MATERNAL AND CHILD HEALTH DISPARITIES AMONG NATIVE AMERICAN WOMEN IN OKLAHOMA: A SECONDARY ANALYSIS OF HEALTH BEHAVIORS, PRIOR WELL-BEING, AND ADVERSE PREGNANCY OUTCOMES, 2004-2011

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As members of the Dissertation Committee, we certify that we have read the dissertation prepared by Sunny Hegwood, titled Maternal and Child Health Disparities among Native American Women in Oklahoma: A Secondary Analysis of Health Behaviors, Prior Well-being, and Adverse Pregnancy Outcomes, 2004-2011 and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

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This dissertation has been submitted in partial fulfillment of the requirements for an advanced degree at the University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

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DEDICATIONS

To Aspen and Violet,
who taught me the meaning of true love.

To Dad,
who instilled within me the importance of lifelong learning.

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ABSTRACT

Utilizing data from the Oklahoma Department of Health Pregnancy Risk Assessment Monitoring System (PRAMS) for the years 2004 through 2011, this study examines racial and ethnic differences in unhealthy maternal behaviors and the consequences of those actions on the health of both mother and child. The maternal behavior variables include smoking cigarettes, drinking alcohol, multivitamin use, and prenatal care utilization. The maternal health variables include gestational diabetes and hypertension. The labor and delivery outcome variables include placental issues, premature rupture of membranes (PROM), low birth weight, and child placement in an intensive care unit. This researcher hypothesized that minorities would engage in risky and unhealthy behaviors while pregnant more often than whites due to social disadvantages in the economic and educational realms. Furthermore, minorities would be more likely than whites to have unfavorable outcomes regarding labor, delivery, and health of the child due to lower socioeconomic status, poor maternal health, and underutilization of preventative care. The researcher finds that minority women seem to adhere to proper maternal health recommendations associated with personal choice, including smoking and drinking, though disparities are evident when compared to whites regarding behaviors associated with socioeconomic status, including prenatal care utilization and multivitamin use. African American women are more likely than whites to experience premature rupture of the membranes, have an underweight baby, and to place their baby in ICU, though less likely to experience placental issues. Native American women are less likely than whites to experience premature rupture of the membranes, have an underweight baby, and to place their baby in ICU, but more likely to experience placental issues. As expected, substantial changes have occurred in the maternal health and well-being of Oklahoma mothers over the course of the two PRAMS data collection phases.

CHAPTER 1:

INTRODUCTION

I. *Becoming a Mother*

I began researching the maternal health of Native American women in Oklahoma in the fall semester of 2005 by analyzing 2000-2003 data from the Oklahoma State Department of Health Pregnancy Risk Assessment Monitoring System (*PRAMS IV*), though it was not until I became pregnant with my own child in 2012 and experienced, firsthand, pregnancy, labor, and delivery that a better comprehension and awareness of the maternal health issues experienced by Native American women in Oklahoma surfaced. At 41 weeks pregnant I decided to follow my doctor's advice and proceed with induction in order to decrease the chances of labor and delivery complications. When my daughter finally did arrive after approximately nine hours, her birth weight was considered normal, there were no labor or delivery complications, and she was not born with any serious anomalies, though she was born with a minor but rather common health problem – a small ventricular septal defect (heart murmur).

My delivery story is not uncommon. Fortunately premature birth, labor and delivery complications, placental problems, congenital anomalies, and ICU observation do not occur in most pregnancies. Though they are more common among certain groups and can be analyzed according to race and ethnicity, level of education, socioeconomic status, overall health status during pregnancy, and participation in risky maternal health behaviors. Still, by virtue of my minority group membership as a Native American woman and as a resident of the state of Oklahoma, my experience is directly applicable to

the present study and is useful to keep in mind when interpreting the outcomes of data analysis.

II. *Project Overview & Research Intent*

> Healthy People 2010 Objective 16-6b calls for 90% of all pregnant women to receive early and adequate care. The receipt of early and adequate care is considered essential in identifying and moderating potential risks that contribute to poor perinatal outcomes, such as preterm labor, low birthweight, and infant or maternal mortality. Early screening, diagnosis, and treatment for potential obstetric complications, such as diabetes and high blood pressure, have the potential to improve birth outcomes (Oklahoma State Department of Health 2008).

Engaging in high-risk health behaviors while pregnant can have detrimental consequences for the health of both mother and child. Health professionals recognize the following high-risk maternal health behaviors: smoking cigarettes, drinking alcohol, failing to take multivitamins or prenatal vitamins, and failing to visit a physician for prenatal care in a timely fashion (Johnson et al. 2006). These behaviors can be divided into two categories: those that are personal choices and those that have to do with financial ability and access to care. The goal is to reduce infant mortality and morbidity by observing healthy maternal behavior, including behaviors from both categories.

It is important when considering these maternal health behaviors to also consider the race or ethnicity of the mother. Minority groups, including Native Americans and African Americans, in general are considered subordinate to whites as a group in terms of social status, education, employment, wealth, or power (Crimmins, Hayward, and Seeman 2004). Evidence of racial inequality can be observed in diverse areas of the social experience and affect the type and degree of advantage one experiences on a daily basis. Compared to whites, minorities are more likely to suffer from social disadvantages in the form of lower social status, differential treatment, and lower levels of education,

employment, wealth, and social power (Crimmins et al. 2004). Overall health and health-related behavior is predictably affected by one's social status and socioeconomic well-being.

Therefore, the researcher hypothesizes that minority women are more likely than white women to engage in certain high-risk health behaviors while pregnant. However, because multivitamin usage and prenatal care are associated with socioeconomic status, but smoking and drinking alcohol could be considered simply lifestyle choices, it could be that minorities make the right choices when it comes to proper maternal health, but aspects related to income and education level, such as access to and education regarding proper maternal health, are more apparent among minority mothers. The current research seeks to address some of these issues regarding proper maternal health and its relation to both the socioeconomic status of minority women and the health of the child after delivery. Health problems during pregnancy, including gestational diabetes and hypertension, and their effect on the health of the child after delivery will also be measured in order to examine the effect they have on pregnancy outcomes when high-risk maternal health behaviors are avoided.

This study examines the connection between social disadvantages and overall maternal health among a sample of Native American, African American, and white women giving birth in the state of Oklahoma between the years 2004-2011. Data come from the Oklahoma State Department of Health Pregnancy Risk Assessment Monitoring System (PRAMS). PRAMS data is immensely valuable considering the wealth of information it provides related to maternal and child health in the state of Oklahoma, especially for more vulnerable populations like Native American and African American

women. Few quantitative studies of maternal health have been conducted that include a large enough sample of Native American women because of the often low numbers of Native Americans in study samples. Due to such small numbers, it is more difficult to make generalizations regarding Native Americans as a group in large-scale quantitative studies; therefore, Native American respondents are often placed in the "other" category without being included in systematic research studies. The result is often a lack of knowledge about the health and well-bring of an entire racial and ethnic group that is more likely to be socioeconomically disadvantaged and underutilize preventive care services. This study seeks to correct this deficiency and answer the following questions:

1. Are minority women (Native Americans and African Americans) more likely than whites to engage in high risk health behaviors while pregnant?
2. Are minority women (Native Americans and African Americans) more likely than whites to experience adverse pregnancy outcomes?
3. Are the differences proposed in Research Questions 1 and 2 due to socioeconomic differences?
4. Are the differences proposed in Research Question 2 due to health-related problems during pregnancy, such as gestational diabetes or hypertension?
5. Has there been any significant change in these differences between the two study cycles (*PRAMS V* [2004-2008] – *PRAMS VI* [2009-2011])?

Utilizing data from the Oklahoma Department of Health "*PRAMS V-VI*," or the Pregnancy Risk Assessment Monitoring System, provides a large enough sample of Native American respondents and the selected variables for this study. Using these previously-collected data, this study examines how low socioeconomic status and increased social disadvantages, in the form of income and education, for minority women

is related to risky and unhealthy behaviors while pregnant, a pattern of behavior which can lead to problematic health conditions for the child, including premature rupture of membranes (PROM), placental issues (including placenta previa and placental abruption), low birth weight, and child placement in an intensive care unit for additional supervision and care. Adverse labor and delivery outcomes can have significant consequences on overall health even after delivery for both mothers and children.

A study of maternal health and high-risk maternal behaviors of this kind is worthwhile because it provides useful information regarding the maternal health of women over a particular time period. By analyzing the data from two Oklahoma PRAMS study phases, the opportunity to notice trends in both overall maternal health, as well as individual maternal health behavior patterns, is greater. In conjunction with taking into consideration the changing social, cultural, economic, and political milieu of the time period over the two study phases, findings based on this data can present more concrete answers to research questions. Therefore, by utilizing research findings from Oklahoma PRAMS data analysis, our understanding of maternal and child well-being among women in Oklahoma can be enriched and progress toward improving outcomes for disadvantaged populations can continue.

Previous research from varied disciplines including sociology, education, economics, public health, and population studies is reviewed in order to establish a connection between social disadvantages in the areas of education and income and overall maternal health and health-related behaviors. Particular attention is paid to documenting the educational and economic discrepancies between minority groups, including Native Americans and African Americans, and whites in order to illustrate that

minority women are generally at a higher risk for poor maternal health and, therefore, are more likely to experience adverse pregnancy outcomes (Lu et al. 2010; Shen, Tymkow, and MacMullen 2005).

III. *Research Limitations*

This research is not without limitations. Because PRAMS questionnaire data are self-reported, it is likely there was under-reporting for both alcohol and tobacco use among all mothers due to social undesirability (Vonderheid, Norr, and Handler 2007). Under-reporting may be even more prominent among adolescents because of legal concerns (Committee on Health Care for Underserved Women 2011). All data on prenatal care and multivitamin use are self-reported; therefore social desirability bias for these variables may be an issue as well. This research contains many sensitive and personal questions, including alcohol and tobacco use, lack of prenatal care, premature birth, placental issues, child placement in an intensive care unit, and annual income. Questions of this kind are frequently passed over or answered untruthfully when completing a questionnaire and often raise issues regarding the validity of measures. Furthermore, recall bias may influence responses, information having been collected anywhere from two to six months after delivery (Melvin et al. 2000), or information may be incorrectly recorded on the birth certificate. Data that come from birth certificates that are analyzed in the present study include age, race, education, marital status, birth weight, and ICU admittance. All other variables come from the Oklahoma PRAMS survey questionnaires.

This study analyzes data from two phases of Oklahoma PRAMS questionnaires for the years 2004-2011, a seven-year interval. There were some changes made to the format of and questions in the PRAMS surveys over the course of these two phases. In the case that some of the questions included in this analysis have changed slightly over these three phases, closely-related question are substituted. The questions from *PRAMS V* that are used in this analysis have been included in Appendix B and the questions from *PRAMS VI* that are used in this analysis have been included in Appendix C.

Furthermore, sample populations differ across the two phases of the Oklahoma PRAMS questionnaires. Tables 4.1-4.2 entitled "Descriptive Statistics of the Study Sample, *PRAMS V* 2004-2008" and "Descriptive Statistics of the Study Sample, *PRAMS VI* 2009-2011" are included in Chapter 4: Data and Methods. As illustrated in Table 4.1, white mothers comprise 9,973 (73.2%) of the cases, African American mothers comprise 1,775 (13.0%) of the cases, and Native American mothers comprise 1,545 (11.4%) of the cases of the 13,619 total respondents in *PRAMS V* (2004-2008). 172 (1.3%) respondents reported their race/ethnicity as "other" and are not considered in the data analysis. 154 (1.1%) respondents did not disclose their race/ethnicity and are not considered in the data analysis.

As illustrated in Table 4.2, white mothers comprise 5,954 (67.4%) of the cases, African American mothers comprise 990 (11.2%) of the cases, and Native American mothers comprise 904 (10.2%) of the cases of the 8,834 total respondents in *PRAMS VI* (2009-2011). 966 (11.0%) respondents reported their race/ethnicity as "other" and are not considered in the data analysis. 20 (0.2%) respondents did not disclose their race/ethnicity and are not considered in the data analysis.

When compared to the general population of Oklahoma in 2013, the study samples are somewhat representative regarding race/ethnicity distribution. 67.5% of the population in the state of Oklahoma is classified as "white alone (not Hispanic or Latino)," 7.7% African American is classified as "black or African American alone," and 9.0% is classified as "American Indian and Alaska Native alone" (U.S. Census Bureau 2014). 5.8% of the Oklahoma state population reported being two or more races in 2013 (U.S. Census Bureau 2014), an option that has been available since the 2000 U.S. Census (Jones and Smith 2001). The small discrepancies between the racial and ethnic distributions in the state population and the study samples may have some to do with how a respondent defines their racial and ethnic identity and has thus reported it on the Oklahoma PRAMS survey questionnaire. The discrepancies may also have to do with the sampling techniques employed by the Oklahoma State Department of Health.

Because Oklahoma PRAMS variables regarding area or type of residence of mothers surveyed are not yet available to outside researchers, there is no way to determine the percentage of respondents that live in either urban or rural areas. It is assumed that because samples are chosen at random and all mothers giving birth in the state during the study phase have an equal chance of being selected, mothers that live in both rural and urban areas within Oklahoma are represented in the data. However, just as the racial and ethnic background of mothers may differ between study phases, the percentage of respondents living within rural or urban areas may differ as well. The data do not include any indication of geographical area or type of residence such as zip code or county, which could be used to discern either rural or urban area, which could have an effect on mothers' access to medical care during pregnancy. Though there are some

weaknesses, PRAMS data are unique and offer several advantages for analyzing maternal health data. The results gleaned from this analysis provide a more concrete understanding of the overall maternal health of women in Oklahoma, focusing primarily on the underserved and more socioeconomically disadvantaged minority populations in the state.

Lastly, socioeconomic status in the present study is measured as education and income. Additional socioeconomic factors that are not included in the analysis, such as wealth, power, prestige, economic assets, occupation, neighborhood, insurance coverage, or the accumulation of human and social capital, could affect overall health of the respondents. Moreover, socioeconomic measures often have interaction effects on dependent variables. Due to the difficulty in measuring socioeconomic status in research studies (Braveman, Cubbin, Marchi, Egerter, and Chavez 2001; Braveman et al. 2005; Crimmins et al. 2004) and the complex ways in which race and ethnicity and socioeconomic status interact (Williams 1996), and it is acknowledged that different indicators of socioeconomic status that are not taken into account may affect data analysis results.

