner's birth outcome. She suggests that there has to be a new way to evaluate and analysis the birth outcomes among the four parental groups including more biological research of the specific cause of poor pregnancy outcomes (Migone, Emanuel, Mueller, Daling & Little, 1991). This analysis is an agreement with the statement that there has to be other factors that would better explain the probability of adverse birth outcomes than the traditionally utilized sociodemographic variables. However, the influence of genetic or biological factors have been dismissed by Collins *et al.* (2007) demonstrating that African-born Blacks have more optimal birth outcomes prior to entering the United States of America. Upon reproduction over three generations, their children's birth outcome digresses to match the adverse birth outcomes as native-born Blacks. Further analysis should search for new psychosocial stress variables and move away from a genetic explanation.

Past analysis by Schoendorf *et al.* (1992) reported that even within a college-educated population, Blacks and Whites were not equivalent. An analysis of the Health Interview Survey demonstrated that Black families had a lower annual income as well as lower self-reported health status than White (Schoendorf, Hogue, Kleinman & Rowley, 1992). The difference in annual income between Black, White, and biracial families could not be examined through this analysis due to no income variable within the data set. Therefore education was used as a proxy for overall socioeconomic status. This proxy does not ensure that the level of education completed will result in equal paying jobs for both Whites and Blacks, rather it follows the assumption that the more education attained the more income earned. However, this annual income inequity can also be explained my structural and institutional racial discrimination. The same psychological stressor that is contributing to adverse birth outcomes could be simultaneously creating other inequities among Black and White college educated populations that will further increase the inequities of birth outcomes. Thus, even if Black college educated infants could be seen as a higher risk population than White college educated infants due to annual income, the same cause, racial discrimination, is contributing to these phenomenon. Therefore a racial discrimination variable must be sought out.

The major limitation of this analysis is the lack of the father's level of education. Since the data set did not include information on the father's educational attainment the assumption of college-educated parents is overestimated. Studies such as Schoendorf *et al.* (1992) report that among infants born to WMWF parents, 73 percent had college educated fathers whereas 50 percent of infants born to BMBF parents had college-educated fathers. Therefore this analysis could have produced an

assumption of more adverse birth outcomes, than that is truly occurring within the college-educated parents population. Unfortunately, there was no way of determining the education level of the father, so the number of college-educated parents was over representative of the population.

Other limitations of this analysis include the small sample size of biracial parents in comparison to same race parents and lack of data on potentially relevant maternal and paternal risk factors. The number of biracial cases was low in comparison of same race parents prior to exclusions. The exclusions further the limitation of biracial cases studies leaving 262 biracial infant deaths versus 9,943 same race infant deaths. BMWF accounted for the lowest number of cases of infant deaths. Thus, some risk ratios were insignificant among those groups. There were also wider confidence intervals for biracial parents compared to same race parents, which further illustrates the low number of cases. The data set was limited to one indicator of socioeconomic status, education. Other variables such as annual income and occupation could have provided a better foundation for a combined socioeconomic variable. In addition, the data set only had two indicators of the father's characteristics, race and age. Other variables such as education, annual income, occupation, and spousal/partner support could have provided a better profile of both parents rather than primarily the inclusion of maternal characteristics.

Another limitation is that this analysis uses the biological mother and father as the race of the parents and thereby the race of the infant, but cannot control for the change in relationships throughout the time of the pregnancy. Since this analysis is looking at a form of racial discrimination through the stress society invokes on them at face value, a change in relationship from the biological father to another partner could

occur. During that exchange, the race of the father could be different from the biological father. Thus, a White mother with a biological Black father could change relationships to a White partner and thereby not be persistently exposed to racial discrimination throughout her pregnancy; thus birth outcomes are not affected. Unfortunately there is no way of knowing the change in relationships throughout the pregnancy. The data set solely provides the race of the biological parents. The data set also excludes the race of the infant, so there is no way of knowing whether the race of the father written on the birth certificate is truly the race of the biological father. Furthermore, there is no indication of the level of spouse/partner support during pregnancy. The level of support could alleviate stress of the mother overall. In addition, the race of the father could be documented on the birth certificate, but the father may not may a role in the mother's life. Overall, this analysis assumes that the biological partners do not change partners throughout the pregnancy and the birth certificate identifies the race of the biological parents.

Despite these limitations, this analysis provides important evidence on the persistence of the difference between Blacks and Whites among four parental groups in infant mortality as well as LBW in a well-educated population. The risk gradient of lowest to highest risk for adverse birth outcomes is maintained even in a low-risk population. Racial discrimination could provide a possible explanation for the lowest adverse birth outcome risk among Whites and highest among Blacks. The addition of a White father to a Black mother provides a protective effect on these adverse outcomes. However, the addition of a Black father to a White mother increases the risk of infant death and LBW. The racial discrimination associated with one individual influences the other individual creating a change in risk for those parents'

infants overall. To test this hypothesis, further analyses should search for a variable to quantify the physiological stress from racial discrimination to test among the traditional risk factors for infant mortality and LBW. Once the variable is established, it should be tested among VLWB infants, since the mortality rate is the highest within that birth weight category and drops significantly for infants weighting 1,500 to 2499 grams at birth.

# Chapter 5

## STATISTIAL ANALYSIS: MATERNAL CHRONIC HYPERTENSION & ADVERSE BIRTH OUTCOMES

### Results

In the six years studied, 11 percent of Black mothers and 8 percent of White mothers of the four parental groups reported preterm deliveries. 6 percent of Black mothers and 6 percent of White mothers of the four parental groups reported low birth weight deliveries. .6 percent of Black mothers and .5 percent of White mothers of the four parental groups reported death of an infant. The two subsamples used in this analysis have two purposes. The first purpose is to see the association of chronic hypertension and birth outcomes according to the race of the mother. The second purpose is further the first statistical analysis by accessing if the addition of a racial discrimination proxy, chronic hypertension, reduces the odds ratio overall and that the race of the father continues to affect birth outcomes, but to a lesser extent. The final study population for the first subsample included 18,922,190 and 3,772,394 infants born to White and Black mothers, respectively. The final study population for the second subsample included 15,383,838; 481,103; 156,449; and 2,174,288 infants born to WMWF, WMBF, BMWF, and BMBF parental groups, respectively.

In the first subsample, Black mothers were more likely to have preterm deliveries, low birth weight deliveries, and infants who died before their first birthday (Table 10). Blacks mothers were more likely to be chronically hypertensive and have less than a college education. Mothers who were Black were more likely to have a

child earlier in life, before age 25, regardless if it was their first pregnancy or pregnancy thereafter. Black mothers are more likely to be unmarried and initiate prenatal care either late in the pregnancy or not at all. White mothers were more likely to be a smoker during pregnancy.

The first statistical analysis established a gradient from low to high risk among the four parental groups as follows: WMWF, WMBF, BMWF, BMBF. This risk gradient will be used as a reference point when describing distributions throughout the four parental groups. Among the second subsample, the risk gradient was maintained for all three birth outcomes: preterm deliveries, low birth weight deliveries, and infant mortality (Table 10). The low to high risk gradient was also seen where WMWF were least likely and BMBF were most likely to be chronically hypertensive. WMBF were least likely to have a minimum of college education and to be married and then the reverse gradient was seen. WMBF, BMWF, and BMBF were more likely to have more pregnancies under the age of 25 compared to WMWF counterparts. WMBF and BMWF were switched in the low to high risk gradient for the likelihood of having low parity and early prenatal care initiation. WMBF were most likely to be smokers following BMWF, WMWF, and BMBF.

Table 10 Total Population Distributions of Study Variables among Black and White Mothers and Four Parental Groups, 2004-2009.

| | | TOTAL | | | |
|---|---|---|---|---|---|
| WHITE (N=18,922,190) | BLACK (N=3,772,394) | WMWF (N=15,383,838) | WMBF (N= 481,103) | BMWF (N= 156,449) | BMBF (N=2,174,288) |
| | | *percent* | | | |

Table 10 continued

| | | | | | | |
|---|---|---|---|---|---|---|
| Preterm Delivery | 9.9 | 15.8 | 9.3 | 11.0 | 12.7 | 14.9 |
| LBW | 5.4 | 11.4 | 5.0 | 6.8 | 8.3 | 10.7 |
| Infant Mortality | 0.5 | 1.0 | 0.4 | 0.6 | 0.7 | 0.9 |
| Hypertension | | | | | | |
| Chronic Hypertension | 0.9 | 2.1 | 0.9 | 1.2 | 1.6 | 2.2 |
| No Chronic Hypertension | 99.1 | 97.9 | 99.1 | 98.8 | 98.4 | 97.8 |
| Education | | | | | | |
| Less than College | 73.3 | 87.2 | 69.4 | 84.9 | 78.6 | 82.4 |
| College or More | 26.7 | 12.8 | 30.6 | 15.1 | 21.4 | 17.6 |
| Parity and Age Group | | | | | | |
| Primiparas | | | | | | |
| ≤19 yr | 7.8 | 13.6 | 6.0 | 11.3 | 10.0 | 10.2 |
| 20-24 yr | 12.3 | 14.1 | 11.4 | 15.8 | 15.2 | 13.5 |
| 25-29 yr | 10.5 | 6.6 | 11.3 | 8.3 | 9.4 | 7.6 |
| 30-34 yr | 6.6 | 3.4 | 7.3 | 4.3 | 6.0 | 4.2 |
| ≥35 yr | 3.2 | 1.9 | 3.5 | 2.1 | 3.8 | 2.4 |
| Multiparas | | | | | | |
| ≤19 yr | 1.7 | 3.4 | 1.3 | 2.4 | 2.0 | 2.4 |
| 20-24 yr | 12.3 | 17.8 | 11.2 | 17.2 | 14.2 | 15.6 |
| 25-29 yr | 17.8 | 18.0 | 18.0 | 19.2 | 16.7 | 19.0 |
| 30-34 yr | 16.5 | 12.2 | 17.8 | 12.2 | 12.9 | 14.5 |
| ≥35 yr | 10.9 | 8.2 | 11.9 | 6.7 | 9.5 | 10.1 |
| Parity Category [a] | | | | | | |
| Low | 86.2 | 80.0 | 87.0 | 84.2 | 86.4 | 81.3 |
| High | 13.8 | 20.0 | 13.0 | 15.8 | 13.6 | 18.7 |
| Marital Status | | | | | | |
| Married | 66.0 | 29.2 | 74.9 | 39.1 | 53.3 | 42.9 |
| Unmarried | 34.0 | 70.8 | 25.1 | 60.9 | 46.7 | 57.1 |
| Prenatal Care [b] | | | | | | |
| Early | 79.3 | 69.3 | 82.3 | 75.6 | 77.4 | 74.0 |
| Late or None | 20.7 | 30.7 | 17.7 | 24.4 | 22.6 | 26.0 |
| Pregnancy Smoking Status | | | | | | |
| Smoker | 5.0 | 3.1 | 4.2 | 8.3 | 4.4 | 2.4 |
| Non-Smoker | 37.6 | 29.9 | 37.1 | 33.2 | 35.5 | 30.4 |

[a] Low parity is defined as mothers under 25 years of age with parity less than 2 and mothers over the age of 25 with parity less than 3.

[b] Early prenatal care is defined as case initiated within the first trimester of pregnancy.

10 percent of Whites and 16 percent of Blacks had a preterm delivery. Among this preterm population, all study variables were distributed similar to that seen in the total population (Table 11).

9 percent of WMWF, 11 percent of WMBF, 13 percent of BMWF, and 15 percent of BMBF gave birth to a preterm infant. Among this preterm population all study variables were distributed similar to the total population except for prenatal care initiation and pregnancy smoking status (Table 11). In the total population, BMBF and WMBF differed with BMBF being the most likely to have initiated prenatal care in late or not at all, whereas in the preterm population the two parental groups are tied for the highest likelihood. Within the preterm population, WMWF were more likely to be smokers than BMWF and BMBF.

Table 11 Preterm Delivery Population Distributions of Study Variables among Black and White Mothers and Four Parental Groups, 2004-2009.

| | PRETERM DELIVERIES | | | | | |
|---|---|---|---|---|---|---|
| | WHITE (N=1,856,127) | BLACK (N=595,559) | WMWF (N=1,021,731) | WMBF (N=52,529) | BMWF (N=19,708) | BMBF (N=323,791) |
| | *percent* | | | | | |
| Preterm Delivery | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| LBW | 34.1 | 46.2 | 33.3 | 38.6 | 42.1 | 46.2 |
| Infant Mortality | 2.7 | 4.6 | 2.4 | 3.1 | 3.7 | 4.2 |
| Hypertension Chronic Hypertension | 1.9 | 3.9 | 2.0 | 2.2 | 3.4 | 4.3 |

Table 11 continued

| | | | | | | |
|---|---|---|---|---|---|---|
| No Chronic Hypertension | 98.1 | 96.1 | 98.0 | 97.8 | 96.6 | 95.7 |
| Education | | | | | | |
| Less than College | 79.0 | 89.5 | 75.0 | 87.7 | 81.8 | 84.9 |
| College or More | 21.0 | 10.5 | 25.0 | 12.3 | 18.2 | 15.1 |
| Parity and Age Group | | | | | | |
| Primiparas | | | | | | |
| ≤19 yr | 9.3 | 14.0 | 7.1 | 12.0 | 10.2 | 10.4 |
| 20-24 yr | 11.7 | 12.0 | 11.0 | 14.1 | 13.3 | 11.6 |
| 25-29 yr | 9.4 | 5.7 | 10.3 | 7.6 | 8.3 | 6.7 |
| 30-34 yr | 6.3 | 3.4 | 7.2 | 4.4 | 5.7 | 4.3 |
| ≥35 yr | 3.9 | 2.4 | 4.3 | 2.4 | 4.9 | 3.0 |
| Multiparas | | | | | | |
| ≤19 yr | 2.5 | 4.3 | 2.0 | 3.1 | 2.6 | 3.1 |
| 20-24 yr | 13.6 | 18.4 | 12.3 | 17.5 | 14.9 | 16.2 |
| 25-29 yr | 16.6 | 17.3 | 16.8 | 18.4 | 16.2 | 18.1 |
| 30-34 yr | 14.8 | 12.2 | 16.1 | 12.1 | 12.8 | 14.4 |
| ≥35 yr | 11.5 | 9.5 | 12.6 | 7.9 | 10.6 | 11.7 |
| Parity Category [a] | | | | | | |
| Low | 83.3 | 76.1 | 84.4 | 80.8 | 82.7 | 77.7 |
| High | 16.7 | 23.9 | 15.6 | 19.2 | 17.3 | 22.3 |
| Marital Status | | | | | | |
| Married | 59.7 | 25.7 | 70.5 | 36.1 | 50.4 | 40.6 |
| Unmarried | 40.3 | 74.3 | 29.5 | 63.9 | 49.6 | 59.4 |
| Prenatal Care [b] | | | | | | |
| Early | 77.2 | 67.7 | 81.3 | 73.9 | 76.7 | 73.9 |
| Late or None | 22.8 | 32.3 | 18.7 | 26.1 | 23.3 | 26.1 |
| Pregnancy Smoking Status | | | | | | |
| Smoker | 6.3 | 3.6 | 5.4 | 9.5 | 5.3 | 2.9 |
| Non-Smoker | 36.5 | 28.5 | 35.9 | 34.6 | 34.9 | 29.2 |

[a] Low parity is defined as mothers under 25 years of age with parity less than 2 and mothers over the age of 25 with parity less than 3.

[b] Early prenatal care is defined as case initiated within the first trimester of pregnancy.

5 percent of Whites and 11 percent of Blacks delivered a low birth weight infant (Table 16). Within this low birth weight population all study variables distributions matched the total population.

5 percent of WMWF, 7 percent of WMBF, 8 percent of BMWF, and 11 percent of BMBF had a low birth weight delivery (Table 16). Among this low birth weight population, all study variables were organized like the total population expect for the prevalence of chronic hypertensive mothers and prenatal care initiation. In this population, WMBF had the lowest risk of chronic hypertension and the highest risk of late or no prenatal care.

Table 12 Low Birth Weight Population Distributions of Study Variables among Black and White Mothers and Four Parental Groups, 2004-2009.

| | LOW BIRTH WEIGHT | | | | | |
|---|---|---|---|---|---|---|
| | WHITE (N=1,020, 650) | BLACK (N=429, 239) | WMWF (N=762, 935) | WMBF (N=32, 484) | BMWF (N=13, 016) | BMBF (N=231, 804) |
| | *percent* | | | | | |
| Preterm Delivery | 62.4 | 64.5 | 62.8 | 62.9 | 64.2 | 64.8 |
| LBW | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Infant Mortality | 5.0 | 6.5 | 4.7 | 5.1 | 5.8 | 6.0 |
| Hypertension | | | | | | |
| Chronic Hypertension | 2.5 | 4.5 | 2.6 | 2.5 | 3.8 | 5.0 |
| No Chronic Hypertension | 97.5 | 95.5 | 97.4 | 97.5 | 96.9 | 95.0 |
| Education | | | | | | |
| Less than College | 80.9 | 89.8 | 76.9 | 88.9 | 82.6 | 85.3 |
| College or More | 19.1 | 10.2 | 23.1 | 11.1 | 17.4 | 14.7 |

Table 12 continued

| | | | | | | |
|---|---|---|---|---|---|---|
| Parity and Age Group | | | | | | |
| Primiparas | | | | | | |
| ≤19 yr | 11.0 | 15.2 | 8.7 | 14.3 | 11.8 | 11.8 |
| 20-24 yr | 14.4 | 14.7 | 13.6 | 16.8 | 16.1 | 14.3 |
| 25-29 yr | 10.9 | 6.9 | 12.1 | 8.7 | 9.5 | 8.1 |
| 30-34 yr | 7.5 | 4.0 | 8.7 | 4.8 | 6.6 | 5.2 |
| ≥35 yr | 4.8 | 2.8 | 5.4 | 2.9 | 5.4 | 3.6 |
| Multiparas | | | | | | |
| ≤19 yr | 2.2 | 3.8 | 1.8 | 2.9 | 2.4 | 2.8 |
| 20-24 yr | 12.3 | 16.4 | 11.2 | 15.5 | 13.4 | 14.5 |
| 25-29 yr | 14.3 | 15.6 | 14.3 | 16.2 | 14.0 | 16.0 |
| 30-34 yr | 12.1 | 10.8 | 13.1 | 10.6 | 10.9 | 12.5 |
| ≥35 yr | 9.9 | 8.8 | 10.8 | 6.8 | 9.2 | 10.5 |
| Parity Category [a] | | | | | | |
| Low | 85.5 | 78.8 | 86.6 | 83.4 | 84.6 | 80.5 |
| High | 14.5 | 21.2 | 13.4 | 16.6 | 15.4 | 19.5 |
| Marital Status | | | | | | |
| Married | 56.2 | 23.9 | 67.8 | 33.2 | 48.0 | 38.2 |
| Unmarried | 43.8 | 76.1 | 32.2 | 66.8 | 52.0 | 61.8 |
| Prenatal Care [b] | | | | | | |
| Early | 75.7 | 68.1 | 79.7 | 72.6 | 75.1 | 73.8 |
| Late or None | 24.3 | 31.9 | 20.3 | 27.4 | 24.9 | 26.2 |
| Pregnancy Smoking Status | | | | | | |
| Smoker | 8.9 | 4.6 | 7.8 | 12.3 | 6.6 | 3.7 |
| Non-Smoker | 34.3 | 27.9 | 34.1 | 29.8 | 34.0 | 28.9 |

[a] Low parity is defined as mothers under 25 years of age with parity less than 2 and mothers over the age of 25 with parity less than 3.

[b] Early prenatal care is defined as case initiated within the first trimester of pregnancy.

.5 percent of Whites and 1 percent of Blacks had an infant that died before its first birthday. Among this infant mortality population, all study variables were distributed similarly (Table 13).

.4 percent of WMWF, .6 percent of WMBF, .7 percent of BMWF, and .9 percent of BMBF had an infant that died before its first birthday. With this

population, only education, parity and age, and marital status followed the distribution of the total population (Table 13). WMBF had the lowest risk of preterm and low birth weight deliveries as opposed to the original low to high risk gradient. WMBF also had the lowest risk of chronic hypertension. The risk of high parity followed a completely new order with WMBF at the highest risk followed by BMBF, WMWF, and BMWF. Prenatal care initiation also followed a new order of WMBF with the highest risk of late or no care followed by BMWF, BMBF, and WMWF. WMBF were still most likely to be smokers, but the order flipped with WMWF bring at higher risk than BMBF.

Table 13 Infant Mortality Population Distributions of Study Variables among Black and White Mothers and Four Parental Groups, 2004-2009.

| | INFANT MORTALITY | | | | | |
|---|---|---|---|---|---|---|
| | WHITE (N=87,945) | BLACK (N=39,316) | WMWF (N=62,139) | WMBF (N=3,055) | BMWF (N=1,089) | BMBF (N=19,635) |
| | *percent* | | | | | |
| Preterm Delivery | 57.7 | 70.7 | 56.9 | 54.7 | 68.5 | 70.6 |
| LBW | 58.4 | 71.3 | 57.7 | 54.1 | 69.8 | 71.4 |
| Infant Mortality | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Hypertension | | | | | | |
| Chronic Hypertension | 1.6 | 3.6 | 1.7 | 1.6 | 3.1 | 4.0 |
| No Chronic Hypertension | 98.4 | 96.4 | 98.3 | 98.4 | 96.9 | 96.0 |
| Education | | | | | | |
| Less than College | 84.4 | 90.6 | 80.4 | 91.8 | 85.4 | 85.8 |
| College or More | 15.6 | 9.4 | 19.6 | 8.2 | 14.6 | 14.2 |
| Parity and Age Group | | | | | | |

Table 13 continued

| | | | | | | |
|---|---|---|---|---|---|---|
| Primiparas | | | | | | |
| ≤19 yr | 11.6 | 13.8 | 9.0 | 13.3 | 11.8 | 10.5 |
| 20-24 yr | 13.1 | 14.1 | 12.4 | 15.5 | 16.1 | 13.3 |
| 25-29 yr | 8.6 | 7.1 | 9.5 | 6.3 | 8.5 | 8.1 |
| 30-34 yr | 5.1 | 4.2 | 5.9 | 3.3 | 6.5 | 5.3 |
| ≥35 yr | 3.3 | 2.9 | 3.8 | 1.7 | 3.9 | 3.9 |
| Multiparas | | | | | | |
| ≤19 yr | 3.3 | 4.8 | 2.6 | 4.8 | 3.4 | 3.5 |
| 20-24 yr | 15.8 | 17.9 | 14.6 | 21.6 | 17.1 | 15.8 |
| 25-29 yr | 15.8 | 15.4 | 16.3 | 17.0 | 13.4 | 15.9 |
| 30-34 yr | 12.2 | 10.2 | 13.6 | 9.2 | 10.1 | 12.2 |
| ≥35 yr | 10.2 | 8.3 | 11.5 | 6.5 | 8.5 | 10.6 |
| Parity Category [a] | | | | | | |
| Low | 81.6 | 77.1 | 82.5 | 78.5 | 82.6 | 78.8 |
| High | 18.4 | 22.9 | 17.5 | 21.5 | 17.4 | 21.2 |
| Marital Status | | | | | | |
| Married | 53.4 | 23.7 | 67.4 | 31.4 | 48.5 | 40.7 |
| Unmarried | 46.6 | 76.3 | 32.6 | 68.6 | 51.5 | 59.3 |
| Prenatal Care [b] | | | | | | |
| Early | 72.7 | 66.6 | 77.4 | 68.5 | 71.9 | 73.0 |
| Late or None | 27.3 | 33.4 | 22.6 | 31.5 | 28.1 | 27.0 |
| Pregnancy Smoking Status | | | | | | |
| Smoker | 8.7 | 4.6 | 7.5 | 12.4 | 6.9 | 3.7 |
| Non-Smoker | 33.4 | 26.9 | 33.7 | 28.3 | 32.9 | 28.0 |

[a] Low parity is defined as mothers under 25 years of age with parity less than 2 and mothers over the age of 25 with parity less than 3.

[b] Early prenatal care is defined as case initiated within the first trimester of pregnancy.

All three birth outcome populations had higher rates of the other two birth outcomes, more chronic hypertension, less education, more pregnancies under the age of 25, higher parity, more unmarried, late or no prenatal care, and more smokers compared to the total population.

The preterm population compared to the low birth weight population had a lower mortality rate, less chronic hypertension, more educated, less first pregnancies

under the age of 25, more multipara pregnancies under the age of 25, higher parity, more married, more early prenatal care, and less smokers. This population compared to the infant mortality population had lower low birth weight, higher chronic hypertension, more education, less pregnancies under 25, lower parity, more married, more early prenatal care, and less smokers.

The low birth weight population in comparison to the infant mortality population had higher rates of preterm deliveries for Whites, WMWF, and WMBF, but lower rates of preterm deliveries for Blacks, BMWF, and BMBF. The low birth weight population also has higher rates of chronic hypertension, more education, lower parity, and more early prenatal care. In comparison to the infant mortality population, Whites and WMWF had lower rates of first pregnancies under the age of 20, but higher rates among Blacks, WMBF, and BMBF. The low birth weight population had more first pregnancies among 20 to 24 year olds and less multipara pregnancies under the age of 25. Compared to the infant mortality population, the low birth weight population had more or the same amount of smokers.

