ABSTRACT

THE IMPACT OF COMBINED MATERNAL ALCOHOL AND TOBACCO USE ON LOW BIRTH WEIGHT IN SINGLETON PREGNANCIES: A POPULATION BASED STUDY IN THE US, 2003

by
Della A. Campbell

Background: The Black-White disparity in birth outcomes in the United States remains embedded. The World Health Organization (WHO) defines low birth weight (LBW) as birthweight less than 2500 grams/5.5 pounds or below the 10th percentile for gestational age. LBW is a frequent marker of poor maternal/infant health outcome. A reduction in the incidence of LBW is a major public health initiative in the US. **Objective:** The objective of the study was to determine the magnitude of risk for low birth weight, defined in this study as neonatal birth weight less than 2500 grams, in relation to combined maternal alcohol and tobacco use. The impact of the combined risk taking behaviors was explored to determine their role in contributing to the racial disparity in low birth weight within the context of the Black woman's cumulative socioeconomic disadvantage and exposure to chronic stressors of the urban environment.

Methods: Design: A population-based study of singleton births born to US – born Black and White women delivered in the USA in 2003. Sample: The natality files produced by the National Center for Health Statistics (NCHS) of the U.S. Department of Health and Human Services. Questions: This study addressed the following questions: (1) What is the incidence and relative risk for LBW in relation to combined maternal alcohol and tobacco use? (2) Does LBW increase with the advancing maternal age of the Black woman? (3) Are there any similarities in maternal age, highest educational attainment by the mother, or population of the place of maternal residence within the Black and White LBW groups reporting the highest incidence of tobacco and/or alcohol use? Theoretical Framework: the weathering hypothesis described by Arlene Geronimus which posits the health of African-American women may begin to deteriorate in early adulthood as a physical consequence of cumulative socioeconomic disadvantage, served as the underpinning for exploring the study variables.

Analysis: Secondary analysis of this data set was performed with SAS V9. Logistic regression was used to calculate the relative risk of the investigational variable (LBW) while controlling for race, age, smoking and drinking status, and geographic place of residence (city population).

Results: Black non-Hispanic women who were both tobacco and alcohol users were 3.2 times more likely to have a LBW neonate and White non-Hispanic women were 2.9 times more likely to have a LBW neonate than non-users. Despite the increased odds for having a LBW infant with concomitant substance abuse of tobacco and alcohol, the rate in the Black women was 2.2 times more than the White women. This risk taking behavior clearly increases the incidence of LBW, but affects both races in a similar fashion.

Future Research: The Black-White disparity in low birth weight is a complex research question with little consensus regarding the exact medical etiology or the pathways through which social environmental factors contribute to the disparity.

This dissertation, in light of the support of the major construct of the weathering hypothesis of advanced maternal aging of the Black woman, suggests that the direction for future research must examine the complex interplay of the multiple factors of the environment, genetics, and stress. Interdisciplinary collaboration among health researchers, urban planners, and policy experts will be the key to understanding what measures must be employed to eliminate the Black-White disparity in low birth weight.

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LIST OF OPERATIONAL DEFINITIONS AND ABBREVIATIONS

African-American: for the purpose of this study, African-American is used interchangeably with Black when describing race.

CDC: Centers for Disease Control and Prevention.

Environment: used interchangeably with Place throughout this document.

FAS: Fetal alcohol syndrome.

Fetal alcohol syndrome: a specific combination of neonatal malformations including facial abnormalities, growth restriction, and disorders of the central nervous system.

Gestation: The intrauterine period of development of the fetus from the time of fertilization of the ovum until birth. The pregnancy gestation is represented as either 40 weeks, 3 trimesters, 10 lunar months, 9 calendar months, or 272-280 days.

Gestational age: fetal age of a newborn calculated from the number of completed weeks since the first day of the mother's last menstrual period to the date of birth.

IUGR: Intrauterine Growth Restriction which is fetal weight under the 10^{th} percentile.

LBW: Low Birth Weight.

Leading Health Indicator: one of the ten high-priority public health issues in the United States developed by the Healthy People 2010 initiative managed by the Office of Disease Prevention and Health Promotion and the U.S. Department of Health and Human Services.

Live Birth: Every product of conception that gives a sign of life is considered a live birth, regardless of the length of pregnancy. All states require the reporting of a live birth regardless of gestational age or weight.

LHI: Leading Health Indicator.

Low Birth Weight: infants with a birth weight of less than 2,500 grams/5.5 pounds or below the 10th percentile for gestational age.

Metropolitan County: The Office of Management and Budget (OMB) use the county as the basic building block. A metro county is defined as a core area containing a large population nucleus together with adjacent communities having a high degree of economic and social integration with that core. All counties within a metropolitan area are classified as metropolitan and contain at least one urbanized area of 50,000 or more people, have central counties, and outlying counties that are economically and socially tied to the central counties (as measured by work commuting).

NCHS: National Center for Health Statistics.

Place: for the purpose of this study, place is defined as the area of geographic residence represented as the population of the city, the county, and whether the area is considered a metropolitan or non-metropolitan area. Environment is used interchangeably with Place throughout this document.

Preterm birth: delivery at less than 37 weeks gestation.

Preterm Small for Gestational Age: SGA infants born at less than 37 weeks gestation.

Primigravida: a women pregnant for the first time.

SGA: small for gestational age.

Small for Gestational Age: A neonatal definition of infants who weigh less than the tenth percentile for gestational age using a standard weight-for-age chart.

Term birth: delivery at greater than 37 weeks gestation.

Term Small for Gestational Age: SGA infants born at term (greater than 37 weeks gestation.

USDHHS: U.S. Department of Health and Human Services.

Very Low Birth Weight: infants with a birth weight of less than 1,500 grams.

VLBW: Very Low Birth Weight.

Weathering Hypothesis: the health of African-American women may begin to deteriorate in early adulthood as a physical consequence of cumulative socioeconomic disadvantage.

CHAPTER 1

INTRODUCTION

1.1 Statement of the Problem

The Black-White disparity in birth outcomes in the United States remains embedded. Non-Hispanic Black women had a low birth weight rate of 11.44% in 2002, while only 5.02% of babies born to Non-Hispanic White women were of low birthweight. The World Health Organization (WHO) defines low birth weight (LBW) as birthweight less than 2500 grams/5.5 pounds or below the 10th percentile for gestational age based on a standard weight-for-age chart. LBW is a frequent marker of poor maternal/infant health outcome (Thompson, Goodman, Chang, & Stukel, 2005). This definition dates back to the early 1900's when all newborns weighing less than 5 lb, 8 ounces were classified as 'premature'. The term LBW was not used routinely until the WHO acknowledged that many infants defined as 'premature' were not born early but were simply of low birth weight (WHO, 2006). Premature births occur before the end of the 37th week of gestation. Greater than 60% of LBW babies are premature (MOD, 2006).

LBW is considered a Leading Health Indicator (LHI) for a group/community/society as described by Healthy People 2010 (USDHHS, 2000a). A major public health initiative is to reduce the incidence of LBW in the United States and a Healthy People 2010 objective is to demonstrate a reduction from 7.6% (1998 baseline) to 5% by 2010 (USDHHS, 2000a). A strong relationship exists between birthweight and infant mortality and long-term childhood developmental difficulties. Current thinking suggests that developmental difficulties, by and large, are linked to maternal alcohol and tobacco use. However, our understanding of demographic bias in these links is lacking.

Alcohol or tobacco use has been established as an independent risk for LBW with smoking alone accounting for 20 to 30 percent of all LBW in the US (Albertsen, Andersen, Olsen, & Gronbaek, 2004; Andres & Day, 2000; Diaz, Dinsmoor, & Lin, 2001; USDHHS, 2000b).

1.2 Purpose of the Study

The purpose of this study was to examine the self-reported risk taking behaviors of maternal tobacco use and alcohol use during pregnancy among American born White and Black women and explore their joint impact on neonatal outcome as measured by birthweight.

1.3 Objective of the Study

The objective of the study was to determine the magnitude of risk for low birth weight, defined in this study as neonatal birth weight less than 2500 grams, in relation to combined maternal alcohol and tobacco use. The impact of the combined risk taking behaviors was explored to determine their role in contributing to the racial disparity in low birth weight within the context of the Black woman's cumulative socioeconomic disadvantage and exposure to chronic stressors of the urban environment.

Although a national problem, low birth weight is not evenly distributed throughout the US population. Black women consistently are twice as likely to have a LBW infant than non-black mothers (Ananth, Misra, Demissie, & Smulian, 2001;

Buescher & Mittal, 2006; Geronimus, 1996). Arline T. Geronimus, Professor of Health Behavior and Health Education and a Senior Research Scientist at the Population Studies Center at the University of Michigan at Ann Arbor introduced the theoretical framework of the weathering hypothesis two decades ago to explore this inequality. She portends that the concept has sufficient empirical support and may be applied to understanding, reducing, and eventually eliminating racial inequality in women's health care.

The concept of weathering is relatively new to the body of work that seeks to understand and promote sound intervention into health disparities. It grew out of the neo-activist 1990's, when new attention was turned toward the cultural context of urban poverty and the role of the built environment and health. Yet, 'weathering' has the potential to guide the development of comprehensive strategies to improve the health of socioeconomically disadvantaged women and reduce the social inequalities that exist in today's healthcare environment. Geronimus (1992, p. 207) coined the term 'weathering' of the African-American woman "as a possible explanation for racial variation in maternal age patterns of births and birth outcomes, the 'weathering hypothesis' is proposed: namely, that the health of African-American women may begin to deteriorate in early adulthood as a physical consequence of cumulative socioeconomic disadvantage".

Weathering is a concept of explaining a Black women's health as a process over time that is reflective of insults and injuries from her conception to the current state. It is indicative of her life experiences that either promote or retard health. For example, if a woman has compromised health during her childbearing years (increased prevalence of hypertension, diabetes, circulating blood lead levels) then the stage is set to replicate this insult at the time of conception and carry it into the next generation. Insults to health could be many and some examples may be environmental hazards, social stressors of repeated social, work, or economic adversity, homelessness, onset of a chronic disease, and/or family disruption due to death or incarceration (Geronimus, Bound, Waidmann, Colen, & Steffick, 2001). These stressors, many chronic in nature and arguably more prevalent in the urban environment, exert a cumulative influence on the Black woman and may accelerate the weathering process.

Residents of impoverished urban areas are victims of excess morbidity and mortality when compared to non-urban dwellers (Vlahov et al., 2007). Having said that, urban dwellers are comprised of the marginalized minority and understanding the disadvantages of the urban dweller would be incomplete without considering the factors that produced the modern urban ghetto. The landscape of today's urban environment is a byproduct of past political, financial, and historical events beginning with the end of the Civil War and the emancipation and release of the African-American slaves. The social manifestations of prejudice and discrimination evolved from two world wars, the Great Northern Migration of African-Americans, the Great Depression, the New Deal, and creation of social engineering by government via of the Federal Housing Administration, Urban Development and Renewal. As a result, there are central core cities of many large metropolitan statistical areas that have extreme poverty, inadequate high-density housing, psychological alienation, noise, safety issues, and other psychological stressors.

How Weathering and Poor Health Outcomes Connect

The minority women who inhabit these cities are less likely to have the opportunity, amenities, or resources available to them to alleviate the stressors of their built environment that are afforded to wealthier women. Galea and associate (2007) stated that the elevated risk for depression in the densely populated central cities may be the result of the quality of the social and built environment of the poorer urban neighborhoods. Vacant housing or homes in disrepair, garbage throughout the common area, vandalism, burglary, lack of green space, drug dealing, noise, and crime are all considered to be neighborhood disorder. Smoking was described as a reward/pleasure as it provides the woman with a break from a burdensome routine or feelings of loneliness and isolation (Stewart, 1996). The constant stress of living in this environment may lead the woman to utilize detrimental lifestyle behaviors of tobacco and alcohol use as coping mechanisms for the stress and its associated negative conditions.

In a broader sense, weathering has been utilized to increase our understanding of the health care disparities of chronic morbidity and increased mortality between the races. The Black population experiences greater incidence of morbidity and mortality as it approaches middle age, or the 40-60 year duo-decade (Geronimus et al., 2001). This early deterioration of the health of Blacks is noted across all socioeconomic strata (Geronimus, Bound, Waidmann, Hillemeier, & Burns, 1996). In general, research supports the findings that Blacks experience poorer health at an earlier age than Whites (Angel & Angel, 2006; Baker, Schootman, Barnidge, & Kelly, 2006; Belue, Taylor-Richardson, Lin, McClellan, & Hargreaves, 2006; Carnethon et al., 2006; Coyne & Marcus, 2006; Franks, Muennig, Lubetkin, & Jia, 2006; Gadson, 2006; Geronimus, 1999, 2001, 2006). Racial inequality in health widens as one ages through middle adulthood when Blacks are noted to experience the morbidity and mortality seen in the White population in a much older person. The weathering hypothesis offers a theoretical explanation that this earlier deterioration is a result of repeated stressors of social or economic adversity and political marginalization that is inherent in living in a race-conscious society that stigmatizes Blacks (Geronimus, Hicken, Keene, & Bound, 2006).

Allostatic Load

As an urban systems concept, weathering makes a great deal of sense. Finding ways to quantify its constructs, however, moves weathering from a concept to a useable research tool. To do just this, Geronimus suggests measuring allostatic load scores among Blacks and Whites in the United States using the National Health and Nutrition Examination Survey (NHANES IV, 1999-2002) data. Allostasis defines the relationship between psychoneurohormonal responses to stress and the mind/body display of health or illness. Allostatic load occurs when there is a chronic elevation of a primary allostatic mediators (cortisol, norepinephrine, epinephrine, and dehydroepiandrosterone sulfate (DHEA-S) that is sustained over time (Shannon, King, & Kennedy, 2007). This leads to altering a person's ability for homeostasis and results in a physical response, elevated systolic or diastolic pressure (high blood pressure) or increased cholesterol levels as examples.

Allostatic scores represent the wear on a body striving to maintain stability in disruptive environments. Ten biomarkers were selected for the study and included: systolic and diastolic blood pressures, body mass index (BMI), glycated hemoglobin, albumin, creatinine clearance, triglycerides, C-reactive protein, homocysteine, and total cholesterol (Geronimus, Hicken et al., 2006). Each of selected biomarkers were given a score of 1 if their result was over the established threshold for within a normal value, and then summed to determine the total allostatic load (maximum value of 10). Previous research suggested that higher allostatic load scores were associated with older age, lower socioeconomic status, declining cognition, increased mortality, an unsupportive childhood and adult relationships (Crimmins, Johnston, Hayward, & Seeman, 2003; Seeman, Singer, Ryff, Dienberg Love, & Levy-Storms, 2002).

The results from Geronimus (2006) and her colleagues confirmed the following: there were significant disparities in health across the 10 studied biomarkers. Blacks had higher mean allostatic load scores than Whites and had a greater probability of that higher score at all ages, both poor Black and poor White had higher scores than those who were not poor in each race,_most important was that the greater poverty rates among the Black did not account for the Black-White difference in scores and therefore poverty alone could not explain the higher allostatic load scores. Poor Black women had the highest score, followed by non-poor Black women. Significant to this study was the result that Black women had higher scores than Black men and White men and women at all ages, the highest difference noted in the non-poor Black compared to the non-poor White.

The researchers concluded, "...racial inequalities in health exist across a range of biological systems among adults and are not explained by racial differences in poverty. The weathering effects of living in a race-conscious society may be greatest among those Blacks most likely to engage in high-effort coping" (Geronimus, Hicken et al., 2006 p.826). Examples of high-effort coping include tobacco, alcohol, poor nutrition, and illicit drug abuse related to repeated social and economic hardship. Black women are perceived to be at double jeopardy because of higher levels of these coping stressors due to the potential for both racial and gender discrimination.

In support of the weathering hypothesis, Shannon, Tekoa, and Kennedy (2007) reviewed the theory of allostasis in evaluating perinatal health outcomes based upon the growing body of scientific evidence supporting the relationship between maternal stress and poor perinatal outcomes including LBW and preterm birth. They concluded that although allostatic load norms for pregnancy are yet to be developed, it is an area of great interest. Future research might identify biomarkers that will serve as predictors of pregnant women at risk for poor outcome.

As with much research, some disagree or note discrepancies in the literature surrounding the weathering theory. Most recently, Thomas (2006) claimed that the weathering hypothesis and allostatic load scores were missing correlations and synthesis of the life expectancy tables. For example, Black women live longer than White. He states that this paradox must be more closely examined if we are to truly understand the weathering hypothesis and the impact of chronic stress to mortality in marginalized populations. The response by Geronimus (2006) centered on morbidity and sub-clinical manifestations that lead to a disabling life expectancy, not mortality. The results of the allostatic load study estimated that Black women had shorter active/healthy life expectancies than did White men, 43 versus 48 additional years respectively. Unlike the Black population, Geronimus and her colleagues identified that as life expectancy increased in the White population there was an associated decrease in the average number of years spent in ill health at the end of life.

The research discussed in the prevalence, onset, and continuation of tobacco and alcohol use fits within the constructs of the weathering framework (Allard-Hendren, 2000; Geronimus, Neidert, & Bound, 1993; Herzig et al., 2006; Martin et al., 2003; Reardon & Buka, 2002; Savitz, Dole, Terry, Zhou, & Thorp, 2001; Ventura, Hamilton, Mathews, & Chandra, 2003). Black teens are less likely to smoke or drink than White teens until the age of the mid- twenties. At that time their rate rises, perhaps as a consequence of competing obligations, chronic stress and/or scarce resources that may contribute to their initiation of this risk taking behavior or their inability or lack of desire to cease that behavior.

1.3.1 Summary

Despite decades of research on the higher incidence of Low Birth Weight in the black population, this healthcare disparity continues to be poorly understood. Even less is understood about what role the multiple variables of maternal age, the population of the place of maternal residence, and the risk taking behaviors of alcohol and tobacco use contribute to LBW. The weathering framework was developed based on the African-American female population, but future research may find it to be applicable to poor White women or other marginalized minority or ethnic groups. The weathering hypothesis demonstrates that Black women are at a high risk of suffering from multiple morbidities, not necessarily life threatening events, that affect a range of biological systems concomitantly and become more pronounced as age increases toward midlife. With this theoretical framework, one would expect to see less optimal perinatal outcome

(LBW) in the Black woman as maternal age increases, compounded by additional risk taking behaviors such as tobacco and alcohol use.

1.4 Primary Question

This study addressed the following primary question:

> What is the incidence and relative risk for low birth weight (neonatal birth weight less than 2500 grams) in relation to combined maternal alcohol and tobacco use.

1.5 Additional Questions

An additional aim of the study addressed the following research questions:

a. Does LBW increase with the advancing maternal age of the Black woman?

b. Are there any similarities in maternal age, highest educational attainment by the mother, or population of the place of maternal residence within the Black and White groups reporting the highest incidence of tobacco and/or alcohol use?

c. How do the multivariable factors of maternal age, educational attainment by the mother, and population of the place of maternal residence contribute to the incidence of LBW in women who use both tobacco and alcohol during pregnancy?

1.6 Gaps Which the Research is Intended to Fill

There is a little research analyzing the relative risk of LBW with self-reported behaviors of both tobacco use and alcohol consumption. Many studies look at the relationship of LBW with one of these behaviors after controlling for confounders of age and race. A MedLine search of published studies of tobacco use in pregnancy yielded over 3000 articles with an additional 191 in the year 2006 and 39 in the first quarter of 2007. Alcohol use in pregnancy represents over 1900 articles with an additional 598 in the year 2006 and 119 in the first quarter of 2007. Multifactorial physical, psychosocial, and environmental characteristics affect the pregnant woman and fetus. Pregnancy outcomes are influenced by many factors, some able to be controlled or accounted for by the pregnant woman such as social support, domestic violence, pregnancy intention, and some often not within her realm of control such as poverty and place of residence. Several behaviors known to affect birth outcome include inadequate or late prenatal care, maternal alcohol, tobacco, and/or drug use, and inadequate nutrition (Ahluwalia, Merritt, Beck, & Rogers, 2001; Albertsen et al., 2004; Diaz et al., 2001; Page, 2004). Of the over 11 thousand published studies on LBW, many studies suggest that pregnancies may have multiple risks that relate to one another but no study has looked at the combined relative risk of the two behaviors of tobacco and alcohol use during pregnancy and their influence on low birth weight in a population based study.

Analyzing the relationship of race and age to these risk behaviors is critical to the concept of the weathering hypothesis, considered a heuristic model. This concept proposes that the health of African American women may begin to deteriorate in early adulthood as a physical consequence of cumulative socioeconomic disadvantage as defined by Geronimus (Buescher & Mittal, 2005; Buescher & Mittal, 2006; Geronimus, 1986, 1996). Geronimus (Geronimus, 1992) purports that disadvantaged women may be more at risk for health inequities even if they have not become mothers and that over time these insults to health accumulate as a 'weathering process' resulting in poorer health status.

This study assessed the relative risk when parturients participate in both tobacco and alcohol use and explored the risk within the weathering framework. Since a population based research study has not been done within this model this study will add to this body of knowledge.

1.7 Significance and Contribution to Urban Systems Research

Although researchers have tried to control for risk factors when analyzing the incidence of LBW, this study examined in detail two social/cultural risk behaviors of maternal tobacco use and alcohol use during pregnancy within the context of race, age, and environment.

The goal of research in urban health is to examine the complex interrelationships among social, cultural, political, economic, geographic, organizational, and bioenvironmental factors that influence the health status and health behaviors of urban populations (UMDNJ, 2001). The incidence of LBW is more pronounced in the African-American community and a large portion of this population receive their care within urban health care systems. In the tri-state area of New York, New Jersey, and Pennsylvania there were a total of 10,328 Black infants born with low birth weight in year 2002. That translates to 5,494 infants in New York; 2,311 infants in New Jersey;

and 2,523 infants in Pennsylvania who are at increased risk for morbidity and long-term developmental difficulties that may have an economic impact to the city's fiscal planning to meet special needs for social and educational support.

Recent research is exploring the built environment, or the neighborhoods in which people reside, and their relationship to the health status of its inhabitants. Berke, Koepsell, Moudon, Hoskins, and Larson (2007) examined the association of the built environment with physical activity and obesity in older persons and their findings suggested that the frequency of walking was associated with the neighborhood characteristics. A Danish study by Nielsen and Hansen (2007) noted that neighborhoods that had green space or gardens within short walking distances of the home dwelling was associated with less stress on the city dweller and decreased likelihood of obesity. Anesthensel and Wight (2007) explored urban neighborhoods and depressive symptoms in older adults but did not find an association with the neighborhood SES and depressive symptoms. Conversely, Galea and Ahern (2007) observed that living in a low SES (urban neighborhood poverty) was associated with incident depression in their population based prospective cohort study in New York City.

Understanding factors contributing to LBW such as tobacco and alcohol use, maternal age, and population density of the residence city, may enable the urban healthcare practitioner to improve care by developing age-targeted and place specific education and intervention, and work to eliminate health care disparities by addressing the underlying urban environment inequalities that may produce or contribute to them.

1.8 Potential Limitations of the Study

Although the recording and reporting of birth data is now an efficient and comprehensive part of state vital statistics processing, the use of births records – upon which this study relied – presents a number of limitations. The study utilized the 2003 natality data set that is produced by the National Center for Health Statistics from data received from each state's birth certificate registry of all births that occurred in the year 2003. Having birth certificates completed by hospital personnel facilitates the accuracy of the data, but some of the information contained on birth certificates must rely on patient self-reporting (Lydon-Rochelle et al., 2005). The key variable in this study, low birth weight, could be verified directly from patient medical records. The reliability of self reported use of tobacco on the birth certificate might be considered a limitation of the study. Historically, women report that they smoke tobacco, but tend not to report the accurate quantity per day (Czeizel, Petik, & Puho, 2004; England, Kendrick, Gargiullo, Zahniser, & Hannon, 2001). Despite this common concern of self-reported information, several national studies have confirmed the trends and variation of information regarding tobacco use on the birth certificate (CDC, 2002a, 2002b; Ventura et al., 2003).

The reporting of tobacco use was changed by the Center for Health Statistics and was projected to be fully implemented for the 2003 birth certificate reporting cycle, but only the states of Washington and Pennsylvania instituted all of the revisions. The previous 1989 tobacco use question was a simple yes or no response and asked the number of cigarettes per day but was non-specific as to history of tobacco use or change in tobacco use through the course of the pregnancy. The 2003 revision questions are now related to the quantity smoked pre-conception, and the quantity smoked during each of the trimesters (first, second, and third). Indiana, New York (minus New York City), Pennsylvania, South Dakota, and Washington reported the tobacco use variable based on the 2003 revision. The data collection fields on tobacco in 2003 had significant changes and therefore were not comparable for reporting with the states that continued to report based on the 1989 data fields. The District of Columbia, 44 states, and New York City reported based on the 1989 version. Despite this limitation, the sample size was large enough to analyze and report on the findings.

Underreporting of alcohol use on the birth certificate is a concern and has been noted as a deficiency in nationally representative surveys of pregnant women. The CDC recognizes that the language of the alcohol question on the 1989 revision is not sensitive enough to measure the behavior.[1] The underreporting is presumed to be related to the societal impression of this behavior in addition to the non-precise wording of the questions on the birth certificate. California, Pennsylvania and Washington did not report alcohol use on the birth certificates. The states that did report accounted for 81% of the births in 2003.

Another consideration of this study is to question whether it is correct to continue to believe a causal relationship exists between birth weight and the risk of infant mortality and developmental disorders. Wilcox (2001) claims that although birth weight is the most accessible variable, it is the most misunderstood. He proposes that birthweight is only important when examining the difference in the residual distribution, the difference in the rate of LBW when comparing two populations. He concludes that birthweight is important to study and continues to be of interest regarding infant mortality and more recently adult onset chronic disorders, even if it is not a causal relationship.

[1] Documentation of the Detail Natality Public Use File for 2003 by the CDC, page 23.

The 2003 Natality file of the CDC does not contain socioeconomic data, which is considered a variable that contributes to LBW. Maternal education, noted as the highest level achieved prior to birth, was intended to serve as a proxy for socioeconomic status. The nature of this study examined the outcome of childbirth that occurred to all women in 2003, from young women under the age of 15 to women greater than 50 years of age. This age span threatened the validity of education as a proxy. Women under 22 years of age were age/time limited in their potential for education simply because by their age it would be unreasonable for them to have achieved a college education or even a high school education at the younger age group. Maternal education was examined but not as a proxy for socioeconomic status.