CHAPTER TWO:

LITERATURE REVIEW

SOCIAL DISADVANTAGES AND MATERNAL HEALTH OF MINORITY WOMEN

I. *Social Disadvantages of Minorities*

The United States is a multicultural and multisocial society with significant variability regarding access to reputable educational institutions, educational achievement, and career attainment, which does not necessarily lend itself to equal opportunity among its residents. In a time when employers' minimum qualifications for hire are increasing, and as more and more people choose to continue their education after high school, educational achievement is becoming increasingly more important for one's success in the job market. Because of the substantial inequalities within the educational realm, there continues to be a causal pathway from poor educational achievement to poor career attainment and low income levels among many minority groups. Native Americans have lagged far behind any other racial or ethnic group for some time, including other minority groups, in the area of economic welfare (DeNavas-Walt, Proctor, and Smith 2013; Snipp 1992). Though in more recent years some degree of equivalence in the economic well-being between Native Americans and African Americans has been reached (Snipp 1989; The Council of Economic Advisors 1998), the welfare of these minority groups is still not comparable to that of whites (DeNavas-Walt et al. 2013; Austin 2013; Pollard and O'Hare 1999).

The socioeconomic status of Native Americans (Cheadle et al. 1994; Austin 2010; Austin 2013) and African Americans (DeNavas-Walt et al. 2013; Ritter and Taylor 2011;

Sernau 2001) has continued to be significantly lower than for the rest of the country's population. Socioeconomic status can be defined as a ranked measure combining an individual's occupation, education level, household income, and/or housing conditions (Næss, Claussen, Thelle, and Smith 2005). Socioeconomic status in the present analysis is measured by combining an individual's total income and education level. Information regarding occupation and housing conditions are not available in the previously-collected data set. Though geographic location (rural or urban) within the state of Oklahoma is a variable that was collected by OPRAMS during the two PRAMS study phases utilized in the present study, it is only be used for PRAMS data operations at this time, and therefore, unavailable to interested researchers. The connection between geographic location, the relatively low level of educational attainment achieved, and low social and economic welfare of Native Americans when compared to whites (Snipp 1992), however, should not be disregarded.

Comparisons of median family income, the percent of the population living in poverty, and the percent of college graduates illustrates the significant disparities in socioeconomic status between Native Americans and those in other racial and ethnic categories. In 1999, almost twenty-six percent of Native Americans were living below the poverty line, compared to 12.4% of the general population (U.S. Census 2004-2005). A similar percentage existed five years later, showing a lack of progress during this time in alleviating disparities based on race or ethnicity. One-quarter of Native Americans were living below the poverty line in 2004, compared to 9% of non-Hispanic whites (U.S. Census Bureau 2007).

In 2000, the median family income for Native Americans was $25,850, compared to $32,150 for the general population (Faircloth and Tippeconnic III 2010). By 2004, the median family income for Native Americans in 2004 had increased to $31,600, while the median family income for non-Hispanic white household has increased to $48,800 (U.S. Census Bureau 2007). The education level of Native Americans lagged behind whites as well, with 77% and 89% of individuals aged 25 and older having earned a high school diploma, respectively; 14% of Native Americans and 30% non-Hispanic whites had earned a bachelor's degree or more in 2004 (U.S. Census Bureau 2007).

Differences in socioeconomic status between whites and Native Americans are due in part to minorities having lower incomes, poorer health, and smaller inheritances (Choudhury 2001-2002; Smith 1995). Racial inequality, residential segregation, minority population size, economic restructuring, intergroup differences in human capital, and the international forces of globalization and immigration are also possible reasons for the substantial socioeconomic inequality between whites and minorities (Jaret, Reid, and Adleman 2003). Though all of these variables are interrelated and are all considered causes of socioeconomic inequality between racial and ethnic groups, inequality on the basis of race and institutional discrimination despite geographic location seem to be the most pervasive in this country.

Economic restructuring, especially in recent years, has also had an effect on the socioeconomic standing of minority populations, particularly for those groups who were already considered poor, disadvantaged, or marginalized prior to the additional hardships brought on by the recent recession (Austin 2010; Sassen 1990). In fact, though the "Great Recession is technically over, when looking at the American Indian employment

situation, there is little sign of recovery. Nationally, Native American unemployment continues to rise, and employment continues to decline" (Austin 2010:6). As a whole, minority populations, including both Native Americans and African Americans, face significant socioeconomic disparities as evidenced by low educational attainment and high rates of unemployment and poverty (Alexander, Wingate, and Boulet 2008; Austin 2010; Castor et al. 2006; Grossman et al. 2002; U.S. Department of Health and Human Services, Indian Health Service 2004).

A. *Educational Inequality*

> Racial and ethnic gaps in educational achievement and attainment have narrowed over the past three decades by every measure available to social scientists, but substantial gaps remain, especially between less advantaged groups such as African Americans, Hispanics, and Native Americans and more advantaged groups such as whites and Asian Americans. The racial and ethnic hierarchy in educational achievement is apparent across varying measures of the academic experience (Kao and Thompson 2003:435).

Inequality on the basis of race or ethnicity occurs when a particular group possesses differential power, experiences differential treatment, and has differential access to valued societal resources, such as education, employment, healthcare, housing, or wealth, by virtue of their membership in that group. Native Americans and African Americans, on the basis of their racial and ethnic identity, more often encounter barriers associated with inequality, racism, and discrimination than do whites, contributing to a lower overall socioeconomic status (House and Williams 2000). Educational achievement and attainment, at both the high school and collegiate levels, are important components of individual success that aids in the improvement of one's overall socioeconomic status.

i. *High School Educational Achievement & Attainment*

High school dropout rates continue to be significantly higher for minority students, particularly Native Americans and African Americans (Kao and Thompson 2003; Snipp 1992; Swanson and Lloyd 2013). Students in the United States are graduating at increasingly higher rates, though the rates for whites and certain minorities are not comparable (Heckman and LaFontaine 2010). For example, though the public school graduation rate among all students in the United States had risen for the third consecutive year to 74.7% in 2010, the highest since 1973, the increase did not include Native Americans, who represented the only racial or ethnic category that experienced a decrease in the graduation rate that year (Swanson and Lloyd 2013). In fact, when others had experienced an increase in the graduation rate over the three years prior, Native Americans had experienced a steady decline during the same period of time; in 2010 when nearly three-quarters of students in this country had graduated high school, only 51.1% of Native Americans did so, the lowest of all racial and ethnic groups (Swanson and Lloyd 2013). Drop-out rates for minority students, especially Native Americans, have been a concern for some time, root causes remaining by and large unaddressed in our country (Brayboy, Fann, Castagno, and Solyom 2012). "In 1980, 26% of Indian youths aged 16-19 had withdrawn from school without a diploma" (Snipp 1992:364; U.S. Census Bureau 1983). By comparing these data, it seems the dropout rate among Native Americans has nearly doubled just within these three decades.

The educational experiences of Native Americans are shared by African Americans. Despite the fact that the percent of high school graduates in 1997 was more

comparable for African Americans and the general population of the United States, 75 percent and 82 percent, respectively (Sernau 2001), it had decreased to 61.7% by 2010, much lower than that of whites (79.6% of whites graduated public school in 2010) (Swanson and Lloyd 2013). The only other racial or ethnic group that fared better than whites were Asians, who experienced an 81.1% overall graduation rate in 2010 (Swanson and Lloyd 2013).

Directly related to the high school graduation rate among Native Americans, they rank well below the national average in the completion of the core curricula required of a high school graduate as a racial or ethnic category (Pavel 1999). Significant variation also exists regarding educational high school achievement, including achievement test scores and class grades, and degree attainment between whites and minority groups. Though standardized test scores of certain minority groups, including Native Americans and African Americans, have lagged far behind those of whites for the past 30 years, this gap is argued by some to be gradually shrinking between African Americans and whites in more recent years (Kao and Thompson 2003), and widening or at least idling by others (Berends, Lucas, and Penaloza 2008; Gaddis and Lauen 2014; Vanneman, Hamilton, Anderson, and Rahman 2009). However, there is no debating that test scores among Native Americans continue to lag far behind the national average, as well as both African Americans and whites (Pavel 1999). Parental socioeconomic status accounts for some of the test gap between whites and minorities, but it does not account for all of it (Kao and Thompson 2003). Family and cultural beliefs stemming from the unique circumstances experienced by certain minority groups and social classes may explain the remaining disparity between both African Americans and whites (Gaddis and Lauen 2014; Kao and

Thompson 2003; Pardasani and Bandyopadhyay 2014), and Native Americans and whites (Kao and Thompson; Huffman 2013). Racial and ethnic dissimilarities in class grades mirror that of test scores, though parental background and student characteristics and behavior may account for much of the variation between racial and ethnic groups (Kao and Thompson 2003).

The disparity in high school achievement and attainment between white and minority students may be related to the racial trend in high school course tracking that exists, whereby low-income and minority students are more likely to be enrolled in vocational training curricula and less likely to be enrolled in college preparatory and academic curricula (Kao and Thompson 2003; Pavel 1999). Furthermore, low-income and minority students (excluding Asians) are more likely to be enrolled in low-level and remedial courses, while whites and Asians make account for most of those enrolled in advanced and honors courses (Kao and Thompson 2003). It is evident by these findings that racial and ethnic educational disadvantage in course taking and tracking in high school persists, resulting in those minority students placed in the vocational track being less academically prepared for college if they ultimately decide to attend.

Because success in the educational realm is exceedingly based on standardized test performance, many minority students do not fare well (Good, Aronson, and Inzlicht 2003; Lomax et al. 1995). Additional issues that are widespread among and unique to Native American students when compared to white and African American students include the lack of Native American educators and role models (Carney 1999; Huffman 2013; Pavel 1999), small school size, rural location, lack of culturally relevant course material, and apathy regarding educational attainment and success (Huffman 2013; Pavel

1999), geographic dispersion, tribal and linguistic diversity, various learning styles in the classroom, and inadequate cooperation between governmental and educational entities including cities, tribes, states, educational institutions, and the federal government (Pavel 1999). The high prevalence of poverty, lack of social services, parental alcohol and drug abuse, lack of parental involvement, student absenteeism, and lack of student interest are also challenges related to poor educational achievement and attainment among minority students (Huffman 2013), including both Native Americans and African Americans.

ii. *Transition to College*

Among all racial and ethnic groups in the United States, Native Americans are the most underrepresented and underserved groups in higher education (Guillory and Wolverton 2008; Tierney, Sallee, and Venegas 2007). Of those Native American students that attend college, only thirty-seven percent actually graduate within six years, compared to 56% of the general population, the lowest among all racial and ethnic groups (including Asian American, African American, Hispanic, and white) (Tierney et al. 2007). Though educational funding is available for Native American students from the federal government, state governments, and tribal governments, as well as institutional and private scholarships, many fail to complete their education, even more frequently than other disadvantaged groups such as African Americans and Hispanics, due to financial reasons (Institute for Higher Education Policy 2007; Tierney et al. 2007), thus affecting their ability to attain more lucrative careers. Tierney et al. (2007) cite student perception of unaffordability, insufficient need-based financial aid to assist students, appropriate academic preparation to meet the GPA standards of certain awards, and the

lack of knowledge about how to pay for college, as well as the considerable variation regarding tuition rates, rules, and guidelines that exist between states and educational institutions.

Most high-schoolers have planned to attend college immediately after high school in recent years; however, much fewer actually make the transition from high school to college (Kao and Thompson 2003; U.S. Department of Education National Center for Education Statistics 1997). Racial and ethnic variation in college attendance among African American, Native American, and white groups is also evident. In 1996, African Americans had 33-34% college enrollment rates (depending on gender; male and female, respectively), Native Americans 30-36%, and whites 44-54% (Kao and Thompson 2003:429). Research has revealed that Native Americans are less likely to be college-bound than all other racial and ethnic groups in the United States (Carney 1999; Gilbert 2000; Institute for Higher Education Policy 2007; U.S. Department of Education National Center for Educational Statistics 1998; Pavel 1999). It could be that Native Americans are less likely to meet the specific criteria that are identified to be important to college admissions officers, including: (a) grade point average, (b) SAT/ACT scores, (c) teacher responses, and (d) involvement in extracurricular activities (Pavel 1999). Native Americans are less likely to enroll in four-year colleges, are underrepresented among those who have completed a bachelor's degree, and are far less likely to graduate in six years compared to the general population (Pavel 1999).

This has significant consequences on the number of Native American students that are able to transition to and achieve success in institutions of higher education. In fact, the number of Native American baccalaureate degrees awarded stayed constant from

1975 to 1981 even though there was an increase in the number of college graduates in the general population (Snipp 1992). According to the U.S. Department of Education (1996), in the 1993-1994 academic year 6,189 Native Americans had earned baccalaureate degrees, a seemingly significant increase from the 3,326 in the 1976-1977 academic year. However, this increase only constitutes a 0.1% increase when the total number of baccalaureate degrees conferred to all racial and ethnic groups is taken into account (1,736,537 in 1976-1977 and 2,210,882 in 1993-1994). The number of degrees awarded to Native Americans increased by only 2,863 in the 17 years between the 1976-1977 and 1993-1994 school years, a figure that does not yet match the total enrollment distribution by race and ethnicity (U.S. Department of Education National Center for Education Statistics 1996). Though the overall enrollment numbers of minority college students has increased since this data was compiled, prominent racial and ethnic gaps continue to exist when compared to white enrollment. As of 2011, the percentage of African American students enrolled in institutions of higher education was 15 percent and American Indians and Alaska Natives numbered 0.9 percent, while 61 percent of students enrolled in college were white (U.S. Department of Education National Center for Education Statistics 2013).