Among the three birth outcome populations, the low birth weight population was most likely to die before their first birthday. The low birth weight population had the highest rates of chronic hypertension. The infant mortality population was least educated, highest parity, most late or no prenatal care, and had the highest rates of unmarried mothers. The low birth weight population had the highest rate of smokers overall.

**Chronic Hypertension and Preterm Delivery**

The preterm delivery rate among Whites was 9.8 per 100 live births whereas the preterm delivery rate among Blacks was 15.8 per 100 live births. Overall, Black

mothers were 1.72 times as likely to have a preterm delivery as White mothers (Table 14, Model1). Adding chronic hypertension alone (Model2) and the other study variables alone (Model 3) to the model reduced the race odds ratio. In the full model (Model 4), chronic hypertension and the other study variables reduced the odds ratio from 1.72 to 1.51. Mothers with chronic hypertension were 2.40 times more likely to have a preterm delivery. All variables were significantly associated with risk of preterm delivery.

Table 14 Logistic Regression Analysis of Preterm Deliveries Among Black and White Mothers, 2004-2009.

| | ODDS RATIO (95% CI)[a] | | | |
|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 |
| Race | | | | |
| White§ | 1.00 | 1.00 | 1.00 | 1.00 |
| Black | 1.72 (1.72-1.73) | 1.70 (1.70-1.71) | 1.53 (1.53-1.54) | 1.51 (1.51-1.52) |
| Hypertension | | | | |
| Chronic Hypertension | | 2.38 (2.36-2.40) | | 2.40 (2.36-2.43) |
| No Chronic Hypertension§ | | 1.00 | | 1.00 |
| Education | | | | |
| Less than College | | | 1.34 (1.33-1.34) | 1.33 (1.32-1.33) |
| College or More§ | | | 1.00 | 1.00 |
| Parity and Age Group | | | | |
| Primiparas | | | | |
| ≤19 yr | | | 1.14 (1.14-1.15) | 1.15 (1.14-1.16) |
| 20-24 yr | | | 0.97 (0.96-0.98) | 0.97 (0.97-0.98) |
| 25-29 yr | | | 1.09 (1.08-1.10) | 1.08 (1.08-1.09) |

Table 14 continued

| | | |
|---|---|---|
| 30-34 yr | 1.28 (1.27-1.30) | 1.27 (1.26-1.28) |
| ≥35 yr | 1.64 (1.63-1.66) | 1.61 (1.59-1.63) |
| Multiparas | | |
| ≤19 yr | 1.41 (1.40-1.43) | 1.43 (1.41-1.44) |
| 20-24 yr | 1.05 (1.04-1.06) | 1.06 (1.05-1.06) |
| 25-29 yr§ | 1.00 | 1.00 |
| 30-34 yr | 1.05 (1.05-1.06) | 1.05 (1.04-1.05) |
| ≥35 yr | 1.26 (1.25-1.27) | 1.24 (1.23-1.25) |
| Parity Category [b] | | |
| Low§ | 1.00 | 1.00 |
| High | 1.25 (1.24-1.26) | 1.25 (1.24-1.26) |
| Marital Status | | |
| Married§ | 1.00 | 1.00 |
| Unmarried | 1.24 (1.23-1.24) | 1.24 (1.23-1.24) |
| Prenatal Care [c] | | |
| Early§ | 1.00 | 1.00 |
| Late or None | 1.02 (1.02-1.02) | 1.02 (1.02-1.02) |
| Pregnancy Smoking Status | | |
| Smoker | 1.14 (1.13-1.15) | 1.13 (1.12-1.14) |
| Non-Smoker§ | 1.00 | 1.00 |

§ Reference category.

[a] The odds ratios were adjusted for age and parity, marital status, when prenatal care was initiated, education, hypertension, and pregnancy smoking status. CI defines the confidence interval.

[b] Low parity is defined as mothers under 25 years of age with parity less than 2 and mothers over the age of 25 with parity less than 3.

[c] Early prenatal care is defined as case initiated within the first trimester of pregnancy.

The preterm delivery rate among WMWF parental group was 6.7 per 100 live births whereas the preterm delivery rate among BMBF parental group was 14.9 per 100 live births. Among biracial parents, WMBF had a preterm delivery rate of 10.9 per 100 live births whereas BMWF had a preterm delivery rate of 12.6 per 100 live births. Overall, BMBF were 1.52 times more likely to have a preterm delivery as WMWF (Table 15, Model 1). The likelihood of preterm delivery was 1.25 times that for WMWF. The likelihood of preterm delivery was 1.06 times that for WMWF. The addition of chronic hypertension alone reduced the race odds ratio for all parental groups besides WMBF, which remained the same (Model 2). Adding other study variables alone (Model 3) to the model reduced the race odds ratio among all parental groups. After adjustments for age and parity, marital status, when prenatal care was initiated, education, hypertension, and pregnancy smoking status (Model 4), chronic hypertension and the other study variables reduced the odds ratio from 1.52 to 1.40 among BMBF. The odds ratio of preterm delivery was reduced from 1.25 to 1.21 among BMWF. The odds ratio of preterm delivery was reduced from 1.06 to 0.99 among WMBF. This change in odds ratio was only significantly associated with risk of preterm delivery at the 90% confidence interval. All other variables were significantly associated with risk of preterm delivery. Chronically hypertensive mothers were 2.47 times more likely to have a preterm delivery. Models 3 and 4 depleted the risk of preterm delivery for WMBF.

Table 15 Logistic Regression Analysis of Preterm Deliveries Among Four Parental Groups, 2004-2009.

| | ODDS RATIO (95% CI) [a] |
|---|---|

Table 15 continued

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Race | | | | |
| White Mother-White Father§ | 1.00 | 1.00 | 1.00 | 1.00 |
| White Mother-Black Father | 1.06 (1.05-1.07) | 1.06 (1.05-1.07) | 0.99 (0.98-1.00)* | 0.99 (0.97-1.00) |
| Black Mother-White Father | 1.25 (1.23-1.27) | 1.24 (1.22-1.26) | 1.22 (1.19-1.24) | 1.21 (1.18-1.23) |
| Black Mother-Black Father | 1.52 (1.51-1.52) | 1.50 (1.49-1.50) | 1.42 (1.41-1.43) | 1.40 (1.39-1.41) |
| Hypertension | | | | |
| Chronic Hypertension | | 2.47 (2.44-2.49) | | 2.47 (2.44-2.50) |
| No Chronic Hypertension§ | | 1.00 | | 1.00 |
| Education | | | | |
| Less than College | | | 1.34 (1.33-1.34) | 1.33 (1.32-1.33) |
| College or More§ | | | 1.00 | 1.00 |
| Parity and Age Group | | | | |
| Primiparas | | | | |
| ≤19 yr | | | 1.15 (1.14-1.15) | 1.16 (1.15-1.16) |
| 20-24 yr | | | 0.96 (0.96-0.97) | 0.97 (0.96-0.97) |
| 25-29 yr | | | 1.08 (1.07-1.09) | 1.08 (1.07-1.08) |
| 30-34 yr | | | 1.28 (1.27-1.29) | 1.26 (1.25-1.28) |
| ≥35 yr | | | 1.64 (1.62-1.65) | 1.60 (1.58-1.62) |
| Multiparas | | | | |
| ≤19 yr | | | 1.43 (1.42-1.45) | 1.45 (1.43-1.46) |
| 20-24 yr | | | 1.05 (1.05-1.06) | 1.06 (1.05-1.07) |
| 25-29 yr§ | | | 1.00 | 1.00 |
| 30-34 yr | | | 1.05 (1.04-1.06) | 1.04 (1.04-1.05) |
| ≥35 yr | | | 1.25 | 1.23 |

| | | |
|---|---|---|
| | (1.25-1.26) | (1.22-1.24) |
| Parity Category [b] | | |
| Low§ | 1.00 | 1.00 |
| High | 1.27 | 1.27 |
| | (1.26-1.27) | (1.26-1.27) |
| Marital Status | | |
| Married§ | 1.00 | 1.00 |
| Unmarried | 1.32 | 1.32 |
| | (1.32-1.33) | (1.31-1.32) |
| Prenatal Care [c] | | |
| Early§ | 1.00 | 1.00 |
| Late or None | 1.03 | 1.03 |
| | (1.03-1.03) | (1.02-1.03) |
| Pregnancy Smoking Status | | |
| Smoker§ | 1.11 | 1.10 |
| | (1.10-1.12) | (1.09-1.11) |
| Non-Smoker | 1.00 | 1.00 |

§ Reference category.

[a] The odds ratios were adjusted for age and parity, marital status, when prenatal care was initiated, education, hypertension, and pregnancy smoking status. CI defines the confidence interval.

[b] Low parity is defined as mothers under 25 years of age with parity less than 2 and mothers over the age of 25 with parity less than 3.

[c] Early prenatal care is defined as case initiated within the first trimester of pregnancy.

* Significant at $p<.10$

The addition of chronic hypertension and other study variables reduced the odds ratio of preterm delivery between mothers race to a greater magnitude than the four parental groups. Even when comparing BMBF and WMWF to Blacks and Whites, the mother subsample experiences a larger risk reduction. Chronic hypertension increases the risk of preterm deliveries by 7 percent more within the four parental groups compared to the mothers alone.

**Chronic Hypertension and Low Birth Weight**

The overall low birth weight rate among Whites was 5.4 per 100 live births whereas the low birth weight rate among Blacks was 11.4 per 100 live births. Overall, Black mothers were 2.25 times as likely to have a low birth weight delivery as White mothers (Table 16, Model 1). Adding chronic hypertension alone (Model 2) and the other study variables alone (Model 3) to the model reduced the race odds ratio. In the full model (Model 4), chronic hypertension and the other study variables reduced the odds ratio from 2.25 to 1.98. Chronically hypertensive mothers were 2.96 times more likely to have a low birth weight delivery. All variables were significantly associated with risk of low birth weight delivery.

Table 16 Logistic Regression Analysis of Low Birth Weight Deliveries Among Black and White Mothers, 2004-2009.

| | ODDS RATIO (95% CI)[a] | | | |
|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 |
| Race | | | | |
| White§ | 1.00 | 1.00 | 1.00 | 1.00 |
| Black | 2.25 (2.24-2.26) | 2.22 (2.24-2.26) | 2.02 (2.01-2.03) | 1.98 (1.97-1.99) |
| Hypertension | | | | |
| Chronic Hypertension | | 2.87 (2.84-2.90) | | 2.96 (2.87-2.96) |
| No Chronic Hypertension§ | | 1.00 | | 1.00 |
| Education | | | | |
| Less than College | | | 1.49 (1.48-1.50) | 1.48 (1.47-1.49) |
| College or More§ | | | 1.00 | 1.00 |
| Parity and Age Group | | | | |
| Primiparas | | | | |
| ≤19 yr | | | 1.45 (1.43-1.46) | 1.47 (1.45-1.48) |

Table 16 continued

| | | |
|---|---|---|
| 20-24 yr | 1.36 (1.34-1.37) | 1.36 (1.35-1.38) |
| 25-29 yr | 1.55 (1.54-1.57) | 1.55 (1.53-1.56) |
| 30-34 yr | 1.91 (1.88-1.93) | 1.88 (1.86-1.90) |
| ≥35 yr | 2.49 (2.45-2.52) | 2.41 (2.38-2.44) |
| Multiparas | | |
| ≤19 yr | 1.33 (1.31-1.35) | 1.35 (1.33-1.37) |
| 20-24 yr | 1.05 (1.04-1.06) | 1.06 (1.05-1.07) |
| 25-29 yr§ | 1.00 | 1.00 |
| 30-34 yr | 1.05 (1.04-1.06) | 1.04 (1.03-1.05) |
| ≥35 yr | 1.33 (1.32-1.34) | 1.29 (1.28-1.31) |
| Parity Category [b] | | |
| Low§ | 1.00 | 1.00 |
| High | 1.18 (1.17-1.18) | 1.18 (1.17-1.19) |
| Marital Status | | |
| Married§ | 1.00 | 1.00 |
| Unmarried | 1.29 (1.29-1.30) | 1.29 (1.29-1.30) |
| Prenatal Care [c] | | |
| Early§ | 1.00 | 1.00 |
| Late or None | 1.06 (1.05-1.06) | 1.05 (1.05-1.06) |
| Pregnancy Smoking Status | | |
| Smoker | 1.66 (1.64-1.67) | 1.65 (1.63-1.66) |
| Non-Smoker§ | 1.00 | 1.00 |

§ Reference category.

[a] The odds ratios were adjusted for age and parity, marital status, when prenatal care was initiated, education, hypertension, and pregnancy smoking status. CI defines the confidence interval.

[b] Low parity is defined as mothers under 25 years of age with parity less than 2 and mothers over the age of 25 with parity less than 3.
[c] Early prenatal care is defined as case initiated within the first trimester of pregnancy.

The low birth weight rate among WMWF parental group was 5.0 per 100 live births whereas the low birth weight rate among BMBF parental group was 10.7 per 100 live births. Among biracial parents, WMBF had a low birth weight rate of 6.8 per 100 live births whereas BMWF had a low birth weight rate of 8.3 per 100 live births. Overall, BMBF were 1.90 times more likely to have a low birth weight delivery as WMWF (Table 17, Model 1). The likelihood of low birth weight delivery was 1.45 times that for WMWF. The likelihood of low birth weight delivery was 1.16 times that for WMWF. The addition of chronic hypertension alone (Model 2) and other study variables alone (Model 3) to the model reduced the race odds ratio among all parental groups. After adjustments for age and parity, marital status, when prenatal care was initiated, education, hypertension, and pregnancy smoking status (Model 4), chronic hypertension and the other study variables reduced the odds ratio from 1.90 to 1.78 among BMBF. The odds ratio of low birth weight delivery was reduced from 1.45 to 1.39 among BMWF. The odds ratio of low birth weight delivery was reduced from 1.16 to 1.03 among WMBF. Chronically hypertensive mothers were 2.47 times more likely to have a low birth weight delivery. All other variables were significantly associated with risk of low birth weight delivery. Models 3 and 4 nearly eliminated the risk of low birth weight delivery for WMBF.

Table 17 Logistic Regression Analysis of Low Birth Weight Deliveries Among Four Parental Groups, 2004-2009.

| | ODDS RATIO (95% CI)[a] |
|---|---|

Table 17 continued

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Race | | | | |
| White Mother-White Father§ | 1.00 | 1.00 | 1.00 | 1.00 |
| White Mother-Black Father | 1.16 (1.14-1.17) | 1.15 (1.14-1.17) | 1.04 (1.02-1.06) | 1.03 (1.02-1.05) |
| Black Mother-White Father | 1.45 (1.42-1.47) | 1.44 (1.41-1.17) | 1.40 (1.37-1.44) | 1.39 (1.35-1.42) |
| Black Mother-Black Father | 1.90 (1.90-1.91) | 1.87 (1.86-1.88) | 1.81 (1.80-1.82) | 1.78 (1.77-1.79) |
| Hypertension | | | | |
| Chronic Hypertension | | 3.02 (2.99-3.05) | | 3.06 (3.02-3.11) |
| No Chronic Hypertension§ | | 1.00 | | 1.00 |
| Education | | | | |
| Less than College | | | 1.49 (1.48-1.50) | 1.48 (1.47-1.49) |
| College or More§ | | | 1.00 | 1.00 |
| Parity and Age Group | | | | |
| Primiparas | | | | |
| ≤19 yr | | | 1.45 (1.44-1.47) | 1.47 (1.43-1.45) |
| 20-24 yr | | | 1.34 (1.33-1.35) | 1.35 (1.34-1.36) |
| 25-29 yr | | | 1.53 (1.52-1.55) | 1.53 (1.51-1.54) |
| 30-34 yr | | | 1.89 (1.87-1.91) | 1.86 (1.84-1.88) |
| ≥35 yr | | | 2.46 (2.43-2.50) | 2.36 (2.36-2.42) |
| Multiparas | | | | |
| ≤19 yr | | | 1.37 (1.35-1.39) | 1.39 (1.36-1.41) |
| 20-24 yr | | | 1.06 (1.05-1.07) | 1.07 (1.06-1.08) |
| 25-29 yr§ | | | 1.00 | 1.00 |
| 30-34 yr | | | 1.04 (1.03-1.05) | 1.03 (1.02-1.04) |
| ≥35 yr | | | 1.32 | 1.28 |

| | | |
|---|---|---|
| | (1.30-1.33) | (1.27-1.29) |
| Parity Category [b] | | |
| Low§ | 1.00 | 1.00 |
| High | 1.21 | 1.21 |
| | (1.20-1.21) | (1.20-1.22) |
| Marital Status | | |
| Married§ | 1.00 | 1.00 |
| Unmarried | 1.44 | 1.44 |
| | (1.43-1.45) | (1.43-1.45) |
| Prenatal Care [c] | | |
| Early§ | 1.00 | 1.00 |
| Late or None | 1.08 | 1.08 |
| | (1.07-1.08) | (1.07-1.08) |
| Pregnancy Smoking Status | | |
| Smoker | 1.58 | 1.57 |
| | (1.56-1.59) | (1.55-1.58) |
| Non-Smoker§ | 1.00 | 1.00 |

§ Reference category.

[a] The odds ratios were adjusted for age and parity, marital status, when prenatal care was initiated, education, hypertension, and pregnancy smoking status. CI defines the confidence interval.

[b] Low parity is defined as mothers under 25 years of age with parity less than 2 and mothers over the age of 25 with parity less than 3.

[c] Early prenatal care is defined as case initiated within the first trimester of pregnancy.

Similar to the preterm delivery logistic regression, adding chronic hypertension and other study variables reduced the odds ratio of preterm delivery between mothers race to a greater magnitude than the four parental groups. Even when comparing BMBF and WMWF to Blacks and Whites, the mother subsample experiences a larger risk reduction. Chronic hypertension increases the risk of low birth weight deliveries by 10 percent more within the four parental groups compared to the mothers alone.

**Chronic Hypertension and Infant Mortality**

The overall infant mortality rate among Whites was 4.7 per 1,000 live births whereas the infant mortality rate among Blacks was 10.4 per 100 live births. Overall, Black mothers were 2.26 times as likely to have an infant died before its first birthday as White mothers (Table 18, Model 1). Adding chronic hypertension alone (Model 2) and the other study variables alone (Model 3) to the model reduced the race odds ratio. After adjusting for age and parity, marital status, when prenatal care was initiated, education, hypertension, and pregnancy smoking status (Model 4), chronic hypertension and the other study variables reduced the odds ratio from 2.26 to 1.89. Mothers with chronic hypertension were 1.92 times more likely to have an infant that died before its first birthday. All variables were significantly associated with risk of infant mortality.

Table 18 Logistic Regression Analysis of Infant Mortality among Black and White Mothers, 2004-2009.

| | ODDS RATIO (95% CI)[a] | | | |
|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 |
| Race | | | | |
| White§ | 1.00 | 1.00 | 1.00 | 1.00 |
| Black | 2.26 (2.23-2.28) | 2.24 (2.21-2.26) | 1.91 (1.87-1.94) | 1.89 (1.85-1.92) |
| Hypertension | | | | |
| Chronic Hypertension | | 1.77 (1.70-1.84) | | 1.92 (1.82-2.03) |
| No Chronic Hypertension§ | | 1.00 | | 1.00 |
| Education | | | | |
| Less than College | | | 1.58 (1.54-1.62) | 1.57 (1.53-1.61) |
| College or More§ | | | 1.00 | 1.00 |
| Parity and Age Group | | | | |

Table 18 continued

| | | |
|---|---|---|
| Primiparas | | |
| ≤19 yr | 1.32 (1.28-1.36) | 1.33 (1.29-1.37) |
| 20-24 yr | 1.16 (1.13-1.20) | 1.17 (1.13-1.20) |
| 25-29 yr | 1.17 (1.14-1.22) | 1.17 (1.12-1.21) |
| 30-34 yr | 1.29 (1.23-1.34) | 1.27 (1.22-1.32) |
| ≥35 yr | 1.70 (1.62-1.78) | 1.66 (1.58-1.74) |
| Multiparas | | |
| ≤19 yr | 1.68 (1.60-1.75) | 1.69 (1.62-1.77) |
| 20-24 yr | 1.16 (1.12-1.19) | 1.16 (1.13-1.19) |
| 25-29 yr§ | 1.00 | 1.00 |
| 30-34 yr | 0.94 (0.92-0.97) | 0.94 (0.91-0.97) |
| ≥35 yr | 1.20 (1.16-1.24) | 1.18 (1.14-1.22) |
| Parity Category [b] | | |
| Low§ | 1.00 | 1.00 |
| High | 1.32 (1.29-1.34) | 1.32 (1.29-1.35) |
| Marital Status | | |
| Married§ | 1.00 | 1.00 |
| Unmarried | 1.27 (1.25-1.29) | 1.27 (1.24-1.29) |
| Prenatal Care [c] | | |
| Early§ | 1.00 | 1.00 |
| Late or None | 1.10 (1.08-1.12) | 1.10 (1.08-1.12) |
| Pregnancy Smoking Status | | |
| Smoker | 1.47 (1.43-1.51) | 1.47 (1.42-1.51) |
| Non-Smoker§ | 1.00 | 1.00 |

§ Reference category.

[a] The odds ratios were adjusted for age and parity, marital status, when prenatal care was initiated, education, hypertension, and pregnancy smoking status. CI defines the confidence interval.
[b] Low parity is defined as mothers under 25 years of age with parity less than 2 and mothers over the age of 25 with parity less than 3.
[c] Early prenatal care is defined as case initiated within the first trimester of pregnancy.

The infant mortality rate among WMWF parental group was 4.0 per 1,000 live births whereas the infant mortality rate among BMBF parental group was 9.0 per 1,000 live births. Among biracial parents, WMBF had an infant mortality rate of 6.4 per 1,000 live births whereas BMWF had an infant mortality rate of 7.0 per 1,000 live births. Overall, BMBF were 1.74 times more likely to have an infant mortality as WMWF (Table 23, Model 1). The likelihood of infant mortality was 1.34 times that for WMWF. The likelihood of infant mortality was 1.22 times that for WMWF. The addition of chronic hypertension alone (Model 2) reduced the race odds ratio for BMBF, increased the race odds ratio for WMBF, and the ratio remained the same for BMWF. The addition of the other study variables alone (Model 3) to the model reduced the race odds ratio among all parental groups. In the full model (Model 4), chronic hypertension and the other study variables reduced the odds ratio from 1.74 to 1.63 among BMBF. The odds ratio of preterm delivery was reduced from 1.34 to 1.20 among BMWF. The odds ratio of preterm delivery was reduced from 1.22 to 1.08 among WMBF. Chronically hypertensive mothers were 2.04 times more likely to have an infant that died before its first birthday. All other variables were significantly associated with risk of infant mortality.

Table 19 Logistic Regression Analysis of Infant Mortality among Four Parental Groups, 2004-2009.

| | ODDS RATIO (95% CI)[a] | | | |
|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 |
| Race | | | | |
| White Mother-White Father§ | 1.00 | 1.00 | 1.00 | 1.00 |
| White Mother-Black Father | 1.22 (1.18-1.27) | 1.23 (1.18-1.27) | 1.08 (1.03-1.14) | 1.08 (1.03-1.13) |
| Black Mother-White Father | 1.34 (1.26-1.42) | 1.34 (1.26-1.42) | 1.21 (1.11-1.31) | 1.20 (1.10-1.30) |
| Black Mother-Black Father | 1.74 (1.72-1.77) | 1.73 (1.70-1.76) | 1.65 (1.61-1.69) | 1.63 (1.60-1.67) |
| Hypertension | | | | |
| Chronic Hypertension | | 1.91 (1.83-1.98) | | 2.04 (1.94-2.15) |
| No Chronic Hypertension§ | | 1.00 | | 1.00 |
| Education | | | | |
| Less than College | | | 1.58 (1.54-1.62) | 1.57 (1.53-1.61) |
| College or More§ | | | 1.00 | 1.00 |
| Parity and Age Group | | | | |
| Primiparas | | | | |
| ≤19 yr | | | 1.33 (1.29-1.37) | 1.34 (1.30-1.38) |
| 20-24 yr | | | 1.15 (1.12-1.18) | 1.15 (1.12-1.28) |
| 25-29 yr | | | 1.16 (1.12-1.20) | 1.16 (1.12-1.20) |
| 30-34 yr | | | 1.27 (1.22-1.33) | 1.26 (1.21-1.31) |
| ≥35 yr | | | 1.69 (1.61-1.77) | 1.65 (1.57-1.73) |
| Multiparas | | | | |
| ≤19 yr | | | 1.72 (1.64-1.80) | 1.73 (1.66-1.81) |
| 20-24 yr | | | 1.16 (1.13-1.19) | 1.17 (1.14-1.20) |
| 25-29 yr§ | | | 1.00 | 1.00 |
| 30-34 yr | | | 0.94 (0.91-0.97) | 0.93 (0.91-0.96) |

Table 19 continued

| | | |
|---|---|---|
| ≥35 yr | 1.19 | 1.17 |
| | (1.15-1.23) | (1.12-1.21) |
| Parity Category [b] | | |
| Low§ | 1.00 | 1.00 |
| High | 1.35 | 1.35 |
| | (1.32-1.38) | (1.32-1.38) |
| Marital Status | | |
| Married§ | 1.00 | 1.00 |
| Unmarried | 1.41 | 1.41 |
| | (1.39-1.44) | (1.38-1.43) |
| Prenatal Care [c] | | |
| Early§ | 1.00 | 1.00 |
| Late or None | 1.12 | 1.12 |
| | (1.10-1.14) | (1.10-1.14) |
| Pregnancy Smoking Status | | |
| Smoker | 1.40 | 1.39 |
| | (1.35-1.44) | (1.35-1.43) |
| Non-Smoker§ | 1.00 | 1.00 |

§ Reference category.