An additional limitation of the study was that geographic detail was restricted to cities and counties with a population of greater than 100,000. Specifically, the county FIPS codes for counties with populations less than 100,000 were not provided on the natality files, instead all of these counties were assigned the same geographic code for "balance of state". Because there were counties with populations less than 100,000 in all of the urban-rural categories except the large central metro category, it was not possible to compute birth and death rates by urbanization level using the standard natality and mortality public-use files. [2] The impact of the variables was explored within the city groups based on population, but conclusions were limited to the large metropolitan city.

Lastly, conclusions drawn from this study are limited to analysis of a single year birth cohort, rather then a trend over time. In addition, some may argue that the standard definition of LBW as less than 2500 grams is an arbitrary number and does not lend itself to comparing different groups across populations (Wilcox, 2001) and limits one's ability

[2] Information obtained from http://www.cdc.gov/nchs/products/elec_prods/subject/natality.htm#note

to make cost-effectiveness and efficacy determinations. Also, illicit drug use before or during pregnancy and nutritional status could not be examined, as they were not part of this data set.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1 LBW and the Black-White Disparity

Research studies assessing healthcare outcomes for various ethnic and racial minorities have identified health care disparities in several disease areas including diabetes, cancer, cardiovascular disorders, mental illness and HIV/AIDS (Smedley, Stith, & Nelson, 2003). Although pregnancy is a state of wellness and not a disease process, health care disparities are also noted during childbearing and in neonatal outcomes.

LBW is internationally used as an indicator of health in a population and is associated with increased risk of morbidity and mortality in the first year of life as well as the potential for developmental disorders and chronic diseases in adulthood (Ananth, Demissie, Kramer, & Vintzileos, 2003; USDHHS, 2000b; Vangen, 2002). The medical community identifies risk factors for LBW as low socioeconomic status (SES), extremes of maternal age (<15 and >37 years), previous preterm birth, substance abuse (alcohol, tobacco, illicit drugs), inadequate prenatal care, infections, and being African-American (Diaz et al., 2001). Historically, infants born to African-American mothers are an average of 300 grams lighter and are twice more likely to be LBW than infants born to White mothers (Buka, Brennan, Rich-Edwards, Raudenbush, & Earls, 2003; Geronimus, 1996).

The LBW rate has risen each year since the 1980's. Ananth, Balasubramanian, Demissie, and Kinzler (2004) note that the rate of LBW has increased over the past two decades for both Black and White women while preterm births increased only for White women. The National Center for Health Statistics (NCHS) reports that LBW reached the highest level in more than 30 years in 2002 when it rose from 7.7 to 7.8% (Martin et al., 2003).

Low birthweight is a leading contributor to infant mortality, and for the first time since 1958, infant mortality increased from 6.8 to 7.0 deaths per 1000 live births in 2002 (Martin et al., 2003), a total of almost 28,000 babies lost. That statistic places the United States 28th in the world, trailing behind many countries that spend far less per capita on healthcare. One possible explanation for this is an increase in births of very low birthweight infants (VLBW), less than 1500 grams, and extreme very low birthweight infants (EVLBW), less than 750 grams. These births are attributed to preterm delivery of multiple gestation pregnancies which accounted for 24 percent of all LBW in the US in 2002, compared to 15 percent in 1980 (Martin et al., 2003). VLBW infants have an increased risk of death in the first year of life of 100 times that of an infant of normal birth weight. Some of the increase in this neonatal weight population is related to the increase in artificial reproductive technology (ART), or infertility management where the odds of having a multiple gestation (twins, triplets, or higher) are significantly increased compared to spontaneous conception.

Infant mortality rates vary significantly depending on where you live. In 2003 the rate for infant mortality was 10.9 infant deaths per 1,000 live births if you lived in the District of Columbia, 10.5 infant deaths per 1,000 live births if you lived in Michigan, and a low of 4.3 infant deaths per 1,000 live births if you lived in Massachusetts (Martin et al., 2005). The CDC (Martin) reports a slow decline in infant mortality for 2003 but the persistence of racial disparities with a range of 4.78 infant deaths per 1,000 live births for

Asian and Pacific Islanders to 13.55 infant deaths per 1,000 live births for the Black, Non-Hispanic population. This statistic also demonstrates state variation with Massachusetts, Minnesota, Oregon and Washington reporting 10 Black infant deaths per 1,000 live births while Tennessee reported 16.9 Black infant deaths per 1,000 live births.

The following table highlights the birth outcomes of singleton pregnancies based on the race and Non-Hispanic origin of the mother.

Table 2.1
Rate of VLBW, LBW, and Mean Birthweight Among Singletons by Race: US, 2001, AND 2002[3]

	2001	2002
Total For All Races		
Percent VLBW	1.10	1.11
Percent LBW	6.04	6.12
Mean birthweight (grams)	3339	3332
Non-Hispanic White		
Percent VLBW	0.81	0.81
Percent LBW	4.96	5.02
Mean birthweight (grams)	3399	3392
Non-Hispanic Black		
Percent VLBW	2.57	2.63
Percent LBW	11.19	11.44
Mean birthweight (grams)	3135	3128

Researchers have attempted to explain the consistent disparity in the Black -White LBW rate by exploring the sociodemographic factors of inadequate or late prenatal care, maternal alcohol, tobacco, and/or drug use, and inadequate nutrition that have been

[3] From "Births: Final Data for 2002," by J.A. Martin, B.E. Hamilton, P.D. Sutton, S.J. Ventura, F. Menacker, & M. L. Munson, 2003, *National Vital Statistics Report, 52(10)*,p.21.

identified as a risk for LBW (Page, 2004). Assuming that all populations have equal access to care, delayed or inadequate prenatal care has not been associated with increased risk for LBW (Gortmaker, 1979; Hueston, Gilbert, Davis, & Sturgill, 2003; Katz, Armstrong, & LoGerfo, 1994; Kotelchuck, 1994). Gould, Madan, Qin, and Chavez (2003) compared US born Black mothers and foreign-born Mexican mothers profiled to be at risk based on inadequate prenatal care, adolescent pregnancy, low SES, and lower maternal and paternal educational levels as reported on the California birth record. Black infants had the highest rate of LBW, neonatal mortality and several other adverse outcomes. The Mexican infants, despite their maternal high risk profile, did not have an increased rate of LBW or neonatal mortality when compared with White infants. Leslie, Galvin, Diehl, Bennett, and Buescher (2003) reported similar findings in North Carolina. With prenatal care utilization and SES similar or lower among the Hispanic and Black women, birth outcomes of Hispanic women were comparable to those of White women. The LBW rate for the White, Hispanic, and Black women were 9.1%, 9.5%, and 18% respectively (Leslie et al., 2003).

There are conflicting reports in the literature regarding the risk of poor perinatal outcome associated with maternal age, conceiving either too young or too old. This inconsistency is noted when examining the influence of age on the Black woman, as findings are fairly constant that, unlike the Black woman, the White woman experiences increased risk at either end of the age range (Ekwo & Moawad, 2000). Geronimus's (1986) early work was based on birth data from the states of Washington, Louisiana, and Tennessee from 1976-1979. This study refuted the concept that the racial inequality of neonatal mortality was due to the increased frequency of teenage births in the Black population. This population based study reported that the Black pregnant woman above the age of 23 had a higher neonatal mortality rate than most Black or White teenagers. This initial study was the precursor to her weathering hypothesis suggesting women of different racial or ethnic backgrounds may experience a different rate of "aging" due to increasing insults to their health over time (Geronimus, 1992).

Rauh, Andrews, and Garfinkel (2001) sampled singleton births of US born Black and White women in New York City between 1987 and 1993. They concluded that the increasing age effect of a higher association of LBW for Black women was increased in the presence of poverty. Ekwo and Moawad (2000) studied the Chicago births spanning 1989-1998 and concluded that Black teenage mothers did not have an inherent increased risk for preterm births.

Data from the Third National Health and Nutrition Examination Survey (NHANES III) reported that early motherhood was independently associated with increased risk of LBW in the Black, White, and Hispanic groups; with the Black rate being the lowest of the three (Okosun, Halbach, Dent, & Cooper, 2000). Rates were 6.2%, 7.4%, and 2.3% for White, Hispanic, and Black respectively. NHANES III is a multistage probability sample of noninstitutionalized US civilians examined between 1988 and 1994. This study lends support to the weathering hypothesis by demonstrating the lower risk of LBW for Black women experiencing childbirth during the early childbearing years. Rich-Edwards, Buka, Brennan, and Earls (2003) analyzed the birth data in Chicago from 1994-1996 and concluded that their data suggests a cumulative reproductive risk with advancing maternal age of the Black woman. The rate of LBW rose sharply with the Black maternal age, but not with the White maternal age, supporting the weathering hypothesis.

Wildsmith's (2002) study of the births to Mexican-Origin women from 1989-1991 suggests support of the weathering hypothesis with neonatal mortality but not with LBW. The risk for LBW in the foreign-born or US born Mexican women was greatest at the earlier ages, declined throughout the twenties, and then began to rise again. For all indicators at each age level, the researchers noted that the US born Mexican women experienced poorer perinatal outcomes and increased evidence of weathering than the Mexican born women.

Ananth, Misra, Demissie, and Smulian (2004) tested the weathering hypothesis in a study on rates of preterm delivery in an age-period-cohort analysis in five year segments from 1975-2000. They examined primigravid women and concluded "for all years, rates of preterm delivery among Blacks were higher at the extremes of maternal age, with the lowest risk being seen in the group aged 25-29 years. The same pattern was also seen for White women, which is inconsistent with the weathering hypothesis" (Ananth et al., p.657).

2.1.1 Summary

The wealth of current research supports the theory that the Black-White disparity in perinatal outcomes, including LBW, cannot be attributed to one or two unique factors in isolation. Evidence linking one or more variables is at times contradictory and the strength of associations vary among studies. This study examined the incidence of LBW by exploring the relationships among risk taking behaviors (maternal alcohol and tobacco use), biologic factors (maternal age and race), and the environment (population density of the place of maternal residence).

2.2 Tobacco Use and Perinatal Outcome

Active tobacco smoking during pregnancy has been associated with poor obstetrical outcomes; including preterm birth, twice the risk for LBW, miscarriage, and infant mortality (Diaz et al., 2001; Martin et al., 2003; Savitz et al., 2001; Windham, Bottomley, Birner, & Fenster, 2004; Windham, Hopkins, Fenster, & Swan, 2000). Government statements have reported a decline in smoking during pregnancy especially in the 25 to 39 year old group (Martin et al., 2003). The District of Columbia and all states except for California report tobacco use during pregnancy on the birth certificate. The National Vital Statistics Report notes that smoking during pregnancy has decreased from 19.5 in 1989 to 11.4 percent in 2002, a 42 percent decline (Martin et al.). Just over 1 in 10 women smoked during pregnancy in 2002. Smoking declined for all age groups and most race and Hispanic origin groups in 2002.

The major compounds found in tobacco smoke are nicotine and carbon monoxide. Both of these substances are detected in the fetal circulation in levels close to the maternal level of the inhaled compounds. Nicotine is metabolized and is detected as cotinine with a greater half-life than nicotine. Animal studies have demonstrated that nicotine causes a predictable decrease in the blood flow of the maternal uterine artery and changes in the fetal umbilical artery blood flow with resultant changes in fetal oxygenation. Carbon monoxide crosses the placenta and enters the fetal circulation, disrupting the oxygen carrying potential to fetal tissues (Andres & Day, 2000).

In 1980, after nearly 30 years of clinical research suggesting a relationship between cigarette smoking and LBW, the United States Surgeon General issued a report listing adverse outcomes of pregnancy that were attributed to tobacco use. A decade later, the 1990 Surgeon General's report linked smoking to intrauterine growth retardation with a reduction of birthweight of 200 grams and a two-fold increase risk of having a LBW infant (Samet, 1990).

The following tables represent a summary of the incidence of smoking, alcohol, and LBW from the Final Birth Report for Year 2002 by the NCHS as reported by race and ethnicity.

Table 2.2
Percent of Births With Smoking, Drinking, and Birthweight Characteristics by Race of Mother[4]

All Births including the 50 states, the District of Columbia, New York City, Puerto Rico, the Virgin Islands, American Samoa, and the Commonwealth of the Northern Marianas

	All Races	Black	White
Mother Smoker•	11.4	8.7	12.3
Mother Drinker•	0.8	0.9	0.8
Infant VLBW	1.5	3.1	1.2
Infant LBW	7.8	13.3	6.8

All Births in the 50 States and D.C.

	All Races	Black	White
Mother Smoker•	13.8	9.8	14.6
Mother Drinker•	0.9	0.9	0.9
Infant VLBW	1.5	3.2	1.2
Infant LBW	8.2	13.8	7.0

• Excludes Data from California

[4] From "Births: Final Data for 2002," by J.A. Martin, B.E. Hamilton, P.D. Sutton, S.J. Ventura, F. Menacker, & M. L. Munson, 2003, *National Vital Statistics Report, 52(10),*p.65.

Table 2.3

Percent of Births With Smoking, Drinking, and Birthweight Characteristics by Non-Hispanic Origin of Mother[5]

All Births including the 50 states, the District of Columbia, New York City, Puerto Rico, the Virgin Islands, American Samoa, and the Commonwealth of the Northern Marianas

	Total	Black	White
Mother Smoker•	13.2	8.8	15.0
Mother Drinker•	0.9	0.9	0.9
Infant VLBW	1.5	3.1	1.2
Infant LBW	8.2	13.4	6.9

All Births in the 50 States and D.C.

	Total	Black	White
Mother Smoker•	14.4	9.8	15.5
Mother Drinker•	1.0	0.9	0.9
Infant VLBW	1.6	3.2	1.2
Infant LBW	8.2	13.8	6.9

Additional information regarding smoking trends in the 2002 NCHS data is that the percentage of tobacco use during pregnancy in age groups remains fairly constant throughout the 14 years that data have been available. The older teen has the highest rate (18.2%) followed by the 20-24 years group (16.7%) and then the younger teens at 15-17 years of age (13.4%). Although the frequency to smoke in the older age group is less, those women tend to be heavier smokers. Rates of smoking in pregnancy declined in 2002 across all age groups. Smoking rates are highest for women who have attended but have not completed high school and lowest for college-educated women. Although

• Excludes Data from California

[5] From "Births: Final Data for 2002," by J.A. Martin, B.E. Hamilton, P.D. Sutton, S.J. Ventura, F. Menacker, & M. L. Munson, 2003, *National Vital Statistics Report, 52(10),* p.66.

increased tobacco use tends to have an increased risk of LBW, no safe level of tobacco use can be identified (Martin et al., 2003).

Researchers agree that tobacco use may be underreported on the birth certificate, especially in light of a poor perinatal outcome (Galea et al., 2007; Northam & Knapp, 2006; Piper et al., 1993; Smulian et al., 2001). The CDC reports confidence in using the self-reported information on the birth certificate by studies that have corroborated the trend with other national surveys (CDC, 2002a, 2002b; Martin et al., 2003).

Authors of a study to explore the functional relationship between measures of tobacco exposure and birth weight noted the limitation of self reported behavior by comparing reported tobacco use and urine cotinine to quantify exposure (England, Kendrick, Gargiullo et al., 2001). They found that…"although birth weight decreased as tobacco exposure increased, the relation between birth weight and tobacco exposure was not linear" (2001, p. 959). Despite the concern that the birth certificate method of self-reporting may be unreliable, it allows for identifying trends in prenatal smoking. The greatest incidence of lower birth weights were seen at low levels of exposure with no significance noted between the races when controlling for confounders, including age. Detrimental effects of tobacco use on infant birth weight have been demonstrated with less than eight cigarettes per day (England, Kendrick, Wilson et al., 2001).

Geronimus, Neidert, and Bound (1993) examined data from the 1987 National Health Interview Survey (NHIS) that utilizes a stratified cluster sampling methodology with an oversampling of Blacks. The findings in this early study are the same as the NCHS 2002 report, Black women were less likely to smoke than White women and initiation of smoking occurred before age 20 for both groups. The researchers noted that

White women were more likely to quit smoking, Black women are less likely to quit at any age cohort, and the Black -White disparity in smoking cessation is pronounced in the childbearing age group. Adolescent Black women were less likely to smoke, but by age 30 more Black women than White women were smokers (Geronimus et al.). This work supported the weathering hypothesis with the concept that the increase in tobacco use as a Black woman ages was a coping mechanism due to cumulative stress and socioeconomic disadvantage she experiences over time (Geronimus, 1992).

Not only do Black and White women exhibit different patterns of smoking during the childbearing years, they may actually process or metabolize the nicotine found in cigarettes differently. Studies have demonstrated that Blacks have a higher level of serum cotinine, the metabolite of nicotine found in cigarette tobacco, than do whites for the same number of cigarettes smoked (England, Kendrick, Gargiullo et al., 2001; English, Eskenazi, & Christianson, 1994; Klebanoff, Levine, Clemens, DerSimonian, & Wilkins, 1998). This would create a disparity in the dose-response relationship of smoking and perinatal outcome of LBW among Black women and White women.

Windham, Hopkins, Fenster, and Swan (2000) explored the risk for LBW from second hand smoke with a prospective design enrolling pregnant women within the first trimester. Their results indicated that the incidence of LBW from high Environmental Tobacco Smoke (ETS) was greater in non-whites. This study supports other research that suggests that ETS exposure, as well as maternal smoking, may affect fetal health and intrauterine growth.

Sprauve, Lindsay, Drews-Botsch and Graves (1999) performed a case-control study in Atlanta from 1993-1994 with maternal interviews and anthropometric measurements of their newborns. They noted that self-reported tobacco use is associated with a dose response relationship between the delivery of a small for gestational age infant and the number of cigarettes smoked per day during the second trimester. They did not note a greater negative effect on the Black infant than the White infant when race and age specific growth curves were used.

Savitz, Dole, Terry, Zhou, and Thorp (2001) conducted the Pregnancy, Infection, and Nutrition Study, a prospective cohort study in North Carolina with enrollment at 24-29 weeks of gestation from 1995-1999. They collected data and biomarkers, including serum cotinine levels throughout the study and immediately post partum. Ninety-five percent of the Black women smoked menthol cigarettes as opposed to 26% of the White women. The study displayed a strong association of a dose response risk between smoking and fetal growth restriction and identified racial differences in the smoking patterns and preferences of Black compared with White women.

A recent study by Bernstein and his colleagues (2005) identified that third trimester tobacco use was a strong and independent predictor of birth weight percentile. This was a randomized trial on women enrolled in a research clinic for smoking cessation and relapse prevention during pregnancy. The prospective study included biomarkers of urine cotinine levels and expired air carbon monoxide level analysis. It appears logical that smoking in the last trimester would have a significant affect on birthweight since the fetus normally gains 100 to 200 g (3.5 to 7 oz) per week, roughly two thirds of the total inutero weight (Bernstein, Plociennik, Stahle, Badger, & Secker-Walker, 2000). Studies previously cited confirm that although Black women tend to smoke less than White women, unlike the White women, Black women tend not to quit smoking during pregnancy. This discovery in itself does not explain the Black-White disparity in LBW due to the small number of Black women who are tobacco users during pregnancy, but it does contribute to the knowledge that discontinuing tobacco use during pregnancy, even late in pregnancy, can improve neonatal birthweight (England, Kendrick, Gargiullo et al., 2001).

2.2.1 Summary

The review of literature demonstrates a plethora of research on the relationship between smoking and its impact on intrauterine fetal growth and identifies tobacco as a risk for the increased prevalence of LBW (Aaronson & Macnee, 1989; ACOG, 2006; Andres & Day, 2000; Bernstein et al., 2005; England, Kendrick, Gargiullo et al., 2001; Walsh, 1994; Windham et al., 2000). There is some information about the age and educational attainment patterns of smoking in childbearing women, but clearly not an exhaustive amount (Adamek, Florek, Piekoszowski, & Breborowicz, 2004; CDC, 2002b; Geronimus et al., 1993; Jun, 2004; Mariscal et al., 2005). This study will examine the risk for LBW in relation to the combined maternal use of tobacco and alcohol during pregnancy. In addition, the study will explore any similarities in maternal age, highest educational attainment by the mother, or population of the place of maternal residence within the Black and White groups reporting the highest incidence of tobacco and/or alcohol use.

2.3 Alcohol Use and Perinatal Outcome

Similar to tobacco use, there is no true safe level of alcohol consumption during pregnancy and most researchers concur that providers of healthcare should be encouraging women not to drink. The effect of prenatal exposure to maternal chronic alcohol consumption on fetal growth is well documented (Aros et al., 2006; Borges, Lopez-Cervantes, Medina-Mora, Tapia-Conyer, & Garrido, 1993; DHHS, 2005; Fraser, 2005; Randall, 2001; Whitehead & Lipscomb, 2003). Since no pattern of consumption can be considered safe, all women attempting to conceive or who become pregnant are advised to abstain by the United States Surgeon General, the American Academy of Pediatrics, and the American College of Obstetricians and Gynecologists (ACOG, 2006; DHHS, 2005). Alcohol intake early in the pregnancy may lead to fetal alcohol syndrome, while abuse in the second or third-trimester may result in IUGR (Intrauterine Growth Restriction) which is fetal weight under the 10^{th} percentile. The extent of damage to the developing fetus is dependent upon the frequency, amount consumed, and the timing during the pregnancy (Handmaker et al., 2006). The CDC considers alcohol use as a major risk factor for poor perinatal outcome, even without any other maternal health or behavior risk factor (Martin et al., 2003). With the exception of California, all states and the District of Columbia record self-reported alcohol use on the birth certificate.

Statistics on the prevalence of reported alcohol use during pregnancy vary widely. In a 1994 study, 14% of pregnant women revealed that they had consumed alcohol within the past month (CDC, 1996). In 2001, 54% of women in the childbearing age group reported alcohol use with 12.5% reporting frequent consumption (Burd et al., 2006). Floyd and Sidhu (2004) report that there has been no significant decline in alcohol use during pregnancy in the past decade and that almost one in eight pregnant women (or roughly 500,000 per year) report alcohol use, with about 80,000 of them acknowledging binge drinking.

Like tobacco use, alcohol use is recognized to be underreported on the birth certificate. This underreporting may be attributed to the social stigma associated with alcohol use in addition to the uncertainty of when the pregnancy began. The overall accuracy of reporting alcohol use when completing a birth certificate form is dependent upon the mother's recall of when pregnancy began and is subject to potential recall bias. Women may state that they consumed some alcohol before they were aware that they were pregnant and did not have alcohol once they knew they were pregnant. Therefore, they may believe that the correct response to the birth certificate question is that they did not consume alcohol.

In 2001, the rate of alcohol use by women during the childbearing years was 54.6% in the United States with drinking during pregnancy reported at 12.4% in 1991 and 12.5% in 2001 (Floyd & Sidhu, 2004). Tough and colleagues in Canada performed a telephonic survey of recently delivered women. Their results concluded that pre-conceptually, 80% drank alcohol and 32% were binge drinking (Tough, Tofflemire, Clarke, & Newburn-Cook, 2006). The highest consumption was among Whites, smokers, those not planning a pregnancy, those not participating in artificial reproduction, and those with higher socioeconomic status. Consumption significantly decreased once pregnancy was confirmed. Prior to pregnancy confirmation, 13.5% of women in the study had been engaging in high risk drinking behaviors, including binge drinking, and an additional 36.4% reported a low-risk drinking pattern (Tough et al.).

The current method of retrospective reporting of this behavior, and the complexities surrounding it, leaves the scientific community lacking a clear understanding of alcohol consumption during the early embryonic development. Unlike smoking, national surveys have not validated the maternal responses. The 1999 birth data reported a 1.0% drinking percentage during pregnancy compared to the 1999 Behavioral Risk Factor Surveillance System (BRFSS) of 12.8 % (Martin et al., 2003). The 2001 natality report from the CDC reports a rate of 0.9% alcohol consumption during pregnancy (Martin et al., 2002) while the Pregnancy Risk Assessment Monitoring System (PRAMS) reports a 4.6% rate of binge drinking from the 19 states participating in the collaborative analysis (Burd et al., 2006). In 2002 self reported alcohol consumption declined to 0.8% (Martin et al., 2003).

In 1987 the CDC introduced the Pregnancy Risk Assessment Monitoring System (PRAMS) because infant mortality rates were not declining at the projected rate. The primary objective of the PRAMS project is to improve the health of mothers and infants by improving outcomes and reducing LBW, neonatal morbidity and mortality, and maternal morbidity. PRAMS provides state-specific data for planning and assessing health programs and for describing maternal experiences that may contribute to maternal and infant health (CDC, 2006b).[6]

Whitehead & Lipscomb (2003) extracted data on births from 1996-1999 from the Pregnancy Risk Assessment Monitoring System (PRAMS) sponsored by the CDC. Their analysis on patterns of alcohol use reported a protective association between low levels of alcohol consumption prior to conception and small for gestational age neonates similar to

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[6] Participation by the states is voluntary and not all State Departments of Health participate with data sharing. Refer to the website for a complete listing and years of individual state participation.

other studies published in Europe (Passaro, Little, Savitz, & Noss, 1996). A potential theory for this lower risk of LBW may be related to the vascular effects of alcohol or dietary differences in women who drink prior to conception. Alcohol is rapidly absorbed and distributed through the body and metabolized by the liver and crosses to the placenta. Moderate alcohol intake has a positive effect on the coagulation system and promotes the growth of vascular endothelial tissue (Mariscal et al., 2005). This may improve oxygenation and the nutritional status of the neonate. Neonates who are growth restricted are known to have decreased levels of vascular endothelial and placental growth factors (Helske, 2001). This may explain how two drinks per week taken intermittently on the weekend by non-smokers decreased the risk of LBW (Mariscal et al., 2005).

A prospective study in Denmark, the Danish National Birth Cohort, reported a similar result of an apparent protective effect of alcohol consumption before conception and two to four drinks per week during pregnancy (Albertsen et al., 2004). The highest incidence of preterm birth was the cohort that abstained from alcohol intake prior to conception and throughout pregnancy.

The published literature on prenatal alcohol exposure demonstrates that this is a public health problem in the United States and indeed worldwide. Despite the low numbers of self-reported alcohol consumption on the birth certificate, an estimated 500,000 women of the over 4 million women who give birth in our country have exposed their fetus to the effects of perinatal alcohol consumption. Cell loss occurs in the fetal brain as alcohol causes neuronal damage through a direct action of a toxin passing through the placenta (Mancinelli, Binetti, & Ceccanti, 2006). Fetal alcohol syndrome is a specific combination of neonatal malformations including facial abnormalities, growth restriction, and disorders of the central nervous system (Allard-Hendren, 2000). Although only a small percentage have FAS (0.30), up to 9.1 children per 1,000 live births have FASD, Fetal Alcohol Spectrum Disorders (Burd et al., 2006). FASD is defined as a spectrum of structural anomalies and neurocognitive and behavioral disabilities (Manning & Eugene Hoyme, 2006). The implications to society are significant with annual health care costs estimated to exceed $4 billion dollars (in 1998 dollars) to care for the children faced with the challenges of FASD (Manning & Hoyme, 2006).