Graduation rates of minority students when compared to white students show a similar disparity. Reports have shown college graduation rates among African Americans to be slowly increasing in recent years. However, the nationwide college graduation rate among African Americans was 43% in 2006, significantly lower than the 63% percentage rate for white students (The Journal of Blacks in Higher Education [JBHE] Foundation 2006/2007). The argument has been made that the intersection between race and class,

residential segregation, the proliferation of racial stereotypes (Sernau 2001; Wilson 1996), as well as the combined effects of continued racial discrimination (JBHE Foundation 2006/2007) have caused many African Americans to remain in the disadvantaged poor and working-class social class positions, an argument that could be made for the Native American population as well, especially taking into consideration the poor educational achievement and attainment evident among these two racial and ethnic groups.

iii. *Education in Oklahoma*

Of particular interest to this study is the information gathered on graduation rates in Oklahoma. Though the rate of high school graduation in 2001 for Native Americans (63.9%) was lower than that for the general population of the state (69.8%), as well as the graduation rate for whites (72.1%), it was significantly higher than for African American students (52.8%) in Oklahoma (Swanson 2004; Tierney et al. 2007). In 2005, the overall graduation rate for the state of Oklahoma was 70.8%, compared to a rate of 63.8% for Native American students, the highest among twelve states (Alaska, Arizona, California, Idaho, Montana, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Washington, and Wyoming) that were compared using 2005 data from the U.S. Department of Education National Center for Education Statistics (Faircloth and Tippeconnic III 2010). The graduation rate for African American students in Oklahoma during the same time was again lower than the other two racial and ethnic categories, at 58.5% (Faircloth and Tippeconnic III 2010; Freeman and Fox 2005). This means that one should expect Native Americans to have relatively high graduation rates compared to

African Americans in the current study sample, which may have an effect on the measure of socioeconomic status for both groups.

It is important to note the differences in the 2001 graduation rates in Oklahoma compared to the United States as a whole. The graduation rate for the United States as a whole was 68%, compared to 69.8% in Oklahoma; the graduation rate for all African Americans was 50.2%, compared to 52.8% in Oklahoma (Swanson 2004; Tierney et al. 2007). Both figures for 2001 high school graduation rates in Oklahoma were higher than for the general population of the United States, though they are comparable. The graduation rate for all whites was 74.9%, compared to 72.1% in Oklahoma – again, comparable figures. However, when considering the graduation rate for Native Americans in Oklahoma (63.9%) compared to the entire population of Native Americans in the United States, (51.1%) (Swanson 2004; Tierney et al. 2007), one notices a significant disparity. The disparity may have to do with geographic location and the significance of poverty among rural reservations throughout the country, where challenges to educational and economic success are sometimes considered overwhelming and insurmountable (Huffman 2013), compared to the many non-reservation Native American communities in Oklahoma. Though rural, most communities in Oklahoma with large populations of Native Americans are relatively near urban areas with many educational and employment opportunities. Access to these urban centers sometimes proves difficult for those that are more socioeconomically disadvantaged, however.

In 2013, Native Americans (those that claimed Native American heritage only) accounted for 9% of the entire population of Oklahoma (U.S. Census Bureau 2014). Native Americans account for 18% of the high school student population (Faircloth and

Tippeconnic III; KewalRemani, Gilbertson, and Fox 2007) and almost 10% of the college student population (Freeman and Fox 2005). This difference may have something to do with how much financial assistance in the form of grant aid is available in the state of Oklahoma. Oklahoma has the greatest amount of grant aid available per year to assist students, $34.9 million, when compared to other states with large Native American populations and the highest Native American high school enrollments (Arizona, Montana, New Mexico, North Dakota, and South Dakota) (National Association of State Sponsored Grant Aid Programs [NASSGAP] 2004; Tierney et al. 2007). Oklahoma grant aid is not, however, reserved solely for Native American education, nor for only need-based aid. Students of all backgrounds, including variations in race and ethnicity, social class, and education achievement, may compete for a portion of what is available. Many tribal higher education programs, however, offer additional aid on top of what is available from the state if students meet the minimum standards for the award, which could include minimum GPA, course load, and tribal enrollment requirements. The discrepancy between the educational struggles of the general population of Native Americans in the United States and the experiences of those living in Oklahoma underscores the importance of taking cultural and geographic diversity into account when examining the experiences of Native Americans as a population, whether educational, economic, or otherwise. However, it becomes difficult when Native Americans account for only a small percentage of the population in most areas and random sampling techniques in quantitative research do not allow for a statistically significant number of Native American respondents or participants (Butterfield 2003; Eriksen 1997; Faircloth

and Tippeconnic III 2010; Rochat 2008; Shotton, Lowe, and Waterman 2013; Snipp 1992).

It is clear from the great deal of data on educational achievement and attainment that members of all racial and ethnic groups do not share similar educational experiences. Because education plays an integral role in one's future success, it makes one question the effect of poor educational achievement and attainment on minority groups, specifically more disadvantaged minority groups such as Native Americans and African Americans. Although Native Americans and African Americans, as racial and ethnic groups, are experiencing an overall increase in degree attainment, they are experiencing very little improvement in comparison to other racial and ethnic categories. If certain minority groups are not able to compete with other groups in the job market due to a lack of educational attainment, it will have a considerable effect on their overall economic well-being. Furthermore, educational accomplishment and economic welfare undoubtedly affect other areas of the social experience as well, including access to adequate healthcare. The ability to accrue capital, in the form of both human and social capital, can affect all facets of one's well-being, including educational, economic, and health and wellness.

B. *Human and Social Capital*

Human capital can be defined as the practical knowledge, acquired skills, and learned abilities that prepare an individual to be productive in the workplace (Becker 1975). Human capital can not only better prepare an individual to be successful in the workplace, but can lead to the acquisition of improved life chances (Becker 1975; Keeley 2007). Life chances (or *lebenschancen*), a concept introduced by Weber (1978 [1968]),

can be thought of as opportunities to access and secure important societal resources, such as food, clothing, shelter, autonomy, education, and healthcare that are directly linked to social class (Dahrendorf 1979; Merton 1968 [1949]; Swedberg 2005; Weber 1978 [1968]). Resources such as these may enable people to better respond to opportunities and to solve personal problems. Because Native Americans are less likely to join the workforce (Faircloth and Tippeconnic III 2010), and often lack the necessary human capital to be successful if and when they enter the job market, members of other racial and ethnic groups are more likely to obtain the higher-paying, more lucrative employment positions, accompanied by benefits packages, job security, and opportunities for upward socioeconomic mobility (Snipp 1992).

However, it doesn't seem to be all about racial or ethnic background. Interestingly, White and Kaufmann (1997) found that after controlling for generation, language, and social capital, race and ethnicity does not have as much of an effect on socioeconomic status or mobility (Kao and Thompson 2003). Generation and language barriers can be associated with recent immigration, though they may have an effect on the successfulness of Native American students living in extremely rural or reservation communities where it is more common to utilize an indigenous language in the home and/or workplace. However, social capital, or the extent of one's social networks, transcends race and ethnicity. The lack of social capital is more related to social disadvantage and the poor living conditions of a community, which can include individuals from all racial and ethnic backgrounds, though social disadvantage is disproportionately higher among many minority populations (Borman and Rachuba 2001). We have witnessed increases in high school completion among most racial and

ethnic groups, though variation does exist when groups are further broken down into subgroups and immigrant status is taken into account (Kao and Thompson 2003).

C. *Economic Disadvantages*

The changing economic circumstances of certain minority groups, particularly Native Americans, have not been extensively analyzed (Gregory, Abello, and Johnson 1997), but by using comparison data from as far back as the 1980s, the significant and continuous inequality that has existed in the overall economic well-being between whites and disadvantaged minorities is revealed. For example, "the decade of the 1980s was one of the best ever for U.S. employment growth, reaching the highest level since World War II" (Gregory et al. 1997:115). During sharp upturns in job opportunities, it is usually the least skilled and the disadvantaged that fare well in the job market (Okun 1973) because low hourly earnings tend to increase and unemployment falls (Gregory et al. 1997). Instead, the economic circumstances of Native American men "further deteriorated relative to whites over the decade" (Gregory et al. 1997:136).

Though Native American women did share in some of the gains the decade of the 1980s brought women in general, due to employment growth for those with less education and labor market experience, by the end of the decade, it seems that white women had moved up the income ladder at a faster pace (Gregory et al. 1997). "At the beginning of the 1980s, Native American women reported incomes that were on average 77.0 percent of white female incomes. By 1989, the ratio had fallen to 69.8 percent" (Gregory et al. 1997:116). During this time period, Native American men who had not graduated from high school saw their real income fall 22%; For Native American men who had completed high school, real income fell 12% (Gregory et al. 1997). Only those

Native Americans who had earned college degrees experienced real income increases during the 1980s; the least educated and least skilled members of society were rewarded less in the job market and found it more difficult to remain employed during this period (Gregory et al. 1997). Because Native Americans were, and are still, disproportionately represented in groups that are less educated and less skilled in the job market, their income is low relative to whites (Faircloth and Tippeconnic III 2010). Though these data are time-specific to the 1980s and there is no comparable study henceforth, the conclusions of Gregory et al. (1997) underscore that although there has been some change since the 1980s regarding the economic status of Native Americans relative to that of whites, substantial gaps remain.

Differentials in median family income and the percent of the population in poverty of African Americans compared to the entire population nearly two decades later in 1997 showed some striking and statistically significant differences; the median family income of African American households was $28,602, while the median family income for the entire United States during the same time was $44,568 (Sernau 2001). The percent of the population who were African American and living in poverty was 26.5, compared to 13 percent for the entire population (Sernau 2001). A possible explanation for the disparity of earnings and rates of poverty between whites and minorities during the 1980s, a decade of increased economic opportunities, as well as near the millennium and in more recent years, could be workplace discrimination toward less advantaged minority groups. In addition, economy-wide changes, not just racial and ethnic-specific changes that affect only Native Americans or other minority groups, should also be carefully considered, especially with respect to the current state of our economy and the effect the

recent recession has had on both our country as a whole, as well as on specific minority groups (Austin 2010; Austin 2013). The effect the recession has had and continues to have is not comparable across racial and ethnic lines. “From the first half of 2007 to the first half of 2010, the American Indian unemployment rate nationally increased 7.7 percentage points to 15.2%. This increase was 1.6 times the size of the white increase” (Austin 2010). Because the present study includes data to 2011, the researcher expects the socioeconomic variables income and education to have an manifest effect on maternal health behaviors and outcomes, though the full and long-term effects the recession on study participants cannot be fully understood or taken into account.

Poverty and economic loss in the form of abrupt unemployment can lead to psychological distress, which affects parenting behavior, parent-child relationships, and family functioning (McLoyd 1990), as well as maternal health and wellness (Oklahoma State Department of Health 2009). According to Austin (2010), Native Americans more often experience “long spells of unemployment [and] have an especially difficult time finding work, [therefore] are more likely to drop out of the labor force by not actively looking for work” (4). McLoyd (1990) argues that considerable reductions in income, or abrupt unemployment, occur more frequently among African American families than for the white population, though Native Americans are not included in her analysis. Faircloth and Tippeconnic III (2010), referring to economic disadvantages of Native Americans in particular state, “the risk of joblessness, family instability and involvement with the criminal justice system are much higher for those that drop out of school” (23). Such events result in both Native American and African American families being thrust into poverty more readily and more frequently than white families. Economic hardships

increase vulnerability to other stressors, making it more challenging for those experiencing financial adversity, often African Americans and other minorities, to cope with new problems and difficulties (McLoyd 1990). Economic hardship and vulnerability is even more pronounced when events outside of the control of the individual are examined separately (Kessler and Cleary 1980; Liem and Liem 1978; McLoyd 1990). The structural changes in the economy that have resulted in the recent recession, for example, could be classified as events outside the control of an individual. Therefore, it will be interesting to see in the current analysis if, after controlling for education, the income of African Americans and Native Americans, has more of an effect on maternal behavior than for whites.

Native Americans are often lumped together as a racial and ethnic category in quantitative research studies and considered as one large homogenous group (McGee, Liao, Cao, and Cooper 1999; Portman and Dewey 2003). Though there is great diversity among Native American peoples, including social, cultural, linguistic, economic, historical, and political, it beyond the scope of this project to delve into the possible tribal differences in educational achievement and attainment or social disadvantages, due to the use of existing quantitative data. Though focusing on the experiences of Native peoples living within the same state may narrow the chasm of tribal cultural dissimilarity, not unlike the research conducted by Tierney et al. (2007), which relied on national and state-by-state data on the educational experiences of Native Americans. Data regarding education attainment should be comparable to the present study given the time period of data collection and the fact that the state of Oklahoma is the geographical area of focus.

After reviewing the above literature, it is evident that certain minority groups, especially Native Americans and African Americans, do not enjoy the same level of educational and economic well-being as whites. Most authors referenced that compare the educational and economic success of racial and ethnic groups have focused on the differences between minorities and whites. However, a certain amount of research compares minority groups to the general population. Even comparing these two minority groups to the general population of the United States, a significant discrepancy remains. Educational achievement and attainment is substantially lower among minority groups, regardless of the comparative measure utilized (Aud, Fox, and KewalRemani 2010). The result is what Marx and Engels (circa 1845-1846) called the *lumpenproletariat* (Marx and Engels 2001 [1939]) or what Lewis (1996 [1966]) referred to as the underclass– a disenfranchised group characterized by significant and long-term impoverishment – that is disproportionately comprised of minorities.

From these conclusions the researcher predicts that that many minorities have limited life chances and underutilize preventive care services because of the inequalities in educational achievement and career attainment compared to whites. When one has limited life chances, it becomes increasingly more difficult to access resources that are often taken for granted by those that are more fortunate. Education increases knowledge about preventive care services, and income increases the means to utilize them. Education and income are key elements that many minority women lack in regard to proper maternal care. Due to the abundance of social disadvantage among minorities, health behaviors, including appropriate maternal health, are often neglected. From these data the researcher feels confident in saying that minority groups, due to social disadvantages in

both the educational and employment domains, have more limited life chances and generally lower socioeconomic status than whites. From this the researcher hypothesizes that the selected minority groups of Native Americans and African Americans underutilize preventive care services.