[a] The odds ratios were adjusted for age and parity, marital status, when prenatal care was initiated, education, hypertension, and pregnancy smoking status. CI defines the confidence interval.

[b] Low parity is defined as mothers under 25 years of age with parity less than 2 and mothers over the age of 25 with parity less than 3.

[c] Early prenatal care is defined as case initiated within the first trimester of pregnancy.

Following the lead of preterm and low birth weight delivery logistic regression, the addition of chronic hypertension and other study variables reduced the odds ratio of preterm delivery between mothers race to a greater magnitude than the four parental groups. Even when comparing BMBF and WMWF to Blacks and Whites, the mother subsample experiences a larger risk reduction. The presence of chronic hypertension increases the risk of infant mortality by 12 percent more within the four parental groups compared to the mothers alone.

**Chronic Hypertension and Birth Outcome Risk Ratios**

A series of risk ratios were performed to determine the effect chronic hypertension has on each race and parental group, as well as its effect on preterm delivery, low birth weight, and infant mortality. The first risk ratio performed demonstrates the risk of having chronic hypertension between Blacks and Whites (Table 20). Blacks were 2.25 times more likely to have chronic hypertension than Whites.

Table 20 Distribution of Chronic Hypertension Among Black and White Mothers, 2004-2009.

| CHRONIC HYPERTENSION | PERCENTAGE OF CHRONIC HYPERTENSION | | RISK RATIO (95% CI)[a] |
|---|---|---|---|
| | WHITE | BLACK | |
| Yes | 0.93 | 2.06 | 2.25(2.23-2.27)*** |
| No | 99.08 | 97.94 | 0.99 (0.99-0.99)*** |

[a] Risk ratio indicates the relative risk for Blacks as compared with Whites, and CI represents the confidence interval.
*** Significant at p<.01

The percentage of chronic hypertension increased in a gradient effect among the four parental groups (Table 21).

Table 21 Distribution of Chronic Hypertension Among Four Parental Groups, 2004-2009.

| CHRONIC HYPERTENSION | PERCENTAGE OF CHRONIC HYPERTENSION |
|---|---|

Table 21 continued

| | WMWF | WMBF | BMWF | BMBF |
|---|---|---|---|---|
| Yes | 0.94 | 1.17 | 1.63 | 2.21 |
| No | 99.06 | 98.83 | 98.37 | 97.79 |

BMBF, BMWF, and WMWF were 2.36, 1.74, and 1.25 times as likely to have chronic hypertension as WMWF, respectively (Table 22).

Table 22 Risk Ratios Associated with Chronic Hypertension Among Four Parental Groups, 2004-2009.[a]

| CHRONIC HYPERTENSION | RISK RATIO (95% CI) | | | |
|---|---|---|---|---|
| | WMWF | WMBF | BMWF | BMBF |
| Yes | 1.00 | 1.25*** (1.22-1.28) | 1.74*** (1.68-1.81) | 2.36*** (2.34-2.39) |
| No | 1.00 | 1.00*** (1.00-1.00) | 1.00*** (1.00-1.00) | 0.99*** (0.99-0.99) |

[a] Risk ratio indicates the relative risk for BMBF, BMWF, and WMBF as compared with WMWF, and CI represents the confidence interval.
*** Significant at p<.01

The second risk ratio was administered to analyze if mothers with chronic hypertension had higher rates of preterm deliveries than those without chronic hypertension. A chronically hypertensive Black mother had twice the risk of a chronically hypertensive White mother to deliver a preterm infant (Table 23).

Table 23 Distribution of Chronic Hypertension Among Black and White Mothers, 2004-2009, According to Preterm Deliveries.

| CHRONIC HYPERTENSION | PERCENTAGE OF PRETERM DELIVERIES | | RISK RATIO (95% CI)[a] |
|---|---|---|---|
| | WHITE | BLACK | |
| Yes | 1.93 | 3.86 | 2.00 (1.97-2.04)*** |
| No | 98.07 | 96.14 | 0.98 (0.98-0.98)*** |

[a] Risk ratio indicates the relative risk for Blacks as compared with Whites, and CI represents the confidence interval.
*** Significant at p<.01

The percentage of preterm deliveries increased in a gradient effect across mothers with chronic hypertension (Table 24).

Table 24 Distribution of Chronic Hypertension Among Four Parental Groups, 2004-2009, According to Preterm Deliveries.

| CHRONIC HYPERTENSION | PERCENTAGE OF PRETERM DELIVERIES | | | |
|---|---|---|---|---|
| | WMWF | WMBF | BMWF | BMBF |
| Yes | 2.02 | 2.17 | 3.36 | 4.27 |
| No | 97.98 | 97.83 | 96.64 | 95.73 |

BMBF with chronic hypertension had more than twice the likelihood of having a preterm delivery compared to WMWF with chronic hypertension (Table 25). Chronically hypertensive BMWF and WMBF were 1.67 and 1.08 times more likely to have a preterm delivery than WMWF.

Table 25 Risk Ratios Associated with Chronic Hypertension Among Four Parental Groups, 2004-2009, According to Preterm Deliveries.[a]

| CHRONIC HYPERTENSION | RISK RATIO (95% CI) | | | |
|---|---|---|---|---|
| | WMWF | WMBF | BMWF | WMWF |
| Yes | 1.00 | 1.08*** (1.02-1.14) | 1.67*** (1.55-1.80) | 2.12*** (2.07-2.16) |
| No | 1.00 | 1.00*** (1.00-1.00) | 0.98*** (0.98-0.99) | 0.97*** (0.97-0.97) |

[a] Risk ratio indicates the relative risk for BMBF, BMWF, and WMBF as compared with WMWF, and CI represents the confidence interval.
*** Significant at p<.01

The third set of risk ratios examines how the prevalence of chronic hypertension in mothers effects the chances of conceiving a low birth weight infant. Black mothers with chronic hypertension have a 1.82 increased risk of having a low birth weight infant than chronically hypertensive White mothers (Table 26).

Table 26 Distribution of Chronic Hypertension Among Black and White Mothers, 2004-2009, According to Low Birth Weight Deliveries.

| CHRONIC HYPERTENSION | PERCENTAGE OF LOW BIRTH WEIGHT | | RISK RATIO (95% CI)[a] |
|---|---|---|---|
| | WHITE | BLACK | |
| Yes | 2.46 | 4.46 | 1.82 (1.78-1.85)*** |
| No | 97.54 | 95.54 | 0.98 (0.97-0.98)*** |

[a] Risk ratio indicates the relative risk for Blacks as compared with Whites, and CI represents the confidence interval.
*** Significant at p<.01

Among chronically hypertensive mothers, WMBF were least likely to have a low birth weight infant followed by WMWF, BMWF, and BMBF (Table 27).

Table 27 Distribution of Chronic Hypertension Among Four Parental Groups, 2004-2009, According to Low Birth Weight Deliveries.

| CHRONIC HYPERTENSION | PERCENTAGE OF LOW BIRTH WEIGHT | | | |
|---|---|---|---|---|
| | WMWF | WMBF | BMWF | BMBF |
| Yes | 2.59 | 2.50 | 3.80 | 4.92 |
| No | 97.41 | 96.41 | 96.20 | 95.08 |

BMBF with chronic hypertension have nearly twice a risk of a low birth weight offspring than WMWF counterparts (Table 28). BMWF with the presence of chronic hypertension have 1.47 times more low birth weight deliveries than WMWF counterparts. Chronically hypertensive WMBF were not significantly associated with the risk of a low birth weight delivery.

Table 28 Risk Ratios Associated with Chronic Hypertension Among Four Parental Groups, 2004-2009, According to Low Birth Weight Deliveries.[a]

| CHRONIC HYPERTENSION | RISK RATIO (95% CI) | | | |
|---|---|---|---|---|
| | WMWF | WMBF | BMWF | BMBF |
| Yes | 1.00 | 0.97 (0.90-1.04) | 1.47*** (1.34-1.60) | 1.91*** (1.86-1.95) |
| No | 1.00 | 1.00 | 0.99*** | 0.97*** |

Table 28 continued

| | | | |
|---|---|---|---|
| | (1.00-1.00) | (0.98-0.99) | (0.97-0.97) |

[a] Risk ratio indicates the relative risk for BMBF, BMWF, and WMBF as compared with WMWF, and CI represents the confidence interval.
*** Significant at p<.01

The final set of risk ratios analyzes how the prevalence of a mother with chronic hypertension has an effect on infant mortality. Overall, mothers with chronic hypertension have almost twice the infant mortality rate of mothers without chronic hypertension (Table 29). However, the risk ratios associated with infant mortality rates show only a slightly higher risk of an infant dying whose mother was chronically hypertensive as mothers without chronic hypertension. Among mothers with chronic hypertension, Black mothers were 2.23 times as likely as White mother to have an infant die before its first birthday.

Table 29 Mortality Rates of Chronic Hypertension Among Black and White Mothers, 2004-2009.

| CHRONIC HYPERTENSION | MORTALITY RATE§ (95% CI)[a] | | RISK RATIO (95% CI)[a] |
|---|---|---|---|
| | WHITE | BLACK | |
| Yes | 8.02 (7.59-8.44) | 18.03 (17.08-18.97) | 2.23 (2.07-2.40)*** |
| No | 4.58 (4.55-4.61) | 10.18 (9.98-10.18) | 2.22 (2.20-2.25)*** |

[a] Risk ratio indicates the relative risk for Blacks as compared with Whites, and CI represents the confidence interval.
§Per 1,000 live births.
*** Significant at p<.01

Infant mortality rates among the four parental groups increased in a gradient fashion (Table 30). In all cases, chronically hypertensive mothers had higher infant mortality rates than mothers without chronic hypertension.

Table 30 Mortality Rates of Chronic Hypertension Among Four Parental Groups, 2004-2009.

| CHRONIC HYPERTENSION | MORTALITY RATE§ (95% CI)[a] | | | |
|---|---|---|---|---|
| | WMWF | WMBF | BMWF | BMBF |
| Yes | 7.19 (6.75-7.63) | 8.39 (5.99-10.79) | 12.99 (8.56-17.42) | 16.19 (15.05-17.33) |
| No | 3.99 (3.96-4.02) | 6.30 (6.07-6.52) | 6.81 (6.40-7.23) | 8.82 (8.63-8.88) |

[a] CI represents the confidence interval.
§Per 1,000 live births.

Among those with chronic hypertension, BMWF and BMBF had a slightly higher risk of infant death than those without chronic hypertension (Table 31). These BMBF and BMWF were 2.25 and 1.81 times more likely to suffer from infant death than chronically hypertensive WMWF. Chronically hypertensive WMBF were not significantly associated with the risk of infant mortality.

Table 31 Risk Ratios Associated with Chronic Hypertension Among Four Parental Groups, 2004-2009, According to Mortality Rates.[a]

| CHRONIC HYPERTENSION | RISK RATIO (95% CI) |
|---|---|

Table 31 continued

| | WMWF | WMBF | BMWF | BMBF |
|---|---|---|---|---|
| Yes | 1.00 | 1.17 | 1.81*** | 2.25*** |
| | | (0.87-1.56) | (1.28-2.55) | (2.05-2.47) |
| No | 1.00 | 1.58*** | 1.71*** | 2.21*** |
| | | (1.52-1.64) | (1.61-1.81) | (2.18-2.28) |

[a] Risk ratio indicates the relative risk for BMBF, BMWF, and WMBF as compared with WMWF, and CI represents the confidence interval.
*** Significant at p<.01

Overall, Black mothers were more likely to have chronic hypertension than White mothers. The prevalence of maternal chronic hypertension increased the risk of preterm and low birth weight deliveries as well as an increased mortality rate associated with a slightly higher risk of infant mortality.

WMBF, BMWF, and BMBF were more likely to have chronic hypertension than WMWF maintaining the low to high risk gradient. The prevalence of maternal chronic hypertension increased the risk of preterm and low birth weight deliveries in a gradient fashion. The prevalence of maternal chronic hypertension also increased overall mortality rates, which increased the risk of infant mortality in a gradient effect. However, chronically hypertensive WMBF were not significantly associated with the risk of a low birth weight delivery nor the risk of infant mortality.

## Discussion

The results of this analysis are fairly consistent with previous analysis, Mustillo *et al.* (2004), reporting that the addition of racial discrimination in describing birth outcomes reduces the race odds ratio. In her analysis, she added a racial discrimination index in order to see if the inclusion of such a variable would close the gap in birth outcomes. She found that the addition of this variable did just that. In this

analysis, there was not a racial discrimination specific variable included within the data set. Therefore, chronic hypertension was used as a proxy for this race-related stress. The addition of chronic hypertension did not reduce the race odds ratio to the magnitude of the racial discrimination variable used in Mustillo's prospective cohort study, but it gave some indication that chronic hypertension may play some role in quantifying race-related stress.

However, the results of this study differed in comparison to a study by Fang *et al*. (1999). Fang analyzed the effect of maternal hypertension through its two subcategories, chronic hypertension and pregnancy related hypertension. He also examined hypertension that was complicated by preeclampsia and eclampsia. Although pregnancy associated hypertension and its complications are important, for the purposes of this analysis the inclusion of these variables did not make sense to the research question. For this analysis, the inclusion of a racial discrimination variable is key. Therefore, the life long stressor of racial discrimination would be a life long condition rather than occurring strictly during pregnancy. It is noted that pregnancy hypertension might be key in further research among WMBF, who only experience racial discrimination when they have a Black father who experienced racism throughout his life. The prevalence of chronic hypertension is higher than its complications, so it was deemed the best fit for this analysis. In Fang's study, he found that Black mothers had the highest prevalence of hypertension and highest incidence of low birth weight. This analysis found the same results. However, the results differed in that Fang reported that the risk ratio of a low birth weight infant in hypertensive mothers was highest among Whites and lowest among Blacks (Fang, Madhavan & Alderman, 1999). The reverse was found in this analysis. Blacks as

well as BMBF and BMWF had significantly higher risk ratios of low birth weight in chronically hypertensive mothers. This may be due to the including chronic hypertension as the only hypertensive measure.

Racial Discrimination, as a psychological stressor, may affect birth outcomes in a variety of ways including, but not limited to, the incidence of chronic hypertension in mothers. Thus, the incidence of chronic hypertension is used as a proxy for this race-related stress. The prevalence of chronic hypertension has been examined and found to be positively associated with both preterm and low birth weight deliveries as well as a positive association with infant mortality. Chronic hypertension might contribute to the Black-White inequity in these birth outcomes. Adjustments for age and parity, marital status, when prenatal care was initiated, education, hypertension, and pregnancy smoking status did not appear to fully mediate the relationships between chronic hypertension and adverse birth outcomes.

Although preterm deliveries are a serious adverse birth outcome, from this analysis it seems as though low birth weight deliveries are contributing more to the death of an infant overall. The low birth weight population was more likely to have chronic hypertension and thereby might contain the population who suffers from racial discrimination. It is noted that preterm and low birth weight deliveries are not mutually exclusive. A preterm baby is highly likely to have low birth weight and vice versa. However, since a greater percentage of low birth weigh infants are contributing to both chronic hypertension and infant mortality, this birth outcome should be further examined.

In every logistic regression, chronic hypertension held the highest risk for that birth outcome. Within Model 4, chronic hypertension increased the risk of that birth

outcome ranging from 1.92 to 2.96 with 1.92 being the only risk lower than 2. The other study variables in Model 4 did not contribute a risk to that magnitude. The study variables risk ranged from 1.02 to 2.41 with one single risk being above 2 twice throughout the six regressions. Thus, chronic hypertension was the largest contributor to each and every birth outcome.

Even though chronic hypertension was the largest contributor to each birth outcome, chronic hypertension only reduces the race odds ratio slightly. The most substantial drop in the race odds ratio occurred in model 3 with the addition of maternal adjustments. Adding chronic hypertension in model 4 reduced the race odds ratio, but ever so slightly compared to model 3. This finding suggests that chronic hypertension is a proxy for stress from racial discrimination, but may not be the most predictive proxy.

In model 2 of the infant mortality regression, the race odds ratio differed from what would be expected as well as the race odds ratio pattern found in the preterm deliveries and low birth weight regressions. Within model 2, the addition of chronic hypertension increased the race odds ratio from 1.22 to 1.23 for WMBF, was reduced from 1.74 to 1.73 for BMBF, and remained the same among BMWF. Even though there was only a .01 increase in the race odds ratio, the finding is still troubling. However, even within the risk ratios for infant mortality, chronically hypertensive mothers only had a slightly higher risk of infant mortality compared to mothers without chronic hypertension. The combination of these findings suggest that chronic hypertension may only be slightly associated with infant mortality.

The WMBF population should be further studied. Similarly to Parker (2000), this parental group interrupted the low to high risk gradient multiple times in having

higher risks than both BMBF and BMWF counterparts. This could be seen through a low case sample, but the multiple reoccurrences of unexpected elevated risk seems something else is occurring. Furthermore, the theory that a Black father could change not only the White mother's birth outcomes, but also maternal characteristics is of great interest. Demographically, WMBF were overall the least likely to have a minimum of a college education, to be married, and were most likely to be a smoker compared to BMBF. WMBF were also more likely to have high parity and late or no prenatal care compared to BMWF. Even though WMBF were demographically a high-risk parental group, their birth outcomes were more optimal compared to BMWF and BMBF. This parental group also did not significantly associate with the risk of low birth weight and infant mortality. In the preterm logistic regression, WMBF had a significantly lower risk than WMWF after the adjustments in Model 3 and 4. In the low birth weight and infant mortality regression, WMBF nearly returned to the parental group with the most optimal birth outcome, WMWF. Due to the discrepancies and findings within this parental group, an analysis with this group as the main focus could be rewarding.

The overall largest limitation of this analysis is the lack of a solely racial discrimination variable. As discussed earlier chronic hypertension has many causes that are not limited to race-related stress. However, this variable was as close as the data set would allow. Inclusion of other variables not contained in the data set like annual income and spousal support would also be of great value. Another limitation is that the number of chronic hypertension cases is relevantly small. In order to get a proper representation of this variable six years were included.

Despite these limitations, this analysis provides important evidence that even a proxy for racial discrimination may play a role in reducing the Black-White gap in birth outcomes. Overall, chronic hypertension is more prevalent in Blacks than Whites. The prevalence of maternal chronic hypertension increased the risk of preterm and low birth weight deliveries as well as an increased mortality rate associated with a slightly higher risk of infant mortality. WMBF, BMWF, and BMBF were also more likely to have chronic hypertension than WMWF maintaining the low to high risk gradient. The prevalence of maternal chronic hypertension increased the risk of preterm and low birth weight deliveries in a gradient fashion. The prevalence of maternal chronic hypertension also slightly increased overall mortality rates, which increased the risk of infant mortality in a gradient effect. However, chronically hypertensive WMBF were not significantly associated with the risk of a low birth weight delivery nor the risk of infant mortality. Even though chronic hypertension may not increase the risk of infant mortality tremendously, the elevated risk of preterm and low birth weight deliveries due to chronic hypertension is putting more infants at risk for death, regardless if they actually die. A variable to better depict racial discrimination should be sought out to see the impact of that sole indicator.

**Discussion: Comparison of the Two Statistical Analyses**

The first statistical analysis ends with a request to find a variable to quantify the physiological stress from racial discrimination. The second analysis attempts to address that request with the introduction of a proxy for racial discrimination, chronic hypertension.

The first statistical analysis greatly limited the sample to achieve a low risk population where parents completed at least 16 years of college. It was found that

even within this low risk population that the risk gradient for parental groups was maintained. The second analysis took the entire population with exclusions for multiple births, gestation less than 20 weeks, and maternal race to get a sense of the population as a whole and what variable could be used to quantify this stress.

For comparison purposes, variables were kept the same except for the introduction of chronic hypertension, the inclusion of smoking, and a variable to distinguish education within the entire population. Through the completion of both analyses, it was found that the odds ratios were lower for the full population than the college educated. In addition, throughout the second analysis the odds ratio were higher for Blacks and Whites than the four parental groups. Thus, it could be expected that the odds ratio would be higher in the college educated if it was limited strictly by maternal race and exclusion the race of the father.

The higher odds ratio among the college-educated population is unexpected and very interesting. It could be hypothesized that as socioeconomic status increases among Blacks and biracial parents that overcoming racial discrimination could be a greater stressor for that population. A Black woman may feel as though she has to work twice as hard as a White woman to get into a prestigious college due to institutional and structural racism surrounding her, not to mention the racial discrimination she has become accustomed to internalize. This could brew the perfect storm for elevated stress and thereby adverse birth outcomes. Thus, moving up the socioeconomic ladder could be adversely affecting this thought to be low risk population. This hypothesis may be not exclusive to birth outcomes and may invoke a new realm of thinking.

A major finding in the first statistical analysis was the amount of excess deaths for BMBF infants that were found in each birth weight category except for an infant weighting more than 1,500 grams and less than 2,500 grams. This finding implies that the higher infant mortality rates among BMBF infants are due to VLBW as opposed to the inclusion of LBW (1,500 to 2,499 grams). Since this finding can lead to several implications for policy interventions and the second statistical analysis demonstrated higher odds ratios for Black and White mothers compared to the four parental groups, it seemed relevant to recreate Tables 3-6. The recreation of these tables would illustrate if Black mothers regardless of the father's race continue to have the highest risk of VLBW among the distribution of birth weights and if Black infants have excess deaths for each birth weight category except for the inclusion of LBW.

Table 32 demonstrates that Black mothers have the highest percentage of delivering a VLBW infant followed by LBW and NBW. The infants of Black college-educated mothers were about four times as likely and more than 2 times as likely to have a VLBW and LBW infant as the White college-educated mothers, respectively. The percent distributions as well as the risk ratio for Black mothers compared to BMBF parents were nearly identical.

Table 32 Distribution of Birth Weights among Infants Born to College-Educated Parents, 2004-2009.[a]

| BIRTH WEIGHT (g) | PERCENTAGE OF BIRTHS | | RISK RATIO (95% CI) |
|---|---|---|---|
| | WHITE | BLACK | |

Table 32 continued

| | | | |
|---|---|---|---|
| <1500 | 0.57 | 2.23 | 3.89 (3.78-4.01)*** |
| 1500-2499 | 3.19 | 6.53 | 2.04 (2.01-2.08)*** |
| ≥2500 | 96.23 | 91.25 | 0.95 (0.95-0.95)*** |

[a] Risk ratio indicates the relative risk for BMBF, BMWF, and WMBF as compared with WMWF, and CI represents the confidence interval.
*** Significant at p<.01

Black college-educated mothers had the highest mortality rates for infants weighting less than 1,500 grams (Table 33). White college-educated mothers had a lower mortality rate compared to Black college-educated mothers in all birth weigh categories except for infants weighting from 1,500 to 2,499 grams. Although Black college-educated mothers had a higher percentage of births among infants weighting 1,500 to 2,499 grams, there were no excess deaths found within that birth category among comparable White infants. Blacks have a 1.19 and 1.46 greater risk of infant death among VLBW and NBW infants than it's White counterparts, respectively. In comparison to Table 5, Black mothers had a higher infant mortality rate compared to BMBF parental group. All other infant mortality rates were nearly identical among Black mothers and BMBF parental groups as well as White mother and WMWF parental groups. In comparison to Table 6, all risk ratios were nearly identical except for NBW was slightly higher among BMBF parental groups compared to Black mothers.

Table 33 Mortality Rates among Infants Born to College-Educated Parents, 2004-2009, According to Birth Weight.[a]

| BIRTH WEIGHT (g) | MORTALITY RATE§ (95% CI)[a] | RISK RATIO (95% CI) |
|---|---|---|

Table 33 continued

| | WHITE | BLACK | |
|---|---|---|---|
| <1500 | 198.07 (191.54-204.63) | 236.62 (224.05-249.19) | 1.19 (1.13-1.26)*** |
| 1500-2499 | 14.81 (14.05-15.56) | 12.03 (10.37-13.68) | 0.81 (0.70-0.94)** |
| ≥2500 | 1.1 (1.04-1.12) | 1.60 (1.44-1.76) | 1.46 (1.32-1.63)*** |
| Total | 2.66 (2.60-2.72) | 7.52 (7.19-7.85) | 2.83 (2.69-2.97)*** |

[a] Risk ratio indicates the relative risk for Blacks as compared with Whites, and CI represents the confidence interval.
§Per 1,000 live births.
*** Significant at p<.01

The recreation of these tables demonstrates that Black mothers regardless of the father's race have the highest risk of VLBW among the distribution of birth weights. Infants born to Black college-educated mothers also have excess deaths for each birth weight category except for the inclusion of LBW. Thus, the race of the father does not manipulate overall findings and VLBW as well as NBW remain the birth weight categories needed to address among Black infants.

Overall, chronic hypertension, a proxy of stress from racial discrimination was the largest contributor to each birth outcome, but may not explain the effect that discrimination can have. Due to the slight reduction in odds ratios, other variables should be sought that could systemically measure racial discrimination and its effect on adverse birth outcomes. However, chronic hypertension's contribution to adverse birth outcomes is just inkling of what the inclusion of a strictly racial discrimination variable could contribute to the gap.