2.3.1 Summary

Research studies have demonstrated that the highest risk of poor perinatal outcome is with binge drinking (Allard-Hendren, 2000; Floyd & Sidhu, 2004; Verkerk, van Noord-Zaadstra, Florey, de Jonge, & Verloove-Vanhorick, 1993; Whitehead & Lipscomb, 2003). Reardon and Buka's (Reardon & Buka, 2002) study on onset and persistence of substance abuse, defined as alcohol and marijuana use, found that onset is similar for both Black and White adolescents at the age of 15. In the 15-17 years of age range they found that alcohol abuse was significantly higher among the Whites than the Blacks. By age 20, the rate of alcohol use and continuation rises among the Blacks while it decreases among the Whites. Theories for the rising dependence of substance abuse may be due to the availability of alcohol in the home and community, and\or peer group differences and age-specific norms, or a coping mechanism for the continual stress found in lower socioeconomic strata (Geronimus, 2001).

This study will examine the risk of both maternal tobacco and alcohol use during pregnancy and the prevalence of LBW. In addition the study will explore how the multivariable factors of maternal age, educational attainment by the mother, and population of the place of maternal residence contribute to the incidence of LBW in women who use both tobacco and alcohol during pregnancy.

2.4 Geographic Residence and Health Outcomes

Maternal behaviors such as alcohol and tobacco use; psychosocial influences including abuse, social support, social participation, demographic, and environmental factors all play a role in pregnancy outcomes. Residents of impoverished urban areas are victims of excess morbidity and mortality when compared to non-urban dwellers (Vlahov et al., 2007). Poverty, the environment, and health are closely associated when discussing physical and psychosocial factors contributing to morbidity and mortality. To explore the role that the environment may contribute to health status we must have an understanding of the development of the central city in the United States and the factors that produced the modern urban ghetto.

The landscape of today's urban environment is a byproduct of past political, financial, and historical events beginning with the end of the Civil War and the emancipation and release of the African-American slaves. The social manifestations of prejudice and discrimination evolved from two world wars, the Great Northern Migration of African-Americans, the Great Depression, the New Deal, the Federal Housing Administration, Urban Development and Renewal. As a result, there are central core cities of many large metropolitan statistical areas that have extreme poverty, inadequate high-density housing, psychological alienation, noise, safety issues, and other psychological stressors.

Today many of the poor share the same medical problems of early onset cardiovascular disease, hypertension, obesity, diabetes, and asthma, and we must realize that their poor health is not caused only by a lack of discipline but may be the result of the built environments in which we live (Berke et al., 2007; Brown, Ang, & Pebley, 2007; Cozier et al., 2007; Cummins, 2007; Cunradi, 2007; Diez Roux, 2007; Jackson, 2003; Nielsen & Hansen, 2007; Stimpson, Ju, Raji, & Eschbach, 2007). In the past thirty years our economy has shifted from being manufacturing based to a global economy based on service, finance, and information technology. The immigration reform of the 1960's also changed the shape of our central cities and frequently created areas of ethnic densities. In summary, the residential segregation noted today in central cities is a by-product of racism, discrimination, and individual prejudices. Our miasma today is not a toxic gas as thought in the 1800's but it is just as illusive. The stress of living in poverty, in over crowded conditions with filth, squalor, and lack of green space may be the root of the growing health care disparities in our country (Epstein, 2003).

One of the most studied health care disparities is low birth weight. Infants born with LBW have an increased risk of mortality within the first year of life and studies have identified the risk of residential segregation as a contributing factor to a higher infant mortality rate for Black infants (Geronimus, Colen, Shochet, Ingber, & James, 2006; LaViest, 1989; Polednak, 1991, 1996; Yankauer, 1950). A recent study by Grady (Grady, 2006) demonstrated that Black women had a higher percentage of LBW babies if they lived in a residential segregated area (9.6 vs. 8.7), and the LBW rate was higher if they lived in poverty (9.3 vs. 8.7), although less than being segregated. Residential segregation is defined as the extent in which racial groups live separately from each other within the urban environment (Grady). The findings were the same for the White women who lived in poverty but were less than the Black woman overall (6.1 vs. 4.8). The purpose of that study was to examine the LBW rate in the boroughs of New York City by investigating the geography of residential segregation and neighborhood poverty. The researcher concluded that as poverty increased in a neighborhood, racial differences in terms of low birthweight cease to exist and that residential segregation and poverty are important determinants of racial disparity in LBW in New York City.

In 1995 neighborhood level data was collected in the city of Chicago for the Project on Human Development in Chicago Neighborhoods (PHDCN). This was an interdisciplinary study of the 847 census tracks that created 343 ecologically meaningful and homogenous neighborhood clusters. Each cluster included about 8,000 residents that were similar in terms of racial and ethnic composition, SES, educational level, and housing density. Buka, Brennan, Rich-Edwards, Raudenbush, and Earls (2003) analyzed the birth outcomes of White-not Hispanic and Black-not Hispanic women from the 1994-1996 birth certificates. When compared to White women, Black women were more likely to be younger, less educated, unmarried, received late or inadequate prenatal care, and smoked during their pregnancy. Infants of the Black women were on average 297 grams smaller than White infants. More than 85% of births to Black women occurred in less than 40% of the 343 neighborhoods. In neighborhoods where over 90% of the births were to Black women, the LBW deliveries increased and the proportion of adults living below the federal poverty level was five times greater than for the majority White birth neighborhoods. The study highlighted the vast differences in the environment in which Black and White pregnant women live and the degree of racism. The residents' perceptions of neighborhood support were different as well with the mostly White neighborhood mean value of support at 0.63 (signifying above average trust and support) and the Black neighborhoods were one standard deviation lower (Buka et al., 2003).

In summary, the study found a positive relationship between levels of neighborhood support and birth weights of infants of White mothers only. No association was found between neighborhood support and birth weights for a predominantly Black neighborhood however, there was a significant effect regarding the level of socioeconomic disadvantage. "As unemployment, poverty, and public assistance levels increased, the mean birth weight of African-American infants decreased" (Buka et al., 2003 p. 1).

Poverty or race alone does not account for poor health outcomes as place does matter. In general, Geronimus reported that the Black-White disparity noted in the mortality rate was related not only to race, but also to the geographic location of residence. The highest White mortality rate was with impoverished Whites in the northern urban locales (Detroit and Cleveland) who had mortality rates similar to those of the African-American nationwide average or the African-American in the southern rural locale. The poorest Whites (in Appalachian Kentucky), had mortality rates that were lower than northern, urban Whites even though the north poverty rate was only one third of the Kentucky rate (Geronimus, 1999). Improving health outcomes must include research to understand how to address interactions between race, behavior, and the environment. This study explored if there is a relation between the population density of the place of maternal residence and the individual variables of smoking or alcohol use during pregnancy. In addition, the study will examine the influence of maternal place of residence and the prevalence of LBW in women who use both tobacco and alcohol during pregnancy.

Thompson, Goodman, Chang, and Stukel (2005) studied regional variation in rates of low birth weight utilizing the 1998 United States birth cohort with county and health care characteristics. After controlling for established risk factors such as maternal age, completion of high school, marital status, tobacco use, alcohol use, entry into prenatal care, race, ethnicity and multiple gestation they were unable to explain the regional variation of LBW. They concluded that although LBW is largely still unexplained, there appears to be a link between residence and perinatal health care delivery as demonstrated by the 3-fold variation of rates across regions that could not be explained by known individual and community risk factors (Thompson et al., 2005). The disparity in the regional rates between Black and White infants reflect what has consistently been and remains in the research literature.

Farley (Farley et al., 2006) and his colleagues explored the role of place by researching the neighborhood socioeconomic status; extent of neighborhood deterioration; and density of fast food restaurants, markets, and tobacco and alcohol outlets. Their sample was live infants born in Louisiana between 1997 and 1998 with a total sample population of 132,772. The hypothesis was that physical and social conditions of impoverished neighborhoods may influence stress and risk taking behaviors of substance abuse and sexual exploitation. The findings included an decreased risk of LBW with a tract-level median household income; a weak association with neighborhood deterioration that was inconsistent when controlling for individual factors; and no relationship with the neighborhood density of fast food restaurants, markets, and tobacco and alcohol outlets (Farley et al.).

This outcome did not support previous research findings that suggested that some type of environmental (place) factor accounted for the lower birth weights of American born Black infants in comparison to infants born from foreign born Black women (O'Campo, Xue, Wang, & Caughy, 1997; Roberts, 1997). Multigenerational studies of birth weights find that infants of European immigrants grow larger while infants of African born Black women become smaller over the generations (Ananth et al., 2003; Belue et al., 2006; Buescher & Mittal, 2005; Collins, Jr., Wu, & David, 2002; Denham, Schell, Gallo, & Stark, 2001; Foster, Wu, Bracken, Semenya, & Thomas, 2000).

Stimpson and Ju (2007) reported on neighborhood deprivation and health risk behaviors in NHANES III and concluded that neighborhood deprivation was associated with increased odds of partaking in health risk behaviors of self-reported excessive alcohol consumption and smoking. These results were independent of sociodemographic factors, BMI, and comorbidities.

Stephen Burka (2002) contends that there are three leading explanations for the disparities in health outcomes in our country. They are racism: (segregation), socioeconomic inequalities, and the environment (place) in which minorities find themselves, particularly in the urban context. Camara Jones defines race as follows: Race is not a biological construct that reflects innate differences, but a social construct that precisely captures the impacts of racism (Collins, 2005). Foster, Bracken, Semenya and Thomas (2000) studied second and third generation birth outcomes of Black women alumni of Meharry Medical College and White women alumni of Yale University. The

Black LBW rate was reduced in the third generation high SES to 6.9% from 11.4% in the second generation for Black infants but continued to be twice the rate of the white infants at 3.3%. The study demonstrated that as SES increases the incidence of LBW decreases regardless of race.

2.4.1 Summary

Geronimus proposes that persistent poverty and segregation or those exposed to environmental hazards varies across locales, with the urban inhabitants most at risk (Geronimus, Bound, & Waidmann, 1999b). The consistent strain of lack of resources and living in a toxic environment contribute to risk taking behaviors and chronic stress. Poverty can be seen in all environments but appears most significant in the central city. Geronimus believes this poverty, combined with the toxic urban environment, creates a potentially lethal combination due in part to three main factors described below (Geronimus, 2000).

- The change in our society from a manufacturing to a service industry leading to loss of jobs, unemployment in the urban areas, and low paying service sector employment that frequently does not support healthcare coverage.
- Rising real estate costs creating a lack of affordable housing in major urban centers, an increase in homelessness with a concomitant reduction of city services like police, fire, and emergency services.
- Reductions in finances to create, maintain, or supervise public spaces in urban areas leading to deterioration of parks and evolution of the space for illicit use.

Geronimus concludes that "socioeconomic characteristics of urban populations are unlikely to be transformed in isolation; they are not associated with an otherwise level playing field" (Geronimus, 2000 p. 869). The environmental factors that may influence birth outcomes remain poorly understood and may be related to financial status and social placement and may not lend itself to scientific study of the physical environment at the time of birth. As discussed previously, it may indeed be a cumulative process with continuous yet insidious stress over time resulting in less healthy lifestyles and poorer neonatal outcomes.

CHAPTER 3

METHODOLOGY

3.1 Research Design

This study was a population-based study of singleton births delivered in the United States of America in 2003.

3.2 Sample

Approximately 4 million birth certificates from the 50 states, the District of Columbia, New York City, Puerto Rico, the Virgin Islands, American Samoa, and the Commonwealth of the Northern Marianas comprise the natality files produced by the National Center for Health Statistics (NCHS) of the U.S. Department of Health and Human Services. These data are made up of all births sent to the Vital Statistics Cooperative Program of the National Center for Health Statistics. With the exception of Guam, where paper copies are sent, the data are received as electronic files from the individual registration centers. The birth data are limited to births within the United States of America to U.S. residents and non-residents. Births to American citizens outside of the U.S. are not included in the data set. *The Public Health Service Act* (Section 308) (d) provides that the data collected by the NCHS, Centers for Disease Control and Prevention (CDC), may be used only for the purpose of health statistical reporting and analysis. The NCHS omits all direct identifiers, as well as any characteristics that might lead to identification of any reported case.

To maintain confidentiality in the reporting system, actual date of birth for the mother and father are not included in the data set. In addition, geographic detail is restricted to cities and counties with a population of greater than 100,000. Specifically, the county FIPS codes for counties with populations less than 100,000 are not provided on the natality files; instead all of these counties are assigned the same geographic code for "balance of state". Because there are counties with populations less than 100,000 in all of the urban-rural categories except the large central metro category, it is not possible to compute birth and death rates by urbanization level using the standard natality and mortality public-use files.[7]

3.3 Data Set

Overall, the data set includes detailed information on 4.1 million births from the year 2003. Data on pregnancies that resulted in singleton births were abstracted from the 2003 natality file. A healthcare person obtains data on the pregnancy and delivery from the woman's medical records for inclusion on the birth certificate. Other information such as sociodemographics (race, level of educational attainment, city, and county of residence) or the exposure to potential risk factors such as use of alcohol or tobacco is obtained from patient self-report.

Changes to the reporting categories of the birth certificate were in place for the 2003 reporting year, but only the states of Washington and Pennsylvania instituted all of the revisions. New items on the 2003 certificate of live birth include history of fertility therapy for this current pregnancy, infections during the current pregnancy, receipt of

[7] Information obtained from http://www.cdc.gov/nchs/products/elec_prods/subject/natality.htm#note

WIC food, material morbidity and breast feeding. Revision to existing items included allowing the ability to capture multiple race, quantity of tobacco use preconception and during each of the trimesters, history of prenatal care, the Body Mass Index (BMI), different/more detailed reporting on the highest level of education attainment by the mother, and onset of labor. Where comparable, the data from Washington and Pennsylvania were combined with data from the other 48 states and the District of Columbia. Data on smoking, alcohol, and education had significant changes in data collection fields in 2003 and therefore several variables were not comparable for reporting with the other 48 states and the District of Columbia. As a result data are therefore expressed as unrevised (1989 format) or revised (2003 format) in the affected variables. The 2003 revisions will be phased in by all states over the next several years.

Race and Hispanic origin are reported separately on the birth certificate. Data provided by race as indicated on the birth certificate of 44 states and the District of Columbia reported according to the 1997 revision by the Office of Management and Budget (OMB) and include: Native American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, and White (note that only one category is permitted to be selected). The 2003 Birth Certificate revisions allow for multiple-race reporting and were collected this way by Pennsylvania and Washington. In addition, California, Hawaii, Ohio (for births occurring in December only), and Utah allowed multi-race reporting. These states account for 20.7 % of the overall births in the country and reported 2.5 % of mothers as multiracial (USDHHS, 2005). Until all states have phased in the ability for multi-race reporting, the CDC has created a bridging procedure to provide uniformity and comparability of the data for analysis purposes.

Race/ethnicity categories include: non-Hispanic white, non-Hispanic black, non-Hispanic Native American, non-Hispanic Asian/Pacific Islander and Hispanic (with five subgroups).

3.3.1 Selected Variables and Descriptions

3.3.1.1 Overview Variables were selected that would provide data to answer the study questions in the most consistent manner. Neonatal birthweight was selected as the single variable to measure the outcome of the pregnancy as either term (weight greater than 2500 grams), or Low Birth Weight (weight 2500 grams or less). Gestational age was purposefully not selected as an additional variable to determine the outcome of the pregnancy. Classification of pregnancy length is considered preterm/premature if a birth occurs before the 37th completed week of gestation, term if a birth occurs after the 37th completed week of gestation up to 41 weeks, and post-term at or after 42 completed weeks of gestation (ACOG, 2002).

The traditional method of determining gestation age is predicated on the Last Menstrual Period (LMP) and concludes with the birth. LMP has been considered more reliable than the date of conception, which occurs about 2 weeks after the LMP. This method is fraught with opportunities for error, including poor maternal recall, menstrual cycles shorter or longer than 28 days (the number that the calculation methodology is based upon), late or absent early ultrasound assessment, and/or late entry into prenatal care. The 1989 revisions to the birth certificate added a clinical estimate of gestation age, determined by physical examination of the newborn based on a standardized, albeit subjective, tool (ACOG, 2002). The clinical estimate is compared with the length of gestation computed from the LMP if the latter appears to be inconsistent with the birthweight. This occurred in 4.6% of the births in 2003 and the CDC concludes that substantial incongruities in these data persist and that research is ongoing to address these data deficiencies relative to the gestational age variable (CDC, 2006a).

3.3.1.2 Variables

Race: White; non-Hispanic White or Black; non-Hispanic Black

Geographic Considerations: American born women excluding Puerto Rico, Virgin Islands, Guam, American Samoa, and Northern Marianas Data.

Pregnancy Considerations: singleton births to American-born women

Neonatal Birthweight: All infants with a birth weight of less than 2,500 grams were classified as low birth weight (MOD, 2006).

Maternal Age: Age of the mother at the time of birth which ranged from less than age 15 to age greater than 50 and represented in 5 year increments.

Marital Status: Single, married, widowed, divorced.

Population of Residence City: less than 100,000; 100,000-250,000; 250,000-500,000; 500,000- 1,000,000; or greater than one million.

Status of Residence County: Non-metropolitan county or metropolitan county.

Educational Attainment: no formal education, 1-8 years of elementary school, 1-2 years of high school, 3-4 years of high school, 1-4 years of college, or greater than 5 years or more of college.

Tobacco Use: smoker or non-smoker; quantity smoked 1-5 per day; 6-10 pr day; 11-20 per day; 21-40 per day; 41 or more cigarettes per day.

Alcohol Use: drinker or non-drinker; 1 drink per week; 2 drinks pr week; 3-4 drinks per week; 5 or more drinks pr week.

3.4 Technical Comments Regarding Selected Variables

Included with the Natality File is a 410 page document titled "Documentation of the Detail Natality Public Use File for 2003". This document contains a list of the data elements, electronic locations, detail record layout, and contains multiple appendices with information to assist in interpreting the file. The following list identifies how the CDC imputed data and describes special attributes of reporting for some variables.

Maternal Age: In 2003, 0.01% were missing maternal age on the birth certificate and was imputed.

Race: A total of 0.5% of births did not have maternal race reported. When race of the mother is missing from the birth certificate, NCHS imputes race using race of the father, if available. (MOD, 2006).

Marital Status: was imputed for 0.04% of the birth records in the 48 states and the District of Columbia where this information was missing.

Highest Education: Educational attainment is available only on the mother, as the NCHS stopped collecting data on the educational attainment of the father in 1995. Women who have not completed a year, are tabulated as having finished the preceding grade. The 2003 variables regarding educational attainment by the mother are excluded for Washington and Pennsylvania, as they are not comparable to the other 48 states and the District of Columbia still reporting on the 1989 variables.

Neonatal Birth Weight: If birth weight was missing, the birth is excluded from the computation of percentages.

Tobacco Use: Cigarette use was reported by 44 states, the District of Columbia, and New York City in a comparable fashion (the 1989 revision). These data represent 76% of the U.S. births in 2003. Indiana, New York (minus New York City), Pennsylvania, South Dakota, and Washington reported the tobacco use variable in a format that was not compatible with the 1989 revisions. The state of California did not report tobacco use on the birth certificate.

Alcohol Use: The areas that reported alcohol use represented 81% of the U.S. births in 2003. The states of California, Pennsylvania, and Washington did not collect data on alcohol use during pregnancy.

Geographic Residence: Data on residence include: population size; city, population size; county, metropolitan/nonmetropolitan county. Cities and counties with a population of less than 100,000 are not separately identified due to confidentiality restrictions.

3.5 Analysis

The secondary analysis of this data set was performed with SAS V9. The initial model was a crude association between combined alcohol and tobacco use and LBW based on relative risk (RR). Chi-Square, Mantel-Haenszel Chi-Square, Cochran-Armitage Trend Test, Cochran-Mantel-Haenszel test, odds ratios and 95% confidence intervals were calculated to test whether cigarette smoking versus no cigarette smoking, and drinking versus no drinking was associated with an increase in the risk of low birth weight for race, age (in 5 year increments), and place (population density of the city and county). The Cochran-Mantel-Haenszel statistic assumes a common odds ratio and tests the null hypothesis that X and Y are conditionally independent, given Z. The purpose of the CMH is to test whether the response is conditionally independent of the explanatory variable when adjusting for the control variable. The Breslow-Day statistic tests the null hypothesis of homogeneous odds ratio, which means it tests whether the odds ratio between X and Y is the same as in different Z categories. It is a test of homogeneous association. The Breslow-Day Test with a significant p value of <.0001 shows there is no homogeneity of the odds ratios across age groups.

The relative risk of delivering a LBW infant according to self-reported alcohol and tobacco use during pregnancy was analyzed. With a logistic regression model that calculated the relative risk of the investigational variable (LBW) while controlling for race (Black versus White), age (in 5 year increments of < 15, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, and 45-49 years), smoking status (smokes versus nonsmoker), whether the mother drank during the pregnancy (versus didn't drink), and geographic place of residence (city population).

3.6 Process

The Study Data Set consists of all American born White; non-Hispanic and American born Black; non-Hispanic women (excluding Puerto Rico, Virgin Islands, Guam, American Samoa, and Northern Marianas Data) with singleton pregnancies.

Table 3.1

Variables Extracted for Analysis from the Natality File

General Socio-Demographic Information	Tobacco Use	Alcohol Use	Geographic Residence
Maternal Age Range <15->50 (0.01% imputed)	Percent with tobacco use (yes/no)	Percent with alcohol use (yes/no)	Classification of Residence County (metro/non-metro)
Race Black or White (0.5% imputed)	Cigarettes before pregnancy (2003 revision states only)	Quantity of alcohol per week (in increments)	Population of residence city (in increments)
Marital Status Single, Married, Widow, Divorced (0.4% imputed)	Percent tobacco use: first, second, & third trimester .(2003 revision states only)		
Highest education achieved (2003 version) None to terminal degree	Quantity of cigarettes per day in increments of 10		
Highest education achieved (1989 version) None to >5 years college			
Neonatal Birthweight <2500 grams/2500 grams or greater			

The following sub-sets were established for both the Black and White populations to determine the frequency of low birth weight:

a) American born Black and White; non-Hispanic women (excluding Puerto Rico, Virgin Islands, Guam, American Samoa, and Northern Marianas Data) with singleton pregnancies (Full Study Data Set).
b) American born Black/White; non-Hispanic women (excluding Puerto Rico, Virgin Islands, Guam, American Samoa, and Northern Marianas Data) with singleton pregnancies who report tobacco use.
c) American born Black/White; non-Hispanic women (excluding Puerto Rico, Virgin Islands, Guam, American Samoa, and Northern Marianas Data) with singleton pregnancies who report alcohol use.
d) American born Black/White; non-Hispanic women (excluding Puerto Rico, Virgin Islands, Guam, American Samoa, and Northern Marianas Data) with singleton pregnancies who have low birth weight.
e) American born Black/White; non-Hispanic women (excluding Puerto Rico, Virgin Islands, Guam, American Samoa, and Northern Marianas Data) with singleton pregnancies who report both tobacco and alcohol use.

Subsequent models were based on multivariable logistic regression to determine the effects on LBW of maternal age (increments of < 15, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, and 45-49 years), race, and the environment (city population density and county designation as metropolitan or non-metropolitan), and the combined risk behaviors of alcohol and tobacco.

CHAPTER 4

RESULTS

4.1 Introduction

This population based study examined births delivered in the United States of America in 2003 to examine the self-reported risk taking behaviors of maternal tobacco use and alcohol use during pregnancy among American born White and Black non-Hispanic women and explore its impact on neonatal outcome as measured by birthweight. Risk was then tested against concepts proposed in the Weathering Theory.

Overall, there were 4,089,950 live births reported in the United States in 2003, representing a 2% increase over the previous year. Increases were noted in the White-Hispanic, Hispanic, American Indian, and Asian or Pacific Islander while a decrease was seen in the Black-Non-Hispanic group (Martin et al., 2005). Increases were noted in the following areas: births to women aged 25-29, 30-34, 35-39, 40-44 years; births to unmarried women; preterm births; LBW; and multiple births particularly high order multiples of triplets and greater. There was a decline in the teenage birth rate; births to women aged 20-24 years; and reported tobacco use (Martin et al., 2005).

4.2 Descriptive Statistics of the Study Data Set

4.2.1 Overview

Of the over 4 million births in the 2003 Natality file, the study data set contained 2,582,991 births who were from American born Black or White; non-Hispanic women with singleton pregnancies (excluding Puerto Rico, Virgin Islands, Guam, American

Samoa, and Northern Marianas Data). The White non-Hispanic group was 2,099,416 and the Black non-Hispanic group was 483,575.

Unless specifically identified, data presented on tobacco and alcohol use are from the 1989 reporting format. For tobacco, that included 44 states, the District of Columbia, and New York City. For alcohol that included data from the District of Columbia and all states except California, Pennsylvania, and Washington. The states reporting in that format on maternal tobacco use represent 76% and on maternal alcohol use represent 81% of the total sample, which allows for a robust analysis.

There was no risk of Type II error, or incorrectly accepting the null hypothesis due to the dissimilar group sizes, as the purpose of the study was not to compare the two groups. A series of logistic regression models were estimated separately for American born White; non-Hispanic women and American born Black; non-Hispanic women. To determine if the risk of LBW was associated with tobacco use, alcohol use, maternal age, or population density of the place of residence, LBW was used as the dependent variable in the logistic regression models. In an attempt to control for Type I errors, the level of significance (alpha) was set at the 0.05 level with a corresponding 95% confidence level. Chi-Square, Mantel-Haenszel Chi-Square, Cochran-Armitage Trend Test , and Cochran-Mantel-Haenszel test were calculated (Bernar, 2006).