II. *Maternal Health of Minority Women*

The overall health of certain minority groups, including African Americans and Native Americans, has never been equivalent to that of whites as a population (Jones 2006). Although the health status of Native Americans has improved considerably since the creation of the Indian Health Service (IHS) in 1955, significant disparities in maternal and infant health compared to other racial and ethnic populations, namely whites, has continued to persist (Alexander et al. 2008; Baldwin et al. 2002; Grossman et al. 2002; U.S. Department of Health and Human Services, Indian Health Service 1997, 2004). In fact, "the burden [of illness and health risks] is especially apparent for American Indian/Alaska Native mothers, infants, and children" (Rhoades et al. 2008). Due to poor maternal health behaviors, the high prevalence of obesity, and an increased risk of experiencing physical or sexual assault, Native American women continue to have more pregnancy-related health concerns and adverse birth outcomes compared to white women (Oklahoma State Department of Health 2007). These inequalities, like those found among African Americans, can be explained in part by the systematically lower socioeconomic status of minorities, poor prior health, high prevalence of certain high-risk maternal health behaviors, and their resultant lower utilization of preventive services (Honigfeld and Kaplan 1987; Young 1997).

A. *Poor Health among Minority Women*

Poor overall health, including obesity, heart disease, and diabetes are significant health concerns among many Native American groups that have Native health advocates, researchers, and indigenous community leaders calling for culturally-specific education initiatives and a shift toward more traditional diets and practices (Fazzino II 2008; Smith-Morris 2006). Certainly, diabetes has become an epidemic in particular Native American communities (Acton et al. 2002; Islam-Zwart and Cawston 2007; Smith-Morris 2006). In fact, across all age categories, the prevalence of diagnosed diabetes is highest among Native Americans (U.S. Department of Health and Human Services, Indian Health Service 2002). The Indian Health Service Division of Diabetes Treatment and Prevention reported a tremendous rate increase in the disease among young Native Americans between 1990 and 2001. 15-19 year-olds experienced a 106% increase; 20-24 year-olds experienced a 69% increase; and 25-34 year-olds experienced an alarming 132% increase in the prevalence of type 2 diabetes (U.S. Department of Health and Human Services, Indian Health Service 2007). Diabetes, particularly gestational diabetes, is important to the present study because it has been linked to congenital birth anomalies and labor and delivery complications, in addition to a host of other adverse pregnancy outcomes.

According to Sahu, Satyakala, and Rani (2009), "two to five percent of pregnancies are complicated by diabetes, of which 90% are classified as gestational diabetes mellitus" (149). Moum et al. (2004) assessed trends in gestational diabetes among Native American and white mothers in the states of Montana and North Dakota using birth records from 1989-2000. Native American mothers in both Montana and North Dakota were more likely than white mothers to have diabetes while pregnant

(Moum et al. 2004). However, Moum et al. (2004) found that the rate of diabetes during pregnancy increased for both Native American and white mothers during the study time period. Therefore, the number of children of diabetic pregnancies at risk for becoming overweight and developing Type 2 diabetes is increasing (Moum et al. 2004). "Congenital malformations [birth defects] are associated with poorly controlled diabetes in the mother immediately prior to conception and during organogenesis [the development of internal organs]" (Carrapato and Marcelino 2001; Moum et al. 2004). Thus, gestational diabetes likely has a direct effect on the increase in the rate of birth defects in infants.

Especially among populations that have witnessed the exponential proliferation of diabetes among individuals, such as certain Native American groups, particular attention should be paid to good maternal health, screening for preexisting conditions, and awareness of the health risks associated with gestational diabetes for both mothers and children. Gestational diabetes is measured as a maternal health variable in this study. Due to the extent that diabetes has plagued Native American populations, and because the study sample is likely to have a large percentage of Native American women, it is expected that gestational diabetes will be a significant factor related to adverse pregnancy outcomes, especially for Native American mothers in Oklahoma. Women with gestational diabetes may even be more prone to detrimental outcomes that those diagnosed with the condition prior to pregnancy due to being less knowledgeable about how to properly manage symptoms, considering it a temporary condition, and having not yet developed habits associated with proper diet, exercise, or medications.

Seeking to reveal the prevalence of diabetes in Tohono O'odham pregnancies and to evaluate the effectiveness of early diabetes screening in high-risk populations, Livingston, Bachman-Carter, Frank, and Mason (1993) found that 5.2% of Tohono O'odham women receiving prenatal care at the Sells Service Unit between the years 1984-1988 suffered from diabetes. 39% of the women had been diagnosed prior to becoming pregnant, while 61% were diagnosed as having developed gestational diabetes (Livingston et al. 1993). That is, they had never been diagnosed with diabetes prior to that date, but diabetes had developed during their pregnancy. The number of diabetic pregnancy cases among Tohono O'odham women could be much higher due to the fact that this study was limited to only those women who sought prenatal care at the Sells Service Unit, the only healthcare facility located on the reservation, excluding women who sought prenatal care elsewhere or chose not to get any prenatal care (Livingston et al. 1993). Considering the IHS data on the high prevalence of diabetes among the Tohono O'odham as they compare to the rest of the country, the researcher agrees that the rate of diabetes among Tohono O'odham mothers should be higher than illustrated by this study's findings. It would not be surprising, however, if there were many Tohono O'odham mothers that chose not to receive prenatal care at all, considering studies that suggest Native American women are more likely than other racial and ethnic groups to receive inadequate or no prenatal care (Baldwin et al. 2002; Castor et al. 2006; Shiao, Andrews, and Helmreich 2005) and the disparity is further compounded when rural or reservation geographical location and the hardships associated with lack of access for many Native Americans, like the Tohono O'odham, is taken into account (Grossman et al. 2002; Harrison and Sidebottom 2009; Johnson, Blewett, Call, and Davern 2010).

B. *High-Risk Maternal Behaviors: Smoking and Substance Abuse*

Health conditions during pregnancy, like gestational diabetes or hypertension can significantly increase the risk of pregnancy complications (Chuang, Velott, and Weisman 2010). However, maternal health behaviors like smoking and substance abuse can also considerably affect pregnancy outcomes. Salihu, Aliyu, Pierre-Louis, and Alexander (2003) assessed the risk of infant mortality that is associated with maternal cigarette smoking by employing data from the National Linked Birth-Death Database. The racial and ethnic groups included in this research study were African American, Native American, Hispanic, white, and "others" (Salihu et al. 2003). Not only was infant mortality 40% higher for smokers compared to nonsmokers, but the proportion of infant deaths due to maternal smoking was highest among Native Americans compared to all other racial and ethnic groups in the study, almost three times the national average (Salihu et al. 2003). Maternal smoking is faulted for a considerable number of infant deaths, as well as a number of labor and delivery complications, including low birth weight, preterm delivery, premature rupture of the membranes, perinatal mortality, placenta previa, placental abruption, and sudden infant death syndrome (SIDS) (Oklahoma State Department of Health 2006, 2011; Salihu et al. 2003). Placenta previa occurs when the placenta is attached to the uterine wall and is the leading cause of vaginal bleeding associated with labor and delivery (Daskalakis et al. 2011). Placental abruption, also associated with abnormal vaginal bleeding prior to delivery, occurs when the placental lining is separated from the mother's uterus (Ananth, Oyelese, Srinivas, Yeo, and Vintzileos 2004). Sudden Infant Death (SIDS), as the term implies, is marked by the sudden death of an infant that cannot be explained by medical science. Though

SIDS can occur long after the infant is taken home, research has indicated that there are prenatal risk factors associated with the syndrome (Lahr, Rosenberg, and Lapidus 2005; Lavezzi, Corna, and Maturri 2010; Sullivan and Barlow 2001), including (1) being a teenage mother (risk decreases as maternal age increases); (2) lower maternal education (risk decreases as maternal education increases); (3) lack of or delayed prenatal care (risk increases as prenatal care is delayed); (4) and maternal smoking (risk is higher for infants whose mothers smoked during pregnancy). Because tobacco use is associated with preterm birth, small size for gestational age, low birth weight, spontaneous abortion, stillbirth, fetal death, and sudden infant death syndrome (D'Angelo et al. 2007), programs aimed at helping pregnant women quit smoking should be implemented and made a significant component of maternal education in general in order to ultimately reduce the number of infants affected in these ways by maternal smoking. Nearly 5% of infant deaths in the United States can be attributed to maternal tobacco use (Salihu et al. 2003). Programs should target mothers that are considered "at risk," including young, unmarried mothers, those with little education, minorities, and those that live in rural areas to receive additional education related to proper maternal health and health behaviors (Tong et al. 2011).

Using the National Center for Health Statistics live birth infant death cohort files from 1995–2001, Alexander et al. (2008) contrasted the maternal risk factors low education, unmarried, young age, high parity, non-metropolitan residence, prior health (hypertension and diabetes), smoking, drinking, and inadequate prenatal care, as well as birth outcomes, including birthweight, gestational age, mortality rates, congenital malformations, and occurrences of SIDS among Native Americans and other racial and

ethnic groups. Native mothers, in general, have more adverse maternal risk factors, including lack of a marital partner and significantly younger age, than Whites and Hispanics (Alexander et al. 2008). After controlling for marital status and age, Alexander et al. (2008) found that Native Americans were still more likely to birth significantly underweight babies. Native American mothers also reported significantly higher levels of hypertension, diabetes, smoking, and alcohol use than the other racial and ethnic groups, were the least likely to visit the physician for prenatal care in the first trimester, and had the highest percentage of births that were considered "very low birth weight" (Alexander et al. 2008). These findings correspond to those that have found alcohol, tobacco, and substance abuse is high among Native American youth in Oklahoma (Beebe et al. 2008; Eichner et al. 2005). Taking into consideration the generally lower childbearing age among Native Americans (Rutman, Park, Castor, Taualii, and Forquera 2008), this finding is particularly important to the present study. This indicates that the IHS must do a better job of serving surrounding Native American communities, and should focus predominantly on regulating preexisting conditions and discussing healthy maternal behavior among young mothers in an effort to reduce unfavorable infant health outcomes.

Also investigating maternal alcohol and drug use, Harrison and Sidebottom (2009) focused on substance abuse before and during pregnancy and identified predictors for use cessation among a sample of Native American, African American, Asian American, Hispanic, and white women, all prenatal patients at four selected urban healthcare centers. Basing their analyses on the Prenatal Risk Overview (PRO), a structured interview that screens for psychosocial risk factors associated with poor birth outcomes, Harrison and Sidebottom (2009) found that reported alcohol and drug use was

higher among unmarried women compared to married women, and highest among Native American women compared to all other racial and ethnic groups, which both supports (Alexander et al. 2008) and contradicts (Shiao et al. 2005) the findings of earlier research. Moreover, older age, current smoking, and lack of transportation predicted both alcohol and drug use continuation on into pregnancy (Harrison and Sidebottom 2009). As previously mentioned, especially among disadvantaged populations in general and Native Americans living in rural areas in particular, access to prenatal care due to limited transportation options is of real concern. Therefore, Harrison and Sidebottom's (2009) finding that lack of transportation can also detrimentally effect whether or not one chooses to quit drinking alcohol or taking drugs while pregnant is even more disturbing. Racial and ethnic groups that are disproportionately poor and rural, (i.e. Native Americans), are at the greatest risk of experiencing adverse pregnancy outcomes compared to all other racial and ethnic groups (Harrison and Sidebottom 2009). Though acknowledged by Harrison and Sidebottom (2009) that some cultural groups required further investigation, it was presumed based on the findings that race and ethnicity could be used as a predictor for alcohol and drug use during pregnancy.

Abma and Mott (1991) analyzed the frequency of substance abuse and prenatal care during pregnancy among a sample of 1,664 young women of African American, Hispanic, and white descent that were pregnant with their first child. Data came from the 1979-1988 phases of the National Longitudinal Survey of Youth. Cigarette, alcohol, and marijuana use, as well as frequency of prenatal care visits were analyzed (Abma and Mott 1991). Control variables included education level, age, income, type of residence (urban

or rural), religiosity (whether or not religious services were attended monthly), and whether or not the child's father was living in the home (Abma and Mott 1991).

Contrary to other studies that have been discussed with the exception of only two (Hummer 1993; Shiao et al. 2005), Abma and Mott (1991) found that white women were more likely than minority women to use substances known to be harmful for babies in the womb, such as alcohol, marijuana, and cigarettes during pregnancy. Forty-one percent of white women in the study sample admitted smoking cigarettes while pregnant, compared to 25% of African American women and 19% of Hispanic women (Abma and Mott 1991). Though whites were more likely than the other two racial and ethnic groups to smoke marijuana and drink alcohol during pregnancy, the differences are not as striking. Twelve percent of white women in the study sample consumed alcohol while pregnant compared to eight percent of African American women and four percent of Hispanic women (Abma and Mott 1991). Thirteen and a half percent of white women in the study sample smoked marijuana while pregnant compared to 11% of African American women and 10% of Hispanic women (Abma and Mott 1991). It is important to note that when relying on self-reported data like those used in this study, especially information that could be considered sensitive, illegal, or stigmatized by many in society, under-reporting could be an issue among many study participants (Committee on Health Care for Underserved Women 2011; Vonderheid, Norr, and Handler 2007). This is a limitation of using self-reported data of this kind and is addressed in the limitations section of the introduction of the present study.

Like other studies (Hummer 1993), Abma and Mott (1991) found that less educated women were more likely than educated women to engage in substance abuse

while pregnant. Women with at least some college education were far less likely to smoke cigarettes or marijuana (21% and six percent, respectively) during pregnancy than were women with 12 years of schooling (42% and 47%) or less (15% and 18%) (Abma and Mott 1991). However, those with less than 12 years of schooling were the least likely to consume alcohol during pregnancy (Abma and Mott 1991). This could be due to the fact that many, if not most, of these women are under the legal limit to drink alcohol, and either do not consume alcohol or are unwilling to admit they do due to such restrictions. From these results, we can assume that college-educated women are more knowledgeable about the relationship between high-risk maternal health behaviors and adverse pregnancy outcomes. In contrast, women who have not attended college seem to be at a higher risk for the detrimental consequences of substance abuse while pregnant. It is evident that college education serves more than just the manifest or intended functions it is designed to provide students, but has beneficial latent or unintended functions as well.