# Chapter 6

# NATIONAL CONCLUSION & POLICY IMPLICATIONS

## Conclusions

Overall, the two national statistical analyses provided an abundance of interesting findings. One major finding is VLBW substantially contributes to the amount of excess infant deaths seen among Black and biracial, BMWF parental groups. An interesting finding is that even within a low-risk population (at least 16 years of education completed) there is a persistent gap between same race Black parents and biracial parents compared to same race White parents. Another key finding is chronic hypertension provided the highest risk contribution to all three birth outcomes, but had virtually no effect on the race odds ratio when maternal risk factors were included. These findings can be enhanced by future research as well as lead to many policy implications.

An excess of deaths for infants born to Black mothers, regardless of the race of the father, were found in each birth weight category except for an infant weighting more than 1,500 grams and less than 2,500 grams. This implies that the higher infant mortality rates among Black infants are due to VLBW as opposed to the inclusion of LBW (1,500 to 2,499 grams). VLBW then becomes a birth weight category that substantially contributes to Black infant death whereas LBW contributes to White infant death. This is extremely interesting when searching for ways to target infant mortality rates among race specifically. In attempt to reduce Black infant mortality rate, this birth weight category should be studied in the future. A policy intervention

that intervenes within the VLBW category could substantially improve Black's infant mortality rate.

The results show that even within a low-risk population (at least 16 years of education completed) there is still a persistent gap between Blacks and biracial parents compared to White parents. This gap is maintained throughout all birth outcomes except in the LBW (1,500 to 2,499 grams) where Blacks have a lower risk of death than Whites. Therefore, traditional socioeconomic factors are not closing the gap as expected. In attempt to reduce the gap in adverse birth outcomes, new unique variables must be tried and understood.

Chronic hypertension as a proxy for stress from racial discrimination is warranted, but contained some troubling findings. The addition of chronic hypertension was the biggest predictor/contributor to each birth outcome. Chronic hypertension would increase the probability of an adverse birth outcome by two to three folds. However, the high risk factor had little effect on race odds ratio. The ratio was reduced through the inclusion of chronic hypertension; the magnitude of the reduction was ever so slightly. Furthermore, after the addition of maternal risk factors, the inclusion of chronic hypertension had virtually no effect. It is assumed that the biggest risk contributor would also have the largest reduction in the odds ratio, but that was not seen here. Therefore, future research should search for a variable that truly presents stress from racial discrimination to assess its effects on the odds ratio and contribution to the birth outcome.

Even though chronic hypertension may not be the most accurate predictor of stress from racial discrimination, the finding that chronic hypertension increased the risk of low birth weight more than any other birth outcome could demonstrate the birth

outcome that is most affected by this race-related stress. This birth outcome would then be the focus of any future research that contains a variable specific to stress from racial discrimination. This finding also demonstrates that even though chronic hypertension only slightly increases the risk of infant mortality, because it substantially increases the risk of low birth weight and low birth weight is one of the leading causes of infant mortality that chronic hypertension is putting more infants at risk for death, regardless if they actually die. The higher risk for low birth weight compared to the lower risk of infant mortality then suggests that low birth weight infants are surviving, but due to underdevelopment those infants will grow up to have persistent adverse health outcomes throughout their life. Therefore, intervening on low birth weight will not only reduce infant mortality rates, but also prevent future health complications.

Overall, there are many data collection and data analyzation recommendations found in performing these statistical analyses. The first recommendation is that Vital Statistics should make the location variable publicly accessible for data analysis. Prior to 2005, Vital Statistics released the location of the pregnancy, but after a revision the location variable was then excluded. In performing a GIS analysis, Appendix B, on another data set, the findings suggest that location is important and is needed for further analysis. Furthermore, the location could be extremely useful for policy implications, because through the location variable the effects of different adopted policies can be analyzed. This level of analysis can determine which policy interventions are most efficient and how other states could obtain those optimal outcomes.

Another recommendation is that preventive research must include the social, cultural, and political context of the life for a woman. This research should include environmental as well as psychological stressors. Data collection should attempt to capture the individual's full life circumstances. Thus, variables such as spouse/partner support, an index for racial discrimination, stress levels that could be measured by cortisol, annual income, the type of neighborhood they live in are all some of the variables that should be regularly collected and distributed publicly in this data set. These variables give more indication about what factors are increasing adverse birth outcomes the most and also could depict ways those factors could be mediated. The current data collection is contains no context of the mother's life and therefore limits the level of analysis performed. If a national data set made these variables the standard, then there would be policy implications that prescribe more than just additional and early prenatal care with limited improvements. In addition, this data collection would allow for new comparisons over the years. Since infant mortality and its recommendations are data driven, more data must be collected.

A specific variable for future research and data collection would be the mother's cortisol level, an indication of stress. Racial discrimination is a controversial factor when describing adverse birth outcomes. A translation of this social cause into a scientific measure can elevate and attract researchers, policy makers, and the public who are on the fence about the real life impact of this exposure. Cortisol levels provide this scientific measure. The mother would be asked a series of questions pertaining to unfair treatment in multiple domains such as the workplace, from police, when buying a house etc and then will be followed by a question asking why did this unfair treatment occur. The respondent could then reply with an answer such as their

race, their religion, their sexual orientation and so on and so forth. This index would then be analyzed with the cortisol levels to assess if the exposure to racial discrimination is associated with a flatter slope. A flatter slope would indicate that racial discrimination seems to affect the mother's stress level to a point where the body can no longer function properly. Therefore the mother produces an infant with adverse birth outcomes. As described earlier cortisol levels will elevate research to the next level and abide by IRB protocols in adding an additional cause to the problem. This research will open doors to new interventions that could create more effective solution and combat any controversial thoughts.

## Policy Implications

These findings also lead to a series of policy implications. First and foremost, it was found that Blacks have excess deaths at VLBW and NBW with the exclusion of LBW. For policy, this means that a variety of interventions have to specifically target these birth weight categories to combat overall Black infant mortality. In attempt to reduce the both VLBW and NBW deaths, a better safety net for women and children will be necessary. This safety net will include family planning, prenatal care, comprehensive health services, and health promotion activities. This intervention will not only provide prenatal care when the mother is pregnant, but also create a health care and prevention community throughout women and children's lives. This safety net will reduce the number of VLBW infants, but will have a more substantial reduction on NBW, since most NBW deaths result from infections, injuries, congenital birth defects, and sudden infant death syndrome (Rowley, 1994).

However, this safety net will not alone eliminate the excess infant mortality because excess rate of infant mortality persists even when women have adequate

access to care. There remains a lack of understanding within the amount of VLBW excess deaths. In attempt to substantially reduce or eliminate these deaths environmental and psychological stressors are hypothesized to contribute to this birth weight category (Rowley, 1994). Therefore further research and data collection described above will new create new policy implications on how to effectively intervene within that birth weight category

In conclusion, future research must analyze the VLBW category and create a new understanding of the factors that contribute to these excess deaths. After knowledge is obtained on the contributing factors, comparative institutional analysis should be conducted assessing which policy adoptions contributed to the most optimal outcomes. An implementation analysis should then be conducted to assess how this policy could be molded to fit that state's needs. The new data collection that includes the location variable will then examine if the policy adopted is efficient over time. These conclusions will now be attempted in the state of Delaware.

# Chapter 7

# DELAWARE CONTEXT

## Literature Review

Locally, Delaware's infant mortality trend resembles a southern state as opposed to the surrounding, affluent East Coast states. In the period of 1998-2002, Delaware ranked 6th worst IMR in the nation at 9.1 deaths per 1,000 live births with the national IMR was 7.0 ("Reducing infant mortality," 2005). Among Blacks in the same time period, IMR was 16.7 deaths per 1,000 live births compared to 6.9 deaths per 1,000 live births for Whites. The city of Wilmington contributed to the highest infant mortality among the state weighting in at 13.5 deaths per 1,000 live births. The suburban areas of Delaware's three counties, New Castle County (8.3), Kent (9.9), and Sussex (8.3) have lower IMRs, but all three counties have an overall higher infant mortality rate than the national average. From the period of 1993-1997 to 1998-2002 IMR increased 17.9% from 7.8 to 9.2 deaths per 1,000 live births. An analysis of the these two time periods found that one-third of the increase was due to the greater amount of extremely low birth weight infants, weighting less than 1,000 grams ("Reducing infant mortality," 2005). The remaining two-thirds was due to a higher risk of death among very low birth weight infants weighting less than 1,500 grams in both Black and White infants. It is noted that among the 10,600 births each year about 90 of those infants die. 70% of these deaths occur in the neonatal period, from birth to 27 days, with the remaining deaths occurring in the postnatal period, 28 to 364 days. The Infant Mortality Task Force that evaluated infant mortality in Delaware suggested

this occurred due to maternal health factors, before or during pregnancy, which result in less healthy infants ("Reducing infant mortality," 2005). In addition, the report surprisingly stated that the increased IMR among LBW infants occurred mostly to low-risk women who were married, 30 years of age or older, living in suburban New Castle County, and receiving perinatal care ("Reducing infant mortality," 2005).

The trend of Delaware infant mortality has steadily increased since the mid-1990s reaching a high of 9.3 deaths per 1,000 live births between 2000 through 2004. This same report found that excess infant mortality among Black infants was largely due to birth weight specific mortality (a stratification of newborn mortality rate by birth weight grouping), while the excess among White infants was due to frequency of low birth weights, 73.4 and 59.4% respectively ("State infant mortality," n.d.). The excess of deaths calculation was made using non-Hispanic white women 20 years of age or older with more than a high school education as a reference population. A Perinatal Periods of Risk analysis comparing two subpopulations by race and county in Delaware found that Blacks have an 8.3 excess of deaths compared to the control population of non-Hispanic White women 20 years of age or older with more than a high school education, whereas Whites who did not fit the at least 20 years of age and more than a high school education requirement had a 1.9 excess in deaths. The same reference population was used for both Blacks and Whites ("State infant mortality," n.d.).

Delaware's high IMRs have continued to progress as the U.S. Census Bureau reported the state as the 5$^{th}$ worst IMR of 9.0 deaths per 1,000 live births in 2005 ("Infant mortality rate--2005," 2008). In 2008, the Robert Wood Johnson Foundation found that Delaware had the 2$^{nd}$ largest gap when viewing infant mortality by the

mother's education ("Unrealized health potential," 2008). The report states that there is an unrealized health potential among infants in Delaware when comparing the rates to the national benchmark ("Unrealized health potential," 2008).

Most states follow the Department of Health and Human Service's Healthy People goals of that time period in constructing their own goals. Delaware's Infant Mortality Task Force in 2004 stated that their goal aligned with Healthy People 2010 of 4.5 deaths per 1,000 live births ("Reducing infant mortality," 2005). This goal was never achieved and a new goal was adopted from Healthy People 2020 of 6.0 deaths per 1,000 live births ("Healthy people 2020," 2014). However, this target still seems out of reach with 5 years left to achieve the goal and no report of any dramatic decline. Current programs in Delaware like smoking cessation, planned birth spacing, and perinatal services are not decreasing IMR, nor the inequities within these rates. The latter could be due to the lack of understanding of the causes to the problem of the widening Black-White gap in birth outcomes. The understanding of racial discrimination could narrow the racial inequity as well as decrease the rate to its target IMR.

The Delaware Infant Mortality Task Force report stated that the large number of neonatal deaths is most likely due to maternal health and these studies support their suggestion. The stresses throughout their lifelong minority status have affected their perinatal outcomes no matter the amount of education, income, or other socioeconomic factors ("Reducing infant mortality," 2005). This progression of analysis is then designed to address this cause of the problem and recommend potential solutions.

## Maps

The following map illustrates the percentage of infant deaths stratified my race occurring within Delaware's three counties (Figure 8). For comparison purposes with the GIS analysis, 2009 data infant mortality data from the Delaware Health Statistics Center was utilized ("Delaware health statistics," 2013). The left side of the map represents the percentage of White infant deaths and the right side represents the percentage of Black infant deaths. From the side-by-side comparison, it is illustrated that Black infant deaths occur more frequently with New Castle County. White infant deaths are more frequent within Kent and Sussex County. Overall, infant deaths most frequently occur in New Castle County followed by Kent and Sussex County.

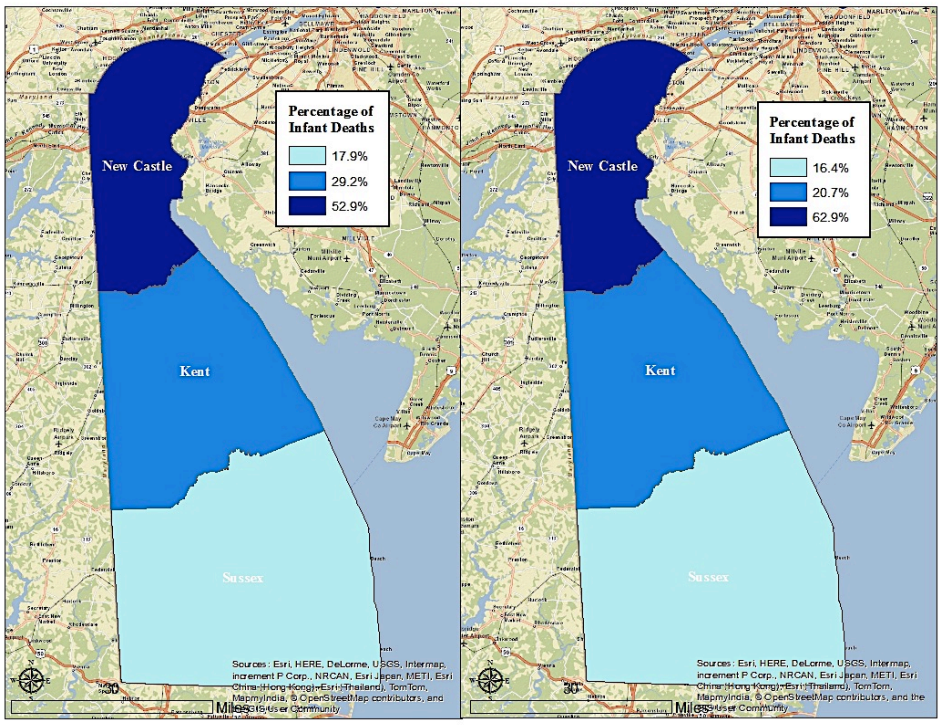


Figure 8 Delaware Counties Percentage of Infant Death Among Whites and Blacks, 2009.

## Comparative Institutional Analysis

This national series of analyses as well as the Delaware literature establish a premise that regardless of the amount of education, income, or prenatal care, the Black population will result in an abundance of adverse birth outcomes contrary to its White counterparts. This is thought to occur within the Black population through the association of an unwavering race-related psychological stressor that does not exist within the White population. However, when imposing this unfamiliar stressor on White mothers through the addition of a Black father, their birth outcomes deteriorate to an unprecedented rate. Thus, there is a specific, unmet need within, but not exclusive to, the Black population that needs to be addressed in order to start to create continuity between the two races.

In Appendix B, spatial statistic analysis marked overall and Black IMR as high clustering for elevated levels of infant mortality. Within these maps Delaware is shown to have elevated levels of infant mortality not experienced by its surrounding neighbors. Therefore, Delaware is an outlier among its neighbors with an increased risk of low birth weight, chronic hypertension, and infant mortality among Blacks. This phenomenon could be explained through examination of the programs and policy interventions that the surrounding states administer in comparison to Delaware's efforts.

To establish a policy intervention for Delaware, a comparative institutional analysis will be performed. This level of analysis will assess the successes and failures of other programs and initiatives that have attempted to decrease the magnitude of adverse birth outcomes associated with the race-related psychological stressor. Intervening on a long life stressor could prove to be extremely overwhelming and complicated. Therefore examining past and current practices is extremely

valuable. The goal of this analysis is not to copy and paste another state's program, but rather to compile ideas, understand others history and shortcomings, and to mold the most effective intervention to meet unique needs of Delaware.

In the process of selecting the two institutions for this comparative analysis two major requirements had to be satisfied. First, the institution had to be successful in closing the Black-White gap in birth outcomes. Most states, cities, and counties set a goal of reducing infant mortality overall. Delaware already shares that same goal, however the goal of this analysis is to reduce the magnitude of the Black-White gap. Therefore, the institution studied had to adopt this goal as well. Second, the institution had to intervene on the effects of racial discrimination felt by the mother. Since this psychological stressor is hypothesized to be a confounding factor to adverse birth outcomes, the institution had to address this risk factor specifically.

In this comparative institutional analysis, two institutions will utilized for comparison purposes. The first institution, based in Kalamazoo County, Michigan, receives federal funds from the Health Resources and Services Administration to create an opt-in community focused on addressing improvements of perinatal health for Blacks. The second institution, based in Boston, Massachusetts, consists of a neighborhood-wide initiative to combat racial inequities through the Center for Health Equity and Social Justice Branch of the Boson Public Health Commission, which encompasses an Anti-Racism Advisory Committee.

When investigating a potential solution to this problem, equity is just, if not more important, than the effectiveness of the purposed idea. This mindset is maintained throughout this analysis as well as the following implementation analysis. In searching for a plausible solution, case studies from published evaluations provided

evidence of different institutions' abilities to address the racial inequity in birth outcomes.

**Alternative 1: Healthy Start**

The U.S. Department of Health and Human Services, Health Resources and Services Administration's Healthy Start program is a well-known federally funded grant to prevent infant mortality in communities where infant mortality rates exceed 1.5 times the national average ("Healthy start," 2015). When researching the Healthy Start program there was a section dedicated to the Infant Mortality and Racism Action Learning Collaborative. This section is key to the needs seen in Delaware. Acquiring the knowledge of how this program addresses racism, which attributes to adverse birth outcomes, was of great importance. Therefore, this was the first program evaluated as a potential alternative to the problem. There are over 105 communities with a Healthy Start program, but none are located in Delaware. ("Saving our nation's," 2011). Since there is a gap in obtaining this program in Delaware, this alternative was considered. Kalamazoo, Michigan was chosen as an illustrative case for the Healthy Start program for several reasons.

First and foremost, Michigan was the state with the most Healthy Start programs. Therefore the programs seem to have been of great use to them. In choosing one of the six Healthy Start programs, Kalamazoo County experienced the highest rate of infant mortality for Blacks within that state, thus this location was of most interest for this analysis.

Second, Healthy Start programs are flexible in that they are designed to address infant mortality in a way that seems fit for that specific community. This flexibility is essential to the policy intervention and implementation process, because

it allows for the community to address their specific needs rather than a mandated grant that could prove insufficient to their desired outcome.

The only other condition essential to consider this alternative for implementation is that the program has to readily address the Black-White gap in birth outcomes. Healthy Babies Healthy Start (HBHS) in Kalamazoo County fulfilled that condition. In addition to that condition, HBHS also stated a clear mission to improve birth outcomes for Black women and infants.

A quasi-experimental study performed by Kothari *et al.* (2014) contained a matched-comparison posttest-only design. Through their analysis, it was found that there was a 200-gram birth weight increase among Black HBHS participants (Figure 9).

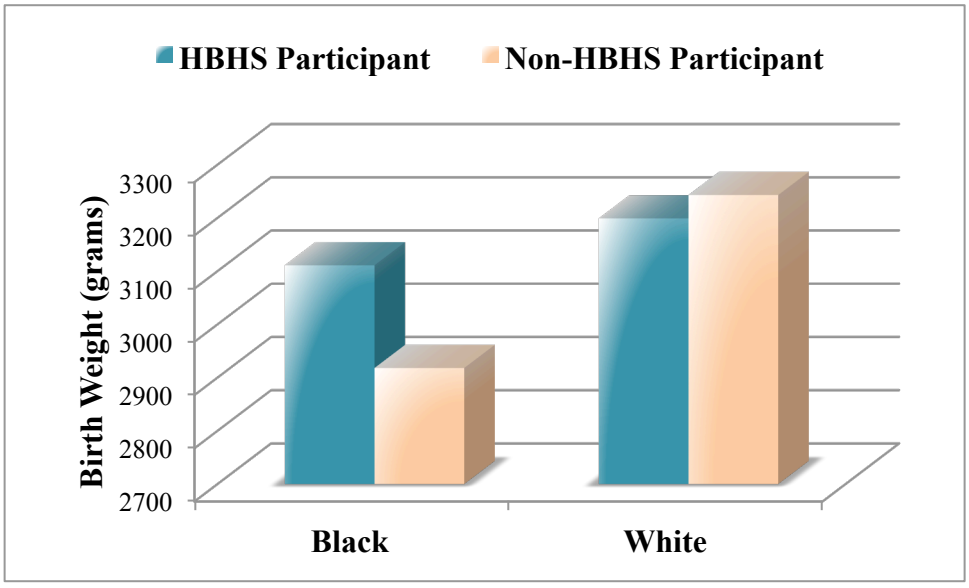


Figure 9 Matched Comparison of Healthy Babies Healthy Start (HBHS) Participants and Non-Participants

However, this birth weight increase was only found in Black infants. It was found that White HBHS participants had a lower birth weight than non-HBHS participants. This finding was found to be insignificant, but illustrates how the HBHS program specifically affects Blacks compared to Whites (Kothari, Zielinski, James, Charoth & Sweezy, 2014). This finding provides a reason to believe that the Black-White gap in birth outcomes would narrow to a certain degree based on the participation in a Healthy Start program.

HBHS by design is an opt-in institution, where the mother can call and decide whether or not she wants to have a case manager throughout her pregnancy. In order to be considered for case management, she has to fit the criteria for eligibility. To fit this eligibility requirement, the mother has live in one of the three specified zip codes and be under 22 weeks pregnancy. If accepted into the program, she will receive care up until her child turns the age of two. There are free classes open to the public, but here again the individual has to decide to enroll in the class ("Healthy babies healthy," 2014).

**Alternative 2: Creating a Health Equity Initiative**

The second illustrative case chosen was that of Boston, Massachusetts. The program in Boston was of interest for several reasons. First, Boston's Public Health Commission (BPHC) has had a long history in putting forth efforts to combat the racial inequity in birth outcomes. For over 30 years, the BPHC has implemented numerous interventions in the hopes of closing the gap. July 1996 marked the start of this effort when they passed legislation assuring health coverage for all women during pregnancy in Massachusetts ("Decline in black", 2014). However, a significant difference was not made in narrowing the gap until 2008 when the focus turned to

racism and its associated stress on health. This new focus also called for the need of a broad, collaborative effort to support women facing these stresses on a daily basis, and the impact of poverty (Figure 10). The BPHC explicitly focused its efforts on combating racial discrimination, which made this institution a key alternative for evaluation ("Decline in black", 2014).

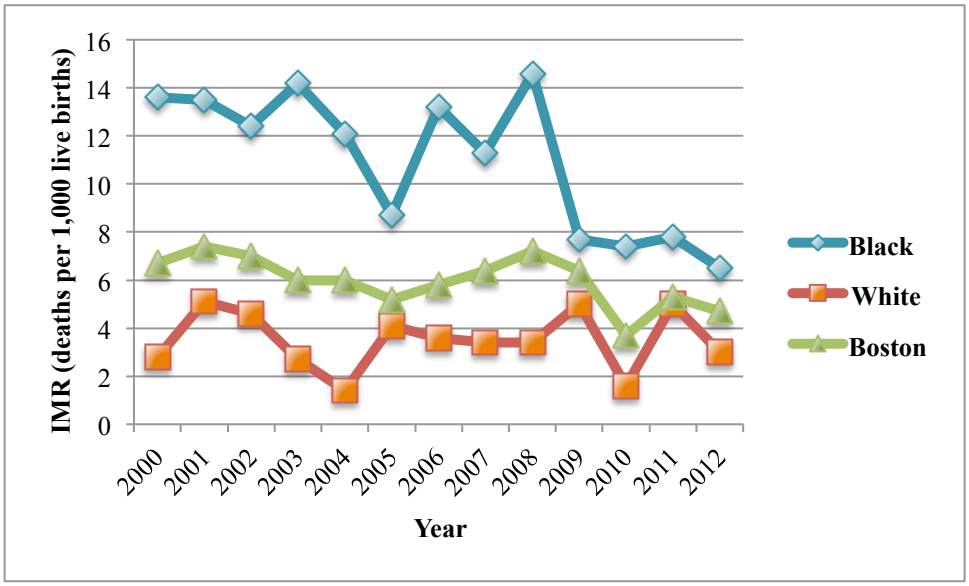


Figure 10 Infant Mortality Rates by Race from 2000-2012.

Second, Boston is similar to Delaware in the sense that they both have various partnerships attempting to achieve the same goal. Therefore, the analysis of this institution would provide knowledge on how these partnerships work together to achieve the same goal.

An analysis conducted by the BPHC revealed that the Black-White gap in birth outcomes decreased by nearly half. The Black to White ratio in 2001-2004 of 3.8

decreased to a ratio of 2.0 in 2009-2012. This decrease in infant mortality rates was seen only among Blacks. The White infant mortality rate remained the same during that time period. These findings gave evidence as to the magnitude of closure in the gap ("Decline in black", 2014).

Another important aspect of this program is the neighborhood focus. A needs assessment is taken for each neighborhood to assess how to serve the different needs of each community. This assessment gets the community involved in speaking up for their neighborhood as well as encourages an overall healthy environment for everyone.

The BPHC's Center for Health Equity and Social Justice contains committee called the Anti-Racism Advisory Committee. This committee actively attempts to undo racism throughout the community as well as internally. Analyzing how this committee makes strides to eliminate racism is of great interest.