This study did not control for covariates that might be associated with LBW, including maternal type of perinatal nutrition, history of maternal periodontal disease, history of bacterial vaginosis, history of assisted reproductive care, or maternal co-morbidities of acute or chronic medical conditions. Acute medical conditions of the mother are the only variables that are found on all birth certificates. The other covariates, although potentially important to the research question, are not a consistent part of the data collection on all birth certificates. Potential confounding factors to the relationship between LBW and combined maternal tobacco and alcohol use included parity, body mass index (BMI), previous adverse pregnancy outcomes, and history of pre-existing medical conditions that were not controlled for in this study. Paternal age was not examined in the context of this study as the intent was to study the relationship of the maternal age based on the weathering theory, not the paternal age. Work by Reichman and Teitler (2001) reported paternal age as an independent risk factor for LBW in the urban population. After adjusting for maternal age, newborn gender, birthplace, parity, marital status, and type of insurance they noted that fathers older than 34 years of age were 90% more likely than fathers aged 20-34 years of age to have a LBW baby. They applied Geronimus' weathering hypothesis to the father and suggest that a paternal weathering phenomenon may exist, supported by her report that impoverished, urban Black men are at extreme risk for morbidity at earlier ages (Geronimus, 1999).

In general, the White non-Hispanic group had a LBW incidence of 5.1% (Table 4.1); most frequently experienced childbearing in the age group of 25-29 years of age (Figure 4.1); were primarily married (75.4%); initiated prenatal care in the first trimester (81.8%); 86% did not smoke tobacco (Table 4.2); 99% did not drink alcohol (Table 4.3); and the women lived in a city of 100,00 or less (81%), in a county (76 %) that was considered to be a metropolitan county (Figure 4.2 and Table 4.4).

Table 4.1*[8]
LBW by Maternal Age and Race

Age in Increments	White Population % LBW	Black Population % LBW
15 years	9.74	15.13
15-19 years	7.75	12.91
20-24 years	5.87	11.39
25-29 years	4.60	10.84
30-34 years	4.22	12.21
35-39 years	5.01	14.83
4044 years	6.46	16.78
45-49 years	7.63	18.33
50 years and >	10.71	16.67
Overall LBW	5.15	12.02

The Black non-Hispanic group had a LBW incidence of 12% (Table 4.1); most frequently experienced childbearing in the age group of 20-24 years of age (Figure 4.1); were primarily not married (72.7%); initiated prenatal care in the first trimester (71.5%); 91% did not smoke tobacco (Table 4.2); 99% did not drink alcohol (Table 4.3); and the women lived in a city with a population under 100,00 (50%) in a county (86%) that was considered to be a metropolitan county (Figure 3.1 and 4.4).

[8] Tables and figures that contain an * after the number indicate that a Table with additional data is located in Appendix B with the same Table/Figure number and name. The additional data include the frequency percent of the N, and column percent of the n.

Figure 4.1* Maternal Age at Childbearing by Race

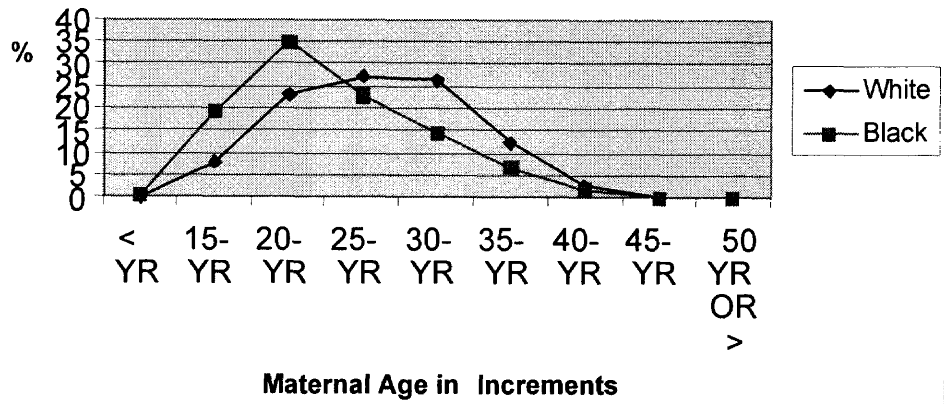


Table 4.2*
Tobacco Use by Race

Race of Mother	Tobacco Use %	% Non-smokers
White	13.68	86.32
Black	8.70	91.30

Table 4.3*
Alcohol Use by Race

Race of Mother	Alcohol Use %	% Non-drinker
White	0.86	99.14
Black	0.84	99.16

Figure 4.2 Population of Residence City by Race

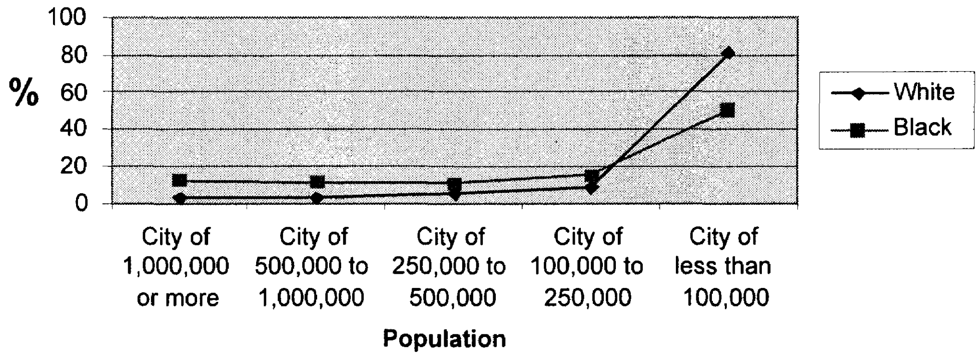
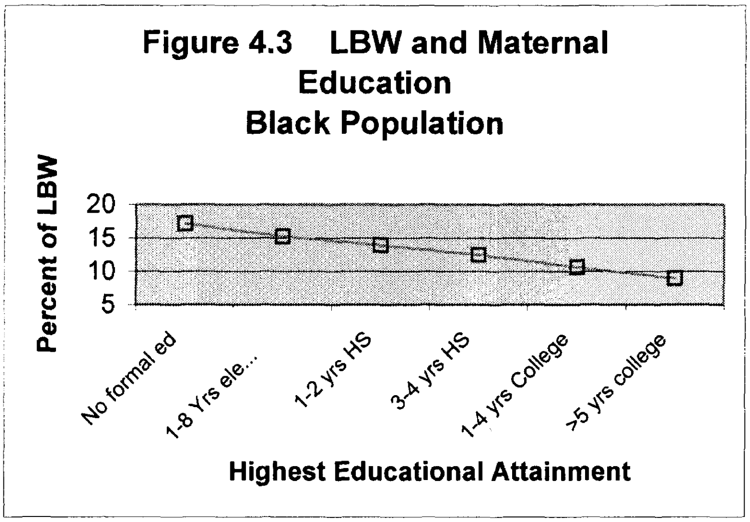


Table 4.4*

Residence of County by Race

	Metropolitan residence county		
Race of Mother	% Metropolitan County	% Non-metropolitan County	Total
White	75.80	24.19	2099416 81.28
Black	86.29	13.71	483575 18.72
Total	77.76	22.23	2582991 100.00

There was an inverse relationship of maternal education and LBW in the Black population. The prevalence of LBW decreased as the highest education attainment of the mother increased (Figure 4.3).

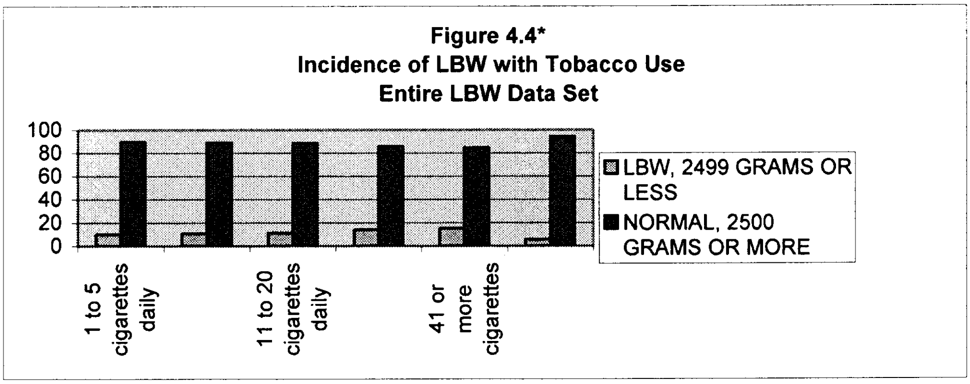


4.3 The Primary Question

The question of the incidence and relative risk for low birth weight (neonatal birth weight less than 2500 grams) in relation to combined maternal alcohol and tobacco use was answered by analyzing reported tobacco and alcohol use individually and then as a combined variable.

4.3.1 Tobacco Use

The incidence of LBW in the entire population for the non-smoker was 5.81%. The LBW rate for 1-5 cigarettes/day, 6-10 cigarettes/day, 11-20 cigarettes/day, 21-40 cigarettes/day, or >41 cigarettes/day was 10.18%, 10.86%, 11.39%, 14.24%, 15.32% respectively. (Figure 4.4*) Women who used tobacco during pregnancy were almost two times more likely to have a LBW neonate than women who did not smoke. The p value of Chi-Square test and Cochran-Armitage Trend Test for tobacco use were significant at less than 0.0001.



The incidence of LBW in the White population for the non-smoker was 4.41% compared to 9.72% in the tobacco using group. The highest incidence of LBW in White women who smoke was 16.55% in the older age group of 45-49 years of age compared to the Black women, $p < .0001$ (Figure 4.5). Tobacco using women were 2.5 times more likely to have a LBW baby than a non-smoking mother in 45-49 years of age group (CI 1.5, 4.1). The LBW rate in the White population for 1-5 cigarettes/day, 6-10 cigarettes/day, 11-20 cigarettes/day, 21-40 cigarettes/day, or >41 cigarettes/day was 8.2%, 9.86%, 10.73%, 13.65%, 15.08% respectively (Table 4.5).

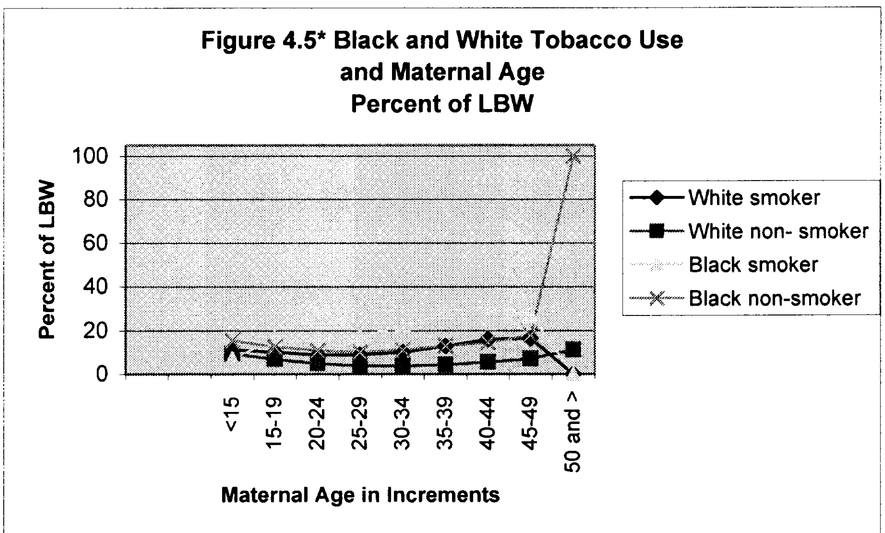


Table 4.5*

Incidence of LBW with Tobacco Use in the White Population

	Tobacco Use						
Birthweight	1 to 5 cigarettes daily	6 to 10 cigarettes daily	11 to 20 cigarettes daily	21 to 40 cigarettes daily	41 or more cigarettes daily	Non-smoker	Total
% LBW	8.20	9.86	10.73	13.65	15.08	4.41	98359 **5.14**
% > 2500 Grams	91.80	90.14	89.27	86.35	84.92	95.59	1815528 **94.86**
Total	3.83	6.03	3.45	0.35	0.02	86.32	1913887 100.00

Frequency Missing = 185529

The incidence of LBW in the Black population for the non-smoker was 11.42% compared to 18.51% in the tobacco using group. The highest incidence of LBW in Black women who smoke was 31.54% in the younger age group of 40-44 years of age compared to the White women, (Figure 4.5) $p < .0001$ and tobacco using women were 2.7 times more likely to have a LBW baby than a non-smoking mother in the 40-44 years of age group (CI 2.3, 3.1). The LBW rate in the Black population for 1-5 cigarettes/day, 6-10 cigarettes/day, 11-20 cigarettes/day. 21-40 cigarettes/day, or >41 cigarettes/day was 17.31%, 19.36%, 20.85%, 22.67%, 17.65% respectively (Table 4.6).

Table 4.6*
Incidence of LBW with Tobacco Use in the Black Population

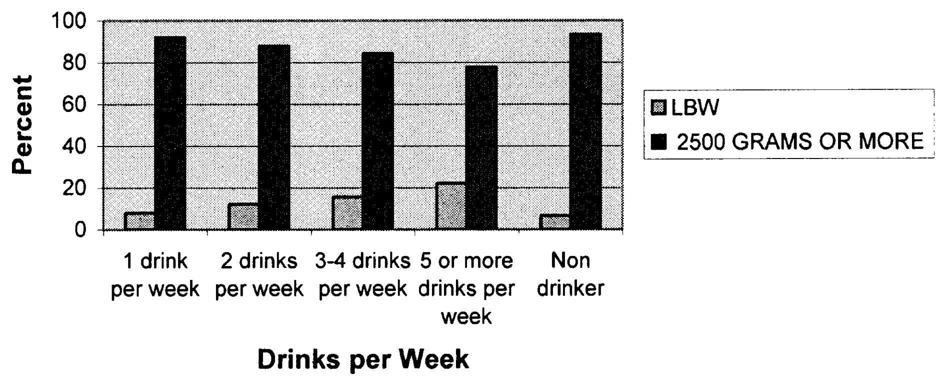
	Tobacco Use						
Birthweight	1 to 5 cigarettes daily	6 to 10 cigarettes daily	11 to 20 cigarettes daily	21 to 40 cigarettes daily	41 or more cigarettes daily	Non-smoker	Total
% LBW	17.31	19.36	20.85	22.67	17.65	11.42	54128 **12.04**
% > 2500 grams	82.69	80.64	79.15	77.33	82.35	88.58	395402 **87.96**
Total	4.52	3.03	1.03	0.10	0.01	91.30	449530 100.00

Frequency Missing = 34045

4.3.2 Alcohol Use

The frequency of LBW in the total population of non-drinking women was 6.50% compared to 11% in the women who drink. The overall LBW rates were not significantly different between the non-metropolitan county and the metropolitan county, with 6.61% and 6.56% respectively. The LBW rate in the total population who consumed 1 drink/week, 2 drinks/week, 3-4-drinks/ week, or 5 or more drinks/week was 8.02%, 12.16%, 15.69%, and 22.19% respectively. (Figure 4.6) value of Chi-Square test and Cochran-Armitage Trend Test for alcohol was significant at less than 0.0001.

Figure 4.6* Incidence of LBW with Alcohol Use
Entire Data Set



The rate of LBW in the White population who did not drink was 5.22% compared to 7.94% in the alcohol using group. The highest incidence of LBW in White women who use alcohol was 14.81% in the age group of 45-49 years of age. These women were twice as likely to have a LBW baby than a non-drinking mother in the same age group (CI .6, 5.9). Reported alcohol use was noted throughout all city and county populations. The LBW rate in the White population who consumed 1 drink/week, 2 drinks/week, 3-4 drinks/ week, or 5 or more drinks/week was 5.97%, 8.95%, 9.83%, 16.28% respectively (Table 4.7).

Table 4.7*

Incidence of LBW with Alcohol Use in the White Population

	Alcohol Consumption					
Birthweight	1 drink per week	2 drinks per week	3-4 drinks per week	5 or more drinks per week	Non drinker	Total
Percent of LBW	5.97	8.95	9.83	16.28	5.22	94225 5.24
Per cent of 2500 grams or more	94.03	91.05	90.17	83.72	94.78	1705283 94.76
Total	0.41	0.13	0.07	0.07	99.32	1799508 100.00

Frequency Missing = 299908

The rate of LBW in the non-drinking Black population was 12% compared to 26.03 % in the alcohol using group. The highest incidence of LBW in Black women who use alcohol was 42.77% in the age group of 40-44 years of age who were 3.8 times more likely to have a LBW baby than a non-drinking mother in the same age group (CI 2.7, 5.2). The highest incidence of LBW in Black women who do not use alcohol was 19.16% in the age group of 45-49 years of age (p 0.04). The LBW rate in the Black population who consumed 1 drink/week, 2 drinks/week, 3-4 drinks/ week, or 5 or more drinks/week was 21.27%, 23.13%, 31.64%, 34.74% respectively (Table 4.8).

Table 4.8*

Incidence of LBW with Alcohol Use in the Black Population

	Alcohol Consumption					
Birthweight	1 drink per week	2 drinks per week	3-4 drinks per week	5 or more drinks per week	Non drinker	
Percent of LBW	21.27	23.13	31.64	34.74	12.00	52781 12.09
Percent of 2500 grams or more	78.73	76.87	68.36	65.26	88.00	383820 87.91
Total	0.26	0.16	0.10	0.13	99.35	436601 100.00

Frequency Missing = 46974

4.3.3 Relative Risk of LBW with Combined Tobacco and Alcohol Use

Changes to the reporting categories of the birth certificate were in place for the 2003 reporting year, but only the states of Washington and Pennsylvania instituted all of the revisions, in addition several states did not collect these data elements. Tobacco use is not reported by the state of California, and is in a non-comparable format from the states of Indiana, New York (minus New York City), Pennsylvania, South Dakota, and Washington. Data on tobacco to determine the relative risk of the combined tobacco and alcohol use was limited to 44 states, the District of Columbia, and New York City. These data represent 76% of the U.S. births in 2003.

The states of California, Pennsylvania, and Washington did not collect data on alcohol use during pregnancy in a format comparable for reporting with the other 48 states and the District of Columbia. The areas who reported alcohol use to determine the relative risk of combined tobacco and alcohol use represented 81% of the U.S. births in 2003.

Relative Risk

The relative risk of delivering a LBW infant according to self-reported alcohol and tobacco use during pregnancy was analyzed using a regression model. Logistic regression was used to calculate the relative risk of the investigational variable (LBW) while controlling for race (Black versus White), age (in 5 year increments of < 15, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, and 45-49 years), smoking status (smokes versus nonsmoker), whether the mother drank during the pregnancy (versus did not drink), and geographic place of residence (city population density and metropolitan county).

To examine the relative risk, a new variable was created based upon the subset of states reporting on the 1989 revision format with a response 'yes' for both tobacco and alcohol use during pregnancy versus a response 'no' for both tobacco and alcohol use during pregnancy. The incidence of LBW in the study data set of both races was 18.6% in the tobacco and alcohol user group versus 6.48% in the non-users group. (Table 4.9) Chi-Square and Cochran-Armitage Trend Test were both significant with *p* values <0.0001. The highest percentage of LBW within this new variable of combined tobacco and alcohol use was in the maternal age group of 40-44 years of age versus the highest percentage of LBW in the age group of under the age of 15 years in the non-risking taking group.

Table 4. 9*

Incidence of LBW with Combined Tobacco and Alcohol Use in the Entire Data Set

	Tobacco & Alcohol Use			Total
Frequency	Yes	No	*p* value	
% LBW, 2499 grams or less	18.60	6.48	<.0001	143114 6.51
% NORMAL, 2500 grams or more	81.40	93.52	<.0001	2054317 93.49
Total	6499 0.30	2190932 99.70	<.0001	2197431 100.00

Frequency Missing = 385560

The highest prevalence of combined tobacco and alcohol use was in a city with a population of 500,000 to 1 million (Table 4.10) but was equally noted in the metropolitan and non-metropolitan county at .3% (Table 4.11). There was no statistical significant difference in the incidence of tobacco and alcohol use in the city population density or metropolitan status.

Table 4. 10*

Combined Tobacco and Alcohol Use and City Residence in Both Races

	Population of Residence City					
	City< 100,000	City 100,000 to 250,000	City 250,000 to 500,000	City 500,000 to 1,000,000	City of 1mill. or more	Total
Combined Use	0.28	0.35	0.34	0.39	0.37	6506 0.30
Non-User	99.72	99.65	99.66	99.61	99.63	2192085 99.70
Total	76.24	8.89	5.52	5.00	4.34	2198591 100.00

Frequency Missing = 384400

Table 4. 11*

Combined Tobacco and Alcohol Use and County Residence in Both Races

	County Metropolitan Residence		
	Nonmetropolitan	Metropolitan County	Total
Combined Use	0.29	0.30	6506 0.30
Non-user	99.71	99.70	2192085 99.70
Total	526441 23.94	1672023 76.05	2198591 100.00

Frequency Missing = 384400

The LBW of the White population with combined risk behaviors of tobacco and alcohol use was 13.78% (Table 4.12) compared to 30.75% in the Black population (Table 4.13). White women who were both tobacco and alcohol users were 2.9 times (CI 2.7, 3.2) more likely to have a LBW infant than non-users (Table 4.13) while the odds for Black women were 3.2 times (CI 2.9, 3.6) more likely (Table 4.15). In the White population, the highest percentage of LBW with combined substance use was in the 20-24 years of age group, the Black population was in the 30-34 years of age group.

Table 4. 12*:

Incidence of LBW with Combined Tobacco and Alcohol Use in the White Population

Frequency	Tobacco & Alcohol Use Yes	No	*p* value	Total
% LBW, 2499 grams or less	13.78	5.14	<.0001	91072 5.16
% NORMAL, 2500 grams or more	86.22	94.86	<.0001	1674177 94.84
Total	4652 0.26	1760597 99.74	<.0001	1765249 100.00

Frequency Missing = 334167

Table 4. 13

Odds Ratio for White Population Combined Tobacco and Alcohol Use and Risk for LBW

Type of Study	Value	95% Confidence Limits	
Case-Control (Odds Ratio)	2.9515	2.7147	3.2090

Table 4. 14*

Incidence of LBW with Combined Tobacco and Alcohol Use in the Black Population

	Tobacco & Alcohol Use			Total
Frequency	Yes	No	*p* value	
% LBW, 2499 grams or less	30.75	11.96	<.0001	52042 12.04
% NORMAL, 2500 grams or more	69.25	88.04	<.0001	380140 87.96
Total	1847 0.43	430335 99.57	<.0001	432182 100.00

Frequency Missing = 334167

Table 4. 15

Odds Ratio for Black Population Combined Tobacco and Alcohol Use and Risk for LBW

Type of Study	Value	95% Confidence Limits	
Case-Control (Odds Ratio)	3.2687	2.9598	3.6097

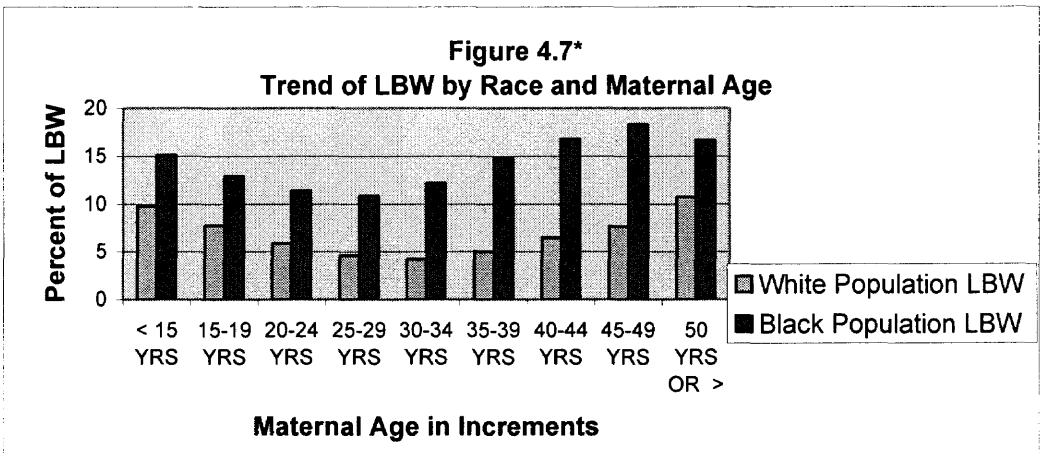
Summary of Combined Tobacco and Alcohol Use Subset

- Self Reported Tobacco & Alcohol Use
  - White: n=4652; LBW 14%;OR 2.9 (2.7,3.2)
  - Black: n=1847; LBW 31%; OR3.2 (2.9,3.6)
- LBW rate was 18.6% vs. 6.5% in the non-user group.
- Highest prevalence was in cities of 500,000 to 1 million in a metropolitan county.
- Combined use of these substances affect both races, however the Black race continues to face double the prevalence rate.

4.4 Additional Questions

4.4.1 LBW and Maternal Age

This study also explored if LBW increased with the advancing maternal age of the Black woman.



The analysis indicated that LBW increased with advancing maternal age for both races. The prevalence of LBW was also increased with the younger age group less than 25 years of age. The *p* value of Chi-Square test and Cochran-Armitage Trend Test were significant at less than 0.0001. Logistic regression confirmed the same results, with *p* values for each level of risk factor category.

There is a 5 year difference between the White and the Black race in the lowest LBW age group and the age group when the LBW rate begins to rise again (Figure 4.7). The lowest percentage of LBW in the White population was in the age group of 30-34 years versus 25-29 years of age in the Black population. LBW increases in the White population in the 35-39 year old group versus the 30-34 year old group in the Black population.

4.4.2 Similarities in Tobacco and Alcohol Use Within the Races

Further analysis was conducted to examine any similarities in maternal age, highest educational attainment by the mother, or population of the place of maternal residence within the Black and White LBW groups reporting the highest incidence of tobacco and/or alcohol use. This analysis was performed on both races and was limited to the LBW data set (n of 166,119). The interaction variable of smoking & drinking will be addressed in the logistic regression results.

The Relationship of LBW and Tobacco Use and Controlling for Maternal Age (Table 4.16)

Among the Black population, under 15 years old age group, the rate of smokers among the whole population was 1.79%; the prevalence of LBW among the women who reported tobacco use was 7% and 15% in the non smoking group. *P* value of chi square test was 0.13, which was not significant. Among the White population, under 15 years old age group, 11% of the women who reported tobacco use had LBW while 10% of the non smoking women had LBW.