C. *Prenatal Care Utilization*

One important topic for this study is to discover if pregnant women follow the American Medical Association's (AMA) guidelines regarding visiting a physician for proper prenatal care. Minority women and women with lower levels of income have been found to be less likely to utilize preventative care services (Basu 2001). Abma and Mott (1991) found that younger women and less educated women were less likely to visit a physician for prenatal care in the first trimester of pregnancy. Moreover, less educated women and women who had their first child before turning twenty years of age were the least likely of all respondents to have followed the AMA's prenatal care guidelines

(Abma and Mott 1991). However, white women, the more educated women (those with at least some college), and older women (those 23 years of age or older) were most likely to have received early prenatal care (Abma and Mott 1991). This finding corresponds with the research of Shiao et al. (2005) who found that Native Americans were less likely than whites and even African Americans to receive prenatal care.

From the results reported here, we can initially assume for the present study that women who are less knowledgeable about proper maternal health include younger women, those with less education, and those living in disadvantaged conditions. Abma and Mott's (1991) findings provide another example of the importance of educating mothers, especially young mothers and those who have not attended college, about proper maternal behavior and health. It is these groups who are less likely to be aware of the damaging effects the absence of prenatal care can have labor and delivery complications they may suffer and on the health of their child after delivery.

D. *Labor and Delivery Outcomes*

Both poor prior health and risky maternal behaviors can have detrimental effects on the health of mothers and children. As illustrated by the reviewed literature, labor and delivery complications often arise when mothers previously exhibit or develop certain health issues like diabetes or hypertension or engage in risky behaviors like smoking, drinking and drug abuse during pregnancy. Shiao et al. (2005) examined race and ethnicity, maternal health behaviors, and infant outcomes. Their study focused on inner-city tertiary care centers during the prenatal and postnatal periods of 354 mothers of white, Hispanic, African American, Asian, and Native American descent. Not

surprisingly, their findings do not completely mirror other studies of this kind because they used different measures and included a sample of Native American mothers. African Americans and Hispanics were more likely to experience premature rupture of membranes (PROM), or prematurely giving birth (Shiao et al. 2005). Hispanics were more likely to have children with congenital defects and children that had to be admitted to an intensive care unit for additional supervision and care (Shiao et al. 2005). However, white mothers were more likely to smoke cigarettes and drink alcohol during pregnancy (Shiao et al. 2005); therefore, one must question the effect that these high-risk maternal behaviors had on infant health outcomes. There was very little difference between whites and the four individual minority groups regarding vaginal bleeding or delivery complications (Shiao et al. 2005). High levels of infant mortality (seven percent) and low birth weight were discovered among African American mothers in this study, confirming the findings of other studies (Kallan 1993; Miranda et al. 2010). Shiao et al. (2005) propose that this is could be due to high incidences of hypertension among African American mothers in the study sample, which corresponds with more current research (Miranda et al. 2010; Odell et al. 2006; Shen et al. 2005) that found higher rates of hypertension and poorer labor and delivery outcomes among African American women. Shiao et al. (2005) recommend that more research be conducted in order to learn more about the relationship between hypertension among pregnant mothers and low birthweight rates. Hypertension is included as a maternal health condition in the current analysis in an effort to respond to this suggestion.

i. *Race, Ethnicity, and Low Birth Weight*

A substantial disparity exists regarding low birth weight according to race and ethnicity, whereby minority women, especially African Americans, are far more likely than white women to give birth to an underweight baby. In a study similar to the present one, Kallan (1993) analyzed the effect race had on baby's low birth weight, along with two intervening variables (health [measured by parity, prior outcomes, and the presence/absence of three conditions – hypertension, diabetes, and infectious disease] and maternal attitudes and behaviors [measured by pregnancy wantedness, smoking, and obtaining prenatal care]) in order to explain reasons for particular adverse pregnancy outcomes, including two measures of low birth weight – preterm birth and intrauterine growth retardation. The data came from the 1988 National Survey of Family Growth. Parity is defined as number of births one has experienced, particularly in reference to whether the birth in question is the first or subsequent birth because first births are at a higher risk for low birth weight (under 2500 grams) (Conley, Strully, and Bennett 2003). Prior outcomes that were analyzed include prior infant loss and/or prior underweight birth (Kallan 1993).

Because African Americans are at higher risk for giving birth to an underweight baby, though it cannot be agreed upon as to why, (Chao et al. 2010; Conley et al. 2003; Emmanuel et al. 1999; Hummer 1993; Kallan 1993; Lu and Halfon 2003; Lu et al. 2010; Mustillo et al. 2004; Odell et al. 2006; Remez 2003; Shiao et al. 2005; Sparks 2009; Zhang, Cox, Graham, and Johnson 2011), particular attention is paid to the relationship between race and ethnicity and the outcome variable low birth weight *(LBW)* in the

present study. The variables tested in the current research, including socioeconomic status (education and income) and maternal risk (smoking, drinking, lack of prenatal care, and lack of multivitamin use), as well as maternal health conditions during pregnancy (gestational diabetes and hypertension), may provide an answer. The connection between smoking and poor birth outcomes, particularly low birth weight, has been well researched (Alexander et al. 2008; Aliyu et al. 2011b; Conley et al. 2003; D'Angelo et al. 2007; Hellerstedt, Himes, Story, Alton, and Edwards 1997; Meis et al. 1997; Oklahoma State Department of Health 1997, 2006, 2008, 2009; Pollack, Lantz, and Frohna 2000; Salihu et al. 2003; Sparks 2009; Suellentrop, Morrow, Williams, and D'Angelo 2006; Wang, Tager, Van Vunakis, Speizer, and Hanrahan 1997). Because it is unclear from reviewing the contradictory findings of previous literature as to whether or not Native American women in general are more likely than whites to smoke during pregnancy (Alexander et al. 2008; Castor et al. 2006; Emmanuel 1999; Salihu et al. 2003; Shiao et al. 2005), it will be particularly intriguing to discover if Native American women in Oklahoma are more or less likely than whites in the state to smoke cigarettes while pregnant.

Surprisingly, Kallan (1993) found no significant effects for prenatal care or education on birth weight; however, smoking and the prior health variables had large effects on pregnancy outcomes. Both pregnancy wantedness and marital status had significant effects on adverse pregnancy outcomes, including low birth weight and intrauterine growth retardation (IUGR) (Kallan 1993). Although a significant portion of the racial gap among preterm births remains unexplained, other sociodemographic variables whose distributions vary by race that were not included in his analysis, including income, wealth, household structure, and the residential social and physical

environment, have the potential to explain at least a portion of the disparity (Kallan 1993). The present study thoroughly investigates the relationships between race and ethnicity, income, education, maternal health, maternal behaviors, and pregnancy outcomes, including birth weight; therefore, it is appropriate to compare statistical results.

Remez (2003) also conducted a study that focused on the prevalence of low birth weight among minority women, utilizing data gathered from 343 Chicago neighborhoods on racial differences in neighborhood-level effects on birth weight, comparing only white and African American mothers. Survey data come from a household survey of 8,782 adults that was conducted in 1995 as part of the Project on Human Development in Chicago Neighborhoods (Remez 2003). Birth certificate data provided information on birth weight and maternal risk factors, including inadequate prenatal care, age, education level, and marital status (Remez 2003). Finally, 1990 U.S. Census data was used to control for neighborhood economic disadvantage, a composite measure of proportion of the population in poverty, on public assistance, and unemployed (Remez 2003).

African American mothers gave birth to underweight babies far more often than white mothers (13% and 5 percent, respectively) (Remez 2003), a finding supported by recent research, as noted above. According to National Vital Statistics Reports on Births (2005), the low birthweight rate among all mothers has been rising fairly steadily since the mid-1980s (Martin et al. 2007). In fact, the low birthweight rate rose from 8.1% in 2004 to 8.2% in 2005, which corresponded to high levels reported almost 40 years earlier (Martin et al. 2007). While these figures represent incredibly high rates of low birthweight among the general population, rates that hadn't been reached in decades, they are still significantly lower than the rates among African Americans (Remez 2003).

African American mothers in Remez's (2003) study were less likely to be married, to follow prenatal guidelines, and to have completed high school, and more likely to be teenage mothers and giving birth for the first time, all variables that are considered "high risk" for experiencing adverse pregnancy outcomes (Alexander et al. 2008). Neighborhood economic disadvantage was markedly different between white and African American neighborhoods. Neighborhoods that were predominantly African American had a higher proportion of families living at or below the poverty line, thus more economic and social disadvantages at the neighborhood level than whites in the sample (Remez 2003), which is supported more current research (Kirby, Taliaferro, and Zuvekas 2006; Lu et al. 2010) that identify neighborhood factors as the source for a large portion of disparities in healthcare access. This means that the greater the indicators of economic and social disadvantage at the neighborhood level, the greater the negative effect (i.e. low birthweight) on infants. Birth weight was highest in predominantly white neighborhoods, whereas birth weight was lowest in predominantly African American neighborhoods (Remez 2003), as previously mentioned. However, while economic disadvantage was associated with low birth weight for African Americans, it was not for whites (Remez 2003). The variation in economic disadvantage across racial lines cannot be fully explained by only considering this data; however, unequal access to medical facilities or preventive care services due to discrimination (Colen, Geronimus, Bound, and James 2006; Karlsen and Nazroo 2002; Mustillo et al. 2004; Remez 2003), lower levels of educational attainment (Colen et al. 2006; Remez 2003), environmental or psychological stressors (Geronimus et al. 2010; Green and Darity, Jr. 2010; Lu et al. 2010; Walters and Simoni 2002), or other cultural barriers to seeking preventative care

(Doshi and Jiles 2006; Pardasani and Bandyopadhyay 2014; Ronsaville and Hakim 2000), may each be a possibility.

Emmanuel et al. (1999) linked birth certificate data for Washington State infants to a statewide database of vital records and hospital discharge summaries of obstetric and neonatal admissions between 1987-1995, including 46,000 births, in order to compare the maternal birthweight, infant birthweight, and gestation of four ethnic groups, including whites, African Americans, Native Americans, and Hispanics. Variables included age, parity, marital status, whether or not the mother is a recipient of Medicaid, smoking while pregnant, late prenatal care, residing in a deprived area, low birth weight, and preterm birth (Emmanuel et al. 1999).

White mothers were found to be at the lowest maternal risk for low birth weight taking into account age (median age was higher), marital status (highest marital percentage) and education (Emmanuel et al. 1999). They were the least likely, when compared to all other racial and ethnic groups, to be having their third (or higher) child, to be dependent on Medicaid, to receive late or no prenatal care, and to reside in a deprived area (Emmanuel et al. 1999). Presumably due to their low maternal risk, white mothers also had the lowest percentage of both underweight and preterm births (Emmanuel et al. 1999). African American mothers were more likely to experience adverse outcomes, especially regarding the birth of underweight babies, compared to all other groups studied (Emmanuel et al. 1999). Smoking was the lowest among Hispanic mothers and highest among Native American mothers (Emmanuel et al. 1999), challenging studies that found that white mothers were more likely to engage in high-risk maternal health behaviors such smoking cigarettes and drinking alcohol (Abma and Mott

1991; Hummer 1993; Shiao et al. 2005). Though the overall goals of this research are unlike those of the present study, their findings of patterns of maternal risk and rates of low birthweight among minority women have an impact on the research hypotheses.

E. *Geographic Location and Maternal Health of Minority Women*

According to the 2010 United States Census, approximately 20% of Native Americans in the United States lived in what is considered an "American Indian area" (federal reservation and/or off-reservation trust land, Oklahoma tribal statistical area, state reservation, or federal-or state-designated American Indian statistical area) (Norris, Vines, and Hoeffel 2012). When studies are conducted that focus on Native Americans in the study sample, oftentimes they are focused on rural locations and not urban areas because of the relatively small overall population of Native peoples in urban locations compared to members of other racial and ethnic categories. However, comparisons can be made between Native Americans and African Americans due to minority status, socioeconomic status, and on the basis of limited life chances.

Selecting only Native American births for additional inquiry, Alexander et al. (2008) compared the maternal risk factors and birth outcomes by geographical region in order to assess whether there are geographic variations in the adverse outcomes regardless of race or ethnicity and suggest intervention strategies. The twelve IHS areas were categorized as West (including Alaska, Albuquerque, Billings, California, Navajo, Phoenix, and Portland), Midwest (including Aberdeen, Oklahoma, and Bemidji), or South/Northeast (including the states in the Nashville IHS area) (Alexander et al. 2008). There were noteworthy regional differences, illustrating the need to guard against

homogenizing research strategies when studying Native Americans as a population. However, comparing regional differences according to this framework may present similar problems due to the variability within each geographic region, i.e. Native Americans living in Alaska compared to Phoenix, for instance, which are both classified as being in the "West" region. Environmental and living conditions and historical circumstances differ considerably even within the geographical categories delineated by the researchers. For example, the difference in the prevalence of diabetes among Native Americans living in Arizona compared to that of Alaska Natives is immense.

Native Americans living in Southern Arizona, including the Tohono O'odham, now have the highest rates in the world of death and disability from Type 2 diabetes (Acton et al. 2002; Fazzino II 2008; Matthews 2006; Smith-Morris 2006; TOCA and TOCC 2002,). The Harvard Project on American Indian Economic Development (2007) reported, "the death rate from preventable diabetes is two times greater for on-reservation Indians than for the U.S. population as a whole" (U.S. Department of Health and Human Services, Indian Health Service 1999b). Regarding the Tohono O'odham in particular, some studies suggest that they suffer four times the rate of white Americans (Smith-Morris 2006), still others report that the rates as six times that of the general population (U.S. Department of Health and Human Services, Indian Health Service 1999b; Livingston et al. 1993). The American Journal of Epidemiology reported a 19-fold disparity between the Pima (known as the Akimel O'odham; related to and residing near the Tohono O'odham) of southern Arizona and the primarily white community of Rochester, Minnesota (Knowler, Bennett, Hamman, and Miller 1978). Diabetes among the Native Alaskan population, on the other hand, is the lowest among all Native

Americans, lower even than the white population. 4.4 percent of the Native Alaskan population had been diagnosed with diabetes in 2010, compared to six percent of the white population in the same area (Alaska Native Epidemiology Center 2015).