There are limitations to this comparative institutional analysis. This analysis focuses on one factor in particular: racial discrimination. Therefore addressing one aspect, racial discrimination, is not meant to be a blanket solution, but rather another way to combat the problem. Since this analysis is attempting to reduce the disparity caused by discrimination in birth outcomes, it does not take all other health outcomes into account. Among the numerous programs occurring and being implemented around the country, this analysis only examines two institutions that reside in two specific locations. There is also an assumption driving this analysis that the successes in another states will be experienced in Delaware. Even with careful implementation analysis the magnitude of outcomes may not resemble each other.

**Discussion**

From these case studies, Delaware could explore two options, either applying for a Healthy Start Program or Creating a Health Equity Initiative. In order to select an option, each alternative will be evaluated in the context of the following criterion. Three criteria were used to evaluate possible policy solutions for Delaware: equity, that one race is not disproportionately affected over another; effectiveness, that there is a reduction in the Black-White gap in birth outcomes, and feasibility, that there are limited barriers to change.

Alternative one is applying for a Healthy Start Program for Delaware. The Healthy Start Program is flexible to the needs of the population that it serves. The program can range from awarding affordable housing to pregnant mothers to administering case management home visits. After an organization is awarded the Healthy Start grant, the funds are released to the grantee. The grantee can use those funds to implement their vision of the best solution to decrease either IMR as a whole, the Black-White gap in birth outcomes, or the prevalence of low birth weight. As long as the program is improving the health of infants and their birth outcomes, then it meets the requirements to be federally funded by the Health Resources and Services Administration.

The following contains the assessment of Alternative 1 under the criterion:

- Equity- like HBHS, Delaware could make their mission to focus primarily on Black mothers in order to close the inequitable gap. This does not mean that Whites would be exempt from the program, but rather the program would be target to intervene directly on racism, which only Black mothers encounter.
- Effectiveness- the study, Kothari *et al.* (2014), did not state the magnitude that the Black-White gap in infant mortality rates closed. Rather it stated that there was an increase in birth weight among Black participants. This increase could decrease the inequity, but there is no knowledge of the size of the gap after implementation.
- Feasibility- this program seems to achieve the feasibility criteria in limiting barriers to change. However, this is a federal grant that has an intricate application

process, which could create that barrier. The application process is open for 18 days with three levels of grant competitions. The levels are individual, community, and regional level. Each application level has a different application attached to it. There is also a 77-page guideline for questions pertaining to how to complete the application. In order to complete the application process, a qualified grant writer with federal grant experience would probably be necessary. Completing the application does not ensure that the money will be received. Therefore this process can be overwhelming, if the organization applying does not obtain a person with these qualifications.

Overall, the Healthy Start program does not fare well in feasibility, there is not enough evidence for effectiveness, but it hits the mark for equity.

Moving forward to alternative two, Creating a Health Equity Initiative invokes a progression of steps involving various organizations. In Creating a Health Equity Initiative, a consortium would need to be established. This consortium would facilitate a relationship with the community, enabling the communities' voice to be heard throughout the health field. The relationship between the community and health field is vital to for any level of success to be achieved. Once a relationship is established then an Anti-Racism Advisory Committee would need to be created to educate about the history of racism and provide knowledge of how to undo racial discrimination. Once the committee is established, a partnership encompassing all organizations relevant to health equity, minorities, reduction of infant mortality, and data analysis should be formed to facilitate collaboration between entities working towards the same goal. These organizations would have previously established partnerships and relationships with the community. Their massive collaboration between hospitals, physicians, community organizations, businesses, and schools would be utilized to educate and change procedures to address racism. The collaborations would impact the health of the population through the communities they live, work, and play in. Since these organizations already involve a focus on

neighborhoods individually to assess each one's needs in order to improve their overall health, the inclusion of a new intervention is thought to make a difference. In addition, the collaboration of these organizations to create one Health Equity Partnership will ensure that everyone is working towards the same goal and can spark new ideas.

The following contains the assessment of Alternative 2 under the criterion:

- Equity-Creating a Health Equity Initiative is intended to affect the entire population's health. However the executive director in Boston made equity, and particularity the inequity of birth outcomes, a focus of those associated programs as well as the health system as a whole. Setting this mission led to changes in the way programs were conducted as well as who was involved. Efforts were designed to specifically decrease the highest IMR, which was found among the Black population.
- Effectiveness- The Boston study revealed that the inequitable gap in birth outcomes was cut in half. For that reason, Creating a Health Equity Initiative could be very effective in closing the Black-White gap in birth outcomes throughout Delaware. It is assumed that similar results will be found. This is explained in greater depth in the implementation analysis.
- Feasibility- Delaware has already been awarded the design grant to develop a state health care innovation plan, which contains population health as one of the six work streams. The population health work stream can be achieved through these collaborations in ensuring healthy neighborhoods that have already been proposed in the guide ("CMMI state innovation," 2014).

Overall, Creating a Health Equity Initiative would be feasibly aligned with the state's current plans, effective in closing the Black-White gap in birth outcomes, and equitable in serving the entire population while addressing inequities.

## Implementation Analysis

The comparative institutional analysis provided evidence that Creating a Health Equity Initiative will be preferred over the Healthy Start program for several reasons. First, Creating a Health Equity Initiative will create a committee as well as new collaborations among organizations that have the largest strike in combatting

infant mortality rates. After training the Health Equity Partnership, the associated organizations will be able teach their community partners to impact the neighborhood wide initiative and would make the overall community healthier. A person does not have to opt in of this community, like HBHS in Michigan. They live in the community and thereby is initiative will have some positive effect on them. Another reason in choosing Creating a Health Equity Initiative over Healthy Start is that Boston illustrated the largest reduction in the magnitude of Black-White birth outcomes. This reduction was achieved through specifically addressing racial discrimination. Since Kalamazoo County only saw an increase in birth weight with no description of the change in gap, Creating a Health Equity Initiative was deemed more useful to fit the needs of Delaware. The third reason is Creating a Health Equity Initiative can still apply for the Healthy Start grant once the committee and partnership is established. Creating a Health Equity Initiative also gives more opportunities for health improvements overall.

Even though the advances by the BPHC sound overwhelmingly effective and pave the direction that Delaware could work towards, there is no way of knowing that the same effects will transpire to Delaware. Therefore, this implementation analysis will carefully examine all aspects of the BPHC and how these goals were achieved.

First and foremost, the history of the BPHC was analyzed. This examination provided evidence as to how the BPHC evolved over time as well as their lessons learned. In reviewing the BPHC's efforts to combat infant mortality over the years, it was found that in 1991 Boston was selected as one of the first 15 sites to launch the initial demonstration phase of Alternative 1, the Healthy Start program. Since the Healthy Start program was considered as a potential solution and also recognized as a

consideration to apply for once BHW is underway, the implementation of this program is included in this analysis. The examination of this program in contrast to the steps BPHC made post inception of BHSI can also provide a further comparison of the two types of institutions. A case study on this program was conducted and included within this analysis to depict programs tried and where success was achieved.

This analysis will begin by illustrating the steps of the implementation process in Boston including their level of success and lessons learned. This will be followed by a discussion of the successes between two alternatives. A general set of policy recommendations will be formed from the two exemplars that could be tailored to any interested state with the goal of closing the Black-White gap in adverse birth outcomes. Then, a suggested plan for Delaware will be drafted based on the knowledge acquired through the history of the BPHC and Delaware's current resources.

The Healthy Start program in Boston was fully funded by the Health Resources and Services Administration (HRSA) during the initial demonstrations phase over the period of six years. Throughout this phase, the project was expected to develop systems for attracting funding in order to sustain the project after funding was concluded. The primary goal of the Boston Healthy Start Initiative (BHSI) was to cut the number of infant deaths in half within the project area by 1997. The infant mortality rate in 1990 was used as a reference point in calculating success. BHSI recognized that by reducing the number of infant deaths it would simultaneously reduce racial, ethnic, and linguistic disparities in infant mortality (Bhaumik, 2000).

BHSI formed a partnership between the BPHC and a Consortium of individual and organizations categorized as consumer, providers, and state and local government.

The Consortium was composed of 12 elected members on the Executive Committee. In addition to the Executive Committee, there were six committees formed to include a wide variety of stakeholders and interests. The six committees are the Finance Committee, Public Information Committee, Education Committee, Evaluation Committee, Transition (Sustainability) Committee, and Consortium/Membership Development Committee. The Executive Committee elected two co-chairs, as well as a chairperson for each of the six committees to formulate the core of the Consortium Board. There were monthly meetings by both the Executive Committee and the Consortium Core that were assigned the responsibility for developing, implementing, analyzing, and restructuring plans for the BHSI. The full Consortium also attends a monthly meeting in order to develop policy and oversee the project. Therefore, the Consortium and its Executive Committee acts as the governing body for BHSI in making all BHSI decisions. There were eight objectives set by the BHSI (Bhaumik, 2000).

The Consortium serves as a venue for interacting with the community to provide a voice for the people in all aspects of the project. A monthly meeting would enable members of the community to learn BHSI's mission and that the community within the project area has a prominent role in creating BHSI. The community would provide their insight as to what does and does not work within the project area as well as their ideas to improve it. The Consortium listened and took steps towards implementing the community's ideas. This empowered the community to feel like they were creating this project rather than feeling forced into something unfamiliar to them. Since the community invested their time and energy into the project, they were also invested in sustaining the institution they built. The feedback loop created

through the community and health field and the Consortium proved to be the most valuable resource for the success of the project. When the people had a place to go to talk about the barriers to access of service, BHSI and service providers as a whole were able to find ways to meet these unmet needs (Bhaumik, 2000).

The Consortium also performed a needs assessment on the project area. Community focus groups were composed in order to perform this assessment not only at the inception of the project, but throughout the implementation process. After assessing the demographics and needs of the community, five broad priority areas of focus were constructed: comprehensive family, health, women's health, youth development, community economic development, and community involvement and leadership (Bhaumik, 2000).

After a relationship was built between the community and the Consortium and the project area's needs were assessed, BHSI begin to build relationships with service providers. Organizations with similar goals were sought to create these linkages that could work in unison in order to provide the most efficient delivery of service. BHSI prompted collaboration among existing health and human service providers. The BHSI created an application process for service providers who desired to be considered within the project area. These applications were then reviewed by community residents as well as experts recruited from academia, international heath consulting firms, hospitals, community and city agencies, the state's Department of Public Health, other concerned state agencies, and newcomer advocacy groups. The reviewers took care to ensure the copulation of service providers represented the racial composition of the population they were serving. The diversity among service providers included within BHSI would create a place of comfort for those who

identified as the same race or culture. There BHSI maintained transparency with the health providers included in this project stating that the project would not be funded six years down the road. The BHSI encouraged these providers to formulate ideas to create a funding pool as soon as possible. They understood that sustainability was key and at all service providers involved had to be aware that if they did not plan for the future, they will not have a future (Bhaumik, 2000).

The project succeeded in lower infant mortality rates as well as improved a host of other heath status indicators for both mother and children. The BHSI was able to reduce infant mortality within the project area, but was not able to fully remove the disparity in infant mortality between the inner city and the rest of the city. The significant differences in infant mortality rates remained among racial and ethnic groups. BHSI acknowledged that the cause of this disparity is deeply rooted and cannot be removed without a radical change in social interactions and constructs. This project was limited to focusing on a broad socioeconomic transformation rather than the reasons for socioeconomic standings across racial groups. Most of these improvements resulted from changes within the deliverance of service, rather than providing additional services. Therefore, these improvements were thought to be sustained even after funding concluded (Bhaumik, 2000).

Other successes emerged throughout this project. The BHSI's Consortium gave the community a voice and hand in health outcomes within their project area. The community now valued their health and felt as though they could make a change. This resulted in a higher volume of utilization among members of the community. This project did not only increase their knowledge of the variety of health services available to them, but it also taught them how they can play a role in influencing

policy decisions as well as the benefits that arise from working collaboratively. The communities sense of sustainability was validated when the Consortium successfully registered under 501©3 as a non-profit organization, which will allow the Consortium to function independently after BHSI no longer exists (Bhaumik, 2000).

Throughout this process, the BHSI learned that community empowerment should start from inception of the project in order to combat political inertia. BHSI learned that taking the time to listen to the community, their needs and idea is the key to success. Rather than mandating the implementation according to the same template, BHSI had to constantly adapt the mindset and model to each individual situation or circumstance. It was found that many gaps in access and utilization of maternal and child health services within the project area resulted from a lack of mutual understanding among residents and city government and various agencies. Health services providers began to understand the importance of addressing the cultural, ethic, and linguistic diversity within the project area. BHSI will be sustainable, in theory, only if the lessons learned throughout this process are maintained. The community has to continue their relationship with the Consortium through monthly meetings and the Consortium has to continue to empower the community's ideas (Bhaumik, 2000).

In examining this case study, there are some take home messages that should be considered if an organization planned to apply for such a grant. The first message is that community empowerment is key. If the community does not feel involved and emotionally invested in the project, then the lack of mutual understanding will continue to create a disconnect between the community and the delivery of services. Therefore the services will be underutilized and health status will continue to decline.

Another take away message is that not necessarily new services or grand institutions have to be built. It can be beneficial to build something out of the resources that already exist. Through the expertise of one program, those organizations can learn how to collaborate and efficiently serve their population.

If Delaware thought that this program could be beneficial in reducing the Black-White gap in adverse birth outcomes, then they could follow a similar method as Boston for implementation. An entity, like the Delaware Division of Public Health, could apply for the grant. If accepted, Delaware could work towards implementing a Healthy Start program by creating their own Consortium in order to learn and empower the community. The Consortium has to gain the trust of the community in order for the project to move forward. Following the establishment of the Consortium, a needs assessment will be administered to gain knowledge of the needs of the community. Existing organizations within Delaware could be notified of the project's mission and if interested an application could be made available to them. A panel of experts as well as members of the community could work together to assess what service providers fit the needs of the community as well as represent the demographics of those served would then review the applications. The conversation between the community and the health system has to be in constant motion at all times. Once the conversation ends, the strides towards success end with it.

A limitation of the case study is the lack of information of the magnitude of success in the reduction of infant deaths. There is a clear goal set by the Consortium and BHSI, but a lack of clear response of how statistics have changed through the implementation of the program. Therefore, there is no clear measure of the success achieved. This analysis primary goal is the reduction of the Black-White ratio in birth

outcomes. BHSI did not shared the same goal and only hoped to reduce infant deaths overall.

Another limitation of BHSI is that the project focused on the delivery of services rather than a more upstream approach. The study acknowledged the existence a root cause of these outcomes especially within different race and ethnic groups, but left it how it laid. Out of the eight objectives, not a single one highlighted undoing racism as a way to address this problem (Bhaumik, 2000).

To date, the BHSI has maintained federal funding since 1991. The mission of the project has evolved from reducing infant mortality rate within the project area to eliminating disparities in perinatal health among Black women. The BHSI provides Black pregnant women with quality health care by funding case management, health education, interconceptional care, and maternal depression services. To receive theses services, a Black pregnant woman has to make a call to her nearest health center and speak with a BHSI case manager ("Boston healthy start," n.d.).

There is a difference in the description of BHSI's between the case study of BHSI by Bhaumik (2000) and the description on the BPHC website, that illustrates a shift in focus within BHSI. The Consortium still exists maintaining monthly meetings with the community as to the improvements needed to advance their health. The Consortium also continues to set the goals and objectives for BHSI. However, BHSI seems to have lost a full community involvement. Since the focus has turned to Black pregnant mothers and does not reference any other population, it is believed that other populations are excluded from the process. The infant mortality disparity may be the greatest among Black women, but excluding the rest of the community seems counterintuitive to the strides made since 1991. Blacks can remain as the target

population, but the advances in the community referenced by Bhaumik seem to have gone unheard unless an individual identifies as Black.

The change from the case study in 2000 to the BPHC's description and mission statement is more in line with the goals of this analysis. However, by limiting the community the resources, voices, ideas, and advancements are limited with it. There is an unmet need within the Black community, but those advancements have to be fought together. Instead of full community empowerment, this project has shifted to a similar Healthy Start program implemented in Kalamazoo County, Michigan that requires the individual to opt into the program rather than be surrounded by it. Although the goal of the project has shifted towards this analysis's goal, the community empowerment described by Bhaumik is desired.

Reverting back to the BPHC's history in combating infant mortality inequities, it was found that in 2006, Boston became the nation's first city to address racial and ethnic disparities in health care. Two years later, the BPHC founded the Center for Health Equity and Social Justice (the Center) that included the Anti-Racism Advisory Committee (ARAC) ("Our history," n.d.).

This analysis will now examine how these organizations were created, their successes and lessons learned, and implications for implementation in Delaware. In 2005, the Mayor created a Health Disparities Task Force. The Task Force was composed of a group of leaders from various entities that issued a set of recommendations as a citywide blueprint for addressing racial and ethic inequities in the realm of health ("Reducing infant mortality," 2005).

The BPHC applied for a Racial and Ethic Approaches to Community Health (REACH) grant. This grant was awarded to BHPC by the Centers for Disease Control

and Prevention that allowed for the creation of the Center of Excellence in the Elimination of Disparities. The forces of REACH and the existing Office of Minority Health located within the BPHC joined to be formally known as the Center for Health Equity and Social Justice in 2008. The two entities' goals aligned with the vision to eliminate racial and ethnic health disparities and to build health equity through community, policy, and systems change. The Center focused on the relationship between social factors and health outcomes with an analysis of the unique and independent role that structural racism plays on these social factors. Overall, the Center provides funding, training, and technical assistance to communities and organizations in Boston as well as Southern New England. The Center repurposes its federal and local monies in order to fund 15 grantees for 3-year cycles (Baril, Patterson, Boen, Gowler & Norman, 2011).

The Center utilized a social ecological model and community-based participatory approach in attempt to reduce health inequities (Figure 11). The Center's overarching goal is that no one is disadvantaged from achieving their full health on the basis of their social position or other socially determined circumstance (Baril, Patterson, Boen, Gowler & Norman, 2011).

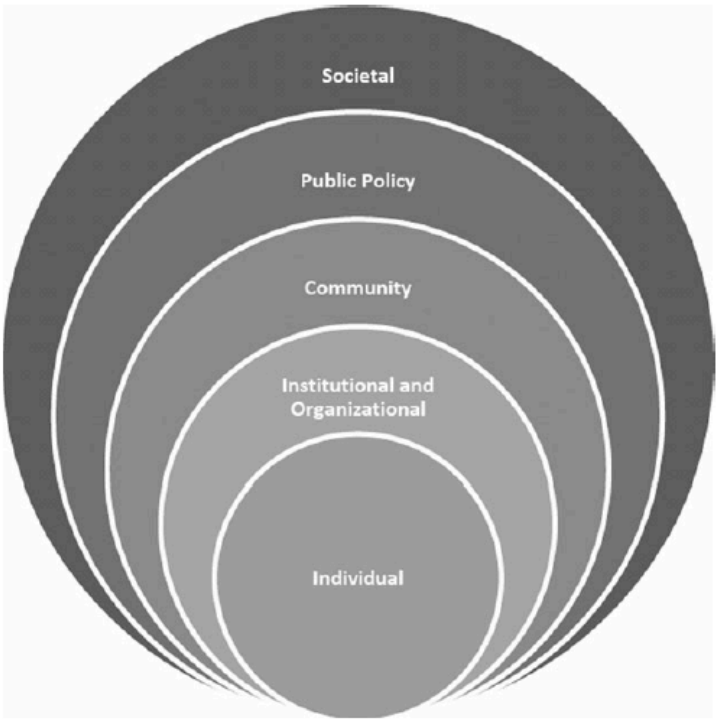


Figure 11 The Social Ecological Model (Baril, Patterson, Boen, Gowler, Norman, 2011).

In meeting this goal the Center utilized a health equity

"framework that highlights racism and discrimination as root causes of inequities in health and that recognizes comprehensive, multilevel racial justice strategies as fundamental to achieving racial and health equity" (Baril, Patterson, Boen, Gowler & Norman, 2011, p.30) (Figure 12).

The work done within the Center is "rooted in the understand that health status is influenced by environmental conditions, social relationships, and institutional structures and that individual choices and behavior are largely shaped by the resources available in the places where people live and work" (Baril, Patterson, Boen, Gowler & Norman, 2011, p. 30-31).

This health equity framework "suggest that racism has an independent influence on all the social determinants of health and that racism in and of itself has harmful impact on health" (Baril, Patterson, Boen, Gowler & Norman, 2011, p.31).

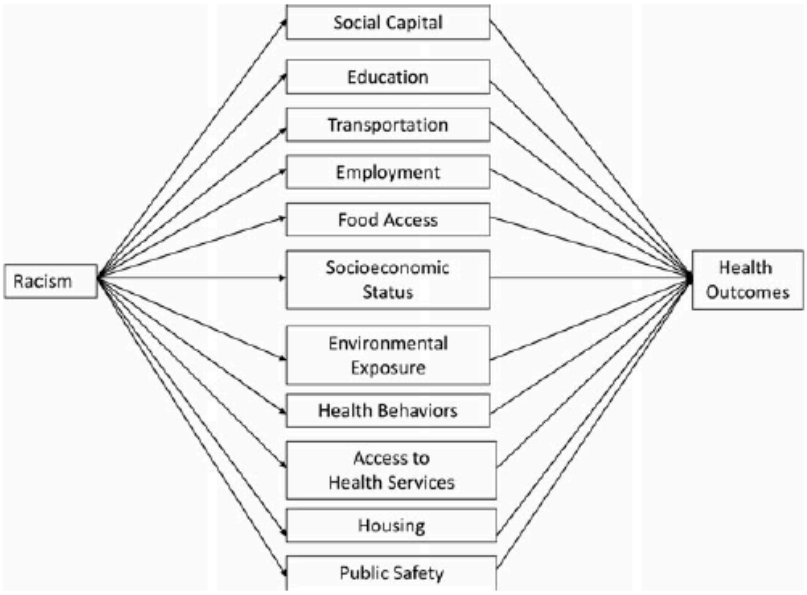


Figure 12 Boston Public Health Commission's Health Equity Framework (Baril, Patterson, Boen, Gowler, Norman, 2011).

The Center acknowledges that advances in improving social conditions needed to reach optimal health status cannot happen without understanding and undoing racism. The Center references the social ecological model in order to translate from theory to practice. Instead of collaborations from existing organizations, the Center utilized its grant funds in order to provide funding for more than 15 organizations and community coalitions. Between 2008 and 2012, the Center granted more than 1.1 million dollars to these organizations, each receiving between 25,000 to 30,000 dollars

annually. This funding is for development, implementation and evaluation of community strategies to address these racial inequities. In addition to the funding, the Center provides the grantees with education, training and technical assistance (Baril, Patterson, Boen, Gowler & Norman, 2011).

Like that of the Consortium in BHSI, the Center engineers the New England Partnership for Health Equity to create a space for collaborative learning through regional meetings, conference calls, and biannual conferences. The Partnership for Health Equity convenes each fall and spring at the New England Health Equity Summit. There are allotted times devotes exclusively to sharing and networking of the grantees. The hope is that by sharing ideas the grantees can work together to achieve their goals. The Partnership plans to launch a website for grantees to regularly keep in contact (Baril, Patterson, Boen, Gowler & Norman, 2011).

The grantees are selected through a competitive request for applications. The grantees' history of working with communities of color, vision of the elimination of health inequities, and their capacity to do policy change work within a multiyear initiative is evaluated when determining grant recipients. A wide variety of grantees are selected to ensure all social determinants are analyzed and addressed (Baril, Patterson, Boen, Gowler & Norman, 2011).

These grants require organizations and coalitions to talk about racism when addressing health disparities. They are asked to engage in conservation regarding the issues of power and think upstream with a social justice lens. The efforts of the 15 grantees aims to give people overall access to services to give the opportunity of an equal footing and the elimination of social structure that restrict opportunities to people of color (Baril, Patterson, Boen, Gowler & Norman, 2011).

The Center provides the grantees with a 3-year timeline to follow as a guide for their implementation. In the first year, all grantees are required to attend training from the BPHC staff on the Center's health equity framework. This training included an undoing racism and community organization workshop that contains a historical analysis of racism as well as discussion about community organizing, leadership development, internalized oppression and privilege, and strategies for undoing racism. The biannual summits offer additional training on racism and strategies to combat it. After training is completed, the assessment process begins to identify the needs, stakeholders, and assets of the community that will be implemented in to year 2 and 3 of the grant. The first year is valuable time for the grantees to become familiar with the community and invoke new ways of thinking. Post assessment, all grantees will develop plans to achieve health equity within their social determinant. The Center allows the grantee to determine their strategic plan on the contingency that the plan is SMART (specific, measurable, attainable, relevant, and time-oriented). This strategic plan must include policy and systems change objectives. Even though these plans will differ across grantees, the Center collects standard qualitative and quantitative data from each grantee to evaluate their success from the grantee's annual report and an annual partnership assessment tool. The evaluation process measures the capacity of the grantees, their influence with regard to the social ecological model, and the whether the grantee reached their intended goals. Each grantee must assess how they will continue their mission after the conclusion of the grant (Baril, Patterson, Boen, Gowler & Norman, 2011).

Throughout the three years, the Center provides the grantees with an unlimited amount of technical assistance. This team of experts is there to offer specific expertise

to the needs of the grantees. Technical support is also available throughout the evaluation process (Baril, Patterson, Boen, Gowler & Norman, 2011).