Among the Black population, in the 15-19 years old age group, the rate of smokers among the whole population was 6.48%; the prevalence of LBW among the women who reported tobacco use was 16% and 13% in the non smoking group. Women in this age group who smoked were 34% more likely to have a LBW than non-smokers or

1.4 times more likely with 95% confidence limits of 1.2 to 1.4. *P* value of chi square test was significant at <.0001. Among the White population, in the 15-19 years old age group, 10% of the women who reported tobacco use had a LBW while 7% of the non-smoking women had LBW.

Among the Black population, in the 20-24 years old age group, the rate of smokers among the whole population was 10.08%; the prevalence of LBW among the women who reported tobacco use was 16% and 11% in the non smoking group. Women in this age group who smoked were 48% more likely to have a LBW than non-smokers or 1.5 times more likely with 95% confidence limits of 1.4 to 1.5. *P* value of chi square test was significant at <.0001. Among the White population, in the 20-24 years old age group, 9% of the women who reported tobacco use had LBW while 5% of the non-smoking women had LBW.

Among the Black population, in the 25-29 years old age group, the rate of smokers among the whole population was 9.86%; the prevalence of LBW among the women who reported tobacco use was 17% and 10% in the non-smoking group. Women in this age group who smoked were 80% more likely to have a LBW than non-smokers or 1.8 times more likely with 95% confidence limits of 1.7 to 1.9. *P* value of chi square test was significant at <.0001. Among the White population, in the 25-29 years old age group, 9% of the women who reported tobacco use had LBW while 4% of the non-smoking women had LBW.

Among the Black population, in the 30-34 years old age group, the rate of smokers among whole population was 9.15%; the prevalence of LBW among the women who reported tobacco use was 22% and 11% in the non-smoking group. Women in this age group who smoked were 2.3 times more likely to have a LBW than non-smokers with 95% confidence limits of 2.1 to 2.4. *P* value of chi square test was significant at <.0001. Among the White population, in the 30-34 years old age group, 10% of the women who reported tobacco use had LBW while 4% of the non-smoking women had LBW.

Among the Black population, in the 35-39 years old age group, the rate of smokers among whole population was 11.86%; the prevalence of LBW among the women who reported tobacco use was 28% and 13% in the non-smoking group. Women in this age group who smoked were 2.6 times more likely to have LBW than non-smokers with 95% confidence limits of 2.3 to 2.8. *P* value of chi square test was significant at <.0001. Among the White population, in the 35-39 years old age group 13% of the women who reported tobacco use had LBW while 4% of the non-smoking women had LBW.

Among the Black population, in the 40-44 years old age group, the rate of smokers among whole population was 14.49%; the prevalence of LBW among the women who reported tobacco use was 32% and 15% in the non-smoking group. Women in this age group who smoked were 2.7 times more likely to have a LBW than non-smokers with 95% confidence limits of 2.3 to 3.1. *P* value of chi square test is <.0001, which is significant. Among the White population, in the 40-44 years old age group, 16% of the women who reported tobacco use had LBW while 6% of the non-smoking women had LBW.

Among the Black population, in the 45-49 years old age group, the rate of smokers among whole population was 14.02, the prevalence of LBW among the women who reported tobacco use was 27% and 18% in the non smoking group. Women in this age group who smoked were 1.6 times more likely to have a LBW than non-smokers with 95% confidence limits of .75 to 3.7. *P* value of chi square test was < 0.2, which is not significant. Among the White population, in the 45-49 years old age group, 17% of the women who reported tobacco use had LBW while 7% of the non-smoking women had LBW.

Among the Black population, in the 50 years old or greater age group, there was 1 non-smoking woman who had a LBW in this age group. *P* value of chi square test was not significant. Among the White population, in the 50 years old or greater age group 11% of the non-smoking women had a LBW. *P* value of chi square test was not significant.

4.4.2.1 Summary Crossing all age groups, LBW is shown to be highly associated with tobacco use, with the *p* value less than 0.0001 of the Cochran-Mantel-Haenszel Test. The overall odds ratio is 1.7 with the 95% confidence limits 1.7 to 1.8. In conclusion, women who smoke during pregnancy have 1.7 times the odds of having a LBW neonate than women who do not smoke during pregnancy.

Table 4.16
Comparison of Black and White LBW Population with Tobacco Use & Maternal Age

Maternal Age	Percent of LBW Controlling for Maternal Age — *Black Pop.* *Tobacco Use* YES	NO	*p*	*White Pop.* Tobacco Use YES	NO	*p*
< 15 YEARS	7.14	15.54	0.13	11.43	9.55	0.4
15-19 YEARS	16.44	12.82	****	10.26	6.90	****
20-24 YEARS	15.58	11.06	****	8.93	5.01	****
25-29 YEARS	17.11	10.23	****	9.09	4.01	****
30-34 YEARS	22.48	11.23	****	10.27	3.78	****
35-39 YEARS	28.27	13.14	****	13.04	4.39	****
40-44 YEARS	31.54	14.56	****	16.19	5.56	****
45-49 YEARS	27.03	18.06	0.2	16.55	7.20	****
50 YEARS OR >	0.00	100.00		0.00	11.27	

**** *p* value <0.0001

The Relationship of LBW and Tobacco Use and Controlling for Maternal Place of Residence (Table 4.17)

Among the Black population residing in a city with a population of less than 100,000, the rate of smokers among the whole population was 8.72%; the prevalence of LBW among the women who reported tobacco use was 18% and 11% in the non-smoking group. Women residing in a city of this population who smoked were 1.7 times more likely to have LBW than non-smokers with 95% confidence limits of 1.6 to 1.7. *P* value of chi square test was < .0001, which is significant. Among the White population residing in a city with a population of less than 100,000, 10% of the women who reported tobacco use had LBW while 4% of the non-smoking women had LBW.

Among the Black population residing in a city with a population of 100,000 to 250,000, the rate of smokers among the whole population was 9.73%; the prevalence of LBW among the women who reported tobacco use was 19% and 12% in the non-group. Women residing in a city of this population who smoke were 1.6 times more likely to have LBW than non-smokers with 95% confidence limits of 1.5 to 1.8. *P* value of chi square test was < .001, which is significant. Among the White population residing in a city with a population of 100,000 to 250,000, 10% of the women who reported tobacco use had LBW while 5% of the non-smoking women had LBW.

Among the Black population residing in a city with a population of 250,000 to 500,000, the rate of smokers among the whole population was 10.95%; the prevalence of LBW among the women who reported tobacco use was 19% and 12% in the non smoking group. Women residing in a city of this population who smoke were 1.7 times more likely to have LBW than non-smokers with 95% confidence limits of 1.5 to 1.8. *P* value of chi square test was < .0001, which is significant. Among the White population residing in a city with a population of 250,000 to 500,000, 10% of the women who reported tobacco use had LBW while 5% of the non-smoking women had LBW.

Among the Black population residing in a city with a population of 500,000 to 1 million, the rate of smokers among the whole population was 11.25%; the prevalence of LBW among the women who reported tobacco use was 20% and 12% in the non smoking group. Women who reside in a city of this population who smoke were 1.9 times more likely to have LBW than non-smokers with 95% confidence limits of 1.7 to 2.0. *P* value of chi square test is < .001, which is significant. Among the White population residing in a city with a population of 500,000 to 1 million, 11% of the women who reported tobacco use had LBW while 5% of the non-smoking women had LBW.

Among the Black population residing in a city with a population of greater than 1 million, the rate of smokers among whole population was 8.05%; the prevalence of LBW among the women who reported tobacco use was 21% and 12% in the non-smoking group. Women who reside in a city of this population who smoke were 2 times more likely to have LBW than non-smokers with 95% confidence limits of 1.8 to 2.2. *P* value of chi square test is < .0001, which is significant. Among the White population residing in a city with a population of greater than 1 million, 11% of the women who reported tobacco use had LBW while 4% of the non-smoking women had LBW.

4.4.2.2 Summary Crossing all city population groups, LBW was shown to be highly associated with tobacco use with the *p* value less than 0.0001 of the Cochran-Mantel-Haenszel Test. To summarize, women who smoked during pregnancy have 1.74 times the odds of having a LBW neonate than women who do not smoke during pregnancy.

The Breslow-Day Test *p* value of <0.0001 was significant and shows there was no homogeneity of the odds ratios across city population groups. To summarize, there was an increased prevalence of LBW in women who smoked and resided in the large metropolitan city.

Table 4.17

Comparison of Black and White LBW Population With Tobacco Use & Population of City and County Designation

	Percent of LBW Controlling for Place of Residence					
	Black Pop. Tobacco Use			White Pop. Tobacco Use		
Population of City	YES	NO	*p*	YES	NO	*p*
< 100k	17.59	11.29	****	9.66	4.42	****
100-250k	18.601	11.91	****	10.15	4.65	****
250-500k	18.24	11.56	****	10.17	4.65	****
500k-1 million	19.70	11.52	****	10.62	4.56	****
> 1 million	21.13	11.52	****	10.53	4.33	****
County non-metro	17.95	11.92	****	9.80	4.76	****
County metro	18.54	11.38	****	9.72	4.35	****

**** *p* value <0.0001

The Relationship of LBW and Tobacco Use and Controlling for Maternal Education (Table 4.18)

Among the Black population with no formal education, the rate of smokers among the whole population was 11.67 %; the prevalence rate of LBW among the women who reported tobacco use was 36% and 16% in the non-smoking women. Women in this age group who smoked were 2.9 times more likely to have LBW than non-smokers with 95% confidence limits of .86 to 9.7. *P* value of chi square test is 0.07, which is not significant. Among the White population with no formal education, 8% of the total women at this educational level who reported tobacco use had LBW and 8% of the non-smoking women had LBW.

Among the Black population with 1-8 years of elementary school, the rate of smokers among the whole population was 1.02%; the prevalence rate of LBW among the women who reported tobacco use was 18% of the total women at this educational level who reported tobacco use had LBW and 15% of the non-smoking women had LBW. Women at this educational level group who smoked were 1.2 times more likely to have LBW than non-smokers with 95% confidence limits of 1.0 to 1.4. *P* value of chi square test is 0.0029, which is significant. Among the White population with 1-8 years of elementary school, 12% of the total women at this educational level who reported tobacco use had LBW and 6% of the non-smoking women had LBW.

Among the Black population with 1-2 years of high school, the rate of smokers among the whole population was 17.8%; the prevalence rate of LBW among the women who reported tobacco use was 19% and 13% of the non-smoking women had LBW. Women in this age group who smoked were 1.5 times more likely to have LBW than non- smokers with 95% confidence limits of 1.4 t o 1.6. *P* value of chi square test is 0.0001, which is significant. Among the White population with 1-2 years of high school, 11% of the total women at this educational level who reported tobacco use had LBW and 7% of the non-smoking women had LBW.

Among the Black population with 3-4 years of high school, the rate of smokers among the whole population was 10.86%; the prevalence rate of LBW among the women who reported tobacco use was 18% and 12% of the non-smoking women had LBW. Women in this age group who smoked were 1.6 times more likely to have LBW than non-smokers with 95% confidence limits of 1.5 to 1.7. *P* value of chi square test is 0.0001, which is significant. Among the White population with 3-4 years of high school, 10% of the total women at this educational level who reported tobacco use had LBW and 5% of the non-smoking women had LBW.

Among the Black population with 1-4 years of college, the rate of smokers among the whole population was 4.40%; the prevalence rate of LBW among the women who reported tobacco use was 18% and 10% of the non-smoking women had LBW. Women in this age group who smoked were 95% more likely to have a LBW than non-drinkers or 1.9 times more likely with 95% confidence limits of 1.8 to 2.0. *P* value of chi square test is 0.0001, which is significant. Among the White population with 1-4 years of college, 9% of the total women at this educational level who reported tobacco use had LBW and 4% of the non-smoking women had LBW.

Among the Black population with 5 or more years of college, the rate of drinkers among the whole population was 0.95%; the prevalence rate of LBW among the women who reported tobacco use was 17% and 9% of the non-smoking women had LBW. Women in this age group who smoked were 2.1 times more likely to have a LBW than a non-smoker with 95% confidence limits of 1.4 to 3.1. *P* value of chi square test is 0.0001, which is significant. Among the White population with 15 or more years of college, 8% of the total women at this educational level who reported tobacco use had LBW and 4% of the non smoking women had LBW.

4.4.2.3 Summary Crossing all educational groups, LBW is shown to be highly associated with tobacco use, with the *p* value less than 0.0001 of the Cochran-Mantel-Haenszel Test. The overall odds ratio is 1.6 with the 95% Confidence Limits 1.6 to 1.7. To summarize, women who smoked during pregnancy had 1.6 times the odds of having a LBW neonate than women who do not smoke during pregnancy.

Table 4.18
Comparison of Black and White LBW Population with Tobacco Use & Education

Percent of LBW
Controlling for Education

	Black Pop. Tobacco Use			White Pop. Tobacco Use		
Maternal Education	YES	NO	*p*	YES	NO	*p*
No formal education	35.71	16.04	0.07	8.45	7.96	0.89
1-8 Years of elementary school	18.20	14.85	0.002	12.14	5.93	****
1-2 year of high school	18.86	12.90	****	11.24	7.16	****
3-4 years of high school	18.23	11.94	****	9.57	5.28	****
1-4 year of college	18.34	10.32	****	8.58	3.94	****
5 years or more of college	17.24	8.91	****	8.18	3.62	****

* p not significant
**** *p* value <0.0001

Summary of Tobacco Use

- LBW is highly associated with tobacco use in both races.
- White women age 45-49 have an OR 2.5 (CI 1.5, 4.1).
- Black women age 40-44 have an OR 2.7 (CI 2.3, 3.1).
- Tobacco prevalence increases with the Black woman's advancing age.
- Tobacco, an unhealthy lifestyle choice, may be a coping mechanism in response to chronic stress.

The Relationship of LBW and Alcohol Use and Controlling for Maternal Age (Table 4.19)

Among the Black population, under 15 years old age group, the rate of drinkers among the whole population was 0.13%; there was no prevalence of drinking and the non-drinker LBW prevalence rate was 15.42%. Among the White population, under 15 years old age group, 1 women that reported drinking 1-2 drinks per week had LBW, no one reported drinking 3 or more per week. 10% of the non drinking women had LBW.

Among the Black population, in the 15-19 years old age group, the rate of drinkers among the whole population was 0.22%; the prevalence rate of LBW among drinkers was 17.55%, compared to non-drinkers the rate was only 13.04%. Women in this age group who drink were 35% more likely to have LBW than non-drinkers or 1.4 times more likely with 95% confidence limits of 0.9 to 2. *P* value of chi square test is 0.067, which is a borderline result indicating that although the rates are different they are not significant. Among the White population in the 15-19 years old age group, 9% of the women who reported drinking 1-2 drinks per week had LBW, and 15% of those who reported drinking 3 or more per week had a LBW. 8% of the non drinking women had LBW.

Among the Black population, in the 20-24 years old age group, the rate of drinkers among the whole population was 0.43%; the prevalence rate of LBW among drinkers was 16.99%, compared to non-drinkers the rate was only 11.47%. Women in this age group who drink were 48% more likely to have a LBW than non-drinkers, or 1.5 times more likely to have LBW with 95% confidence limits of 1.29 to 1.93. *P* value of chi square test was < 0.001, which is significant. Among the White population, in the 20-24 years old age group, 9% of the women who reported drinking 1-2 drinks per week had LBW, and 12% of those who reported drinking 3 or more per week had LBW. 6% of the non drinking women had LBW.

Among the Black population, in the <u>25-29 years old age group</u>, the rate of drinkers among the whole population was 0.64%; the prevalence rate of LBW among drinkers was 21.25%, compared to non-drinkers the rate was only 10.81%. Women in this age group who drink were 2.2 times more likely to have LBW with 95% confidence limits of 1.83 to 1.69. *P* value of chi square test is < 0.001, which is significant. Among the White population, in the 25-29 years old age group, 7% of the women who reported drinking 1-2 drinks per week had LBW, and 12% of those who reported drinking 3 or more per week had LBW. 5% of the non drinking women had LBW.

Among the Black population, in the <u>30-34 years old age group</u>, the rate of drinkers among the whole population was 1.14%; the prevalence rate of LBW among drinkers wais 27.78%, compared to non-drinkers the rate was only 12.02%. Women in this age group who drink were 2.8 times more likely to have LBW than non-drinkers with 95% confidence limits of 2.38 to 3.32. *P* value of chi square test is < 0.001, which is significant. Among the White population, in the 30-34 years old age group, 5% of the women who reported drinking 1-2 drinks per week had LBW, and 11% of those who reported drinking 3 or more per week had LBW. 4% of the non drinking women had LBW.

Among the Black population, in the <u>35-39 years old age group</u>, the rate of drinkers among the whole population was 1.75%; the prevalence rate of LBW among drinkers was 39.48%, compared to non-drinkers the rate was only 14.43%. Women in this age group who drink were 3.8 times more likely to have LBW than non-drinkers with

95% confidence limits of 3.2 to 4.6. *P* value of chi square test is < 0.001, which is significant. Among the White population, in the 35-39 years old age group, 6% of the women who reported drinking 1-2 drinks per week had LBW, and 15% of those who reported drinking 3 or more per week had LBW. 5% of the non drinking women had LBW.

Among the Black population, in the 40-44 years old age group, the rate of drinkers among the whole population was 2.35%; the prevalence rate of LBW among drinkers was 42.77%, compared to non-drinkers the rate was only 16.39%. Women in this age group who drink were 3.8 times more likely to have LBW than non-drinkers with 95% confidence limits of 2.7 to 5.2. *P* value of chi square test is < 0.001, which is significant. Among the White population, in the 40-44 years old age group, 10% of the women who reported drinking 1-2 drinks per week had LBW, and 16% of those who reported drinking 3 or more per week had LBW. 6% of the non drinking women had LBW.

Among the Black population, in the 45-49 years old age group, the rate of drinkers among the whole population was 0.38; the prevalence rate of LBW in the one reported drinker was 100%, compared to non-drinkers the rate was only 19.16%. *P* value of chi square test is < 0.04 which is borderline, but significant. Among the White population, in the 45-49 years old age group, 12% of the women who reported drinking 1-2 drinks per week had LBW, and the 1 woman who reported drinking 3 or more per week had a LBW. 8% of the non drinking women had LBW.

Among the Black population, in the 50 years old or greater age group, there was one (1) non-drinking woman who had LBW in this age group. Among the White population, in the 50 years old or greater age group, there were 8 non-drinking woman who had LBW in this age group.

4.4.2.4 Summary Crossing all age groups, LBW is shown to be highly associated with drinking, with the *p* value less than 0.0001 of the Cochran-Mantel-Haenszel Test. The overall odds ratio is 2.51 with the 95% Confidence Limits 2.31 to 2.73. To summarize, women who drink during pregnancy have 2.5 times the odds of having a LBW neonate than women who do not drink during pregnancy.

The Breslow-Day Test with a significant p value of <.0001 shows there is no homogeneity of the odds ratios across age groups. The within-strata odds ratios identify the trend of increasing age groups having bigger odds ratios. To summarize, older drinkers have a greater probability of having LBW than younger drinkers.

Table 4.19
Comparison of Black and White LBW Population with Alcohol Use & Maternal Age

	Percent of LBW Controlling for Maternal Age					
	Black Pop. Alcohol Use			White Pop. Alcohol Use		
Maternal Age	YES	NO	*p*	YES	NO	*p*
< 15 YEARS	0.00	15.42		11.11	9.89	0.9
15-19 YEARS	17.55	13.04	0.06	10.58	7.83	.008
20-24 YEARS	16.99	11.47	****	9.50	5.95	****
25-29 YEARS	21.25	10.81	****	7.69	4.63	****
30-34 YEARS	27.78	12.02	****	6.07	4.28	****
35-39 YEARS	39.48	14.43	****	7.55	5.06	****
40-44 YEARS	42.77	16.39	****	11.59	6.47	****
45-49 YEARS	100.0	19.16	0.04	14.81	7.83	0.18
50 YEARS OR >	0.00	50.00		0.00	11.27	

+ *p* value <0.0001

The Relationship of LBW and Alcohol Use and Controlling for Maternal Place of Residence (Table 4.20)

Among the Black population residing in a city with a population of less than 100,000, the rate of drinkers among the whole population was 0.62%; the prevalence rate of LBW among drinkers was 24.14%, compared to non-drinkers the rate was only 11.74%. Women residing in a city of this population who drink were 2.4 times more likely to have LBW than non-drinkers with 95% confidence limits of 2.1 to 2.7. *P* value of chi square test is < .001, which is significant. Among the White population residing in a city with a population of less than 100,000, 7% of the women who reported drinking 1-2 drinks per week had a LBW, and 14% of those who reported drinking 3 or more per week had a LBW. Five percent (5%) of the non drinking women had LBW.

Among the Black population residing in a city with a population of <u>100,000 to 250,000</u>, the rate of drinkers among the whole population was 0.68%; the prevalence rate of LBW among drinkers was 24.15%, compared to non-drinkers the rate was only 12.45%. Women residing in a city of this population who drink were 2.2 times more likely to have LBW than non-drinkers with 95% confidence limits of 1.8 to 2.7. *P* value of chi square test is < .001, which is significant. Among the White population residing in a city with a population of 100,000 to 250,000, 7% of the women who reported drinking 1-2 drinks per week had a LBW, and 13% of those who reported drinking 3 or more per week had a LBW. Five percent (5%) of the non drinking women had LBW.

Among the Black population residing in a city with a population of <u>250,000 to 500,000</u>, the rate of drinkers among the whole population was 0.62%; the prevalence rate of LBW among drinkers was 27.86%, compared to non-drinkers the rate was only 12.16%. Women residing in a city of this population who drink were 2.8 times more likely to have LBW than non-drinkers with 95% confidence limits of 2.1 to 3.6. *P* value of chi square test is < .001, which is significant. Among the White population residing in a city with a population of 250,000 to 500,000, 7% of the women who reported drinking 1-2 drinks per week had a LBW, and 8% of those who reported drinking 3 or more per week had a LBW. 5% of the non drinking women had LBW.

Among the Black population residing in a city with a population <u>of 500,000 to 1 million</u>, the rate of drinkers among the whole population was 0.74%; the prevalence rate of LBW among drinkers was 30.52%, compared to non-drinkers the rate was only 12.28%. Women reside in a city of this population who drink were 3.1 times more likely to have LBW than non-drinkers with 95% confidence limits of 2.5 to 3.8. *P* value of chi square test is < .001, which is significant. Among the White population residing in a city with a population of 500,000 t o 1 million, 6% of the women who reported drinking 1-2 drinks per week had LBW, and 12% of those who reported drinking 3 or more per week had a LBW. Five percent (5%) of the non drinking women had LBW.

Among the Black population residing in a city with a population of greater than 1 million, the rate of drinkers among the whole population was 0.68%; the prevalence rate of LBW among drinkers was 29.97%, compared to non-drinkers the rate was only 12.16%. *P* value of chi square test is < .001, which is significant. Among the White population residing in a city with a population of greater than 1 million, 6% of the women who reported drinking 1-2 drinks per week had LBW, and 10% of those who reported drinking 3 or more per week had a LBW. Five percent (5%) of the non drinking women had LBW.

Among the Black population residing in a county identified as a Non-metropolitan county, 25% of the women who reported drinking 1-2 drinks per week had LBW, and 32% of those who reported drinking 3 or more per week had LBW. 12% of the non drinking women had LBW. Among the White population residing in a county identified as a Non-metropolitan county, 9% of the women who reported drinking 1-2 drinks per week had a LBW, and 15% of those who reported drinking 3 or more per week had a LBW. Six percent (6%) of the non drinking women had LBW.

Among the Black population residing in a county identified as a metropolitan county, 22% of the women who reported drinking 1-2 drinks per week had a LBW, and 34% of those who reported drinking 3 or more per week had a LBW. 12% of the non drinking women had LBW. Among the White population residing in a county identified as a metropolitan county, 6% of the women who reported drinking 1-2 drinks per week had a LBW, and 12% of those who reported drinking 3 or more per week had a LBW. Five percent (5%) of the non drinking women had LBW.

4.4.2.5. Summary Crossing all city population groups and county designation, LBW is shown to be highly associated with drinking with the *p* value less than 0.0001 of the Cochran-Mantel-Haenszel Test. The overall odds ratio is 2.55 with the 95% Confidence Limits 2.35 to 2.77. To summarize, women who drink during pregnancy have 2.5 times the odds of having a LBW neonate than women who do not drink during pregnancy. No significant difference was demonstrated in the prevalence of LBW based on population of the mother's residence (city population).

The Breslow-Day Test p value of <0.7 and is not significant and shows there is homogeneity of the odds ratios across non-metropolitan and metropolitan county groups. To summarize, no significant difference was demonstrated in the prevalence of LBW in the presence of alcohol use based on the mother's county of residence being non-metropolitan or metropolitan.

Table 4.20
Comparison of Black and White LBW Population With Alcohol Use & Population of City and County Designation

Percent of LBW
Controlling for Place of Residence

	Black Pop. Alcohol Use			White Pop. Alcohol Use		
Population of City	YES	NO	*p*	YES	NO	*p*
< 100k	24.14	11.74	****	8.01	5.21	****
100-250k	24.15	12.45	****	8.39	5.37	****
250-500k	27.86	12.16	****	7.67	5.37	***.
500k-1 million	30.52	12.28	****	7.47	5.40	***
> 1 million	29.97	12.16	****	6.55	4.65	**
County non-metro	27.34	12.34	****	10.57	5.77	****
County metro	25.82	11.94	****	7.32	5.02	****

** *p* value 0.05
*** *p* value 0.01
**** *p* value <0.0001

The Relationship of LBW and Alcohol Use and Controlling for Maternal Education (Table 4.21)

Among the Black population with no formal education, the rate of drinkers among the whole population was .84%; the prevalence rate of LBW among non-drinkers was 18%. Among the White population with no formal education, the prevalence rate of LBW among non-drinkers was 8%. One mother reported drinking 1-2 drinks per week and had LBW.

Among the Black population with 1-8 years of elementary school, the rate of drinkers among the whole population was 1.02%; the prevalence rate of LBW among drinkers was 30.95%, compared to non-drinkers the rate was only 15.12%. Twenty nine percent (29%) of the total women at this educational level who reported drinking 1-2 drinks per week had LBW, and 34% of those who reported drinking 3 or more per week had LBW. Fifteen percent (15%) of the non drinking women had LBW. Women in this age group who drink were 2.5 times more likely to have LBW than non drinkers with 95% confidence limits of 1.5 to 4.0. *P* value of chi square test is 0.0001, which is significant. Among the White population with 1-8 years of elementary school, 14% of the total women at this educational level who reported drinking 1-2 drinks per week had LBW, and 33% of those who reported drinking 3 or more per week had LBW. Eight percent (8%) of the non drinking women had LBW.