Due to the incredible cultural and geographic diversity among Native American communities throughout this country, differences in maternal health status compared with other racial and ethnic categories can certainly be discerned. The Indian Health Service is divided into twelve physical areas within the United States: Alaska, Albuquerque, Bemidji, Billings, California, Great Plains, Nashville, Navajo, Oklahoma, Phoenix, Portland and Tucson. These can be grouped into larger geographic regions, such as the South, Northeast, Midwest, and West, in the way the 2010 United States Census Bureau has compared data (Norris et al. 2012) or Alexander et al. (2008) did in their study of regional differences in pregnancy outcomes among Native Americans, as compared to other racial and ethnic groups. The results of their pregnancy outcomes study indicate that the South and Northeast IHS regions had more instances of low birth weight and problems that occurred before 33 weeks (very preterm) gestation, as well as higher risks for perinatal mortality (Alexander et al. 2008). The Midwest, however, had the highest risks for infant mortality and SIDS, especially among low birthweight infants (Alexander et al. 2008), suggesting possible environmental conditions specific to the area. Furthermore, the Midwest had more instances of teenage pregnancy, mothers with low educational attainment, non-metropolitan residence, diabetes, and smoking when compared to the other geographical regions (Alexander et al. 2008). Because Oklahoma was categorized as “Midwest” in this study, I expect to find that young mothers comprise a significant portion of the study sample, low educational attainment will be evident, and

the rate diabetes among pregnant women, especially Native American mothers, will be high in the current analysis. Though maternal smoking was found to be highest in the Midwest region, I don't predict that the results of the present study will correspond with these findings.

Differences in geographic location undoubtedly has an effect on the great diversity of Native peoples; and hence, maternal health outcomes of Native American women across the country. In a similar way, contrasting neighborhood-level surroundings, ie: rural versus urban environments may also affect maternal health outcomes of Native American women. In order to identify health disparities between Native Americans and Alaska Natives living in urban Indian health organization (UIHO) areas and the general population living in select urban counties, Castor et al. (2006) analyzed United States Census data and vital statistics data between 1990 and 2000. Significant disparities in both the health and socioeconomic realms between Native Americans/Alaska Natives and the general population were uncovered. Native American/Alaska Native mothers were more likely to receive late or no prenatal care, smoke cigarettes while pregnant, consume alcohol while pregnant, experience labor and delivery complications attributable to chronic liver disease, and birth children that passed due to sudden infant death syndrome (SIDS) (Castor et al. 2006).

These results corroborate the findings of Emmanuel et al. (1999), and likewise contradict those of Hummer (1993) and Shiao et al. (2005). They also correspond with studies that have found urban Native Americans are more likely to smoke during pregnancy compared to those living in rural areas (Baldwin et al. 2002). Because only urban Native populations are included in this study, their findings may have been

somewhat skewed compared to studies that include Native Americans that live in both rural and urban areas. Furthermore, the study sample included only those urban Native Americans living in UIHO areas (according to the authors, roughly 66% of urban Native Americans do not live in UIHO service areas). Castor et al. (2006) assert, however, that the degrees of disparity uncovered in this study between Native Americans sampled and the general population in UIHO areas are comparable to nationwide statistics.

Socioeconomically, the urban Native Americans/Alaska Natives in this study were twice as likely to be poor, unemployed, and to not have graduated college compared to the general population during this time period (Castor et al. 2006). Compared to Snipp's (1992) findings from the 1980s and the data on public school graduation in 2010 (Swanson and Lloyd 2013), it seems that there has not been much improvement for Native Americans compared to the general population with regard to educational achievement and career attainment. In fact, Castor et al. (2006) express concern over the current circumstances of urban Native populations. "Any presumptions that American Indians/Alaska Natives [AI/AN] are thriving in cities should be reconsidered. Clearly, this population faces many of the same challenges as nonurban AI/AN populations" (Castor et al. 2006:1484).

The variables found to be most critical to the unfavorable maternal well-being of the urban Native American population include socioeconomic status, lack of prenatal care usage, and most striking, alcohol consumption during pregnancy among Native women (Castor et al. 2006). The alcohol consumption rate among Native American mothers was three to four times the rate for the general population (Castor et al. 2006), paralleling studies (Alexander et al. 2008; Harrison and Sidebottom 2009) that also found higher

rates of alcohol consumption among Native American women compared to other racial and ethnic categories. “Improvements in health care access, high quality data collection, and policy initiatives designed to provide sufficient resources and a more unified vision of the health of urban American Indians/Alaska Natives” (Castor et al. 2006:1484) is needed in order to address the significant health disparities between Native American/Alaska Native populations and the United States population as a whole. Addressing these issues should begin with partnerships between tribal, federal, state, and local public health institutions. Though no counties in the state of Oklahoma were included in this study, due to the high Native American population in most Oklahoma counties, I predict that socioeconomic status and lack of prenatal care usage will be similarly linked in the present analysis. However, I do not believe that the alcohol consumption rate among Native Americans in the study sample will match the results documented by Castor et al. (2006). Reasoning is discussed further in Chapter Three.

Utilizing the 1989-1991 National Linked Birth-Death Database, Baldwin et al. (2002) sought to create a national profile of rural and urban Native American/Alaska Native maternal and infant health. Whites and African Americans were chosen as reference groups and analyzed in this study as well, because whites, as a group, have some of the most favorable pregnancy outcomes, while African Americans have some of the worst (Baldwin et al. 2002). Baldwin et al. (2002) focused on patterns of prenatal care, birthweight, infant mortality, and cause of death among both rural and urban populations to uncover the differences in maternal risks (parity, cigarette use, alcohol use, prior preterm birth, and prior health [including cardiac disease, chronic hypertension, diabetes, and pregnancy complications like eclampsia, anemia, oligohydraninios,

pregnancy-induced hypertension, incompetent cervix, uterine bleeding, placental abruption, and placenta previa]), patterns of prenatal care use, and birth outcomes [low birthweight and death] between Native American/Alaska Native populations living in rural and urban counties of the United States, both inside and outside IHS areas.

Compared to rural mothers, urban mothers were more likely to be unmarried, to be having their first child, and to be smokers. Rural mothers were more likely to have had pre-existing medical conditions, complications of pregnancy, and a prior preterm or small-for-gestational-age infant (Baldwin et al. 2002). Rural mothers were significantly more likely to have received inadequate prenatal care than were urban mothers of Native American infants (Baldwin et al. 2002). This suggests that limited transportation services in rural areas or significant geographic distance from health service centers lead to a general lack of access to proper prenatal care facilities, including IHS facilities, for Native American women, despite the fact that a large proportion of rural Native Americans live within IHS service areas. However, due to the diversity among the Native American population, there is considerable variation among IHS service areas regarding patterns of prenatal care usage and should be investigated more thoroughly to enhance accessibility among the communities they serve.

Interestingly, the difference in prenatal care between urban and rural Native Americans/Alaska Natives decreased, but did not completely disappear, when they adjusted for the maternal risk characteristics variables (Baldwin et al. 2002). The low birthweight rate for urban Native American births, though, was almost 10% higher than that for rural births (Baldwin et al. 2002). There was not a statistically significant difference for overall infant death rates between rural and urban Native Americans

(Baldwin et al. 2002). Though the goal of this study was to compare the experiences of rural and urban Native American/Alaska Native groups, the study uncovered some striking differences between Native Americans and the other racial and ethnic groups included in the sample for reference. Patterns of inadequate prenatal care for Native Americans were comparable to African Americans, which is consistent with the hypotheses of the present study. The direness of the situation is even worse than these statements indicate when one realizes that the rates of inadequate prenatal care for Native American/Alaska Native mothers regardless of geographic location were twice the rates of white mothers (Baldwin et al. 2002). Furthermore, postneonatal death rates among Native Americans/Alaska Natives have been found to be more than twice that of whites (Baldwin et al. 2002; Blabey and Gessner 2009). This reiterates the importance of access to healthcare facilities and proper maternal education particularly among disadvantaged minority populations, including Native Americans, no matter their type of residence or community. Confirmed by similar studies that report the existence of preventable health disparities between minority and white populations (Blabey and Gessner 2009; The Harvard Project on American Indian Economic Development 2007; U.S. Department of Health and Human Services, Indian Health Service 1999b), Baldwin et al. (2002) call for "improved access to health services, health education, and prevention programs targeted at injury prevention, sleep position and conditions, and prevention and management of febrile illnesses" (1496).

In a similar study and using the same data as Baldwin et al. (2002), Grossman et al. (2002) sought to uncover geographic variations in urban Native American and Alaska Native populations with regard to rates of infant mortality, low birth weight, prenatal care

use, and maternal–child health care service availability. Grossman et al. (2002) found that a significant variation exists between urban areas for Native American/Alaska Native populations, as well as between Natives and whites living in the same metropolitan areas. Probable causes for the disparity include higher rates of poverty, lower levels of maternal education, and higher rates of other pregnancy risk factors among Native American women compared to whites (Grossman et al. 2002).

Directly related to the current study, Grossman et al. (2002) reveal that Tulsa, Oklahoma is ranked third in the nation regarding number of Native American birth counts. According to the 1990 United States Census, both Tulsa and Oklahoma City were listed among the eight cities with the highest Native American populations (Thornton 1997). Two more Oklahoma cities, Lawton and Oklahoma City, are also listed in the top 52 cities with the largest urban Native American populations to serve via outreach and referral center (ORR), Indian Health Service (IHS) clinic or hospital, tribal clinic or hospital, or urban health center (UHC) (Grossman et al. 2002). The IHS facilities in the cities of Lawton, Tulsa, and Oklahoma City are charged with meeting the medical needs of large urban Native American populations, but are sometimes criticized for insufficiently meeting their needs citing poor staff care (Ruckman 2014), lack of funding (U.S. Department of Health and Human Services, Indian Health Service 1999a; Warne 2011), or the high volume of patients and increasing wait time. Grossman et al. (2002) cite the lack of adequate resources of urban health programs that are necessary to meet the needs of Native American and Alaska Native populations living in urban areas, as well as the lack of uniformity regarding access to maternal and child healthcare among urban healthcare centers.

F. *Comparisons with Other Minority Groups: Indigenous Maternal Health*

Other minority groups, including indigenous groups such as First Nations of Canada (Heaman, Blanchard, Gupton, Moffatt, and Currie 2005; Luo, Wilkins, Platt, and Kramer 2004; Oliveira et al. 2013; Stout and Harp 2009), Aboriginal Australians (Mohsin, Wong, Bauman, and Bai 2003; Porter, Skinner, and Ellis 2011), and Native Hawaiians (Blaisdell 1993; Keiffer, Mor, and Alexander 1994), face similar disparities regarding maternal health and when compared to non-minority status women in the same geographic area. It could be that these women, like African Americans and Native Americans in the United States, have a systematically lower socioeconomic status and underutilize preventative care services. Utilizing Hawaii vital record data between the years 1979 and 1990, Keiffer et al. (1994) sought to uncover the potentially differing relationships between maternal and infant risks and outcomes for Native Hawaiian and white infants. Native Hawaiians were less likely to be married, to live in a rural area, and to have achieved high educational attainment (more than twelve years) (Keiffer et al. 1994). They were also less likely to have received adequate prenatal care (Keiffer et al. 1994). Interestingly, in spite of inadequate prenatal care and teenage and unmarried childbearing, the rate of low birthweight among Native Hawaiians was below the national average (Keiffer et al. 1994). However, Hawaiian infants did experience a higher risk of mortality, predominantly among those of normal birthweight during the postneonatal period (Keiffer et al. 1994). There seems to be a connection between three disadvantaged minority populations – Native Hawaiians, Native Americans, and African Americans – whereas the ethnic gap in mortality between these groups and whites is widest,

interestingly, for infants born at normal birth weights and gestational ages (Honigfeld and Kaplan 1987; Keiffer et al. 1994; Kleinman 1990). Figures related to educational achievement and inadequate prenatal care are analogous to findings focusing on Native Americans and African Americans from various geographical locations (Bengiamin, Capitman, and Ruwe 2010; Johnson, Call, and Blewett 2010; Keiffer et al. 1996; Oklahoma State Department of Health 1995a). Keiffer et al. (1996) stress the importance of public health initiatives in order to reduce infant mortality that address Hawaiian infants' unique and culturally-specific pattern of risk factors and the social and economic environment in which such risks are evident, mirroring the call of so many health professionals and researchers alike for increased awareness and culturally-specific education of proper maternal health for Native Americans (Call et al. 2006; Fazzino II 2008; Smith-Morris 2006) and neighborhood-level programs for African Americans (Cubbin, Pedregon, Egerter, and Braveman; Remez 2003; Kirby et al. 2006).

G. *After Delivery: Parenting Competence & Compliance with Well-Child Guidelines*

There is one study that uses both quantitative and qualitative methods and focuses solely on one particular Native American population. It was conducted by Dalla and Gamble (1997) and deals with a different variable from those mentioned previously: parenting competence. The quantitative portion of their study included adolescent Navajo mothers living in a rural community on the Navajo reservation and was based on the principles of the Process Model of Parenting Competence created by Belsky, Robins, and Gamble (1984). The four factors of parenting competence outlined by the model include (1) the personal resources of the caregiver (self-esteem and confidence in the parenting

role); (2) quality of the marital relationship; (3) environmental sources of stress (poverty) and support (support network other than husband); and (4) child characteristics (temperament and physical health) (Dalla and Gamble 1997).

The child characteristics, including pregnancy risk and child risk, are of particular interest for the purposes of this study. Pregnancy risks included lack of prenatal care, weight gain of 20 or greater than 36 pounds, anemia, spotting, or high blood pressure during pregnancy, as well as the use of alcohol, drugs, or unprescribed medication during pregnancy (Dalla and Gamble 1997). Child risks included low birth weight (<88 ounces or about 2500 grams), placement of the infant in an intensive care unit after birth, frequent serious illnesses such as croup, measles, chicken pox, or rubella, and the presence of physical handicaps or disabilities evident at birth (Dalla and Gamble 1997).