The Center staff maintains interaction with the grantees through regular phone calls to discuss progress and address any challenges they may be facing. In addition to phone calls from the Center staff, there are also conference calls with the other grantees to create a learning environment. The grantees also receive bimonthly email updates, funding opportunities, articles, reports, and an excess of other resources (Baril, Patterson, Boen, Gowler & Norman, 2011).

The limitations stated within the Center's grant model is that there is no longitudinal data collection. Thus, there is no long term analysis conducted of the impact the grantee has post the three year grant cycle. In addition, it is difficult to capture the change in health outcomes. Overall, the Center has to set the benchmarks for health equity and use these as reference points for success (Baril, Patterson, Boen, Gowler & Norman, 2011).

The Center learned form previous grants that combatting these social structures take a lot of time. Previously the Center administered one-year grants. It was found that the grantee were unsuccessful in fitting that much influence in that little time slot. The first year of the grant is an essential time to understand the community as well as the organization's role. The Center also learned that giving the grantees the opportunity to figure out their own strategic plan enabled innovation and a better fit for each community (Baril, Patterson, Boen, Gowler & Norman, 2011).

An important branch of the Center is the Anti-Racism Advisory Committee (ARAC), which was not acknowledged in the report by Baril *et al.* (2011). ARAC identities their priority in addressing racism as a root cause of health inequities. In

2013, the Committee administered an all staff survey to assess the construct of racism within their workplace, BPHC. Addressing racism internally provided the Committee with the knowledge of how to combat discrimination within their walls before they addressed it outside of those walls. The survey asked for ways BPHC could promote racial justice and health equity. The recommendations received from the survey are currently moving in the implementation phase. The survey aimed to uplift staff voices and align their internal practices and policies with their external health equity priorities. The survey included questions as to whether tan employee ever felt discriminated against in the workplace, if there are opportunities for people of color to be promoted, are the efforts BPHC conducts outside of the work place to promote anti-racism effective and are they doing enough, what policies at BPHC would they like to see ARAC address to further its anti-racism work and so on and so forth ("BPHC ARAC staff," 2013).

Training by ARAC is conducted throughout the BPHC staff so that all entities associated with BPHC promote anti-racism. Every year, the ARAC participated in the Young Women's Christian Association (YWCA) sponsored Stand Against Racism movement. It was initiated in 2008 to raise awareness that racism is still very real today and that in order to combat it, it can no longer be ignored. Many organizations come together for this event ("Anti-racism advisory committee ," n.d. ).

One of the goals set by BPHC was to reduce low birth weight rates among Boston infants as well as reduce the gap between White and Black low birth weight rates by 25 percent by 2016. This overarching goal was set for all bureaus, centers, committees, and community partner to play a role in achieving this goal. One example is the Healthy Start in Housing partnered with the Boston Housing Authority

to provide stable housing and case management for pregnant women and their families who are at high risk for becoming homeless ("Health equity goals," n.d.).

The history of the BPHC in its efforts to combat the racial inequities in birth outcomes is important to the understanding of how an organization of that magnitude can be applied to Creating a Health Equity Initiative. The examination of its history also enables the selection of different recommendations in order to create a plan that could be generally applied to any state. A lesson learned throughout the 23 years reviewed is that the definition of the problem is essential to meet the ends. In addition, social problems can be very complicated and there are ways to make slight improvements through the delivery of services, but in order to see sustainable, prolonged changes the root causes of those social problems have to address in an upstream approach.

**Policy Recommendations**

Through the initial examination of polices in Kalamazoo County, Michigan and Boston, Massachusetts and further analysis of Boston's policies surrounding reducing infant mortality, these exemplars contained some commonalities and themes that could be developed into general policy recommendations. The commonalities and themes found in these exemplars expose policies that have been implemented with some level of success. Thus, these policies could be used as general policy recommendations for any state that contains the goal of closing the Black-White gap in birth outcomes. Within each exemplar there were specific policies unique to that institution. Those specific policies become even more paramount in determining a set of policy recommendations that are innovative and could be generalizable across the nation.

Overall, the objective of this analysis is to add knowledge of how to close the Black-White gap in birth outcomes. This could be achieved through addressing all causes of IMR, including a focus and understanding of the detrimental effects of racial discrimination on insular minorities' perinatal outcomes. In order to work towards closing this inequitable gap, a progression of policy changes should to be implemented:

**1: Create a Consortium to facilitate a relationship between the community and the health field.** Individual and organizations categorized as consumers, providers, and state and local government could all come together to make a Consortium. The Consortium could decide to hold monthly Executive Consortium meetings where two co-chairs and a chair from each of the established committees discuss ways to combat inequities and ways to meet the communities' needs. The Consortium, as a whole, could conduct monthly meetings with the community to build a relationship that could empower the community to describe their circumstance and provide knowledge to the health field on interventions they might address the community's well being.

**2: Craft an Anti-Racism Advisory Committee to work towards addressing and building knowledge of racism as a cause of health inequities.** Racism is not always explicitly stated as a cause of health inequities. Sometimes it is mentioned, but little is done to intervene on this specific cause. Thus, this Committee will acknowledge racism as a cause and bring others into the same realization to work towards addressing and building knowledge on racism. The Committee could facilitate this realization by conducting an undoing racism workshop multiple times throughout the year.

This Committee is typically a branch of the Division of Public Health under a combination of offices that address minorities and health equity. The Committee usually administers a survey to assess the presence of racism within that Department in understanding employees prospective on whether the Department is doing anything to address racism on a day-to-day basis. The survey could also ask the respondent their ideas of how to promote an anti-racism work environment and overall anti-racism advocate.

**3: Form a Health Equity Partnership to foster collaboration with entities that shared the same goal in eliminating health inequities.** There are many organizations that are working to achieve the same goal. These organizations tend to overlap and lack a binding force. The Health Equity Partnership could serve as their way to innovate across organizations with the same goal and emphasize how each organization's specialization could be used to create a holistic plan for combating adverse birth outcomes.

The Partnership could decide to conduct a monthly meeting where two members from each organization could be required to attend and other members would be welcome to join, but not required. During these meetings, the Anti-Racism Advisory Committee could be asked to train the Health equity Partnership on how to teach and promote anti-racism within the community.

The established partnerships through each organization has could then be trained on undoing racism. If the organization has trouble training their partnerships, the Anti-Racism Advisory Committee could be asked to stand in to ensure all partnerships have knowledge of how to combat these social constructs.

**4. Prioritize decreasing infant mortality among Blacks.** Creating a Health Equity Initiative is intended to improve the health of the entire population. However, there has to be serious emphasis made on correcting the racial inequity in birth outcomes. Closing this gap should start a domino effect of numerous improvements in health across the board for Black residents.

Therefore, the Partnership should be briefed on the studies that contribute to this understanding. The better the Partnership is at obtaining a more comprehensive knowledge of the problem, the better suited they will be in implementing an effective solution. After this knowledge is obtained the partnership will be able to better address risk factors that occur before childbearing years, instead of exclusively during perinatal period. The definition of a "high-risk" mother could be elevated to including all Black mothers, no matter their educational attainment or income level. Racism could also be considered as a social determinant of health (Clark, Huisingh, Ommerborn & Grooms, n.d.)

**Potential Implementation for Delaware**

These general policy recommendations could be used to facilitate an implementation process for an interested state such as Delaware. The purpose of these policy recommendations is to close the Black-White gap in birth outcomes. These recommendations could be implemented in throughout Delaware with Wilmington as a key target area. The demographics of Wilmington, Delaware are very similar to those of the case study in Boston, Massachusetts. Both cities make up the largest city in their state. In addition, their demographics and inequities are verily similar (Table 34). Boston and Wilmington both encompass around the same number of neighborhoods, 15 and 16, respectively. These similarities provide more evidence that

the success of birth outcomes in Wilmington could match those of Boston. The difference is that Boston has created an environment of collaboration whereas Delaware has programs of overlap that have not yet realized how they can help one another.

Table 34 Demographics, Socioeconomic Status, and Infant Health Indicators among Boston, Massachusetts , Wilmington, and Delaware (Shah, Dodds, Sims, Batra, Mutonyi & Panati, 2011), ("Wilmington kids count," 2007), ("Profile of Delaware," n.d.), ("State of Delaware," 2013).*

| Location | Female | Race | Below the Poverty Line | Unemployment | Less than High School Education | Decrease in Adolescent Birth Rate | Prenatal Care | Very Low Birth Weight | Infant Mortality Rate |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *percent* | | | | | |
| Boston | 52 | 53 (non-White) | 17 | - | - | 19 (over one year) | 83 | - | - |
| White | - | - | - | 9 (males) | 7 | - | - | - | - |
| Black | - | - | - | 32 (males) | 20 | - | - | - | - |
| Massachusetts | - | 24 (non-White) | - | - | - | - | - | - | - |
| Wilmington | 52.3 | - | - | 13.3 | 18 | 29 (over ten years) | - | - | 12.4 |

Table 34 continued

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| White | - | 35.5 | Highest Poverty Rate (% not given) | - | - | - | 89.4 | 9.1 | 5.7 |
| Black | - | 56.4 | - | - | - | 38 (over ten years) | 81.8 | 17.7 | 17 |
| Delaware | - | - | - | 9.6 | 12.3 | - | - | - | 9.2 |
| White | - | 70 | - | - | - | - | - | - | - |
| Black | - | 20 | - | - | - | - | - | - | - |

Beyond demographics, Delaware's Division of Public Health (DDPH) was analyzed to obtain an understanding of the existing organizations that can be utilized for this policy change. The Infant Mortality Task Force was established in 2004 under the representation of Governor Ruth Ann Minner. The Task Force was charged with creating a blueprint to guide reduce Delaware's infant and perinatal mortality rate to 4.5 deaths per 1,000 live births by 2010. Data from 2003 was used as their reference year for data analysis. The report provided 20 recommendations to achieve this goal. The Task Force was also charged with creating an annual report to show progress of each year ("Reducing infant mortality," 2005). This Infant Mortality Task Force is similar to the Mayor's Health Disparities Task Force in Boston where both entities created a blueprint for the city to guide them throughout the process.

The Task Force recommended the creation of the Delaware Healthy Mother and Infant Consortium (DHMIC). The creation of DHMIC was passed in late 2005

and celebrated its first meeting in February of 2006. Similar to that of the BHSI Consortium, DHMIC was changed with ensuring effective implementation of recommendations established by the Infant Mortality Task Force. The DMHIC also has to review and analyze evaluations and reports and to make recommendations as needed. The Consortium meets twice a year with the Secretary of Health and Social Services to present progress and any further recommendations. DHMIC will also meet once a year with the Governor to present the annual report as well as progress towards implementation of the recommendations outlined in the Task Face report. The Consortium is compassed of 15 gubernatorial appointments ("Reducing infant mortality," 2005). Since the Consortium is already established in Delaware, the first policy recommendation has already been met. However, the Consortium could continue to work to involve and build relationships with the community.

The Task Force report also recommended the creation of the Center for Excellence in Maternal and Child Health and Epidemiology (CEMCHE) within the Division of Public Health and DDPH. The Center was then established in 2006. The CEMCHE was charged with analyzing and report Delaware's Infant Mortality data as well as addressing health issue of women and children. An epidemiologist and three other full time positions were hired to properly staff this Center ("Reducing infant mortality," 2005). In 2008 the Center's name changed to Center for Family Health Research & Epidemiology. The Task Force outlined a big data focus within their report and this Center is charged with meeting those recommendations.

Under the Infant Mortality Task Force, Healthy Women, Healthy Babies (HWHB) was established. HWHB is a program for women, who are Delaware residents, that provide extra services to women who are pregnant, planning to be

pregnant, or want to live healthier lives in general. The services provided to the woman include, health and wellness, nutrition, family planning, mental health, and prenatal care for those who are pregnant. This program is free to women who qualify. Women are eligible if she identifies as an African American woman or whose most recent pregnancy had serious problems such as miscarriage, preterm delivery, low birth weight delivery, infant was born with health problems, or stillbirth or infant death. If a woman does not meet those requirements, she has to have a least two of the following risk factors: have chronic disease, are overweight, have stress, depression, mental health issue, are pregnant and younger than age 18 or over age 35, have been pregnancy for three or more months without prenatal care, or are at risk for birth defects due to family history or exposure to toxic material. A person can them opt to call a health provider near them and access these services ("Healthy women, healthy," n.d.). Even though this program is not classified as a Healthy Start program, it is very similar to the BHSI in its procedures, services, and eligibility requirements.

Both BPHC and DDPH have an Office of Minority Health. For Boston this Office combined forces with the REACH recipients to create the Center for Health Equity and Social Justice. Under Delaware Health and Social Services' Division of Public Health, the Office of Minority Health (OMH) mission is "to promote and advocate for the elimination of health disparities among all racial and ethnic minority groups and other underserved populations in Delaware" ("Minority health services," 2014). To fulfill their mission, the OMH works with communities to build capacity to prevent diseases, identifies and supports assets to close the health disparity gap within the public health system, and meet with other organizations to inform minority groups of the available treatment and preventive health services. OMH's goal is to ensure

that state, local, and private policies, programs and implementation strategies are focused on significantly decreasing morbidity and mortality rates among minority groups ("Minority health services," 2014).

The DDHS also has a Bureau of Health Equity (BHE) that is comprised of the Office of Minority Health and the Office of Women's Health. This Bureau acts like that of Boston's Center for Health Equity and Social Justice. In addition to racial minorities, the BHE emphasizes work with persons with disabilities, the lesbian, gay, bisexual, transgender, questioning population, and the aging population. The BHE utilizes a health equity strategic map to implement its mission "to promote and advocate for policy, programs, services, and initiatives which will eliminate the impact of the social determinations of health to ensure all Delawarean can achieve their optimal health with a special focus on the underserved populations in Delaware" ("Bureau of health," 2014).

After acknowledging that Delaware contains five similar programs of the seven illustrated in Boston, Delaware would not have to make vast institutional changes in order to achieve similar goals (Table 35). Delaware could apply for grants, such as REACH and the Healthy Start program. However, this analysis does not see those programs as an essential need in order to achieve its goal of reducing the racial inequity in birth outcomes. The Center for Health Equity and Social Justice grant model can prove to be of great use and something to consider down the road, but at this time a smaller movement is believed to make a big change.

Table 35 Comparison of Public Health Programs within Boston and Delaware.

| BOSTON | DELAWARE |
|---|---|
| Boston Healthy Start Initiative (BHSI) | Healthy Women Healthy Babies* |

Table 35 continued

| | |
|---|---|
| BHSI Consortium | Delaware Healthy Mother and Infant Consortium (DHMIC) |
| Mayor's Health Disparities Task Force | Governor's Infant Mortality Task Force |
| Racial and Ethnic Approaches to Community Health (REACH) | N/A |
| Office of Minority Health (OMH) | Office of Minority Health (OMH) |
| Center for Health Equity and Social Justice | Bureau of Health Equity |
| Anti-Racism Advisory Committee (ARAC) | N/A |
| N/A | Center for Family Health Resources & Epidemiology |
| N/A | State Infant Mortality Collaborative (SIMC) |

*Not a Healthy Start program. HWHS many similarities to the Healthy Start program in Boston.

Through this analysis, it was found that efforts to close the racial inequity were most effective when Boston's Health Equity Framework was applied to the program. The focus of undoing racism was a key concept to changing social structures. The Anti-Racism Advisory Committee is essential to understanding discrimination internally and thereby applying those practices and policies to all collaborators. If this committee can be implemented in Delaware that provides training, surveys, and make undoing racism a priority, then advancements in birth outcomes among Blacks could potentially see improvements.

The general policy recommendations will now be utilized to exhibit how a state, such as Delaware, could potentially go through the implementation process. The first recommendation of creating a Consortium has already been meet through the establishment of the Delaware Healthy Mother and Infant Consortium. The second recommendation of crating an Anti-Racism Advisory Committee could work towards establishment by the Delaware Division of Public Health under The Office of Minority Health and the Bureau of Health Equity. Working closely with the Bureau of

Health Equity may produce the most effective results, since the Bureau acknowledges unnatural causes, a documentary series exploring racial inequalities, on their home page. The third recommendation of forming the Health Equity Partnership could involve members from the Office of Minority Health, the Bureau of Health Equity, the Delaware Healthy Mother and Infant Consortium, Healthy Women Healthy Start, the Center for Family Health Resources & Epidemiology, the State Infant Mortality Collaborative, and the Anti-Racism Advisory Committee. All of these entities are currently working towards the same goal and collaboration among those seven organizations could foster a holistic plan for combating adverse birth outcomes. The Partnership will be referred to as the Delaware Health Equity Partnership. The fourth recommendation of prioritizing decreasing infant mortality among Blacks sets a baseline for the Delaware Health Equity Partnership to achieve success.

**SMART Strategic Plan**

When implementing these general policies a specific, measurable, attainable, relevant, and time-oriented (SMART) strategic plan has to be developed for implementation in Delaware. Success will be achieved if the Black-White gap in birth outcomes is closed by a factor of two in the time frame of ten years. The infant mortality rate found in the 2009 birth cohort linked birth-infant death files will be used as a reference point for evaluating success. The Center for Family Health Resources & Epidemiology will be charged with conducting this level of analysis. The time frame is double that of Boston, because Delaware does not have a grant model in place. Boston has both the REACH grant and Healthy Start program to foster partnerships with grantees that have to follow their anti-racism guidelines whereas Delaware acquires neither grant opportunity. This analysis does not jump to the

application process for these grants for several reasons. First, the combination of organizations that makes up the Delaware Health Equity Partnership mentions and acknowledges racism in some form, but does not explicitly state any interventions to specifically target racism. Therefore if the Anti-Racism Advisory Committee was added which is apart of the Partnership, then the acknowledgement of another cause to the problem may see improvements. The second reason is that the Delaware Partnership for Health Equity already has partnerships and established relationships with the community. Thus, through the creation of the Anti-Racism Advisory Committee and the training they administer could be passed along to these organizations, resulting in positive birth outcomes. The establishment of this Committee is somewhat of a pilot to assess if adding one branch can significantly decrease adverse birth outcomes. If the pilot shows improvements, but not to the extent desired, then the DDHP could decide whether to go through the REACH and/or Healthy Start application process. This analysis already describes how the grant model would be implemented, so that if this decision is made, there is already a plan already in place for it. Furthermore, it has to be acknowledged that when it comes to health improvements and especially when intervening on a cause like racial discrimination, the results will not be instantaneous, so time is of the essence.

Creating a Health Equity Initiative will be facilitated through the Delaware Partnership for Health Equity. The Partnership will seek behavioral changes in members of each neighborhood becoming more involved and speaking up about the changes they want to see in their community. The Partnership could also involve the Anti-Racism Advisory Committee to address the communities concerns pertaining to

racial discrimination. The overarching goal is to address racism through established partnerships in Delaware to promote optimal health for all.

Another vial task charges the Anti-Racism Advisory Committee to assess each neighborhood on their needs in order to be a healthy neighborhood. A threat is that a lot of people are involved in this process, which can make things complicated. However, if the Partnership outlines the goals and responsibilities of each collaborative partner, then Creating a Health Equity Initiative should run smoothly. There is a possibility of intuitional inertia due to a new committee assessing the collaborators. Each collaborator may not understand why a new committee was thrown into the mix. The Delaware Partnership of Health Equity must ensure their collaborators that the Anti-Racism Committee are experts in their field and can provide additional information on how to combat health inequities within each community. Overall, everyone has to work together in order to achieve a common goal. To ensure the success of this policy, the recommendations have mirrored those that the low birth weight brief conducted in Boston that had a positive impact on the inequity since 2008.

## Conclusion

In conclusion, Delaware has one of the worst infant mortality rates across the nation. Current policies have slightly lower infant mortality rates, but the overall Black-White gap in birth outcomes has continued to persist. Thus, new policy interventions were sought out through comparative institutional analysis. Through the commonalities and themes in two exemplars, four general policy recommendations were suggested. These general policies were then molded to the unique needs of Delaware through an implementation analysis. It was found that Boston has the most

effective policy to combat this inequity and that Boston's organizations as well as demographics is very similar to those in Delaware. After comparing Boston and Delaware, it was found that an additional branch to the Division of Public Health could potentially intervene specifically on the cause of racial discrimination. Through partnerships and the creation of an overall Delaware Health Equity Partnership, Creating a Heath Equity Initiative could lower the risks of infant mortality among Blacks.

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## Appendix A

## LEGAL ANALYSIS

This analysis will address how racial discrimination became such a prominent contributor to poor prenatal outcomes. One unintended contributor would be the Supreme Court of the United States of America. The court's role in racial discrimination is described through the facet that too much racial discrimination has been rendered constitutionally irrelevant by decisions of the Supreme Court. The Equal Protection Doctrine of the 14th Amendment to the U.S. Constitution fails to eliminate racial discrimination, thereby perpetuating racism and in turn producing poor health outcomes. This legal analysis will address how the Supreme Court's definition is too narrow to effectively help minorities to alleviate these inequities.

### Law Compliance with Discrimination

The original intent of the 14th Amendment was to help the freedman, meaning any African American that was a slave at one point in time, and establish them as a citizen of the United States. Extending citizenship to the freedman allowed for African Americans, like Dred Scott, to obtain basic human rights. The major objective of the amendment succeeded, although over time the flaws in the amendment to protect each individual's equality were discovered. The language of the amendment states that "no State shall…", which limits the protection of one's equality. If the federal government were to make a law in violation of the Equal Protection Clause, the amendment would not have the authority to strike it down.

Furthermore, the amendment only prohibits public discrimination, not private, allowing private entities the constitutional power to discriminate. In addition, the Equal Protection Clause does not automatically prohibit discrimination; the discrimination has to be proven as either purposeful or intentional. After this validation, then the plaintiff must justify that there is a case for the discrimination. The justification procedure was clarified by the construction of the hierarchy of scrutiny. Under this hierarchy there are three guidelines that would cause for more skepticism from the court: fundamental rights, political process, and discrimination both discrete and insular. For this analysis, the focus would be categorized as discrete and insular minorities. That categorization receives the highest level of scrutiny, which is referred to as strict scrutiny. This level of scrutiny contains a condition where the means and the ends have to match up perfectly. A reasonable or logical relationship between the two will not satisfy this condition; there has to be a compelling interest, meaning the government's interest has to be balanced against the individual's constitutional right to be free of the law. The combination of these unintended factors or interpretations of the 14th Amendment Equal Protection Clause has allowed the persistence of racial discrimination (Hayman, 1998).

**History of Racial Discrimination through Supreme Court Decisions**

The 14th Amendment of the United States of America Constitution had originally intended to combat racial discrimination. However, over time the amendment was constantly reinterpreted. Those interpretations built onto one another creating the legal construction that lies before us.

The foundation of this legal construction was molded by the first major case in 1856. In Scott v. Sandford (60 U.S.C. 393), it was declared that all American

Africans, whether free or enslaved, were not citizens of the United States of America. Thus, the Constitution did not apply to them and excluded them from any human rights. Furthermore, the deliverance of this opinion invoked discrimination that was not commonly felt by the colored men living in New England States. They had actively exercised their right of suffrage, but that right would now be revoked in result of this opinion. Chief Justice Taney acknowledged that the hierarchy of races had to be maintained in order for society to continue and if restricting citizenship were the answer, then he would provide it (Hayman, 1998).

This case predated the establishment of the 14th Amendment. However, it sets the precedent for how discrimination was structured into society as well as the Constitution. Racial discrimination was declared the law of the country and all, whether it was a free or a slave state, had to abide by it. In his dissent, Justice McLean explains how the framers thought that slavery would fade out. Due to that assumption, the terms freedmen or colored were never included in the Constitution, so that there would not be a legal distinction between the two. However, due to the lack of language, Chief Justice Taney concluded that African Americans were purposefully not included in the Constitution and thus not citizens. His opinion poured the foundation for the racial hierarchy that it would abide by. Following this case, the 14th Amendment was established, which returned citizenship to men among all races (Hayman, 1998).

Fast-forwarding to 1883, our next major case is the series of Civil Rights Cases (109 U.S. 3). These cases were important to the persistence of racial discrimination in two ways: by the three distinctions made and the declaration of conclusion to the reconstruction. The first distinction made was slavery is distinct from racial

discrimination. Since the 13th Amendment prohibited slavery, there was no need for another amendment to reference the phenomenon of slavery. The second distinction was public action is distinct from private action. Therefore, the 14th Amendment only applied to the actions of state officials, not individuals. The third distinction was the redress of action is distinct from primary measures in the face of inaction. Thus, Congress only obtained the power to respond to the wrongful actions of the state, but could not act affirmatively. These three distinctions limited the amount of people protected, revoked any proactive laws, and permitted discrimination among private actors. After this ruling, the Amendment allowed for a great deal of racial discrimination. Furthermore, Justice Bradley depicted this Amendment as powerless and there was nothing anyone could do to change it, because the reconstruction of the Constitution was over (Hayman, 1998).

Our next major case is Plessy v. Ferguson (163 U.S. 537). The opinion of the case was delivered in 1896 that established the separate but equal doctrine. It was said that no discrimination was present, because there were railcars for everyone even if their mode of transportation was separated by their race. In delivering the opinion Justice Brown took a step further in stating that this is natural. Race is biological and biologically there are superior and inferior races. Racism comes as part of this natural order. This order is intended by nature and by god, thus nothing can change it. He also stated that he has nothing to do with their sense of inferiority. Blacks are creating that sense themselves and as for the law, the law cannot remove that badge; they have to, because they made it (Hayman, 1998).