Among the Black population with <u>1-2 years of high school</u>, the rate of drinkers among the whole population was 1.08%; the prevalence rate of LBW among drinkers was 29.23%, compared to non-drinkers the rate was only 13.75%. Twenty eight percent (28%) of the total women at this educational level reported drinking 1-2 drinks per week had LBW, and 32% of those who reported drinking 3 or more per week had LBW. Fourteen percent (14%) of the non drinking women had LBW. Women in this age group who drink were 2.6 times more likely to have LBW than non drinkers with 95% confidence limits of 2.1 to 3.1. *P* value of chi square test is 0.0001, which is significant. Among the White population with 1-2 years of high school, 12% of the total women at this educational level who reported drinking 1-2 drinks per week had LBW, and 22% of those who reported drinking 3 or more per week had a LBW. Nine percent (9%) of the non drinking women had LBW.

Among the Black population with <u>3-4 years of high school</u>, the rate of drinkers among the whole population was 0.73%; the prevalence rate of LBW among drinkers was 27.34%, compared to non-drinkers the rate was only 12.49%. Twenty two percent (22%)

of the total women at this educational level who reported drinking 1-2 drinks per week had LBW, and 36% of those who reported drinking 3 or more per week had a LBW. Twelve percent (12%) of the non drinking women had LBW. Women in this age group who drink were 2.6 times more likely to have a LBW than non-drinkers with 95% confidence limits of 2.3 to 2.9. *P* value of chi square test is 0.0001, which is significant. Among the Black population with 3-4 years of high school, 10% of the total women at this educational level who reported drinking 1-2 drinks per week had a LBW, and 17% of those who reported drinking 3 or more per week had a LBW. Six percent (6%) of the non drinking women had LBW.

Among the Black population with <u>1-4 years of college</u>, the rate of drinkers among the whole population was 0.39%; the prevalence rate of LBW among drinkers was 18.86%, compared to non-drinkers the rate was only 10.63%; 16% of the total women at this educational level reported drinking 1-2 drinks per week had a LBW, and 25% of those who reported drinking 3 or more per week had a LBW. Eleven percent (11%) of the non drinking women had LBW. Women in this age group who drink were 90% more likely to have a LBW than non-drinkers or 1.9 times more likely with 95% confidence limits of 1.5 to 2.4. *P* value of chi square test is 0.0001, which is significant. Among the White population with 1-4 years of college, 5% of the total women at this educational level who reported drinking 1-2 drinks per week had a LBW, and 8% of those who reported drinking 3 or more per week had a LBW. Four percent (4%) of the non drinking women had LBW.

Among the Black population with <u>5 or more years of college</u>, the rate of drinkers among the whole population was 0.25%; the prevalence rate of LBW among drinkers was

6.52%, compared to non-drinkers the rate was only 9%. Seven percent (7%) of the total women at this educational level reported drinking 1-2 drinks per week had a LBW, and 0% of those who reported drinking 3 or more per week had a LBW. None percent (9%) of the non drinking women had LBW. *P* value of chi square test was not valid due to the small sample size. Among the White population with 5 or more years of college, 3% of the total women at this educational level who reported drinking 1-2 drinks per week had a LBW, and 4% of those who reported drinking 3 or more per week had a LBW. Four percent (4%) of the non drinking women had LBW.

4.4.2.6 Summary Crossing all educational groups, LBW is shown to be highly associated with drinking, with the p value less than 0.0001 of the Cochran-Mantel-Haenszel Test. The overall odds ratio is 2.5 with the 95% Confidence Limits 2.27 to 2.69. To summarize, women who drink during pregnancy have 2.5 times the odds of having a LBW neonate than women who do not drink during pregnancy.

Table 4.21
Comparison of Black and White LBW Population with Alcohol Use & Education

	Percent of LBW Controlling for Education					
	Black Pop. Alcohol Use			White Pop. Alcohol Use		
Maternal Education	YES	NO	*p*	YES	NO	*p*
No formal education	15.12	30.95	****	25	7.7	0.21
1-8 Years of elementary school	30.95	15.12	****	20.56	8.02	****
1-2 year of high school	29.23	13.75	****	14.96	8.95	****
3-4 years of high school	27.34	12.49	****	11.6	6.3	****
1-4 year of college	18.86	10.63	****	5.67	4.24	****
5 years or more of college	6.52	9.00	**	2.98	3.68	0.04

* *p* not significant
** *p* value 0.05
**** *p* value <0.0001

Summary of Alcohol Use

- LBW is highly associated with alcohol use in both races.
- Alcohol use is presumably underreported.
- White women age 45-49 have an OR 2.0 (CI.6, 5.9).
- Black women age 40-44 have an OR 3.8 (CI2.7,5.2).
- Possible protective mechanism noted with 1-2 drinks per week in other studies was not found.

4.4.3 Logistic Regression Analysis

Logistic regression analysis was used to determine the probability of having a LBW infant based on maternal age, educational attainment by the mother, and population of the place of maternal residence of women who use both tobacco and alcohol during pregnancy. In the entire data set of the women who used both tobacco and alcohol, the highest prevalence of LBW was in a city with a population of 500,000 to 1 million (Table 4.22).

Table 4.22
Combined Tobacco & Alcohol Use & LBW in the Entire Data Set

Percent of LBW
Controlling for Place of Residence

Population of City	LBW YES	LBW NO	*p*
< 100k	16.38	83.62	****
100-250k	19.97	80.03	****
250-500k	22.63	77.37	****
500k-1 million	28.84	71.16	****
> 1 million	27.65	72.35	****
County non-metro	16.84	83.16	****
County metro	19.14	80.86	****

**** *p* value <0.0001

There were 4658 White women and 1848 Black women who reported both tobacco and alcohol use during pregnancy (Table 4.23 and 4.24). The model for the regression was based on: maternal age 25-29 years, maternal education at 3-4 years of high school, and the population of the residence city at less than 100,000. After controlling for age, education, and place, the odds of a black woman who smoked and drank having a LBW baby was 2.8 times greater than a Black woman who did not smoke or drink. A White woman who smoked and drank had a 2.5 times greater chance of having a LBW baby than a woman who did not drink or smoke.

Table 4.23*

Combined Tobacco & Alcohol Use by Maternal Age in the White Population

	Maternal Age									
	< 15 YRS	15-19 YRS	20-24 YRS	25-29 YRS	30-34 YRS	35-39 YRS	40-44 YRS	45-49 YRS	50 yrs or >	Total
Combined user	0.58	0.33	0.34	0.20	0.20	0.30	0.49	0.37	0.00	4658 0.26
Non-user	99.42	99.67	99.66	99.80	99.80	99.70	99.51	99.63	100.00	1761363 99.74
Total	141640 8.02	416509 23.58	483456 27.38	464554 26.31	213015 12.06	43680 2.47	1898 0.11	71 0.00	1198 0.07	1766021 100.00

Frequency Missing = 333395

Table 4.24*

Combined Tobacco & Alcohol Use by Maternal Age in the Black Population

	Maternal Age									
	< 15 YEARS	15-19 YEARS	20-24 YEARS	25-29 YEARS	30-34 YEARS	35-39 YEARS	40-44 YEARS	45-49 YEARS	50 yrs or >	Total
Combined User	0.09	0.13	0.26	0.40	0.75	1.27	1.91	0.00	0.00	1848 0.43
Non-User	99.91	99.87	99.74	99.60	99.25	98.73	98.09	100.00	100.00	430722 99.57
Total	2348 0.54	83496 19.30	153164 35.41	97313 22.50	60916 14.08	28409 6.57	6666 1.54	256 0.06	2 0.00	432570 100.00

Frequency Missing = 51005

Summary of Logistic Regression

- After controlling for maternal age, educational attainment of the mother, place of residence (population of the city, and metropolitan status of the county)
- Black woman OR 2.8, (CI 2.5, 3.1)
- White woman OR 2.5, (CI 2.3,2.7)

CHAPTER 5

INTERPRETATION OF THE DATA

5.1 Introduction

The purpose of the study was to determine the magnitude of risk for low birth weight (neonatal birth weight less than 2500 grams) in relation to combined maternal alcohol and tobacco use, and to explore the role of these risk factors in contributing to the Black-White disparity in low birth weight within the theoretical framework of the weathering hypothesis. The incidence of LBW is more pronounced in the African-American community and large portions of this population receive their care within urban health care systems. Understanding factors contributing to LBW; such as tobacco and alcohol use, maternal age, and population density of the residence city, may enable the urban healthcare practitioner to improve care by developing age-targeted and place specific education and intervention, and work to eliminate health care disparities by addressing the underlying social inequalities that may produce or contribute to them.

The study data set of American born White and Black non-Hispanic women represented 2,582,991 of the over 4 million women in the 2003 Natality file from the CDC. The White non-Hispanic group was the larger group at just over 2 million women and the Black non-Hispanic group was just under one half million. Despite the differences in the size of the two groups, both are considered to be large data sets with a significant sample size.

5.2 General Discussion of the Study Data Set

This section will address essential findings of alcohol consumption, tobacco use, and the incidence of LBW in the full data set of American born White and Black non-Hispanic women.

Overall, women living in cities with a population of 500,000 to 1 million had the highest percent of reported drinking (across all quantities of alcoholic consumption) in a metropolitan county. Women living in cities of 250,000 to 500,000 had the highest incidence of smoking 1-5 cigarettes daily, but higher intake of tobacco per day was then noted in cities with populations less than 100,000 in a non-metropolitan county. Without specific socioeconomic data it is impossible to note if this finding of increased tobacco consumption in the smaller city is consistent with previous research that identified a trend for increased smoking during pregnancy in the less educated and poorer women across both races (Perreira, 2006).

The incidence of LBW in the Black group was consistently at least twice that of their White counter parts (12% versus 5%). This finding was consistent with the literature in that infants born to African-American mothers are an average of 300 grams lighter and are twice more likely to be LBW than infants born to White mothers (Buka et al., 2003; Geronimus, 1996). The CDC reported LBW as 11.19% in 2001 and 11.44% in 2002 (Black non-Hispanic race) versus 4.96% and 5.02% for the same years (White non-Hispanic race) (Martin et al., 2003).

Black women experienced childbearing 5 years earlier, were not married, smoked less, and lived in large metropolitan counties of greater than one million more often when compared to White women. The highest incidence of LBW in Black women (18.33%)

was in the upper age group of 45-49 years (*p* <0.0001) while White women had the highest incidence of LBW (9.74%) in the earliest age group of <15 years (*p* <0.0001). Similar results were seen in the study reported by Rich-Edwards, Buka, Brennan, and Earls in 2003 when they concluded that their data suggested a cumulative reproductive risk with advancing maternal age of the Black woman. The rate of LBW rose sharply with the Black maternal age, but not with the White maternal age. This finding is consistent with the weathering hypothesis proposed by Geronimus and will be discussed in detail in the section on maternal age and LBW. Tables 5.1 and 5.2 represent major summaries of the data set variables.

Table 5.1
Summary of Variables in the Entire Data Set

Variable	White Population n = 2,099,416	Black Population n= 483,575
Marital Status	Married: 75%	Married: 27%
Prenatal Care in 1st Trimester	Yes: 82%	Yes: 72%
Maternal Tobacco Use	Yes: 14%	Yes: 9%
Maternal Alcohol Use	Yes: 1%	Yes: 1%
LBW, overall	5.15%	12.02%
Maternal Age Lowest LBW	30-34(4.2%)	25-29 (10.8%)
Maternal Age Highest LBW	15-19(7.8%)	45-49(18.3%)
City Pop. Lowest LBW	1 mill(4.7%)	<100k(11.8%)

Table 5.2
Educational Attainment of the Mother

Variable	White Population n = 2,099,416		Black Population n= 483,575	
Most frequent highest level	1-4 years of college, 45%	****	3-4 years of HS, 52%	****
Highest LBW rate	1-2 yrs HS (9%)	****	1-8 yrs elemen.(15%)	****
Lowest LBW rate	5 or more college (3.7%)	****	5 or more college (9%)	****

**** *p* value <0.0001

5.3 Detailed Discussion of the Study Variables

5.3.1 Tobacco Use

All women who used tobacco during pregnancy were almost two times more likely to have a LBW neonate than women who did not smoke. The prevalence of tobacco use among the White women was 15% while only 9% in the Black women. There was an obvious trend of higher incidence of LBW with an increasing amount of tobacco use per day. Black women who smoked had a LBW incidence 7% higher than non-smoking Black women yet still two times greater than White women who smoke and two and one half times greater than White women who did not smoke. Tobacco use was evenly distributed throughout the city and county populations. These findings have been widely supported in the literature with active tobacco use increasing the risk of LBW twofold across all races (Diaz et al., 2001; Martin et al., 2003; Savitz et al., 2001; Windham et al., 2004; Windham et al., 2000). Research on exposure to environmental tobacco smoke (ETS) has demonstrated that heavier smoking in the Black race had crude rates of LBW six times greater than those of non-exposed pregnancies (Windham et al., 2000).

As in the overall incidence of LBW, the highest incidence of LBW in the Black non-smoking group was in the upper age group of 45-49 years while the White non-smoking group had the highest incidence of LBW in the earliest age group of <15 years. These age groups had the highest LBW incidence despite the fact that this was unrelated to tobacco use. Women in the Black non-Hispanic group who reported tobacco use were 2.7 times more likely to have a LBW baby than a non-smoking mother while the White non-Hispanic smoking group was 2.5 times more likely. The use of tobacco appears to have a similar affect on both the Black non-Hispanic and White non-Hispanic pregnant woman and does not account for the LBW discrepancy between the two races.

For tobacco use, on average the White non-Hispanic group had a higher rate than the Black non-Hispanic group. This finding was also noted in the natality report of Births: Final Data for 2002, where White non-Hispanic mothers had a tobacco use rate of 15% and Black non-Hispanic mothers had a rate of 8.8% (Martin et al., 2003). The highest smoking rate in the White group was in the younger age group of 15-25 years while for the Black group it was in the 40-49 year old age group. These age groups also represent the highest frequency of LBW. The percentage of tobacco use during pregnancy in the selected age groups has remained fairly constant throughout the 14 years that data have been available to the CDC.

5.3.1.1 Tobacco Use Summary There was an increased and statistically significant prevalence of LBW in women who smoked and resided in the large metropolitan city. For this study, the overall prevalence of tobacco use in the Black population and the increased prevalence as maternal age advances support a central concept within the weathering hypothesis. Tobacco use is considered an unhealthy lifestyle choice and may be a behavior that is selected as a coping mechanism for a growing sense of stress, material hardship, or uncertainty (Geronimus, 1992; Geronimus & Korenman, 1993). This coping mechanism may be observed more in the urban, high poverty areas where the insults of environmental and psychosocial stressors are sustained over a period of time. This pattern may influence their use of tobacco and potentially their failure at attempts for cessation and contribute to the potential for poor maternal and neonatal health. Table 5.3 represents a summary of the tobacco use subset.

Table 5.3
Summary of Tobacco Use Subset

Variable	White Population n = 2,099,416	*p* value	Black Population n= 483,575	*p* value
LBW, non-smoker/smoker	4.4%/9.7%	****	11.4%/18.6%	****
Most frequent daily use	6-10 cigarettes	****	1-5 cigarettes	****
Highest LBW by cigs/day	41 or more (15%)	****	21-40 (23%)	****
Highest LBW by age	45-49 yrs (16.6%)	****	40-44(32%)	****
Highest LBW by city pop	500-1mil(10.7%)	****	>1 mil (21%)	****
Highest LBW by county	Non-metro(5%)	****	Metro(19%)	****
Highest LBW by schooling	1-8 yrs elem(12%)	****	1-2 HS (19%)	****

*** *p* value <0.0001

5.3.2 Alcohol Use

Self reported alcohol consumption was very low for both races (< 1%). This was an anticipated limitation of the study based on the literature that alcohol is underreported on birth certificates. The overall accuracy of reporting alcohol use when completing a birth certificate form is dependent upon the mother's recall of when pregnancy began, is subject to potential recall bias, and the perceived social stigma of admitting to this risk taking behavior while pregnant.

Despite this limitation it was clear that alcohol consumption contributed to LBW in the Black population, with a 26% incidence of LBW versus 12% incidence in the non-drinking group. The effect was not as great in the White population where LBW was 7.94% in the drinking group and 5.22% in the non-drinking group.

Black women in the age group of 40-44 years of age who drank were 3.8 times more likely to have a LBW baby than a non-drinking mother in the same age group. As with tobacco use, alcohol use during pregnancy had a dose dependent response with an increasing rate of LBW noted with increased consumption. Although Metropolitan mothers tended to drink more than the non-metropolitan mothers, the overall LBW rates were not significantly different between the two geographic locations. The most frequently reported consumption by both races was 1 or 2 alcoholic drinks per week. Of interest is that the metropolitan mothers who reported an intake of 1 or 2 alcoholic drinks per week had lower LBW rates than those mothers who drank 1 or 2 alcoholic drinks per week and lived in a non-metropolitan area. This finding, by itself, is contradictory to the weathering hypothesis where the expectation was that there is increase in poor perinatal outcome in the densely populated central cities due to the risk taking behavior of alcoholic consumption as a coping mechanism related to various environmental stressors of living in the urban environment.

5.3.2.1 Alcohol Consumption Summary It is difficult to suggest causality or even risk estimates due to the extremely low prevalence rate of self reported alcohol consumption on the birth certificate. However, it is interesting to consider if the lower prevalence of LBW in the groups who reported 1 or 2 drinks per week may reflect the protective mechanism noted in the PRAMS study and other European studies (Passaro et al., 1996; Whitehead & Lipscomb, 2003). The CDC recognizes the inadequacy of the alcohol reporting questions and is addressing the language to be more sensitive to the intent of the data collection. Revisions to a national data set like the standardized birth certificate registry is a large undertaking and requires several years for all states to fully implement the changes. This was evident with the changes on the tobacco and education questions that have only been fully implemented in two states despite the expected completion date of 2003. Table 5.4 represents a summary of the data from the alcohol use subset.

Table 5.4
Summary of Alcohol Use Subset

Variable	White Population n = 2,099,416	*p* value	Black Population n= 483,575	*p* value
LBW, non-drinker/drinker	5.2%/7.9%	****	12%/26%	****
Most frequent use/wk	1 drink	****	1 drink	****
Highest LBW	5 or > (16.3%)	****	5 or >(34.8%)	****
Highest LBW by age	45-49yrs(15%)	****	40-44yrs(43%)	****
Highest LBW by city pop	100-250K(8%)	****	500-1m(31%)	****
Highest LBW by county	Non-metro(11%)	****	Non-metro(27%)	****
Highest LBW by schooling	1-8 elem(21%)	****	1-8 elem(31%)	****

*** *p* value <0.0001

5.3.3 Combined Tobacco and Alcohol Use

Both races showed a trend of an increased incidence of LBW with tobacco use and increasing alcoholic consumption. The overall LBW in the study data set of both races was 3 times higher in the tobacco and alcohol user group versus the non-users group.

Black non-Hispanic women who were both tobacco and alcohol users were 3.2 times more likely to have a LBW neonate and White non-Hispanic women were 2.9 times more likely to have a LBW neonate than non-users (both odds statistically significant). The prevalence of combined tobacco and alcohol use was highest for both races in the age group of 40-44 years. Despite the increased odds for both races to have a LBW infant with concomitant substance abuse of tobacco and alcohol, the rate in the

Black women was 2.2 times more than the White women. This risk taking behavior clearly increases the incidence of LBW, but affects both races in a similar fashion and thus more research needs to be done to identify the factor(s) that can explain this continued discordant rate of LBW in the Black population.

Clearly the history of underreporting of alcoholic consumption on birth certificates creates an area of uncertainty when attempting to determine the relative risk of LBW with the combined risk behavior of tobacco and alcohol use. The increased risk of LBW with tobacco use has been historically well documented and replicated in many epidemiological studies, including this population-based study. In addition, the CDC and other agencies through other testing measures, such as the NHANES, have validated the reliability of self-reported tobacco use. Research consistently places the risk at twice as likely for a pregnancy to have an outcome of LBW compared to non-smoking pregnancies within the same race. The effect is noted across both races in a similar fashion.

What is less known is the effect of alcohol use and LBW pregnancy outcomes. This study has demonstrated that alcoholic consumption appeared to have a greater influence on the odds of having a LBW neonate in the Black non-Hispanic group than in the White non-Hispanic group. This study found that a Black woman who reported consuming 1 drink per week was twice as likely to have a LBW baby as a non-drinking Black woman.

Within each category of alcoholic consumption, the odds were greater to have a LBW if you were a Black non-Hispanic woman than if you were a White non-Hispanic woman (Table 5.5). At 1 drink per week, 2 drinks per week, 3-4 drinks per week, and 5 or more drinks per week the Black non-Hispanic incidence of LBW was 3.5, 2.5, 3.2, and 2.1 times respectively greater than the LBW rate in the White non-Hispanic group who drank alcohol. Of interest is that this was not noted in the same fashion in the odds ratio for LBW with tobacco use.

Although in general for both races, smoking women were twice as likely to have a LBW neonate than non-smoking women, the risk was not the same with the quantity of tobacco use per day and the odds for having a LBW neonate. Both races had similar odds for having a LBW baby in the lower usage of 1- 10 cigarettes per day, however, the tobacco using White population had higher odds than the tobacco using Black population at the higher amounts of 11- >40 cigarettes per day (Table 5.6).

This variation in the influence of alcohol versus tobacco on the odds of having a LBW infant is a finding that needs further examination in light of the recognized underreporting of alcohol consumption. Presuming that both races share an equivalent percentage of underreporting alcohol use, the lack of this information when determining perinatal outcomes would appear to effect the Black population more than the White population. This study's findings relative to determining risk of alcohol use and pregnancy outcome may bear significance to understanding the Black-White discordance in neonatal birthweight.

5.4 Discussion of Additional Questions

5.4.1 LBW and Maternal Age of the Black Woman

Based on the weathering hypothesis this study expected to find less optimal perinatal outcome, measured in this study as LBW, in the Black woman as maternal age increased, regardless of additional risk taking behaviors of tobacco and alcohol use. The results are mixed in that they supported, in part, the weathering concept. In the Black population the lowest occurrence of LBW was in the 25-29 years of age group and there was an increased frequency of LBW as the maternal age increased above that group. However, there was a higher incidence of LBW in the younger age groups of <15 years to age 24. In fact, the bimodal trend of LBW in both races paralleled each other with a 5 year difference consistently noted in the trend; the lowest percent of LBW in the Black group was 25-29 years of age versus 30-34 years of age for the lowest percent of LBW in the White group (Figure 5.1).

Geronimus' (1992) weathering hypothesis would predict the Black non-Hispanic group to have its lowest percentage of LBW earlier than the White non-Hispanic group. To fully meet the concept of the weathering hypothesis, the lowest incidence of LBW would have been seen in the earlier age groups with a gradual increase noted over advancing maternal age. Instead, in this analysis the lowest incidence of LBW occurred in the 25-29 years of age group.

The study results support the findings noted by Ananth, Misra, Demissie, and Smulian (Ananth et al., 2004) in their age-period-cohort analysis of preterm birth in five year segments from 1975-2000. Their results of poor perinatal outcome, measured as preterm birth, were higher at the extremes of maternal age in the Black group, with the lowest risk being seen in the group aged 25-29 years. The results of this current study are also consistent with Wildsmith who studied the births to Mexican-Origin women from 1989-1991 (2002) and that did not support the weathering hypothesis with LBW. The risk for LBW in the foreign-born or US born Mexican women was greatest at the earlier ages, declined throughout the twenties, and then began to rise again.

There was no difference in outcome after adjusting for maternal education and place of residence for both races. In conclusion, in terms of maternal age, the study did not show divergent trends in the association between maternal age and low birthweight for the Black, non-Hispanic mothers and did not support the Weathering Hypothesis originally proposed by Geronimus' observations.

5.4.2 Similarities in Tobacco and Alcohol Use Within the Races

There was no similarity between the races when examining the percent of LBW in the univariate analysis of maternal age, population of residence city, metropolitan status of the county of residence, tobacco use, maternal education or alcohol use (Tables 5.7-5.9). As a benchmark, this study relied on the work of Perreira and Cortes (2006) report that the influencing factors for alcohol and tobacco use in pregnancy are related to demographic data such as race and ethnicity; socioeconomic statistics of income and education; psychosocial influences of the family; paternal behaviors especially in regards to domestic violence and substance abuse practices; and maternal stress especially related to the desire for the pregnancy.

There were, however similarities noted when the analysis was restricted to the LBW data set. Both races had the highest incidence of tobacco and alcohol use in the age group of 40-44 years of age. This was a surprising result as the literature notes tobacco use to be more prevalent in the White population at an earlier age with decreases as maternal age advances, the opposite is reported for the Black population. An analysis of the total population demonstrated the highest tobacco use in the White population in the 45-49 year olds and in the 40-44 year olds in the Black population. The National Vital Statistic Reports have reported a decline in smoking during pregnancy especially in the 25 to 39 year old group (Martin et al., 2003). Despite an overall decline in the tobacco use during pregnancy in the 2003 report, this may represent a new trend in the older age groups of women who smoke during pregnancy.

Tobacco use was equally distributed between the metropolitan and non-metropolitan status of the county of residence for both races. One might imply by this finding that the younger aged mothers may have been more truthful in reporting alcohol consumption during pregnancy. Older women may have been more sensitive to the social taboo of this risk taking behavior and less inclined to answer truthfully. The highest incidence of alcohol use was noted to be at 1-8 years of elementary school as the highest educational attainment of the mother in both races. No other similarities were noted.

5.4.3 Logistic Regression Analysis

After controlling for age, education, and place, the odds of a black woman who smoked and drank having a LBW baby, was 2.8 times greater than a Black woman who did not smoke or drink. A White woman who smoked and drank had a 2.5 times greater chance of having a LBW baby than a woman who did not drink or smoke.

It is clear that this combined risk taking behavior had a significant effect on the risk of having a LBW neonate. It is not a surprise that the age group that had the highest incidence of both tobacco and alcohol use was in the 40-44 year old group for both races based on the results presented on individual tobacco and alcohol use. Although the odds ratio for the risk of having a LBW infant are very similar for both races, the actual incidence of LBW is quite startling with 13.78% for the White population and 30.73% for the Black population. Converting that percentage to newborns that may be at risk for long term chronic illnesses, learning disabilities, and other medical/social stigma simply by being born at a weight that is less than optimal brings the importance of trying to understand and rectify this disparity in birth weight in the races.