A sample (N=17) of adolescent Navajo mothers were asked to complete a series of self-report questionnaires about topics related to these four factors of parenting competence (Dalla and Gamble 1997). Contrary to the expectations of the investigators, child risk factors had very low associations with the outcome parenting variables, maternal competence, child acceptance, and feelings of parental role restriction (Dalla and Gamble 1997). Although the study's objective was to provide a causal path from "pregnancy risk" to "child risk" among Navajo teenage mothers and their children using quantitative correlational techniques, the sample size was much too small to glean any useful quantitative information from the analysis. This study is yet another example illustrating how quantitative methods often fail to capture useful and informative data regarding the Native American population due to insufficient respondents.

The qualitative portion of their study aimed to document adolescent Navajo mothers' perceptions of parenting competence and included a sample of eight adolescent Navajo mothers that participated in the in-depth interview process. The qualitative portion of their study is also limited in its usefulness in relation to the present study because the analysis inquired about child health after birth, but not about prenatal care; therefore, a relationship between the two could not be established with the available qualitative data. However, it may be theorized that although young Navajo mothers desire to observe healthy maternal behaviors and heed guidelines for proper maternal care, they are often restricted by their socioeconomic plight and lack of access to proper prenatal care facilities.

In both investigations group diversity among respondents was evident, emphasizing that similarity among Native American respondents, apparently even those from comparable backgrounds, should not be readily assumed. Because of high rates of teenage pregnancy in the Native American population (Rutman et al. 2008) and due to limited research concerning Native American parenting and pregnancy, Dalla and Gamble (1997) noted that it is important to focus more heavily on this overlooked population. However, they also note that due to cultural diversity, what it means to be "at risk" and also competent will vary from culture to culture. Because of this variability, the researchers opted to study only one Native American population.

Related to parenting competence after delivery, Hummer (1993) focused on well-child guidelines compliance and examined infant mortality rates between African Americans and whites in the United States using the 1988 National Maternal and Infant Health Survey, the same data set used by Ronsaville and Hakim (2000) in their analysis

of well-child guidelines compliance. Of particular interest in this study were the intervening variables between race and ethnicity and infant mortality, including sociodemographic characteristics (education, income, and maternal age of childbirth), maternal health (low pregnancy weight gain, inactivity, and maternal health problems), health care (timing and quantity of prenatal care and health insurance), and infant health (length of gestation and birth weight).

According to Hummer (1993), African Americans earn approximately half the yearly income of whites, and are much more likely to give birth at younger ages and to have not completed high school when compared to whites. In reference to the maternal health variables, African Americans have poorer pregnancy-related health compared to white women, with the exception of the inactivity variable (Hummer 1993). Taking the sociodemographic variables income and education in to consideration, one could surmise that African American women are more active while pregnant working most likely in low-skill, low-wage jobs to support themselves and their families. Because such occupations are often physically demanding, they have the potential to be harmful to the overall health and well-being of mothers, which could detrimentally affect the health of babies. African Americans are also far less likely to have received adequate prenatal care and to not have health insurance (Hummer 1993). African American infants are more likely to be born premature and to be born smaller than those born to white mothers (Hummer 1993). Not surprisingly after considering these results, African Americans were found to have rates of infant mortality 2.2 times higher than whites (Hummer 1993).

In addition to the discrepancies between African American and white infants described above, Hummer (1993) also found that there were interaction effects among

race and education, maternal health, and prenatal care. Interaction effects occur in statistical analyses when there is a simultaneous influence of two or more variables on a dependent variable. Hummer (1993) explains the interpretation of the race*education interaction effect:

> Regardless of race, less educated women may be exposed to many identical hardships; on the other hand, more-educated African American women may experience many additional and unique hardships compared to more educated Anglo women (Hummer 1993:543).

More educated women are at lower risk for adverse pregnancy outcomes compared to less educated women (Abma and Mott 1991; Hummer 1993). However, it is important that race and ethnicity also be taken into account when examining the maternal risk factors for pregnancy-related complications. More educated minority women, due to their level of educational achievement, should be at a lower risk for such complications; however, due to their minority status, they may be at risk for additional hardships that are more similar to the experiences of the disadvantaged, poor, and minority populations in general (Hummer 1993; Nepomnyaschy 2009). Additional hardships could include personal, institutional, or legal discrimination, segregation, racial inequality, and devaluation of human capital (Christopher 2005; Kirby et al. 2006).

Hummer (1993) explains the race*maternal health and race*prenatal care interactions in a similar fashion, whereas the racial disparity is more prevalent among women with inadequate prenatal care and many maternal health problems, measured here by summing the number of actions taken to prevent premature birth and early delivery and including the following actions: bed rest, hospitalization, reduced work hours, taking medicine to prevent miscarriage and early labor, receiving hormone shots, stopping intercourse during pregnancy, using condoms to prevent infection, and having the cervix

sewn closed in an effort to delay birth. Engaging in a high number of such actions is believed to be a useful indicator of poor maternal health (Hummer 1993). Though conditions like gestational diabetes, hypertension, anemia, and sexually-transmitted diseases, health problems that are known to negatively affect pregnancy outcomes, are not included, this measure is known to be an excellent predictor of infant mortality (Hummer 1993).

Like more-educated African American women, African American women that seem to be at low risk for poor maternal health and inadequate prenatal care may face additional hardships attributable to their minority status (Nepomnyaschy 2009). "African American women who seem to be at a low risk for infant death may experience additional risks because of the continued institutional and individual-level discrimination they face in U.S. society" (Hummer 1993:543). Hummer (1993) stresses that in order to improve the infant mortality rate among African Americans so that they have a chance of survival equal to that of white infants, a serious effort needs to be made toward improving the socioeconomic status, health, and health care of African American women in the United States. Because of the comparability of the plight of African Americans and that of other minority groups, including Native Americans, the researcher again concludes that the risks for African American women as analyzed in this study are consistent and comparable to that of Native Americans.

Ronsaville and Hakim (2000) examined racial differences in compliance with the American Academy of Pediatrics well child guidelines in the first six months of life among a sample of women living throughout the United States in order to determine specific risks for inadequate compliance and care. The study included African American,

Hispanic, and white mothers and infants that participated in both the 1988 National Maternal and Infant Health Survey and the 1991 longitudinal follow-up survey. Native Americans were again excluded from the analysis due to underrepresentation (1.6% of the total study population). Compliance with guidelines was measured by the number of physician visits for well child care, timing of the visits, and number of immunizations (Ronsaville and Hakim 2000). Full compliance was defined as making at least three well-child physician visits, the first being before the infant reaches 2 months of age, and having completed all immunization requirement (Ronsaville and Hakim 2000). Adequate compliance was defined as making at least three well-child physician visits that began by the time the infant reached 2 months of age, but without completing all immunization requirements (Ronsaville and Hakim 2000). Inadequate compliance was defined as not making a well-child physician visit in the first 2 months of the infant's life, or making fewer than three visits by 7 months, regardless of if the immunization requirements had been met (Ronsaville and Hakim 2000).

Ronsaville and Hakim (2000) found that African American and Hispanics were 70% less likely than whites to fulfill all the well child guidelines. Furthermore, though poor maternal education and low income were significantly associated with risks for incomplete well child care, the discrepancy between African Americans and whites did not diminish when socioeconomic status, mother's education, and income were taken into account (Ronsaville and Hakim 2000). Although the racial differences evident in the findings cannot be fully explained, Ronsaville and Hakim (2000) speculate that cultural barriers and/or institutional discrimination, as well as maternal attitude toward childbirth, might play a role and that these racial and social disparities should be studied further.

"Research has shown that race, economic status and social class are intricately intertwined and that ethnic and cultural patterns of health beliefs and health risk behaviors may affect both health and use of preventive care" (Ronsaville and Hakim 2000:1441). In addition, Ronsaville and Hakim (2000) admit that possible over-sampling of African American women in their study might have played a role in their racial findings.

Most studies that focus on health differentials between whites and minority groups focus on African Americans, and to a lesser extent, Hispanics, despite widespread recognition of the often unique challenges faced by other minority populations in the United States (Alexander et al. 2008; Baldwin et al. 2002; Castor et al. 2006; Grossman et al. 1994). Unfortunately, in many large scale studies, Native Americans are generally excluded or lumped under the "other" category because of their low numbers in the study sample (Butterfield 2003; Eriksen 1997; Faircloth and Tippeconnic III 2010; Rochat 2008; Shotton et al. 2013; Snipp 1992). Furthermore, studies that do include Native Americans in their study sample often conduct nationwide or regional studies that compare all Native Americans, regardless of specific cultural group, to other racial and ethnic groups (Eriksen 1997; McGee et al. 1999; Portman and Dewey 2003), discounting cultural diversity. Consequently, relatively little is known concerning the health status characteristics of Native American women in general or within specific communities (Oklahoma State Department of Health 1994).

This study, therefore, addresses this gap by including and focusing on a sample of Native American women. Native Americans are not a homogenous racial and ethnic group. This study acknowledges that various Native American communities differ

substantially with regard to social and cultural ideals, economic well-being, and geographic location. Though the 39 tribes in Oklahoma also differ according to their social and cultural ideals and to some extent their economic well-being, they are more related on the basis of geographic location than if a sample of Native American women from various geographic locations throughout the United States were to be included in this study. In other words, the Native women in this sample, although from different tribal communities, will have more in common due to living in close proximity to one another than if a nationwide sample of Native Americans was utilized for the purposes of this research.

CHAPTER THREE:

THEORETICAL APPLICATION AND HYPOTHESES

I. *The Conceptual Framework*

The framework illustrated below is an adaptation of the causal framework used by Kallan (1993) in his study of race, low birth weight, and two intervening variables: (1) health and (2) attitudes and behaviors. Though parity (the number of times a woman has given birth), prior outcomes, and pregnancy wantedness were included in Kallan's study, they are replaced by alternate variables in the present analysis. Instead, drinking, multivitamin use, and three additional pregnancy outcomes have been added in the present study, including placental issues, premature rupture of membranes (PROM), and child placement in an intensive care unit. Health conditions of the mother during pregnancy are also taken into account, and include (1) high blood sugar during pregnancy (gestational diabetes), and (2) high blood pressure during pregnancy (hypertension). Race and ethnicity of the mother is the primary focus of this analysis. Emphasis is placed on Native American mothers and how their experience may differ from African American and white mothers.

FIGURE 3.1: THE CONCEPTUAL FRAMEWORK (*Adapted from Kallan, 1993*)

	Sociodemographic	*Behavior/Health*	*Outcomes*
	1	2	3
(R/Ethnic)	Age	Smoking	Birth Weight
	Marital Status	Drinking	PROM
	Socioeconomic	Prenatal Care	Placental Issues
	▪ Education	Multivitamin Use	Placement in ICU
	▪ Income	Mother's Health	
		▪ Gestational Diabetes	
		▪ Hypertension	

II. *Hypotheses*

It is expected the results of this analysis will yield similar findings to the infant health study conducted by Shiao et al. (2005) and the Native Hawaiian maternal risk study conducted by Keiffer et al. (1994). Because of higher levels of social disadvantage (both lower socioeconomic status and lower utilization of preventive care services), minority women will be more likely than whites to engage in the risky health behaviors "prenatal care" and "multivitamin use" while pregnant. In other words, minority women will be more likely to never visit the physician for prenatal care and to never take multivitamins. Because of the presence of these risky and unhealthy behaviors, these women will experience a higher prevalence of complications in labor, delivery, and/or compromised health of the child. Minority women will not, however, be more likely than whites to smoke cigarettes or drink alcohol while pregnant due to the fact that these behaviors are considered lifestyle "choices" and are not as strongly connected to income and level of education, or access to and education about proper maternal health, as in the case of multivitamin use and visits for prenatal care.

There is little, if any, useful data regarding the maternal health of Native Americans in the United States due to their small numbers even though they may be represented in random sampling. By tapping into these data, the present study sheds some light on the current situation for minority women, Native Americans in particular, and fills an important gap in the literature regarding racial and ethnic differences in maternal health. Due to sharing similar circumstances with African-American women, such as lower socioeconomic status, limited life chances, and higher levels of social disadvantage, the hypothesis of this study is that Native American women will more

likely to engage in risky and unhealthy maternal behaviors by delaying early prenatal care and use fewer multivitamins, thus giving birth to babies with more problematic health outcomes. It is expected, however, that minority women will not have more problematic health concerns that are associated with the consequence of smoking cigarettes or drinking alcohol compared to whites.

A similar study conducted by Hummer (1993), found that although education had an effect on the knowledge about prenatal care and maternal health guidelines, well-educated African American women faced additional hardships compared to well-educated white women that caused complications in labor and delivery. Though the reason was not fully explained by the variables used in the study by Hummer (1993), it was hypothesized that institutional discrimination could possibly explain some of the disparity between African American and white women. In the present analysis, it is expected that higher level of education will decrease risky health behaviors for pregnant minority women; however, the socioeconomic variables, education and income, will not entirely close the disparity between whites and minorities in this respect.

Furthermore, health conditions of the mother during pregnancy that are taken into account, including gestational diabetes and hypertension, will have an effect on whether or not the mother experiences labor and delivery complications, as well as the health of the infant. If the mother has experienced any of these conditions, she will be more likely to suffer labor and delivery complications, including premature birth, low birth weight, placental issues, and child placement in an intensive care unit.

The results gleaned from analyzing the Oklahoma PRAMS data from the years 2004-2011 reveal some change over time. Two PRAMS study cycles (*PRAMS V*: 2004-

2008 and *PRAMS VI*: 2009-2011) are analyzed in the present study. Due to a possible increase in the involvement of tribal and state programs designed to encourage healthy maternal behaviors and increase knowledge about and access to prenatal care, especially for disadvantaged and resource-poor women, risky maternal health behaviors will have declined over time. However, there are other considerations that must be taken into account, including the current state of the economy—and the increased lack of access to health care for the working poor. Because there is a high probability that the women represented in Oklahoma PRAMS data have been significantly economically affected, possibly losing their jobs, homes, or insurance, there may be more evidence of this during the *PRAMS VI* (2009-2011) survey cycle. Therefore, this may have an effect on whether or not women were involved in certain risky health behaviors while pregnant, including visiting the physician for proper prenatal care and taking the recommended prenatal multivitamins.