The separate but equal doctrine took racial discrimination to the next level. Not only was it constitutional, but it was also natural. The order is natural, because

Whites by nature are superior to Blacks. Justice Brown validated the social construct of race by scientific evidence and the reassurance of god. Therefore, the superiority and inferiority of race was constructed on these false merits and thereafter internalized by all Americans, holding no exception for Whites. The separation of races by different rail cars was to remind Blacks of their inferior status to Whites. It was a message that Blacks were powerless; so powerless that they lacked the choice of their location on a rail train. But this also provided a message to Whites that even if you were poor, you were still better off than Blacks. Any thought of retaliation should be forgotten, because you do not want to end up like them. Thereafter race became more important than class. Although it made and maintained classes by preserving the vital slavery that was needed to keep the hierarchy as well as economic stability. This way labor would stay cheap and Blacks would stay disadvantaged (Hayman, 1998).

Earlier in this paper it was explained how researchers continued to search for this biological understanding of the problem. This thought process originated through the racial construct built by the words of Justice Brown. Americans agreed and believed the words of Justice Brown and those beliefs still carry weight to this day. Scholars are still searching for this scientific confirmation that outcomes between races are different due to the biological difference in the color of skin.

The separate but equal doctrine would remain for a half of a century. Within that 50-year span another major case occurred, United States v. Carolene Products Co. in 1938 (304 U.S. 144). The court declared that the 14$^{th}$ Amendment could not be applied to this case, since it was against the federal government. This ruling mirrored the opinion of the Civil Rights Cases of 1883 (109 U.S. 3) stating that the Amendment only applies to state actors. However, Justice Stone feared that the court was giving

the government too much power and discretion. Thus, he explained that in ordinary cases the court would defer to the legislature, giving the plaintiffs the burden of justification. However, that would not be the case if the plaintiff fit into a particular category described in footnote four of the opinion. Footnote four indicated three guidelines that would cause for more skepticism from the court: fundamental rights, political process, and discrimination both discrete and insular. The court decided to adopt these categories in creation of a hierarchy of scrutiny. Justice Stone determined that discrete and insular minorities would be subject to the highest level of scrutiny, also known as strict scrutiny. This elevated level of scrutiny was intended to decrease racial discrimination (Hayman, 1998).

Sixteen years later, the separate but equal doctrine was overturned in Brown v. Board of Education of Topeka, Kansas, referred to as Brown I (347 U.S. 483). In 1954, Justice Warren struck down Plessy v. Ferguson (163 U.S. 537) stating that it is unconstitutional to segregate in public schools. He expressed the notion of viewing segregation and the consequences it has had in the context of the present day. One year later, Brown I was revisited to address the state's concerns on how to desegregate, which is referred to as Brown II (349 U.S. 294). These concerns were taken into account in the deliverance of the opinion. This opinion did not render the same hope that Brown I inspired. It was loaded with phases such as "good faith", "practicable date", and "all deliberate speed", which are all very vague and unrestricted. The opinion projected a feeling that desegregation was unimportant and unlikely to occur. The two cases together were one step forward and five steps back in regards to eliminating racial discrimination in a public school setting (Hayman, 1998).

More steps towards the decline of racial discrimination came in Loving v. Virginia (1967). Virginia had a state law prohibiting interracial marriage. Purposeful discrimination was proven in this case due to discrimination on its face given that Blacks were not allowed to marry Whites. Thus the hierarchy of scrutiny from footnote four of United States v. Carolene Products Co. (304 U.S. 144) opinion was utilized in this case. The justification was also achieved due to under inclusiveness, since the only interracial marriage prohibited were those involving White persons. Justice Warren stated this was a law to maintain White Supremacy. Therefore he struck down the interracial marriage law. The past three major cases, excluding Brown II, invoke a sense that racial discrimination was on track towards elimination (Hayman, 1998).

This track is soon detoured in the case of Washington v. Davis in 1976 (426 U.S. 229). Harley and Sellers argued that Test 21, a test that measured verbal ability, vocabulary, and reading comprehension for acceptance into the District of Columbia Police Department, was discriminatory on the grounds that the ratio of Whites to Blacks passing the exam was 4:1. Therefore the exam was disadvantaging Blacks at a higher ratio preventing job access. Justice White delivered the opinion stating that impact does not equal discrimination. The plaintiffs would have to prove that the discrimination was intentional by the makers of the test to disadvantage Blacks. He elaborated that the test is neutral and contained no signs of facial discrimination. It was no ones fault that Blacks performed worst on the exam than Whites. Furthermore, Justice White refused to open the can of worms that a statue designed to serve neutral ends is nevertheless invalid if in practice it benefits or burdens one race more than another. His fear was any agreement to this notion would raise serious questions

about other statues that may be more burdensome to the poor and the average Black, than the more affluent White. Therefore the court ruled that the plaintiff failed to prove discrimination, because they did not show that the makers of the test were malicious and intentionally attempting to negatively affect African Americans (Hayman, 1998).

This case begins to depict how difficult it is to prove purposeful discrimination when the law, exam, etc does not explicitly say Blacks cannot, for example, become a police officer. Such cases would not be as easy to prove as the previous case, Loving v. Virginia. The hierarchy of scrutiny exists, but the plaintiff still has to prove purposeful discrimination before it can even come into play. The act of proving malice and intentional discrimination by an actor is near impossible. Therefore legally sanctioned racial discrimination would continue to persist.

Eleven years later, there was another attempt to prove purposeful discrimination that was not facially discriminatory in McCleskey v. Kemp (481 U.S. 279, 1987). In attempting to prove discrimination, McCleskey provided the court with a Baldus study, conducted by jurists David C. Baldus, Charles Pulaski, and statistician George Woodworth, which concluded that all individuals convicted of murdering whites were more likely to receive the death penalty. Justice Powell answered his plea with the explanation that a defendant who alleges an equal protection violation has the burden of proving the existence of purposeful discrimination. The study contains no proof that there was a discriminatory effect on him. Thereafter, McCleskey suggested that the state as a whole acted with discriminatory purpose. Justice Powell responded to McCleskey's claim in that it takes into serious question the principles that underlie

the entire criminal justice system. If this claim were accepted, then he would have opened a large can of worms that would not have been easy to close (Hayman, 1998).

In this case, like that of Washington v. Davis (426 U.S. 229), there was no facial discrimination. McCleskey thought the Baldus study would hold enough evidence, but since he, himself, was not included in the study, the study as well as McCleskey failed to provide the discrimination the court requires. McCleskey was thereafter sentenced to the death penalty. Here again the hierarchy was of no use, since discrimination was not proven in the eyes of the court (Hayman, 1998).

The next major case occurs in 2007, Parents Involved in Community Schools v. Seattle School District No.1, (551 U.S. 701) reverts any progress that was made since the desegregation opinion in 1954. In this case, the hierarchy of scrutiny was finally utilized due to the fact that the government distributed burdens or benefits on the basis of individual racial classification. This case was now subject to strict scrutiny. Any use of race must be narrowly tailored to a compelling interest. The compelling interest can be satisfied in one of two ways: (1) it has to uphold diversity or (2) it has to remedy the effects of past intentional discrimination. It was found that there was not a compelling interest. Promoting diversity did not stand, because diversity only has to be promoted in a higher education context according to the opinion of Grutter v. Bollinger (539 U.S. 306) in 2003. Since the public schools in questions are not those of higher education, then the compelling interest was not upheld. The court also rejected remedying discrimination, because there was never de jure (a type of segregation that the state intentionally set to enforce racial segregation) in Seattle. The law did not exist, so there was no need for a remedy (Hayman, 1998).

If there was a need for a remedy, the remedy could not be over inclusive or under inclusive. Therefore the remedy would have to be in perfect alignment with those who were affected. Every victim of discrimination and only victims of discrimination could be included in this plan. This definition extremely complicates any attempt to construct a remedy, so this will enviably always be struck down. In addition, there is not a lot of de jure discrimination left in the United States, so that compelling interest will be highly unlikely to satisfy. Following this ruling, schools have reverted back to segregation leaving some areas completely segregated. All the momentum started 61 years ago has only reverted back to its original form, allowing for young minds to be subject to the ways of the past and maintaining racial discrimination for the future (Hayman, 1998).

**Definition Too Narrow to Help Minorities**

The history of these cases highlight just how narrow the definition of discrimination is in the Supreme Court setting. The court starts by constructing the hierarchy of superior and inferior races. The 14th Amendment is then established to generate citizenship for all, as well as the hope to project equality. However, the Equal Protection Clause of the 14th Amendment has several limitations, including the amount of people it can protect, the inability to invoke proactive laws, and the condoning of discrimination among private actors. The separate but equal doctrine is created and upheld in the existence of the Amendment until it is struck down 50 years later. Within that time period, the court attempts to promote equality again by creating a hierarchy of scrutiny, which advanced racial classifications to the highest possible level of scrutiny. Although this hierarchy is also proven to be ineffective. This was illustrated in two cases where the case lacked the presence of facial discrimination; so

proving purposeful discrimination was near impossible. The proof of malice and intentional discrimination is unreasonable due the fact that humans lack the ability to read someone's mind. Even when the case is subject to facial discrimination and granted the highest level of scrutiny, there has to be a compelling interest. One compelling interest only works in the context of higher education. The other interest lacks the location as well as a remedy that can fit the tall order of being perfectly aligned with those who have been discriminated upon. This historical legal analysis describes how an Amendment that is intended to help minorities in reality results in perpetuating the discrimination it was created to strike down.

Coming full circle, if a plaintiff was to bring the inequity in birth outcomes to the Supreme Court the court would rule that impact was insufficient in proving purposeful discrimination. Thereafter the case would be dismissed. Congress has the responsibility to pass a new or revised constitutional amendment/law to close the loopholes that have sprung in the 14th Amendment.

## Appendix B

## GIS ANALYSIS

### Conceptual Model

Governor Ruth Ann Minner initiated The Infant Mortality Task Force in May of 2005. The Task Force is charged with providing an annual report of activities as well as progress to the Governor. The 2005 annual report stated that Delaware's infant mortality trend resembles a southern state as opposed to the surrounding, affluent East Coast states ("Reducing infant mortality," 2005). The first spatial analysis tests this statement to illustrate if there is high-high and low-low clustering for overall, Black, and White infant mortality rate. The results of this analysis would demonstrate if cluster patterns were statistically significantly higher or lower infant mortality rate among surrounding states; and therefore could show states that could possibly benefit from a policy intervention.

The second spatial statistic analysis attempts to explain the persistently elevated death rate among Blacks. Low birth weight, a common determinant of infant mortality was utilized. Low birth weight is one of the top two leading causes of infant death. Therefore, analyzing the distribution of low birth weight may paint a more elaborate picture of its contribution to infant death. This analysis will also provide an explanation as to whether the clusters of low birth weight occur at random.

A theorized association between low birth weight and chronic hypertension, a proxy for psychological stress from racial discrimination, will be included in the spatial analysis. Stress from racial discrimination is thought to contribute to adverse

birth outcomes, including lower birth weights. Maps will be constructed to visualize the distribution of chronic hypertension as well as low birth weight between Blacks and Whites. Those maps will then be tested to assess if the autocorrelation could be the result of random chance. After the autocorrelations are computed, the rates of low birth weight and chronic hypertension will be analyzed for Delaware exclusively. This analysis will assess if there is a high or similarly matching prevalence of both low birth weight and chronic hypertension within the state of Delaware. Overall, the second part of the spatial statistics analysis will examine if there is an autocorrelation within an independent variable (chronic hypertension) and dependent variable (low birth weight) that is contributing to the corresponding infant mortality rate for that state.

**Data**

The first spatial statistic analysis draws on publicly available Infant Mortality Rate Data from The Henry J. Kaiser Family Foundation. The Kaiser Foundation extracted Period Linked Birth-Infant Death Data from 2008-2010 from Vital Statistics to compute the infant mortality rate for each state along that time period ("Infant mortality rate," n.d.). Infant mortality rates were computed for each state and then stratified by race. This data set was chosen, because it contained racially stratified infant mortality rates for each state. These infant mortality rates were the most recent as well as the only option given by the organization. This data set will demonstrate which states have the highest racial and overall infant mortality rate that could possibly benefit from a policy intervention.

The second GIS spatial statistics analysis draws on publicly available natality (counts of live births) data for the six years of data used later in both statistical

analyses. This data was extracted from the Centers for Disease Control and Prevention, which encompasses data from the National Center for Health Statistics on Natality Data for years 2004-2009. The data set consists of a representative sample of births for the location variable selected through that time period. ("About natality, 2003-2006," 2015) ("About natality, 2007-2012," 2015). A total of 10,421 individual cases were available in datasets from 2004 to 2009. Each year included a sample size ranging from 1,702 to 1,759 individuals. These six years of data files were chosen for several reasons. First, the data set used later for both statistical analyses does not include a location variable after 2005. Thus, to obtain a location variable to map the prevalence of low birth weight and chronic hypertension among the years studied, another data set had to be utilized. Second, this data set includes a sample of the same births that are used in later analyses. The overarching goal of this analysis is to illustrate the relationship between race, chronic hypertension, and low birth weight as well as testing the illustration to examine if there is a spatial correlation between the two variables.

This GIS analysis poses the following research questions: Is Delaware a hot spot for high risk of infant mortality among surrounding lower risk states? Is there a spatial autocorrelation between the distribution of low birth weight and chronic hypertension? Are Whites and Blacks distribution of birth outcome and maternal risk statistically significant? Two hypotheses are inferred: Chronic hypertension will be spatially significant among Blacks, but not Whites. Chronic hypertension will mirror the spatial distribution of low birth weight among Blacks, but not Whites.

## Analyses

For the first analysis, Getis-Ord General G spatial statistic test will be performed to assess the high to low clustering of infant mortality across the nation. Delaware and its surrounding states will be the main focus of this analysis to determine if Delaware has an unmet need for policy intervention.

For the second analysis, Morans I global spatial statistic autocorrelation test will be performed to determine if low birth weight and chronic hypertension are spatially clustered by random chance. The neighboring distance was set at 1,000 miles, so that larger states in the West could have a distance large enough to include their neighbors.

## Results

In the overall IMR for the United States, there seemed to be patterns of high and low clustering. After running the General G test, it was found that given a z-score of 3.16, there is less than a 1 percent likelihood that this high-clustered pattern of overall IMR, could have been a result of random chance. As seen in Figure 13, Delaware is apart of this high-clustering pattern and therefore may benefit from policy intervention.

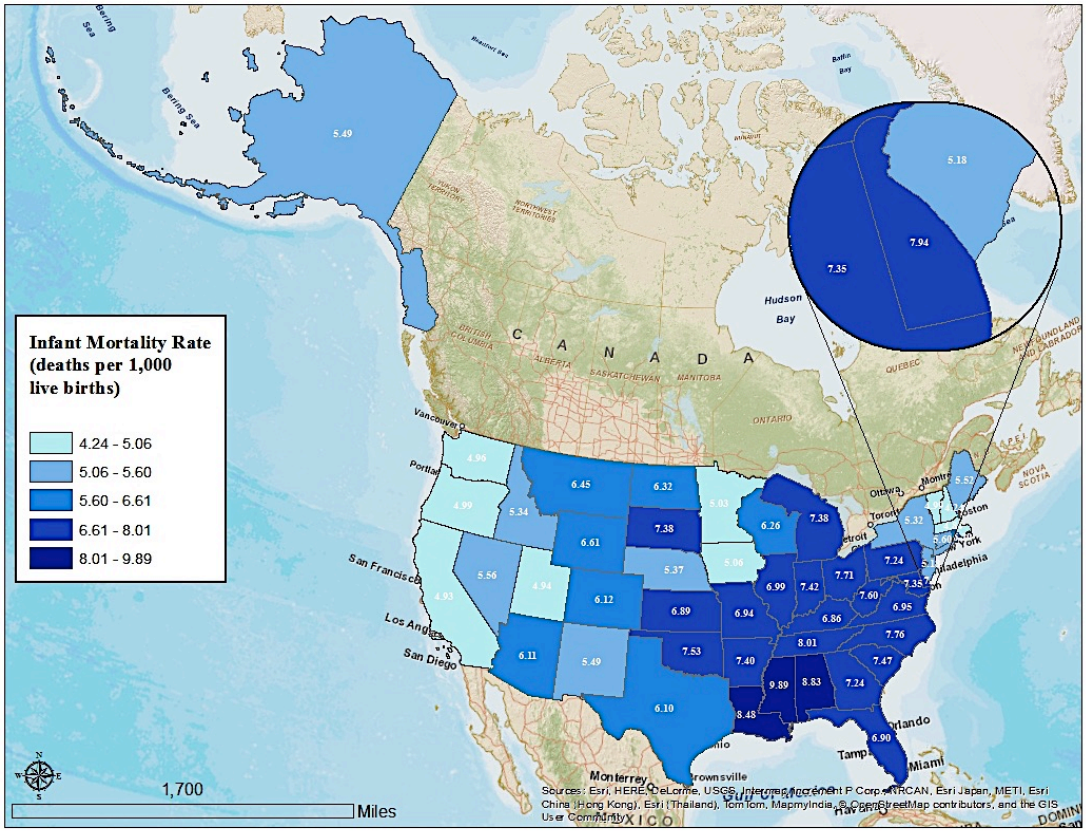


Figure 13 Overall U.S. Infant Mortality Rates, 2008-2010.

Among Blacks, there seemed to be areas of high clustered IMR. Given the z-score of 4.33, there is less than a 1 percent likelihood that this high-clustered pattern of Black IMR, could have been a result of random chance. Delaware seems to be one of the higher-clustered groups (Figure 14).

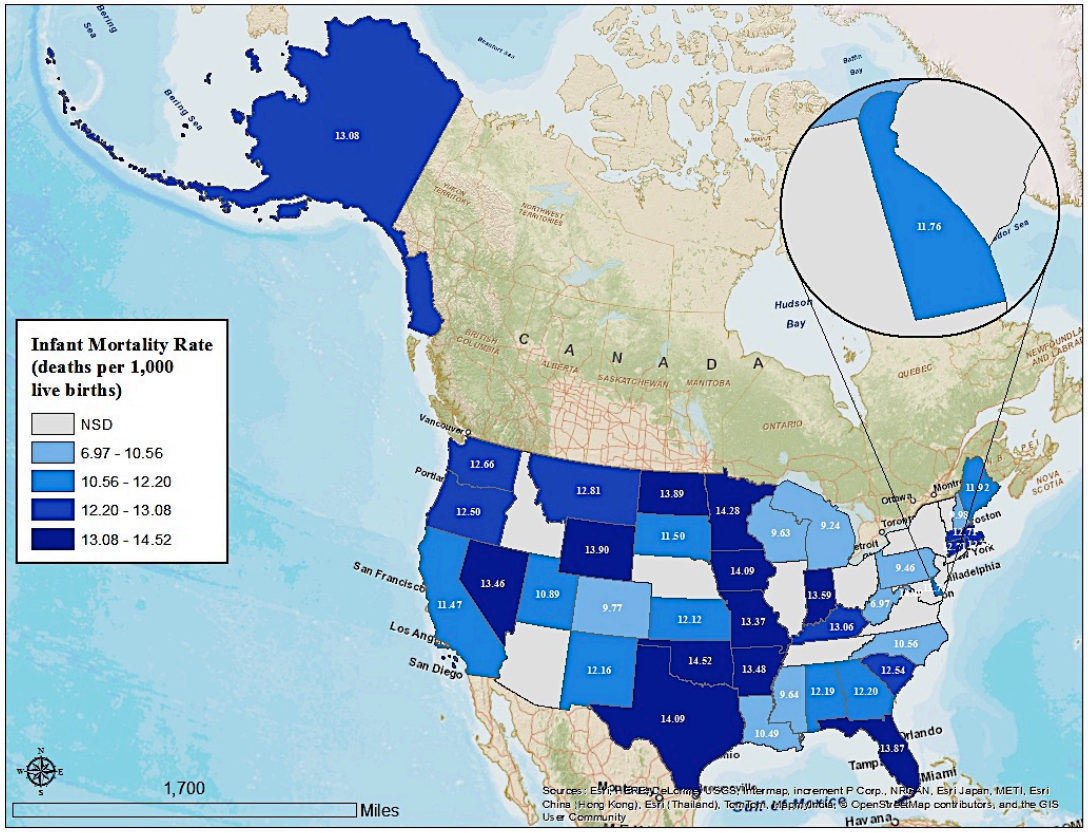


Figure 14 Infant Mortality Rates among Blacks, 2008-2010.

Among Whites, there seemed to be random clusters of IMR. Given the z-score of 1.22, there does not appear to be a pattern significantly different than random clusters. This finding was insignificant. Delaware is among states with the lowest IMR (Figure 15).

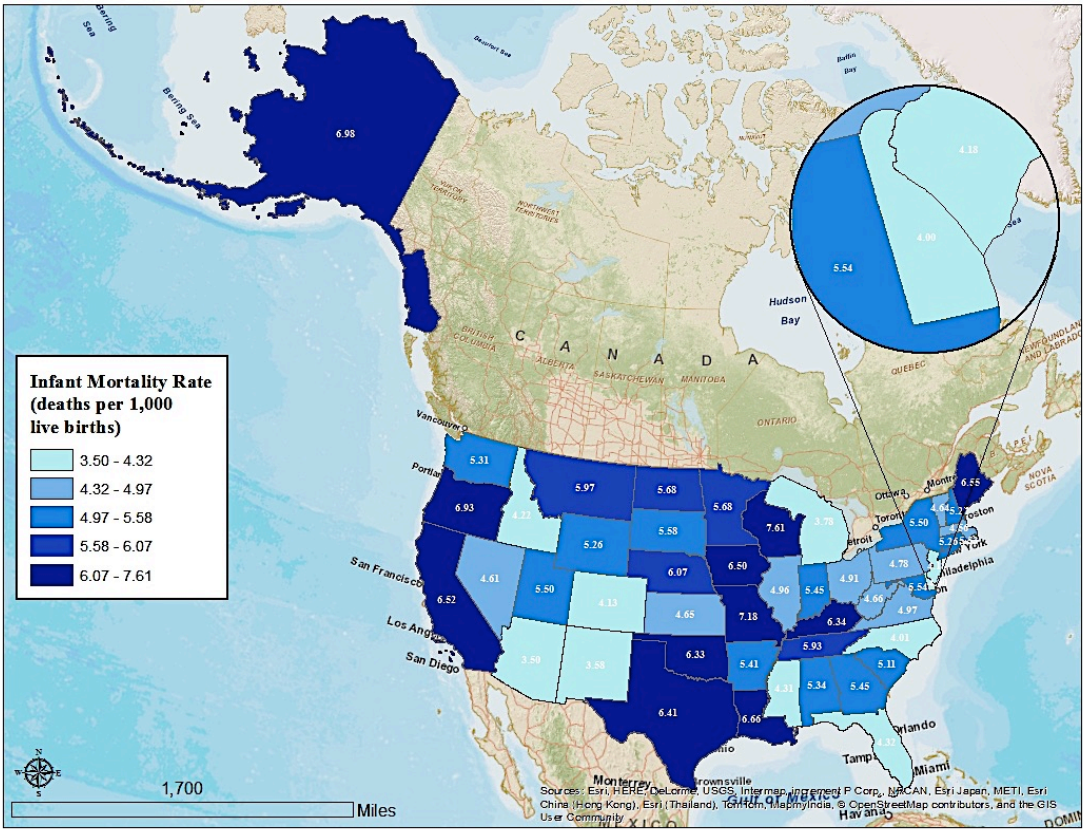


Figure 15 Infant Mortality Rates among Whites, 2008-2010.

In the six years studied, 42 percent of the individuals identified as Black and 58 percent identified as White. There was a 31 percent prevalence of chronic hypertension and 40 percent prevalence of low birth weight. Among chronically hypertensive mothers, 12 percent were Black and 19 percent were White. 17 percent of Black mothers and 23 percent of White mothers had a low birth weight delivery. Only 49 states were valid for this spatial analysis, since Hawaii and Alaska do not have neighboring states.

All six years were given a z-score of greater than three, so there is less than 1 percent likelihood that this clustered pattern of Black, low birth weight infants could have been a result of random chance (Table 36). Thus, nearby states have similar Black, low birth weight rates, which indicate global spatial clustering. States neighboring within a 1,000-mile radius have similar low birth weight rates among the Black population.

Table 36 Moran's Index of Spatial Autocorrelation for Low Birth Weight among Blacks

| LOW BIRTH WEIGHT AMONG BLACKS | | | | | | |
|---|---|---|---|---|---|---|
| YEAR | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| MORAN'S INDEX | 0.17 | 0.21 | 0.23 | 0.21 | 0.24 | 0.25 |
| Z-SCORE | 3.72*** | 4.40*** | 4.87*** | 4.50*** | 4.99*** | 5.19*** |

*** Significant at p<.01

Since all years were spatially significant, the most recent year, 2009, of low birth weight among Blacks is displayed (Figure 16). Within this map, there are clusters of higher rates of low birth weight in Southern states (Florida, Mississippi, Louisiana, Alabama, Georgia, and South Carolina), Northeastern states (Delaware, Maryland, Pennsylvania, New York) and Midwestern states (Missouri, Illinois, and Arkansas). A cluster of the lowest rate of low birth rate contains Idaho, Montana, Wyoming, North Dakota, and South Dakota. Given a z-score of 5.19, there is less than a 1 percent likelihood that these low and high clustered patterns of Black, low birth weight infants could have been a result of random chance.