5.4.3.1 Summary There is a large amount of data analyses in this study and synthesizing the overall conclusions can be challenging. The study clearly supports previous findings of the Black population having a two-fold increase of LBW when compared to the White population. This study was controlled for American born White; non-Hispanic and American born Black; non-Hispanic women only (excluding Puerto Rico, Virgin Islands, Guam, American Samoa, and Northern Marianas data) to lessen variability in the findings. The prevalence of LBW was 12.02% in the Black group and

5.15% in the White group. In the entire data set, the overall LBW rate in women who used tobacco during pregnancy was 5.81% and 6.50% for those that reported alcohol use during pregnancy.

The variables of maternal place of residence, smoking and alcohol use alone or in tandem, maternal age, and highest educational attainment of the mother were explored within each racial group to determine the influence on poor perinatal outcome. The results for the Black population will be presented first, followed by the statistics for the White population in parenthesis. The most frequent maternal age at time of delivery was in the 20-24 year old group (25-29); 8.7% (13.68%) reported tobacco use during pregnancy; 0.84 % (0.86%) reported the intake of alcohol during pregnancy; a LBW rate of 30.75 % (13.78%) with concomitant use of tobacco and alcohol; and 86.29% (78.76%) of the women lived in a county classified as metropolitan. All of these findings were consistent with the published literature of the usual age of onset of tobacco use (Geronimus et al., 1993; Obel, Olsen, Dalsgaard, & Linnett, 2002; Savitz et al., 2001; Stewart, 1996; Ventura et al., 2003; Walsh, 1994; Windham et al., 2004) and age of childbearing (Ananth et al., 2003; Geronimus & Bound, 1990; Geronimus, Bound, & Waidmann, 1999a; Geronimus & Korenman, 1993; Martin et al., 2003) and the presumed underreporting of alcohol use (Lydon-Rochelle et al., 2005; Mariscal et al., 2005; Martin et al., 2003; Randall, 2001; Reichman & Hade, 2001) in addition to the LBW disparity between the Black and White race (Ananth et al., 2003; Ananth et al., 2001; Astone, Ensminger, & Juon, 2002; Baker & Hellerstedt, 2006; Balchin, Whittaker, Patel, Lamont, & Steer, 2007; Barten, Mitlin, Mulholland, Hardoy, & Stern, 2007; Belue et al., 2006; Buka, 2002; Colen, Geronimus, Bound, & James, 2006; Foster et al., 2000; Geronimus, 2001; Hillemeier, Geronimus, & Bound, 2001; Okosun et al., 2000).

The frequency of LBW in the total population of non-smoking women was 6% compared to 11% in the women who smoked . The analysis performed on the tobacco use variable revealed that 18.51% (9.72%) of the women smoked; the age with the highest incidence of smoking was in the 40-44 year old group (45-49) which resulted in an OR of 2.7 (CI 2.3, 3.1) for the Black population and an OR of 2.5 (CI 1.5, 4.1) for the White population with p values <.0001 in both groups. This finding was partially contradictory to the literature in that the highest incidence of tobacco use was expected to be seen in the White population in the earlier age group (Geronimus et al., 1993). However the analysis did support the gradual increase of tobacco use in the Black population as the woman age (Cogswell, Weisberg, & Spong, 2003; English et al., 1994; Geronimus, Colen et al., 2006; Geronimus et al., 1993; Obel et al., 2002; Pirie, Lando, Curry, McBride, & Grothaus, 2000; Savitz et al., 2001). There was smoking noted in the under 15 years of age group in the White population, but it was not a significant finding. The greater prevalence for LBW was 22.67 %, which occurred with 21-40 cigarettes per day for the Black group compared to 15% in the White group, which occurred with 41 or more cigarettes per day compared to 11.42% (4.41%) in the non-smoker. There was an inverse relationship of maternal education and LBW in the Black population. The prevalence of LBW decreased as the highest education attainment of the mother increased. In the LBW subset, both races had the highest incidence of tobacco and alcohol use in the age group of 40-44 years of age, and the highest frequency of tobacco use in the Black population was in the 1-2 years of high school education group. In the Black group, the highest incidence of tobacco use was in the cities with a population of over 1 million with these women having two times the odds of having a LBW than women who smoked and lived in a smaller populated city (CI 1.8, 2.2). The smallest number of smokers was in the city of under 100,000 with OR 1.6 (CI 1.6, 1.7). This finding may be related to other pollutants, stressors, and ETS seen in the urban environment more often than in the less populated cities (Morenoff, 2003; Muzet, 2007; Nielsen & Hansen, 2007; Pickett, Ahern, Selvin, & Abrams, 2002; Rich-Edwards et al., 2003; Stewart, 1996; Stimpson et al., 2007; Vlahov et al., 2007).

The frequency of LBW in the total population of non-drinking women was 6.50% compared to 12% in the women who drank. The overall LBW rates were not significantly different between the non-metropolitan county and the metropolitan county, with 6.61% and 6.56% respectively. Studies on the use of alcohol variable and perinatal outcome performed on the LBW subset revealed that 26.03% (7.94%) of the women reported that they had used alcohol during pregnancy; the age with the highest incidence of drinking was in the 40-44 year old group (45-49) which resulted in an OR of 3.8 (2.76, 5.25) for the Black population and an OR of 2 for the White population with p values <.0001 in both groups. This result has not been found in the literature, with research identifying increased alcohol use in the White population (Floyd & Sidhu, 2004; Mancinelli et al., 2006; Reichman & Hade, 2001; Tough et al., 2006; Tough, Clarke, Hicks, & Clarren, 2005) however due to the repetitive comments about underreporting of alcohol use during pregnancy, it is difficult to assume that the numbers are a valid representation of reality (Burd et al., 2006; Czeizel et al., 2004; Martin et al., 2003, 2005; Reichman & Hade, 2001). The highest frequency of alcohol use in the Black population was in the 1-8 years of elementary education group with an OR of 2.5 (CI 2.1, 3.1). In the Black group, the highest incidence of alcohol use was in the cities with a population of 500,000 to over 1 million (spans two categories) with these women having three times the odds of having a LBW than women who drank and lived in a smaller populated city (CI 2.5,3.8). The lowest amount of drinkers was in the city of under 250, 000 (spans two categories) with OR 2.5 (CI 2.1,3.1). This finding supports the weathering hypothesis relating to risk taking behaviors as a coping mechanism for the chronic stress in the urban environment (Geronimus, 1986, 1992, 2000, 2001; Messer et al., 2006; Morenoff, 2003; Muzet, 2007; O'Campo et al., 1997; Pickett et al., 2002).

In the subset on the combined risk taking behavior of tobacco and alcohol use, the overall LBW rate was 18.6 for the users of both substances and 6.48 for the non-users. By race, this was a prevalence of LBW of 30.75 for the Black group with OR 3.2 (CI 2.9,3.6) and 13.78 for the White group OR 2.9 (CI 2.7,3.2). The age group with the highest incidence of combined use was in the 40-44 years of age (40-44) and the lowest incidences were in the less than 15 years of age group (25-29) and the over 50 years of age group for both races. In the LBW subset, the age group with the highest incidence of combined use was in the 30-34 years of age (20-24) and the lowest incidence was in the 25-29 years of age group (30-34). After controlling for maternal age, highest educational attainment of the mother, and maternal place of residence, the Black woman who smoked and drank during pregnancy had a 2.8 times (CI 2.5, 3.1) increased risk of having a LBW than a non-using Black woman while the White woman was 2.5 times (CI 2.3, 2.7) more likely to have a LBW than a non-using White woman.

CHAPTER 6

CONCLUSIONS

6.1 Overview

LBW disparity in the United States continues to plague the perinatal environment. The healthcare community has often assumed that if the socioeconomic status of the mother improved, the odds of having a LBW infant would decrease based on the recognition of poverty's contribution to health care disparities. A recent study reported that this presumption was only correct when examining the White population. The Black-White disparity continued regardless of the socioeconomic status of the mother evidenced in the study that Black women who were college educated and in a moderate to high socioeconomic status still faced a higher incidence of having a LBW neonate than their White counterparts (Colen et al., 2006). The National Longitudinal Survey of Youth (NLSY70) is the only longitudinal United States data set that includes socioeconomic position as a unit of measure and also has other recognized predictive variables of LBW including maternal alcohol and tobacco use, and prenatal care. This longitudinal study interviewed subjects annually from 1979 to 1994 and then biennially from 1996 to 2002.

Colen and her associates (2006) analyzed non-Hispanic Black and White women who were 14-22 years of age in 1979 and lived in a household that did not exceed 200% of the national poverty threshold. They defined chronically poor as living in a household where income-to-needs ratio was <200% of poverty in both childhood and adulthood, and upwardly mobile as living in that environment in childhood but not in adulthood. Their results indicated that White women who had childhoods in poverty but an increase of family income as adults had a 50% decrease in the probability of having an LBW baby (11.82 chronically poor versus 4.62 upwardly mobile). For the Black women, although the probability of LBW was decreased (14.62 chronically poor versus 9.99 upwardly mobile) it failed to reach statistical significance. Note that as with almost all results regarding the Black-White disparity in LBW, the prevalence of LBW in the Black upwardly mobile population was twice that of the White population. This population based finding begs the question: Why is the Black woman unable to translate upward mobility in socioeconomic status into improved outcome?

This study identified the relative risk of LBW when mothers partake in both tobacco and alcohol use during pregnancy. The findings, although interesting, do not identify this behavior as a major factor in explaining the discordant birthweight outcomes within the Black and White non-Hispanic populations. The findings of an apparent increased influence of alcohol on the LBW outcome in the Black race may bear closer examination, especially considering the underreporting history of alcohol use. Is there truly a different effect from alcohol in Black women, do Black women in general respond more truthfully to this birth certificate question, or do residents of the urban environment choose other substances for their coping, such as cocaine or other illicit drugs? The birth certificates vary in the data collection questions regarding additional substance abuse involving illegal drugs. Responding to specific drug related questions might place the woman in jeopardy of an investigation by the agency for family and child protection in the specific state with potential legal ramifications. One could presume that this type of substance abuse would be more underreported then alcohol.

When reporting on LBW rates, we must consider the definition of LBW at less than 2500 grams (Wilcox, 2001). Years of data analysis have demonstrated that the Black newborn is 300 grams lighter than their White counterparts (Buka et al., 2003; Geronimus, 1996). Is it appropriate to compare across the races on the same number? Perhaps one should consider LBW for the Black neonate at less than 2200 grams and explore what impact that numeric change would make in the incidence of LBW in this population. If this arbitrary numeric cut off were changed, it may alter the rate of LBW but not have any affect on the Black infant mortality rate, of which LBW is a significant predictor. The Black infant mortality rate far exceeds the White rate, and has for several decades. The question remains, why are Black infants smaller in birthweight and at higher risk for death in the first year of life than other racial and ethnic groups in this country?

This study has identified the significant risk of combined smoking and alcohol use in pregnancy as a predictor of LBW. It has contributed to furthering our knowledge of the Black-White disparity as it relates to LBW and meets the core functions of public health defined as assessment, policy development, and assurance. The assessment core was supported by data that explored the relationship of maternal age along with biologic, environmental, and psychosocial influences of LBW. Women continue to need to be informed, educated and empowered about the value of not using tobacco or drinking alcohol during the preconception period and/or to stop with pregnancy confirmation (Alamar & Glantz, 2006; Levy, Bauer, & Lee, 2006; Rigotti, 2006).

The Public Health Agenda

The findings of this study present a compelling reason to aggressively support the public health agenda of education and policy development. Healthcare providers need to stay informed of legislative bills and understand their relationship to practice and health care initiatives. At the national level, on February 15, 2007 the Family Smoking Prevention and Control Act, a bipartisan supported bill known as S.623 and H.R. 1108, was introduced by Senator Kennedy, Democrat of Massachusetts and Representative Waxman, Democrat of California. This bill would give the Food and Drug Administration the authority to regulate tobacco as a drug. It would allow the agency to prevent tobacco advertising to children, control the sale of tobacco to minors, regulate tobacco health claims, and assist with smoking addiction cessation.[9] At the state level, Maryland introduced The Maryland Healthy Places Act into the legislature in January 2007. This bill claims that it would ultimately improve health by improving the built environment by setting up health impact assessments, planning for walkable communities, and addressing health disparities.[10]

Part of the assurance core concept relates to healthcare providers referring people to appropriate resource systems for the purpose of promoting and improving the health of this population. These data strongly support the need for smoking and alcohol cessation preconception to minimize the odds for LBW, regardless of race or ethnicity. This message needs to be repeated during every prenatal encounter with the health care provider along with strategies and systems to support the mother. Appropriate referrals to support groups, web sites, and healthcare industry funded cessation programs should

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[9] Retrieved 4-4-2007 from http://thomas.loc.gov/home/gpoxmlc110/h1108_ih.xml
[10] Retrieved 4-4-2007 from http://mlis.state.md.us/2007rs/hearsch/0308_hgo_1515.htm

be made at the earliest encounter. Resources to sustain this type of support could occur with a fully funded Maternal and Child Health Block Grant with a guaranteed set of comprehensive services geared to the childbearing woman. At a health system level this comprehensive service could address preconception, pregnancy, birth, and the first year of the newborn's live. In addition there should be promulgation of system level policies to regulate the type and extent of services available via a regionalized perinatal plan to ensure the best management of the mother and neonate during the childbearing experience.

A publication by the Public Health Advisory Board addressed the trends in preterm birth and low birthweight.[11] It stated that although it is tempting to attribute observed differences in mortality by race/ethnicity to poverty, prejudice, and inequality in income, a review of data on poverty and family structure suggests this may be an oversimplification. SES has long been stated as a predictor of poor health outcome, despite the lack of SES data in most studies and large data sets, as noted in this study with the Natality Data Set. The statistics on children living in two parent households are only 35% for Black, 64% for Hispanic, and 75% for white. The proportion of non-marital childbearing in the Black race was 70%, 41% in the Hispanic race, and 26% in the White race. When examining the influence of poverty, it was noted that the proportion of Hispanic children living in poverty is as high or higher than the proportion of black children living in poverty, yet black children have worse health indicators than Hispanic children.

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[11] Trends in LBW, Retrieved electronically on 4-19-2007 from http://phpab.org/HealthandtheAmericanChild/phpab3.html

Their conclusions were:

- Little is known about how the interactions of poverty, education, family structure, social "connectedness," neighborhood integrity, and other sociocultural factors affect the health of children.
- Social relationships in communities and family support may contribute to the developmental well-being of children and offset the harmful effects of stress, while the loss of such relationships may impact children's health.[12]

Summary

The Black-White disparity in low birth weight is a complex research question with little consensus regarding the exact medical etiology or the pathways through which social environmental factors contribute to the disparity. The literature supports that the risk taking behaviors of tobacco and alcohol use are highly associated with an increased risk of LBW and that living in a highly deprived neighborhood increases your likelihood in partaking in those behaviors. While social determinant is not uniquely urban, when viewed through the characteristics of density, diversity, complexity, and sheer numbers of inhabitants it is transformed (Vlahov et al., 2007). In addition to the standard approach to providing information, the healthcare provider must have an understanding of the living conditions in the cities in which people live and recognize that ameliorating those conditions may offer the greatest promise for reducing morbidity, mortality, and disparities in health and for improving quality of life and well being.

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[12] Trends in LBW, Retrieved electronically on 4-19-2007 from http://phpab.org/HealthandtheAmericanChild/phpab3.html

6.2 Implications for Future Research

Perhaps the most exciting research today involves the concept of allostasis as it relates to maternal psychosocial stress and adverse pregnancy outcome, including LBW. Allostasis serves as the framework to evaluate responses to stressful events and includes genetic risk factors, lifestyle behaviors, environmental experiences, and current psychosocial stressors. LBW is a multifactorial phenomenon with a yet undefined etiology as evidenced by the quantity of conflicting literature and the wide range of responses to specific interventions.

The research on the built environment, socioeconomic place, chronic poverty, high risk lifestyle and unhealthy behaviors do contribute to adverse perinatal outcome but in a dynamically changing context. What appear to be a consistent factor is what role those variables play as potential stressors to the individual. We know that our body's response to stress is to attempt homeostasis in the face of changes to our lifestyle and environment by regulating our stress mediators of cortisol, adrenocorticotropic hormone (ACTH), norepinephrine, and epinephrine. Once the stress is managed, the level of those stress mediating hormones return to baseline. We are now discovering that if stress is chronic, the set point for those mediators at the cellular level is affected and may result in less than optimal health or disease. With this growing body of knowledge we are faced with the need to develop and implement interventions that can modify the initiation of the stressor (clean air, green space, employment, education, and enrichment opportunities) and introduce clinical interventions to modify the perception of stress and reduce/alter the physiological response to chronic stress. Research is also needed to explore allostatic load as it pertains to pregnancy and adverse perinatal outcomes.

On the horizon of another exciting avenue in research is in the area of cytokines and initiation of labor. Cytokines are a group of proteins and peptides that allow one cell to communicate with another. They play a key role in the immune system and inflammatory responses. Ethnic differences in polymorphisms in cytokines may be the underlying reason for the increase of preterm birth and low birthweight infants in one race versus another.

In order to understand the actual influence of alcohol and additional substance abuse, one must have confidence in the sample of consumers versus non-consumers. A definitive research study would be a longitudinal study of women throughout pregnancy with administration of risk taking behavior questionnaires in addition to collection of serum assays for substances to validate the responses. This would clearly be a costly and time-consuming project with a potentially rigorous protocol to implement.

Although no one variable has been demonstrated to have a singular causal relationship for low birth weight, the research must continue from multiple disciplines with diverse methodological approaches to explore all possible risk factors and prevention strategies for LBW. This dissertation, in light of the support of the major construct of the weathering hypothesis of advanced maternal aging of the Black woman, suggests that the direction for future research must examine the complex interplay of the multiple factors of the environment, race, biologic responses, genetics, and stress. Interdisciplinary collaboration among health researchers, urban planners, and policy experts will be the key to understanding what measures must be employed to eliminate the Black-White disparity in low birth weight.

APPENDIX A

STATISTICAL TABLES

Table 4.1*

LBW by Maternal Age and Race

Race of Mother Frequency Percent Col Pct	Maternal Age in Increments < 15 YRS	15-19 YRS	20-24 YRS	25-29 YRS	30-34 YRS	35-39 YRS	40-44 YRS	45-49 YRS	50 YRS OR >	Total
White LBW	133	12825	28771	26125	23390	13075	3553	189	12	108073
Frequency	0.01	0.61	1.37	1.25	1.11	0.62	0.17	0.01	0.00	5.15
Missing = 1346	9.74	7.75	5.87	4.60	4.22	5.01	6.46	7.63	10.71	
Black LBW	383	11825	19298	11828	8448	4890	1316	57	1	58046
Frequency	0.08	2.45	4.00	2.45	1.75	1.01	0.27	0.01	0.00	12.02
Missing = 552	15.13	12.91	11.39	10.84	12.21	14.83	16.78	18.33	16.67	

Maternal Age at Childbearing by Race (Data of Figure 4.1)

Race of mother	Maternal Age in increments									
Frequency Percent Row Pct	< 15 YRS	15-19 YRS	20-24 YRS	25-29 YRS	30-34 YRS	35-39 YRS	40-44 YRS	45-49 YRS	50 YRS OR >	Total
White	1365 0.05 0.07	165692 6.41 7.89	490316 18.98 23.35	568816 22.02 27.09	554230 21.46 26.40	261354 10.12 12.45	55050 2.13 2.62	2481 0.10 0.12	112 0.00 0.01	2099416 81.28
Black	2537 0.10 0.52	91725 3.55 18.97	169557 6.56 35.06	109270 4.23 22.60	69287 2.68 14.33	33033 1.28 6.83	7849 0.30 1.62	311 0.01 0.06	6 0.00 0.00	483575 18.72
Total	3902 0.15	257417 9.97	659873 25.55	678086 26.25	623517 24.14	294387 11.40	62899 2.44	2792 0.11	118 0.00	2582991 100.00

Table 4.2*
Tobacco Use by Race

Race of mother Frequency Percent Row Pct	Tobacco use YES	NO	Total
White	262023 11.08 13.68	1652995 69.89 86.32	1915018 80.97
Black	39156 1.66 8.70	410887 17.37 91.30	450043 19.03
Total	301179 12.73	2063882 87.27	2365061 100.00

Frequency Missing = 217930

Table 4.3*
Alcohol Use by Race

Race of mother Frequency Percent Row Pct	Alcohol use YES	NO	Total
White	15592 0.70 0.86	1788119 79.77 99.14	1803711 80.47
Black	3693 0.16 0.84	434141 19.37 99.16	437834 19.53
Total	19285 0.86	2222260 99.14	2241545 100.00

Frequency Missing = 341446

Population of the City of Maternal Residence by Race (Data of Figure 4.2)

Race of mother	Population of residence city					Total
Frequency Percent Row Pct	City of 1,000,000 or more	City of 500,000 to 1,000,000	City of 250,000 to 500,000	City of 100,000 to 250,000	City of less than 100,000	
White	67376 2.61 3.21	67414 2.61 3.21	91382 3.54 4.35	170960 6.62 8.14	1702284 65.90 81.08	2099416 81.28
Black	59308 2.30 12.26	55922 2.17 11.56	51916 2.01 10.74	72364 2.80 14.96	244065 9.45 50.47	483575 18.72
Total	126684 4.90	123336 4.77	143298 5.55	243324 9.42	1946349 75.35	2582991 100.00

Table 4.4*

Residence of County by Race

Race of mother Frequency Percent Row Pct	Metropolitan residence county: Metropolitan County	Non-metropolitan County	Foreign resident	Total
White	1591330 61.61 75.80	507942 19.66 24.19	144 0.01 0.01	2099416 81.28
Black	417280 16.15 86.29	66287 2.57 13.71	8 0.00 0.00	483575 18.72
Total	2008610 77.76	574229 22.23	152 0.01	2582991 100.00

Incidence of LBW with Tobacco Use of the Entire Data Set (Data of Figure 4.3)

Frequency Percent Col Pct	Tobacco Use: 1 to 5 cigarettes daily	6 to 10 cigarettes daily	11 to 20 cigarettes daily	21 to 40 cigarettes daily	41 or more cigarettes daily	Non-smoker	Total
LBW, 2499 GRAMS OR LESS	9529 0.40 10.18	14016 0.59 10.86	8054 0.34 11.39	1031 0.04 14.24	55 0.00 15.32	119802 5.07 5.81	152487 6.45
NORMAL 2500 GRAMS OR MORE	84075 3.56 89.82	115051 4.87 89.14	62639 2.65 88.61	6210 0.26 85.76	304 0.01 84.68	1942651 82.20 94.19	2210930 93.55
Total	93604 3.96	129067 5.46	70693 2.99	7241 0.31	359 0.02	2062453 87.27	2363417 100.00

Frequency Missing = 219574

Black and White Tobacco Use and Maternal Age (Data of Figure 4.4)

Percent of LBW

Frequency Percent Col Pct	Tobacco Use White smoker	White non-smoker	Chi Square	Tobacco Use Black smoker	Black non-smoker	Chi Square
Maternal Age UNDER 15 YEARS Frequency Missing = 139	24 1.96 11.43	97 7.91 9.55	0.4053	3 0.13 7.14	359 15.26 15.54	0.1350
Maternal Age 15-19 YEARS Frequency Missing = 18741	4264 2.90 10.26	7275 4.95 6.90	<.0001	896 1.06 16.44	10091 11.99 12.82	<.0001
Maternal Age 20-24 YEARS Frequency Missing = 59610	9544 2.22 8.93	16205 3.76 5.01	<.0001	2432 1.57 15.58	15409 9.94 11.06	<.0001
Maternal Age 25-29 YEARS Frequency Missing = 76662	5685 1.16 9.09	17213 3.50 4.01	<.0001	1662 1.69 17.11	9082 9.22 10.23	<.0001
Maternal Age 30-34 YEARS Frequency Missing = 83906	3891 0.83 10.27	16354 3.48 3.78	<.0001	1268 2.06 22.48	6285 10.20 11.23	<.0001
Maternal Age 35-39 YEARS Frequency Missing = 45435	2340 1.08 13.04	8693 4.03 4.39	<.0001	967 3.35 28.27	3342 11.58 13.14	<.0001
Maternal Age 40-44 YEARS Frequency Missing =10721	707 1.59 16.19	2221 5.01 5.56	<.0001	310 4.57 31.54	845 12.45 14.56	<.0001
Maternal Age 45-49 YEARS Frequency Missing = 558	24 1.25 16.55	128 6.66 7.20	<.0001	10 3.79 27.03	41 15.53 18.06	0.2002
Maternal Age 50 YEARS OR OLDER Frequency Missing = 41	0 0.00 .	8 11.27 11.27		0 0.00 0.00	1 50.00 100.00	0.1573

Table 4.5*

Incidence of LBW with Tobacco Use in the White Population

Frequency Percent Col Pct	Tobacco Use 1 to 5 cigarettes daily	11 to 20 cigarettes daily	21 to 40 cigarettes daily	41 or more cigarettes daily	6 to 10 cigarettes daily	Non-smoker	Total
LBW, 2499 grams or less	6009 0.31 8.20	7085 0.37 10.73	924 0.05 13.65	49 0.00 15.08	11378 0.59 9.86	72914 3.81 4.41	98359 5.14
NORMAL, 2500 grams or more	67261 3.51 91.80	58960 3.08 89.27	5845 0.31 86.35	276 0.01 84.92	104065 5.44 90.14	1579121 82.51 95.59	1815528 94.86
Total	73270 3.83	66045 3.45	6769 0.35	325 0.02	115443 6.03	1652035 86.32	1913887 100.00

Frequency Missing = 185529

Table 4.6*

Incidence of LBW with Tobacco Use in the Black Population

Frequency Percent Col Pct	Tobacco Use 1 to 5 cigarettes daily	11 to 20 cigarettes daily	21 to 40 cigarettes daily	41 or more cigarettes daily	6 to 10 cigarettes daily	Non-smoker	Total
LBW, 2499 grams or less	3520 0.78 17.31	969 0.22 20.85	107 0.02 22.67	6 0.00 17.65	2638 0.59 19.36	46888 10.43 11.42	54128 12.04
NORMAL, 2500 grams or more	16814 3.74 82.69	3679 0.82 79.15	365 0.08 77.33	28 0.01 82.35	10986 2.44 80.64	363530 80.87 88.58	395402 87.96
Total	20334 4.52	4648 1.03	472 0.10	34 0.01	13624 3.03	410418 91.30	449530 100.00