The inset map of Delaware shows that Delaware is one out of eight states with the highest rate of low birth weight among Blacks. Two of Delaware's neighboring states Pennsylvania and New Jersey, have slightly lower rates of low birth weight.

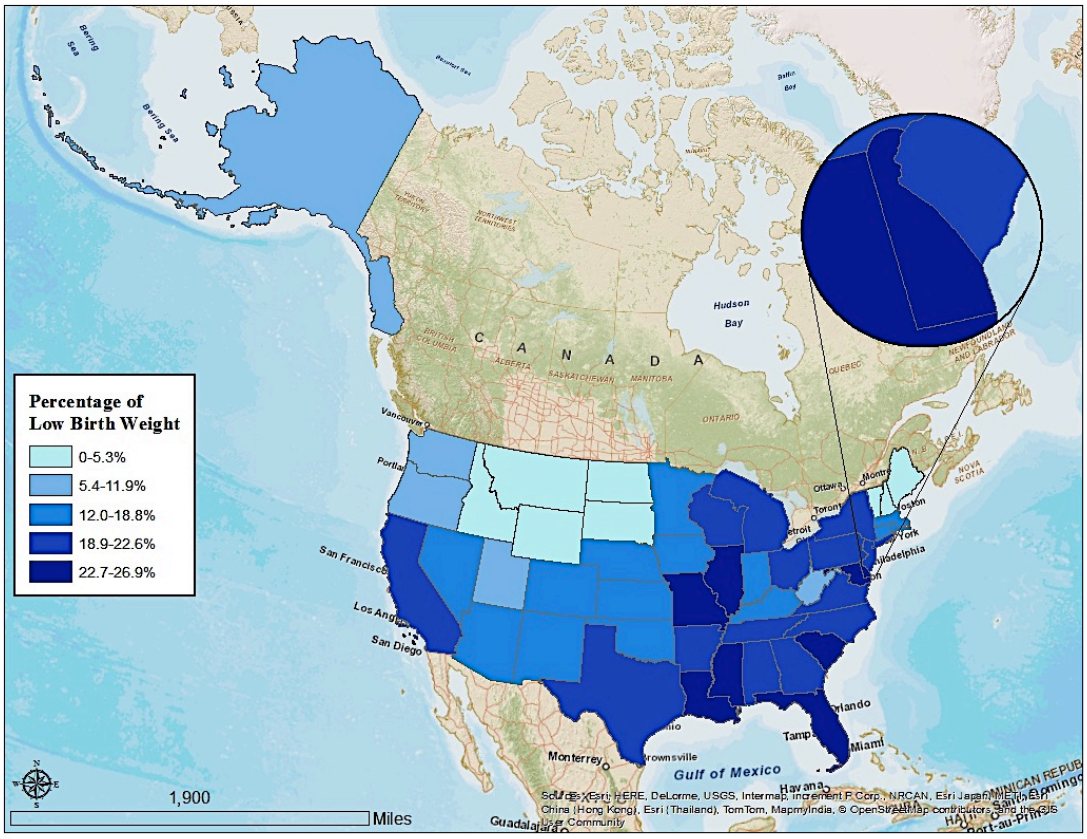


Figure 16 Low Birth Weight Infants Among Blacks, 2009.

For every year with the exception of 2008, the low z-scores demonstrate that the pattern of low birth weight among White mothers does not appear to be significantly different (Table 37). The distribution of White mothers who have a low birth weight delivery seem to be geographically located by random chance. Therefore,

the low birth weight rates among White mothers are dissimilar to the nearby states. The z-score of 1.82 for 2008 data on White mothers who had a low birth weight infant there is less than 10 percent likelihood that these low and high clustered patterns of White, low birth weight infants could have been a result of random chance. Even though, the z-score is significant at a 90 percent confidence, the statistic is not as strong as a z-score greater than three.

Table 37 Moran's Index of Spatial Autocorrelation for Low Birth Weight among Whites

| LOW BIRTH WEIGHT AMONG WHITES | | | | | | |
|---|---|---|---|---|---|---|
| YEAR | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| MORAN'S INDEX | -0.01 | 0.05 | 0.02 | 0.06 | 0.07 | 0.03 |
| Z-SCORE | 0.26 | 1.28 | 0.7 | 1.47 | 1.82* | 0.88 |

* Significant at p<.10

Even though 2008 was the only year that the spatial autocorrelation was remotely significant, the 2009 map was included as the visual for this analysis (Figure 17). The choice of the inclusion of this map opposed to the 2008 occurred for several reasons. First, the z-score was not greater than three. Thus, Moran's Index had a substantially lower significance compared to the Black low birth weight maps. Second, the maps serve an additional purpose of comparing low birth weights as well as chronic hypertension among races and variables. The same years had to be maintained for the best compatibility.

When viewing the map, there seems to be a reverse prevalence of low birth weight infants in comparison to Blacks. However, states such as Missouri Oklahoma, Kansas, and New Mexico have a high or similar rate of low birth weight between the two races. There seems to be higher rates of low birth weight among Western and Midwestern states as well as lower rates among Southern states. However, these visualizations are not statistically significant.

Delaware falls into the next to lowest low birth weight natural breaks category accessed through GIS software. Thus the low birth weight population in Delaware is highly skewed by the inclusion of Blacks, who have a substantially higher percentage of this adverse birth outcome. Two of Delaware's neighboring states have the same level of White low birth weight deliveries.

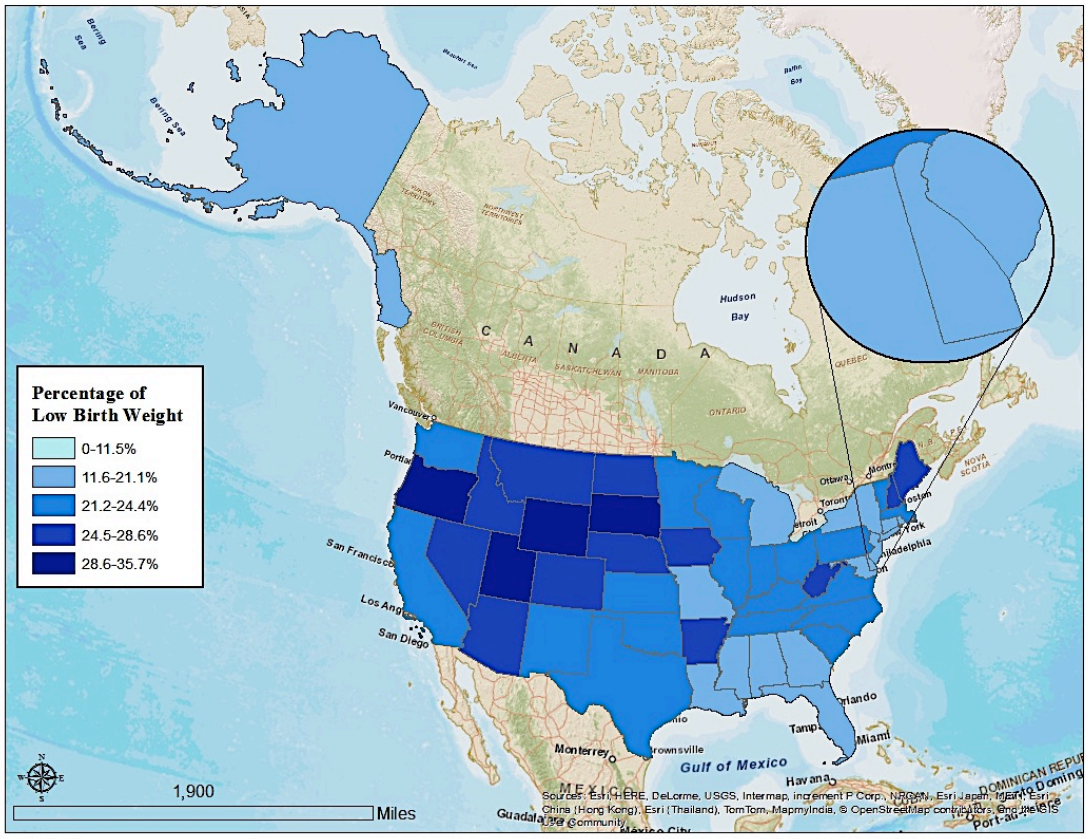


Figure 17 Low Birth Weight Infants Among Whites, 2009.

All six years, provided a z-score that was greater than three. So there is less than 1 percent likelihood that this clustered pattern of chronically hypertensive Black mothers could have been a result of random chance (Table 38). Thus, nearby states have similar distributions of chronically hypertensive Black mothers, which indicate global spatial clustering. States neighboring within a 1,000-mile radius have similar rates of chronic hypertension among the Black mothers.

Table 38 Moran's Index of Spatial Autocorrelation for Chronic Hypertension among Blacks

| CHRONIC HYPERTENSION AMONG BLACKS | | | | | | |
|---|---|---|---|---|---|---|
| YEAR | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| MORAN'S INDEX | 0.27 | 0.21 | 0.20 | 0.22 | 0.22 | 0.23 |
| Z-SCORE | 5.21*** | 4.45*** | 4.23*** | 4.57*** | 4.64*** | 4.74*** |

*** Significant at p<.01

2009 was maintained as the year for geographical display (Figure 18). All years, including 2009 were spatially significant. There are clusters of higher rates of low birth weight throughout the Southern states (Texas, Mississippi, Louisiana, Tennessee, North Carolina, and South Carolina), Northeastern states (Delaware, Maryland, Pennsylvania, New York, New Jersey) and Midwestern states (Wisconsin, Illinois, and Michigan). A cluster of the lowest rate of low birth weight contains Idaho, Montana, Wyoming, Utah, North Dakota, Nebraska, Oregon and South Dakota. Given a z-score of 4.74, there is less than a 1 percent likelihood that these low and high clustered patterns of chronically hypertensive Black mothers could have been a result of random chance. Overall, the distribution of Black chronic hypertension was very similar to the distribution of Black low birth weight geographically. It could be assumed that the prevalence of chronic hypertension is associated with the risk of low birth weight among Blacks both generally and spatially.

Delaware ranked within the second highest category for Black mothers with chronic hypertension. Delaware's neighboring state, New Jersey, had the same level of Black chronic hypertension.

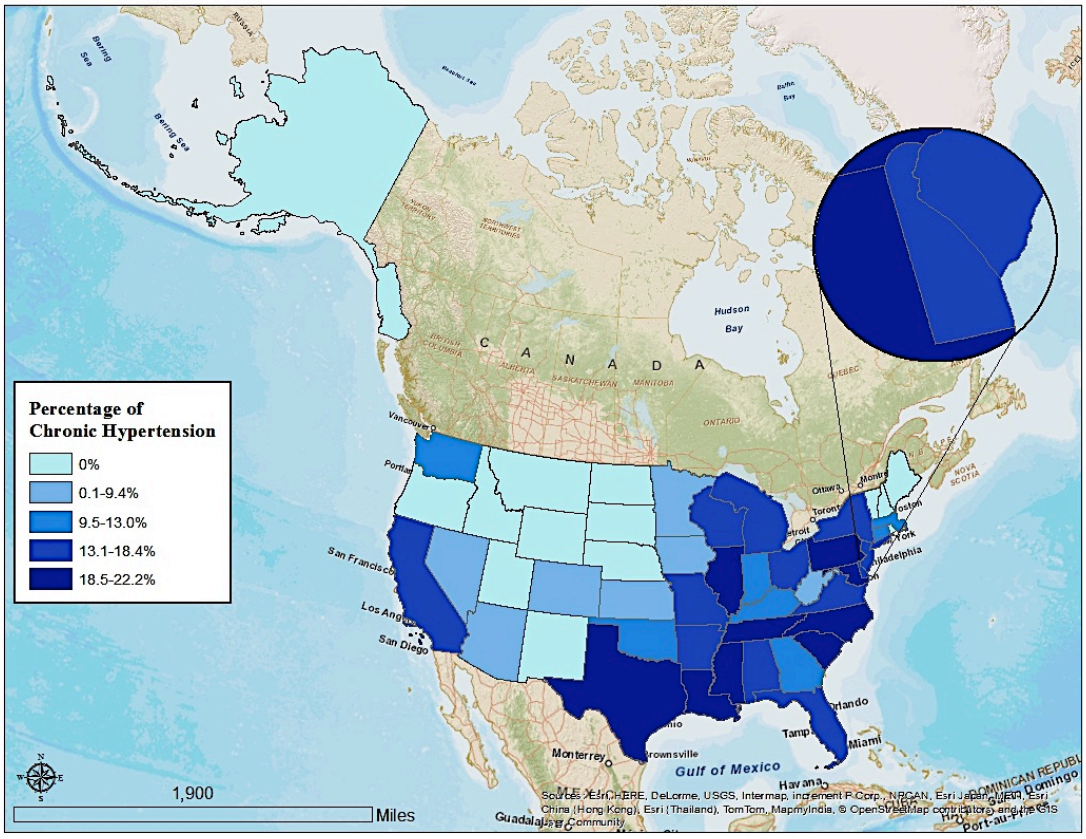


Figure 18 Chronic Hypertension Among Black Mothers, 2009.

A z-score of 1.93 in 2007 and 1.75 in 2008 meant that there is less than 10 percent likelihood that a clustered pattern of chronically hypertensive White mothers could have been a result of random chance (Table 39). However the statistic for those years is not as strong as a z-score greater than three. For the most part, the distribution of chronically hypertensive White mothers seem to be geographically located by random chance. Thus, the prevalence of chronic hypertension among White mothers is dissimilar to the nearby states.

Table 39 Moran's Index of Spatial Autocorrelation for Chronic Hypertension among Whites

| CHRONIC HYPERTENSION AMONG WHITES | | | | | | |
|---|---|---|---|---|---|---|
| YEAR | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| MORAN'S INDEX | 0.00 | 0.06 | -0.01 | 0.08 | 0.07 | 0.05 |
| Z-SCORE | 0.39 | 1.63 | 0.19 | 1.93* | 1.75* | 1.36 |

*Significant at p<.10

Looking at the map, there seems to be a higher prevalence of chronic hypertension across the nation (Figure 19). Three states in total (Wyoming, Georgia, and Montana) make up the two lowest categories of chronic hypertension among White mothers. There also seems to be a reverse of values of chronically hypertensive White mothers compared to Black mothers in some states. However, this map has an overwhelming elevated rate of chronic hypertension within all states. It is noted that the visualizations seen throughout this map are not statistically significant.

Delaware falls into the middle category for White chronically hypertensive mothers. Two of Delaware's neighboring states (New Jersey and Maryland) had the same level of White chronically hypertensive mothers. The year 2009 was used over 2007 and 2008, because those years had a low significance and the maps needed to be comparable overall. Comparing low birth weight and chronic hypertension among Whites side by side does not seem to follow any common pattern. Therefore, it is assumed that White chronically hypertensive mothers is not geographically associated with the prevalence of low birth weight.

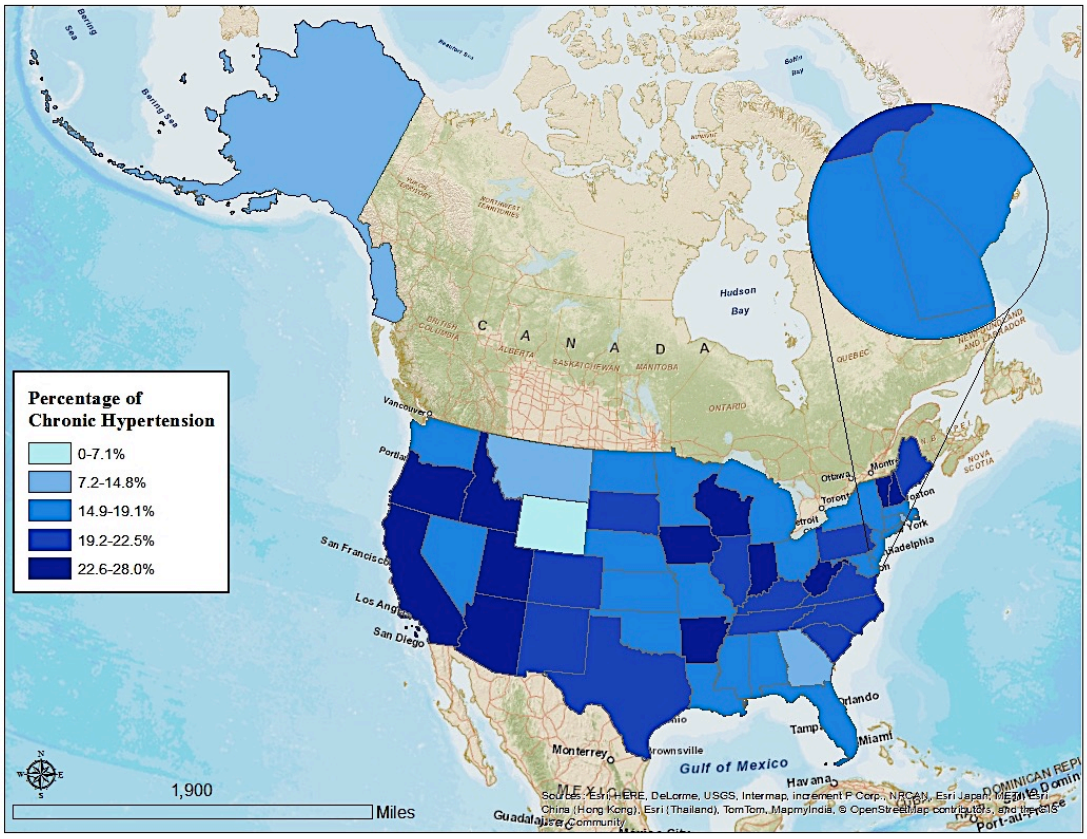


Figure 19 Chronic Hypertension Among White Mothers, 2009.

## Discussion

The Getis-Ord General G spatial statistic found patterns of high-clustered areas among overall and Black IMR. The White IMR was found to be insignificant. The pattern since is useful for demonstrating states that could benefit from policy interventions. Delaware fit this criterion

Overall, the Moran's Index spatial autocorrelation found that low birth weight and chronic hypertension among Blacks had less than a 1 percent likelihood that these low and high clustered patterns could have resulted from random chance. This significance was maintained throughout the six years studied. The result of this test

confirmed that the patterns on seen within the two maps are statistically significant. This allows for educated inferences to be made about the study population. On the other hand, White low birth weight and chronic hypertension population's autocorrelations were slightly significant or not significant. This result demonstrates that this population is geographically located by random chance.

When the focus turned to Delaware, two statistically significant patterns can be inferred. Delaware was one of eight states with the highest low birth weight among Blacks. Of its three surrounding neighbors, Delaware had a higher rate of low birth weight among two of the three states. Delaware also had the second highest prevalence of chronic hypertension among Blacks. Two of the three surrounding states had a higher prevalence of chronic hypertension than Delaware. Even though the statistics are not significant Delaware had next to the lowest rate for low birth weight and placed in the middle for prevalence of chronic hypertension among Whites. The same two surrounding neighbors (New Jersey and Maryland) were in the same low birth weight and chronic hypertension categories. From these results it can be assumed that Delaware has high rates of both chronic hypertension and low birth weight among Blacks. In addition, Blacks in Delaware have the highest rate of conceiving a low birth weight infant among neighboring states. There is a possible association between maternal chronic hypertension and low birth weight infants among Blacks in Delaware.

A side-by-side comparison of low birth weight and chronic hypertension maps were analyzed. Among Blacks, the geographic distribution of chronic hypertension closely mirrored the distribution of low birth weight. It is assumed that the similarities in distributions both generally and geographically are seen due to an association

between chronic hypertension and low birth weight. It could be the case that chronically hypertensive Black mothers are giving birth to low birth weight infants at a higher rate than chronically hypertensive White mothers. There is also a possibly that chronic hypertension has a different affect on Black mothers, opposed to White mothers when it comes to adverse birth outcomes. This phenomenon is predicted due to the overall higher prevalence of chronic hypertension among Whites, but a lower rate of low birth weight. For example, Wyoming has the highest rate of low birth weight and is also the lone state with the lowest rate of chronic hypertension across the nation, among Whites. Further statistical analysis involving logistic regressions should be performed to test the association of chronic hypertension and low birth weight infants.

Even though there seems to be no constant spatially significance between low birth weigh and chronic hypertension among Whites, the year 2008 should be analyzed further. For the year 2008, both chronic hypertension and low birth weight were somewhat significant for Whites. Since this is the only year low birth weight was remotely significant and happened to be significant in the chronic hypertension population as well, it may be of interest to assess what happened in 2008 for both rates to become remotely significant.

The first statistical analysis used period linked birth infant death files to calculate the infant mortality rates for each state. This data set contained several limitations. One limitation is that the rates were computed from period linked rather than birth cohort data set. The birth cohort data set, used in later analysis, is preferred over the period linked data set, because the birth cohort follows that the infant from the time of birth to the time of death whereas the period linked counts all infants that

were born within that year and all infants that died in that year. Therefore the period linked data set could over include births and under include deaths.

The second limitation is only one time period was available from 2008-2010. The three years of infant mortality were combined to create one rate for each state. Therefore there was no way to select the infant mortality rate for 2009 exclusively. Even though 2009 is included in the infant mortality rate, the maps from this analysis are not perfectly comparable to the second analysis maps.

The final limitation is that the infant mortality rates for Delaware were substantially lower than rates previously found. In 2005, infant mortality in Delaware was reported to be 9.0 deaths per 1,000 live births ("Infant mortality rate--2005," 2008). The Infant Mortality Task Force stratified infant mortality by race reaching an infant mortality rate of 16.7 deaths per 1,000 live births for Blacks and 6.9 deaths per 1,000 live births for Whites ("Reducing infant mortality," 2005). The sum of these infant mortality rates are all substantially higher than the 7.94 deaths per 1,000 live births for Delaware's overall population, 11.76 deaths per 1,000 live births for Blacks, and 4.00 deaths per 1,000 live births for Whites. To ensure Delaware's infant mortality rate did not drop over the 2005 to 2008 time period a Community Health Status Assessment by the Delaware Division of Health and Social Services provided five year average infant mortality rates for Delaware. The assessment reported Delaware's overall infant mortality rate as 8.3 deaths per 1,000 live births, 15.6 deaths per 1,000 live births for Blacks, and 5.7 deaths per 1,000 live births for Whites ("State of Delaware," 2013). The discrepancies in lower than actual infant mortality rates could be from the over inclusion of births in the period linked that did not die within

that same year. The biggest concern with these rates is that Delaware may not be deemed a hot spot due to misrepresented data when in actuality it is.

The data set use for the second spatial analysis had several limitations. The data request form limited to the number of variables available at each extraction. This request form allowed for one location variable and four other variables of choice for the organization of results. The form is flooded with various selections including location, maternal residence, other maternal characteristics (Hispanic origin, age of mother, race, education, and marital status), birth characteristics (year, month, weekday, gender, birth weight, birthplace, gestational age, plurality, delivery method, month prenatal care began, live birth order, and medical attendant), and maternal risk factors (anemia, diabetes, incompetent cervix, tobacco use, cardiac disease, eclampsia, lung disease, chronic hypertension, hydramnios/oligohydramnios, and pregnancy-associated hypertension). However, if more than four variables of interest are selected there is no way to determine the distribution of all selected variables. The variables selected that are not included within the four organizational variables will then be used merely to control the sample of the population extracted. For example, if birth weight distributions are the variable of interest, the exact birth weights will not be shown unless it is included in one of the four variable organizations. Therefore, there is no inkling if the infant weighted 499 grams or 1,500 to 1,999 grams at birth.

Another limitation is when the data selection is used to analyze a population, for example a college educated population, the sample size given in substantially lowered as well as some states are excluded due to lack information for one year but not the next. The sample size may also be too low to distribute due to confidently restrictions. Thus, an original part of this analysis (not mentioned) tried to limit the

population to mothers who were either Black or White, married, and had more than a high school education numerous states were excluded. Therefore, making it near impossible to run a spatial autocorrelation. Even when increasing the neighboring distance to 2,000 miles or 3,218,688 meters does not contain enough neighboring states. The lack of highly spatial autocorrelations had no purpose in explaining the population and variables at interest.

The third limitation is that the natality file did not contain a linked death certificate. The linkage of the infant's death certificate could have had implications as to whether death from low birth weight or a chronically hypertensive mother, or the combination of all three spatially occurred by random chance. There were linked birth-infant death records available. However, a maternal chronic hypertension variable was not available within that data set. The chronic hypertension variable is of great importance to this analysis in establishing this variable as a proxy for the psychological stress of racial discrimination. Thus, the natality file was the best data set available for this analysis.

Despite these limitations, the first spatial analysis found patterns of high-clustered areas among overall and Black IMR. The White IMR was found to be insignificant. The pattern since is useful for demonstrating states that could benefit from policy interventions. Delaware fit this criterion. The second spatial analysis found that there is a significant spatial autocorrelation for both low birth weight and chronic hypertension among Black mothers. However, this autocorrelation is not significant for Whites. Therefore, Whites with chronic hypertension and a low birth weight infant are distributed by random chance whereas Blacks are clustered among neighboring states with the same adverse outcome. Further research is suggested to

assess if there is a statistically significant association between low birth weight and chronic hypertension in the form of a logistic regression.