Frequency Missing = 34045

Incidence of LBW with Alcohol Use in the Entire Data Set (Data of Figure 4.6)

Frequency Percent Col Pct	Alcohol Consumption 1 drink per week	2 drinks per week	3-4 drinks per week	5 or more drinks per week	Non drinker	Total
LBW, 2499 grams or less	689 0.03 8.02	367 0.02 12.16	264 0.01 15.69	393 0.02 22.19	145293 6.50 6.54	147006 6.57
NORMAL, 2500 grams or more	7903 0.35 91.98	2651 0.12 87.84	1419 0.06 84.31	1378 0.06 77.81	2075752 92.83 93.46	2089103 93.43
Total	8592 0.38	3018 0.13	1683 0.08	1771 0.08	2221045 99.33	2236109 100.00

Frequency Missing = 346882

Table 4.7*

Incidence of LBW with Alcohol Use in the White Population

Frequency Percent Col Pct	Alcohol Consumption 1 drink per week	2 drinks per week	3-4 drinks per week	5 or more drinks per week	Non drinker	Total
LBW, 2499 grams or less	444 0.02 5.97	209 0.01 8.95	121 0.01 9.83	196 0.01 16.28	93255 5.18 5.22	94225 5.24
NORMAL, 2500 grams or more	6996 0.39 94.03	2126 0.12 91.05	1110 0.06 90.17	1008 0.06 83.72	1694043 94.14 94.78	1705283 94.76
Total	7440 0.41	2335 0.13	1231 0.07	1204 0.07	1787298 99.32	1799508 100.00

Frequency Missing = 299908

Table 4.8*

Incidence of LBW with Alcohol Use in the Black Population

Frequency Percent Col Pct	Alcohol Consumption 1 drink per week	2 drinks per week	3-4 drinks per week	5 or more drinks per week	Non drinker	Total
LBW, 2499 grams or less	245 0.06 21.27	158 0.04 23.13	143 0.03 31.64	197 0.05 34.74	52038 11.92 12.00	52781 12.09
NORMAL, 2500 grams or more	907 0.21 78.73	525 0.12 76.87	309 0.07 68.36	370 0.08 65.26	381709 87.43 88.00	383820 87.91
Total	1152 0.26	683 0.16	452 0.10	567 0.13	433747 99.35	436601 100.00

Frequency Missing = 46974

Table 4.9*

Incidence of LBW with Combined Tobacco and Alcohol Use in the Entire Data Set

Frequency	Tobacco & Alcohol Use Yes	No	*p* value	Total
LBW, 2499 grams or less	1209 0.06 18.60	141905 6.46 6.48	<.0001	143114 6.51
NORMAL, 2500 grams or more	5290 0.24 81.40	2049027 93.25 93.52	<.0001	2054317 93.49
Total	6499 0.30	2190932 99.70	<.0001	2197431 100.00

Frequency Missing = 385560

Table 4. 10*

Combined Tobacco and Alcohol Use and City Residence in Both Races

Frequency Percent Col Pct	Population of Residence City City of less than 100,000	City of 100,000 to 250,000	City of 250,000 to 500,000	City of 500,000 to 1,000,000	City of 1,000,000 or more	Total
YES	4621 0.21 0.28	686 0.03 0.35	411 0.02 0.34	430 0.02 0.39	358 0.02 0.37	6506 0.30
NO	1671623 76.03 99.72	194833 8.86 99.65	120880 5.50 99.66	109606 4.99 99.61	95143 4.33 99.63	2192085 99.70
Total	1676244 76.24	195519 8.89	121291 5.52	110036 5.00	95501 4.34	2198591 100.00

Frequency Missing = 384400

Table 4. 11*

Combined Tobacco and Alcohol Use and County Residence in Both Races

Frequency Percent Col Pct	County Metropolitan Residence Nonmetropolitan	Metropolitan County	Total
YES	1518 0.07 0.29	4988 0.23 0.30	6506 0.30
NO	524923 23.88 99.71	1667035 75.82 99.70	2192085 99.70
Total	526441 23.94	1672023 76.05	2198591 100.00

Frequency Missing = 384400

Table 4.12*

Incidence of LBW with Combined Tobacco and Alcohol Use in the White Population

Frequency	Tobacco & Alcohol Use Yes	No	*p* value	Total
LBW, 2499 grams or less	641	90431	<.0001	91072
	0.04	5.12		5.16
	13.78	5.14		
NORMAL, 2500 grams or more	4011	1670166	<.0001	1674177
	0.23	94.61		94.84
	86.22	94.86		
Total	4652	1760597	<.0001	1765249
	0.26	99.74		100.00

Frequency Missing = 334167

Table 4.14*

Incidence of LBW with Combined Tobacco and Alcohol Use in the Black Population

Frequency	Tobacco & Alcohol Use Yes	No	*p* value	Total
LBW, 2499 grams or less	568	51474	<.0001	52042
	0.13	11.91		12.04
	30.75	11.96		
NORMAL, 2500 grams or more	1279	378861	<.0001	380140
	0.30	87.66		87.96
	69.25	88.04		
Total	1847	430335	<.0001	432182
	0.43	99.57		100.00

Frequency Missing = 334167

Table 4.23*

Combined Tobacco & Alcohol Use by Maternal Age in the White Population

Frequency Percent Col Pct	Maternal Age and p value									
	< 15 YRS/	15-19 YRS/	20-24 YRS/	25-29 YRS/	30-34 YRS/	35-39 YRS/	40-44 YRS/	45-49 YRS/	50 YRS or > /	Total
	****	****	****	****	0.47	****	****	****	0.002	
Combined User	7 0.00 0.58	470 0.03 0.33	1406 0.08 0.34	981 0.06 0.20	939 0.05 0.20	636 0.04 0.30	212 0.01 0.49	7 0.00 0.37	0 0.00 0.00	4658 0.26
Non-User	1191 0.07 99.42	141170 7.99 99.67	415103 23.50 99.66	482475 27.32 99.80	463615 26.25 99.80	212379 12.03 99.70	43468 2.46 99.51	1891 0.11 99.63	71 0.00 100.00	1761363 99.74
Total	1198 0.07	141640 8.02	416509 23.58	483456 27.38	464554 26.31	213015 12.06	43680 2.47	1898 0.11	71 0.00	1766021 100.00

Frequency Missing = 333395

**** *p* value <0.0001

Table 4.24*

Combined Tobacco & Alcohol Use by Maternal Age in the Black Population

Frequency Percent Col Pct	Maternal Age and *p* value									
	< 15 YRS/	15-19 YRS/	20-24 YRS/	25-29 YRS/	30-34 YRS/	35-39 YRS/	40-44 YRS/	45-49 YRS/	50 YRS or > /	
	****	****	****	****	****	****	****	****	0.07	Total
Combined User	2 0.00 0.09	111 0.03 0.13	404 0.09 0.26	390 0.09 0.40	454 0.10 0.75	360 0.08 1.27	127 0.03 1.91	0 0.00 0.00	0 0.00 0.00	1848 0.43
Non-User	2346 0.54 99.91	83385 19.28 99.87	152760 35.31 99.74	96923 22.41 99.60	60462 13.98 99.25	28049 6.48 98.73	6539 1.51 98.09	256 0.06 100.00	2 0.00 100.00	430722 99.57
	2348 0.54	83496 19.30	153164 35.41	97313 22.50	60916 14.08	28409 6.57	6666 1.54	256 0.06	2 0.00	432570 100.00

Frequency Missing = 51005

**** *p* value <0.0001

Table 5.5

Odds Ratio for Incidence of LBW With Alcohol Use in the Black and White Populations

	1 Drink/week		2 Drinks/week		3-4 Drinks/week		5 or more Drinks/week	
Race	% of n	Odds Ratio	% of n	Odds Ratio	% of n	Odds Ratio	% of n	Odds Ratio
Black n= 52781	0.06 ****	1.9	0.04 ****	2.2	0.03 ****	3.3	0.05 ****	3.9
White n=94225	0.02 ****	1.1	0.01 ****	1.7	0.01 ****	1.9	0.01 ****	3.5

**** $p < .0001$

Table 5.6

Odds Ratio for Incidence of LBW With Tobacco Use in the Black and White Populations

	1-5 cigs/day		6-10 cigs/day		11-20 cigs/day		21-40 cigs/day		41 or more cigs/day	
Race	% of n	Odds Ratio	% of n	Odds Ratio	% of n	Odds Ratio	% of n	Odds Ratio	% of n	Odds Ratio
Black n= 380735	3.66*	1.6	2.35*	2	0.75	2.2*	0.07	1.6*	0.001	1.8*
White n=1677649	3.48*	1.9	5.38*	2.6	2.93	3.4*	0.29	3.8*	0.01	2.3*

* All p values <.001

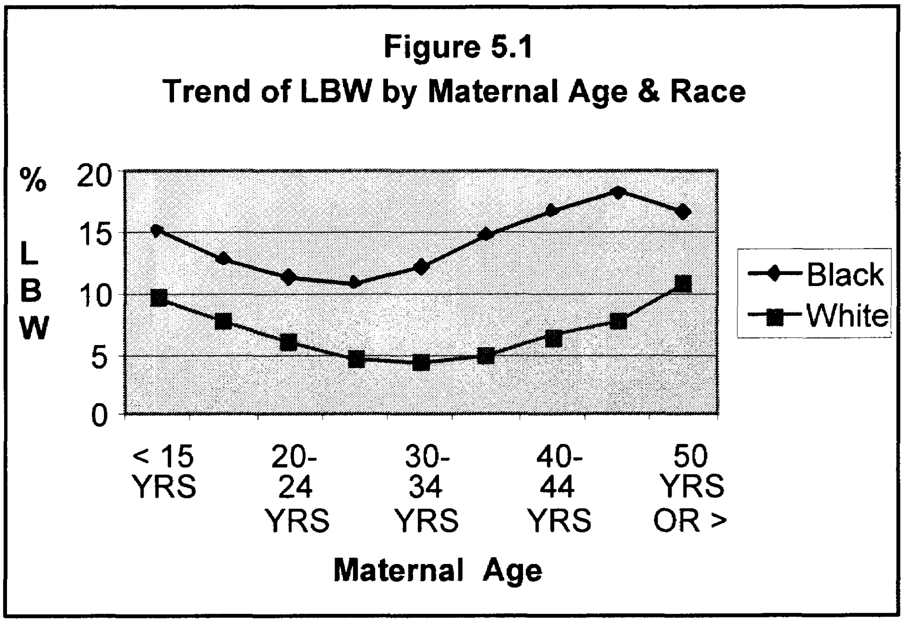

Figure 5.1
Trend of LBW by Maternal Age & Race
% LBW
20
15
10
5
0
< 15 YRS
20-24 YRS
30-34 YRS
40-44 YRS
50 YRS OR >
Maternal Age
Black
White

Table 5.7
Univariate Logistic Regression

White Population

Variable	Num. at risk (% of tot. pop)	% LBW	*p* Trend & Chi-Sq	Odds Ratio	95% Confidence Interval		*P* of logistic regression
Maternal Age			<0.0001				**<.0001**
			<0.0001				
<15 years	1,365 (0.07)	9.74		2.242	1.874	2.682	<.0001
15-19 years	165,556(7.89)	7.75		1.743	1.706	1.782	<.0001
20-24 years	489,988(23.35)	5.87		1.295	1.273	1.317	<.0001
25-29 years	568,475(27.10)	4.6		1.000			<.0001
30-34 years	553,926(26.4)	4.22		0.915	0.899	0.932	<.0001
35-39 years	261,182(12.45)	5.01		1.094	1.071	1.118	<.0001
40-44 years	54,988(2.62)	6.46		1.434	1.383	1.487	<.0001
45-49 years	2,478(0.12)	7.63		1.714	1.477	1.989	<.0001
50 years & >	112(0.01)	10.71		2.493	1.370	4.536	0.0028
Population of Residence City			0.67				**<.0001**
			<0.0001				
<100,000	1701148(81.08)	5.15		1.000			<.0001
100,00 to 250,000	170892(8.15)	5.21		1.012	0.990	1.035	0.2913
250,000 to 500,000	91321(4.35)	5.35		1.042	1.011	1.073	0.0067
500,000 to 1,000,000	67371(3.21)	5.26		1.024	0.989	1.059	0.1868
1,000,000 & more	67338(3.21)	4.68		0.904	0.872	0.938	<0.0001
Metropolitan County			<0.0001				**<.0001**
			<0.0001				
Non-metro	507487(24.19)	5.79		1.180	1.164	1.196	<0.0001
metropolitan	1590439(75.8)	4.95		1.000			<0.0001
Tobacco Use			<0.0001				**<.0001**
			<0.0001				
Non-smoker	1652035(86.32)	4.41		1.000			<.0001
1-5 cigarettes/d	73270(3.83)	8.2		1.935	1.883	1.989	<.0001
6-10 cigarettes/d	115443(6.03)	9.86		2.368	2.319	2.148	<.0001
11-20 cigarettes/d	664045(3.45)	10.73		2.602	2.536	2.670	<.0001
21-40 cigarettes/d	6769(0.35)	13.65		3.424	3.193	3.671	<.0001
41 or more/d	325(0.02)	15.08		3.845	2.837	5.211	<.0001

Table 5.7, continued
Univariate Logistic Regression

White Population

Variable	Num. at risk (% of tot. pop)	% LBW	*p* Trend & Chi-Sq	Odds Ratio	95% Confidence Interval		*p* of logistic regression
For Revised States Only							
Mother's Education			<0.0001 <0.0001				**<.0001**
8th grade or less	3004(2.07)	4.69		0.833	0.700	0.992	0.0403
9-12, no diploma	13878(9.58)	7.54		1.380	1.278	1.490	<.0001
High School graduate or GED	38123(26.3)	5.58		1.000			
College credit, no degree	29257(20.19)	4.65		0.824	0.768	0.884	<.0001
Associate or Bachelor's Degree	46520(32.1)	3.7		0.649	0.608	0.693	<.0001
Master's, Doctorate, or professional degree	14151(9.76)	3.51		0.616	0.557	0.680	<.0001
For UnRevised States Only							
Mother's Education			<0.0001 <0.0001				**<.0001**
No formal education	393(0.02)	8.4		1.372	0.960	1.959	0.0825
1-8 years elementary	27751(1.43)	8.08		1.316	1.259	1.375	<.0001
1-2 years high school	109436(5.64)	8.94		1.470	1.436	1.504	<.0001
3-4 years high school	662725(34.15)	6.26		1.000			<.0001
1-4 years college	878528(45.27)	4.23		0.660	0.651	0.670	<.0001
5 years or more of college	261635(13.48)	3.66		0.569	0.556	0.582	<.0001
Alcohol Use			<0.0001 <0.0001				**<.0001**
Non-drinker	1787298(99.32)	5.22		1.000			<.0001
1 drink/week	7440(0.41)	5.97		1.153	1.047	1.269	0.0037
2 drinks/week	2335(0.13)	8.95		1.786	1.549	20.59	<.0001
3-4 drinks/week	1231(0.07)	9.83		1.980	1.641	2.389	<.0001
5 or more drinks/week	12.4(0.07)	16.28		3.532	3.031	4.117	<.0001

Table 5.8
Univariate Logistic Regression

Black Population

Variable	Num. at risk (% of tot. pop)	% LBW	*p* Trend & Chi-Sq	Odds Ratio	95% Confidence		*p* of logistic regression
			<0.0001 <0.0001				**<.0001**
Maternal Age							
<15 years	2532(0.52)	15.13		1.466	1.313	1.638	<.0001
15-19 years	91622(18.97)	12.91		1.219	1.187	1.253	<.0001
20-24 years	169384(35.07)	11.39		1.058	1.033	1.084	<.0001
25-29 years	109147(22.6)	10.84		1.000			<.0001
30-34 years	69197(14.33)	12.21		1.144	1.111	1.179	<.0001
35-39 years	32981(6.83)	14.83		1.432	1.382	1.485	<.0001
40-44 years	7843(1.62)	16.78		1.659	1.559	1.765	<.0001
45-49 years	311(0.06)	18.33		1.846	1.385	2.462	<.0001
50 years & >	6(0.0)	16.67		1.696	0.192	14.086	0.6493
Population of Residence City			<0.0001 <0.0001				**<.0001**
<100,000	243837(50.48)	11.76		1.000			<.0001
100,00 to 250,000	72298(14.97)	12.31		1.053	1.027	1.080	<.0001
250,000 to 500,000	51853(10.74)	12.10		1.033	1.003	1.063	0.0303
500,000 to 1,000,000	55852(11.56)	12.43		1.065	1.036	1.095	<.0001
1,000,000 & more	59183(12.25)	12.27		1.049	1.021	1.078	0.0006
Metropolitan County			0.0008 0.0002				**<.0001**
Non-metro	66241(13.71)	12.46		1.049	1.024	1.076	0.0002
metropolitan	416774(86.28)	11.95		1.000			<.0001
Tobacco Use			<0.0001 <0.0001				**<.0001**
Non-smoker	410418(91.30)	11.42		1.000			<.0001
1-5 cigarettes/d	20334(4.52)	17.31		1.623	1.563	1.685	<.0001
6-10 cigarettes/d	13624(3.03)	19.36		1.862	1.782	1.945	<.0001
11-20 cigarettes/d	4648(1.03)	20.85		2.042	1.901	2.193	<.0001
21-40 cigarettes/d	472(0.1)	22.67		2.273	1.832	2.820	<.0001
41 or more/d	34(0.01)	17.65		1.661	0.688	4.013	0.2592

Table 5.8, Continued
Univariate Logistic Regression

Variable	Num. at risk (% of tot. pop)	Black Population % LBW	*p* Trend & Chi-Sq	Odds Ratio	95% Confidence		*p* of logistic regression
For Revised States Only							
Mother's Education			<0.0001 <0.0001				**<.0001**
8th grade or less	201(1.19)	12.44		1.030	0.672	1.576	0.8935
9-12, no diploma	4070(24.09)	14.47		1.226	1.091	1.378	0.0006
High School graduate or GED	6021(35.63)	12.12		1.000			<.0001
College credit, no degree	4036(23.89)	10.11		0.815	0.717	0.927	0.0018
Associate or Bachelor's Degree	21123(12.56)	9.09		0.725	0.613	0.857	0.0002
Master's, Doctorate, or professional degree	446(2.64)	8.07		0.636	0.449	0.903	0.0112
For UnRevised States Only							
Mother's Education			<0.0001 <0.0001				**<.0001**
No formal education	134(0.03)	17.16		1.45	0.925	2.271	0.1049
1-8 years elementary	8432(1.83)	15.25		1.258	1.184	1.336	<.0001
1-2 years high school	49675(10.78)	13.94		1.132	1.100	1.164	<.0001
3-4 years high school	240751(52.26)	12.52		1.000			<.0001
1-4 years college	141807(30.78)	10.61		0.83	0.812	0.847	<.0001
5 years or more of college	19879(4.32)	8.92		0.685	0.651	0.720	<.0001
Alcohol Use			<0.0001 <0.0001				**<.0001**
Non-drinker	433747(99.35)	12.0		1.000			<.0001
1 drink/week	1152(0.26)	21.27		1.981	1.720	2.282	<.0001
2 drinks/week	683(0.16)	23.13		2.208	1.848	2.638	<.0001
3-4 drinks/week	452(0.10)	31.64		3.395	2.784	4.140	<.0001
5 or more drinks/week	567(0.13)	34.74		3.906	3.285	4.644	<.0001

Table 5.9

MultiVariable Logistic Regression

White Population

Odds Ratio Estimates

Effect		Point Estimate (*p* value)	95% Wald Confidence Limits	
Maternal Age	UNDER 15 YEARS vs 25-29 YEARS	1.407 (***)	1.157	1.712
Maternal Age	15-19 YEARS vs 25-29 YEARS	1.268 (***)	1.235	1.301
Maternal Age	20-24 YEARS vs 25-29 YEARS	1.110 (***)	1.088	1.131
Maternal Age	30-34 YEARS vs 25-29 YEARS	0.993 (0.4)	0.973	1.013
Maternal Age	35-39 YEARS vs 25-29 YEARS	1.184 (***)	1.156	1.213
Maternal Age	40-44 YEARS vs 25-29 YEARS	1.530 (***)	1.469	1.593
Maternal Age	45-49 YEARS vs 25-29 YEARS	1.907 (***)	1.611	2.256
Maternal Age	50 YEARS OR > vs 25-29 YEARS	3.131 (***)	1.497	6.545
Maternal Education No formal education vs 3-4 years of high school		1.250 (0.3)	0.808	1.932
Maternal Education 1-8 Years of elementary school vs 3-4 years of high school		1.251 (***)	1.194	1.312
Maternal Education 1-2 year of high school vs 3-4 years of high school		1.392 (***)	1.358	1.427
Maternal Education 1-4 year of college vs 3-4 years of high school		0.687 (***)	0.676	0.698
Maternal Education 5 years or more of college vs 3-4 years of high school		0.594 (***)	0.579	0.610
Combined maternal tobacco and alcohol use 1-YES vs NON		2.538 (***)	2.332	2.762
Population of City of 100,000 to 250,000 vs City of less than 100,000		1.061 (***)	1.035	1.088
Population of City of 250,000 to 500,000 vs City of less than 100,000		1.056 (***)	1.022	1.091
Population of City of 500,000 to 1,000,000 vs City of less than 100,000		1.041 (***)	1.002	1.081
Population of City of 1,000,000 or more vs City of less than 100,000		0.960 (0.06)	0.921	1.002

***** *p* value <.01.**

Table 5.9

MultiVariable Logistic Regression

Black Population

Odds Ratio Estimates

Effect		Point Estimate (*p* value)	95% Wald Confidence Limits	
Maternal Age	UNDER 15 YEARS vs 25-29 YEARS	1.137 (***)	1.000	1.294
Maternal Age	15-19 YEARS vs 25-29 YEARS	1.083 (***)	1.050	1.116
Maternal Age	20-24 YEARS vs 25-29 YEARS	1.011 (0.42)	0.985	1.037
Maternal Age	30-34 YEARS vs 25-29 YEARS	1.181 (***)	1.143	1.219
Maternal Age	35-39 YEARS vs 25-29 YEARS	1.468 (***)	1.412	1.527
Maternal Age	40-44 YEARS vs 25-29 YEARS	1.699 (***)	1.586	1.819
Maternal Age	45-49 YEARS vs 25-29 YEARS	2.034 (***)	1.484	2.788
Maternal Age	50 YEARS OR > vs 25-29 YEARS	12.077 (0.078)	0.755	193.201
Maternal Education	No formal education vs 3-4 years of high school	1.448 (0.125)	0.902	2.325
Maternal Education	1-8 Years of elementary school vs 3-4 years of high school	1.221 (***)	1.139	1.309
Maternal Education	1-2 year of high school vs 3-4 years of high school	1.117 (***)	1.084	1.150
Maternal Education	1-4 year of college vs 3-4 years of high school	0.803 (***)	0.785	0.822
Maternal Education	5 years or more of college vs 3-4 years of high school	0.624 (***)	0.591	0.658
Combined maternal tobacco and alcohol use	1-YES vs NON	2.801 (***)	2.531	3.101
Population of City of 100,000 to 250,000	vs City of less than 100,000	1.066 (***)	1.037	1.095
Population of City of 250,000 to 500,000	vs City of less than 100,000	1.026 (0.10)	0.995	1.059
Population of City of 500,000 to 1,000,000	vs City of less than 100,000	1.034 (***)	1.004	1.065
Population of City of 1,000,000 or more	vs City of less than 100,000	1.031 (***)	0.999	1.063

***** *p* value <.01.**

APPENDIX B

NCHS TECHNICAL NOTES

This CD-ROM contains the Natality Detail public use files for 2003. The data files are in ASCII format and the United States file has been compressed. The United States file is named Nat03us.zip while the Territories file is named Nat03ps.dat. Documentation is contained in the file Natdoc03.pdf. This is an Adobe Acrobat file.

WARNING! DATA USE RESTRICTIONS

Read Carefully Before Using

The Public Health Service Act (Section 308) (d) provides that the data collected by the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), may be used only for the purpose of health statistical reporting and analysis.

Any effort to determine the identity of any reported case is prohibited by this law.

NCHS does all it can to assure that the identity of data subjects cannot be disclosed. All direct identifiers, as well as any characteristics that might lead to identification, are omitted from these datasets. Any intentional identification or disclosure of a person or establishment

violates the assurances of confidentiality given to the providers of the information. Therefore, users will:

1. Use the data in these datasets for statistical reporting and analysis only.

2. Make no use of the identity of any person or establishment discovered inadvertently and advise the Director, NCHS, of any such discovery.

3. Not link these datasets with individually identifiable data from other NCHS or non-NCHS datasets.

APPENDIX C

INSTITUTIONAL REVIEW BOARD APPROVAL

UMDNJ
UNIVERSITY OF MEDICINE & DENTISTRY OF NEW JERSEY

Office of the Institutional Review Board
Newark Campus

NOTICE OF APPROVAL
IRB PROTOCOL NUMBER: 0120060005
(Refer to this number when making inquiries)

PRINCIPAL INVESTIGATOR/DEPT: Della Campbell, Ph.D., APRN-C, CNA-BC/Nursing/School of Nursing

CO-INVESTIGATOR(S): Jeffrey R. Backstrand, Ph.D.

TITLE: The Impact of Combined Maternal Alcohol and Tobacco Use on Low Birth Weight in Singleton Pregnancies: A Population Based Study in the US, 2003.

PERFORMANCE SITE(S):

SPONSOR/PROTOCOL NUMBER: Department Funded

TYPE OF REVIEW:	FULL [ ]	**EXEMPT [#4]**
TYPE OF APPROVAL:	**NEW [X]**	RENEWAL [ ]

APPROVAL DATE: 1/23/2006

1. **Adverse Events**: Any on-site serious adverse events, or any unanticipated problems involving risk to subjects or others, or any serious or continuing non-compliance that occurs in relation to this study must be reported to the IRB Office (45 CFR 46, 21 CFR 50, 56) as outlined in the investigator instructions for adverse event reporting. For further guidance, please refer to http://www.umdnj.edu/irbnweb/forms/AErepform_instr.pdf.
2. **Data: Data set approved for this study: Natality Detail Public Use Files for 2003**
3. The investigator(s) did not participate in the review, discussion, or vote of this protocol.
4. **Please submit any proposed change to the protocol as an amendment for IRB approval before they are implemented.**

IRB Chair/Vice Chair or Designee — January 25, 2006 (Date)

DHHS Federal Wide Assurance Identifier: FWA00000036

CC: Department Chair

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