CHAPTER FOUR:

DATA ANALYSIS AND METHODOLOGY

I. *Description of the Data*

This study utilizes data from the Oklahoma State Department of Health "*PRAMS V* and *PRAMS VI*," or the Pregnancy Risk Assessment Monitoring System (PRAMS) for the years 2004-2011. PRAMS was developed by the Centers for Disease Control and Prevention (CDC) in 1987 as an ongoing state-based data system aimed at recording maternal behaviors and experiences before, during, and after pregnancy, as well as variety of sociodemographic and programmatic variables intended to aid in the examination of behavioral information. Gilbert, Shulman, Fischer, and Rogers (1999) explain the impetus for the establishment of PRAMS:

> The surveillance system [PRAMS] was developed after some key observations in the mid-1980s: the U.S. infant mortality rate was no longer declining as rapidly as it had in previous years; the prevalence of low birthweight was showing little change; maternal behaviors such as smoking, drug and alcohol use, and limited use of prenatal and pediatric care were contributing to the slow rate of decline; and the primary sources of population-based data on births and birth outcomes were birth and death certificates, which contained minimal information on maternal behaviors or on use of maternal and child health (MCH) program services (199-200).

PRAMS is intended to produce state-specific maternal health data and to supplement information garnered from vital records that can be utilized in comparisons of maternal behaviors and well-being between and among participating states (Gilbert et al. 1999; Rogers, Ahluwalia, and Melvin 1998). The population from which PRAMS draws their samples includes all mothers who gave birth to a live infant in the particular geographic area (within the specific state) during the study cycle. Mothers who gave birth

outside of their state of residence are excluded, as are infants known to be adopted. If a multiple gestation case is chosen, only one infant is randomly selected for inclusion in the study sample. Women who had induced abortion, whose fetus died, or whose infant was stillborn are not included, but mothers of infants who died are included in the study sample. Mothers are sampled and initially contacted during the postnatal period of about two and six months in order to ensure the necessary information regarding maternal behavioral health during pregnancy and the child's health during early infancy can be recalled to the best of their ability.

Since the establishment of PRAMS in 1987, the number of states and areas that participate has increased to 38 and includes the states/areas of Alabama, Alaska, Arkansas, Colorado, Delaware, Florida, Georgia, Hawaii, Illinois, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York, New York City, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming. States or areas that have previously participated in PRAMS include California, the District of Columbia, Indiana, Montana, North Dakota, and the Aberdeen Tribal area in South Dakota (CDC 2011c).

Oklahoma PRAMS (OPRAMS) is a population-based survey of women who have had a recent delivery in the state of Oklahoma. A systematic sampling approach is used to randomly select approximately 200 new mothers each month from the state's live birth registry (Oklahoma State Department of Health 1995a). The data collected is based on the responses of three mailed questionnaires that are sent between two and six months post-delivery. The OPRAMS office makes at least four attempts to contact potential

survey respondents via mail. Telephone interviews are attempted for non-respondents. Telephone contact with potential respondents is attempted over the course of approximately two to three weeks. Up to 15 attempts are made to contact mothers via telephone to each number on file. Call attempts are interspersed throughout the day and made on various days of the week in order to increase the chance of making telephone contact with a potential respondent. OPRAMS telephone interviewers frequently reschedule a more appropriate time to administer telephone interviews to better accommodate mothers' schedules (Gilbert et al. 1999).

Telephone interviews and reminders are crucial to getting phone response to meet the CDC's mandated response rate (Gilbert et al. 1999). The PRAMS protocol specifies that officially published data must meet or exceed minimum weighted response rates of 70% for years prior to 2007 and 65% thereafter (CDC 2014). While the PRAMS response rate was historically high, response rates have been declining of late and without phone interviews, the Oklahoma State Department of Health would not meet thresholds considered necessary by the CDC to analyze weighted data. Also many mail survey questionnaires are sent in after the phone phase begins, since mothers are called to remind them to complete the survey over the phone or to mail in the paper copy. Responses from women who complete the questionnaire by either mail or phone are combined and then weighted to be representative of all mothers who had a live-born infant in the state.

Although the response rate to the OPRAMS surveys is still rather high (an overall response rate of 72.2% was recorded for the *PRAMS V* survey cycle), there is an effort to increase the response rate among women in certain high-risk groups (Gilbert et al. 1999),

particularly Native American respondents (Kim et al. 2008; Rochat 2008). According to Kim et al. (2008), "although contact rates among AI [American Indian] mothers were low when compared to whites, both AI and Non-Hispanic White [NHW] mothers who were successfully contacted had high participation rates" (124). In many states, increased attention toward and staff support for the telephone phase of PRAMS data collection has been implemented in order to improve response rates among all women in high-risk groups (Gilbert et al. 1999). It is expected that state or regional-specific collaboration among tribal, state, and local entities may facilitate greater participation in and improved response rate to PRAMS questionnaires particularly among Native American populations.

The PRAMS survey questionnaire consists of two sections – core questions that are included in the surveys of all participating states and additional questions that can either be selected from a list of standardized questions developed by the CDC or by the individual states (CDC 2011c; Gilbert et al. 1999). Therefore, each participating PRAMS state has the ability to design their own survey questionnaire that meets the current needs of their specific state. The core section that is incorporated in the survey questionnaires of all participating states includes questions concerning the following topics:

- Attitudes and feelings about the most recent pregnancy,
- Content and source of prenatal care,
- Maternal alcohol and tobacco consumption,
- Physical abuse before and during pregnancy,
- Pregnancy-related morbidity,
- Infant health care,

- Contraceptive use, and
- Mother's knowledge of pregnancy-related health issues, such as the adverse effects of tobacco and alcohol; benefits of folic acid; and risks of HIV (CDC 2011c).

Gilbert et al. (1999) evaluated PRAMS methodology, especially concentrating on if recent changes to the questionnaire have enhanced efficiency or flexibility. The authors examine sampling and stratification techniques, data collection, questionnaire format, and data management and weighting. Response rates, contact rates, cooperation rates, refusal rates, and questionnaire completion rates were used as measures of effectiveness of the PRAMS survey. The eleven states that used the mail and telephone methodology to collect data in 1996, including Alabama, Alaska, Florida, Georgia, Maine, Michigan, New York, Oklahoma, South Carolina, Washington, and West Virginia, were evaluated in this study.

PRAMS data collection for a monthly sample of women typically lasts between two and three months. As described above, mothers are first mailed a series of packets, and then phone contact is attempted. According to James and Bolstein (1990), the PRAMS strategy of combining Dillman's Total Design Method (TDM) (Dillman 1978) – a practical and cost-efficient data collection design that makes numerous and varied contacts to potential respondents – and monetary incentives is one of the most effective approaches to increasing response rates among new mothers (Gilbert et al. 1999). In addition to monetary incentives for participation in the PRAMS survey questionnaire, the incentive provided to potential respondents of the 1996 OPRAMS included a baby bib. Mothers that participated in the 1996 OPRAMS survey questionnaire were given a

growth chart to track their newborn's physical development. Mothers whose babies had died were sent a sachet by the OPRAMS office (Gilbert et al. 1999). Originally designed as an incentive and reward program for the mothers of children that have died in order to boost response rates among this population, OPRAMS has recently began to gift such items as bibs, gift stationary, magnets, and cloth books to all participating respondents (CDC 2011a).

The PRAMS questionnaire format has changed several times since the 1987 inception of the data collection system. Each questionnaire has been developed with the help of numerous health research professionals at the CDC and each PRAMS state to respond to current issues of concern. For example, the 1996 survey questionnaire added core questions regarding infant sleep position in response to recent evidence that suggested the risk of SIDS was decreased when sleeping infants were placed on their backs (Gilbert et al. 1999). The 2000 survey questionnaire added questions regarding compliance with well-baby checkups, weight gain during pregnancy, and knowledge of folic acid benefits, emergency contraception, and sexually transmitted diseases, including HIV. For each PRAMS phase, new questions have been developed or established questions revised in order to address emerging public health concerns, for either all participating PRAMS states or issues concerning only individual states.

Response rate is defined as the successful contact with and the cooperation and participation in the PRAMS survey questionnaire by the respondent, including both the mail and telephone data collection methods. The overall response rates in 1996 for the 11 states included in the study by Gilbert et al. (1999) that used the mail and telephone methodology ranged from 66% to 80%, with 10 of the 11 states achieving a response rate

of 70% or more. The first mailed PRAMS questionnaire accrued the greatest response rate, with fewer respondents participating in each successive mail contact attempt. Telephone contact increased response rates in all states; the increase in response rate due to the telephone phase ranged from three percent to 22% in the 11 states examined in this study, which according to the authors, is consistent with other studies that have used a mixed-mode methodology (Brambilla and McKinlay 1987; Gilbert et al. 1999; Dillman 1978; Fiset, Milgrom, and Tarnai 1994; Sutherland, Beaton, Mazer, Kriukov, and Boyd 1996). The substantial variation in telephone response rate across states may be explained in part by the varying methods states have employed to garner additional survey questionnaire responses via telephone. Some states have increased the number of call attempts to make contact with potential respondents, the number of sources used to procure multiple telephone numbers of respondents, the number of staff available to carry out telephone interviews, employed professional telephone interviewers, or established affiliations with other telephone survey groups in order to share resources, namely interviewer staff (Gilbert et al. 1999).

Because researchers that use PRAMS data are frequently interested in comparing the prevalence of certain maternal health behaviors and birth outcomes among high-risk subpopulations within states, including women of certain minority groups, those considered to have low socioeconomic status, and young maternal age, PRAMS samples are stratified (Gilbert et al. 1999). Subpopulations represented in the high-risk strata are often oversampled by PRAMS states in order to fulfill the comparative research needs of certain public health interests fundamental to understanding maternal health disparities within individual states. The characteristics of women that are most likely to respond to

the PRAMS survey have been consistent across states. PRAMS response rates are highest among first-time mothers, married women, white women, women with at least a high school education, and women delivering a normal-birthweight infant (Gilbert et al. 1999).

With the intention of resolving this disparity among survey respondents, the OPRAMS, as previously discussed, have oversampled among women in certain high-risk subgroups, including African American and Native American women, and weighted the data in order for it to be generalizable to the entire population of the state of Oklahoma. Overall response rates were 72.2% for the 2004-2008 (*PRAMS V*) survey cycle year (Oklahoma State Department of Health 2014a), and 68.3% for the 2009-2011 (*PRAMS VI*) survey cycle (Oklahoma State Department of Health 2014b), both meeting the requirements set by the CDC for analyzing weighted data (CDC 2014). Due to high response rates to the PRAMS survey questionnaire, the efficiency of PRAMS and the CDC in having data available annually for interested researchers, and the flexibility in questionnaire format, theme, and methods of data collection, PRAMS can be considered a unique, valuable, and easily accessible source of maternal health data that is unlike other maternal and child health data sources. However, more effort must be made to reach non-respondents, which most often include women from high-risk subgroups. High-risk subgroups most often include very young, low-income, uneducated, and minority women, women from whom we need more information regarding their health during and after pregnancy in order to improve the maternal health and well-being of all mothers.

PRAMS data have informed state policies and programs regarding unintended pregnancy in at least three states, including Georgia, Oklahoma, and Washington (Melvin

et al. 2000). In most states, PRAMS data serves as the only source of state-specific, population-based data on the pervasiveness of unintended pregnancy, which makes PRAMS particularly valuable to programs aimed at the prevention of unintended pregnancy. All three states mentioned above identified unintended pregnancy as a priority public health concern and have used the research findings from PRAMS to inform health policies and amend health programs charged with monitoring or decreasing the pervasiveness of unintended pregnancy or to procure additional funds for allied programs, including family planning programs (Melvin et al. 2000; Rogers et al. 1998).

Because unintended pregnancy, measured by pregnancy mistiming or unwantedness, was especially high in Oklahoma at 50%, the state has created a series of slideshows featuring PRAMS data and findings that can be presented to a wide range of audiences in an effort to educate the public regarding the prevalence of unintended pregnancy, especially among teenage mothers, Medicaid recipients, and those without at least a high school education. Unintended pregnancy was also significantly higher among African American women compared to white women (Melvin et al. 2000). The Oklahoma State Department of Health have used OPRAMS data to issue policy statements to the Oklahoma state legislature that have increased funding for the expansion of family planning services and have increased an awareness of and community-based mobilization regarding access to prenatal care, contraception and reproductive health, and pregnancy testing (Melvin et al. 2000; Rogers et al. 1998). Because PRAMS includes a variety of measures of overall maternal health and well-being, the potential to inform public policy regarding the health of pregnant women goes beyond pregnancy unintendedness. Increasing prenatal care utilization, the prevention of

birth defects, or educating pregnant women on the importance of healthy eating habits are just a few examples of the headway that can be made on a state-level by utilizing PRAMS data.

II. *Previous Utilization of PRAMS Data*

PRAMS data have been utilized for a variety of research projects by both the CDC and individual PRAMS offices, as well as for a number of studies conducted by outside researchers. The CDC circulates *Morbidity and Mortality Weekly Reports (MMWR),* which provides public health information and recommendations for healthy living. The *MMWR* often report findings from PRAMS data analysis from several states that participate in PRAMS data collection, including Oklahoma. The CDC is in a position to inform public health policies throughout the nation by utilizing these state-level PRAMS data. In addition, The Oklahoma State Department of Health also periodically circulates *PRAMS-GRAMS* or the more recently named *PRAMS Briefs*, studies that use OPRAMS data to exclusively focus on a specific issue of importance to the health and well-being of women and infants of the state, such as access to prenatal care, alcohol use, tobacco use, poverty, physical abuse, birthweight, breastfeeding, postpartum depression, and issues related to race/ethnicity, among many other themes. *PRAMS-GRAMS* are mainly sent to healthcare providers and individuals in the research community. OPRAMS has twice focused on perinatal health disparities among Native American mothers in the state, once in 1994 (Oklahoma State Department of Health 1994) and again in 2007 (Oklahoma State Department of Health 2007). The 1994 and 2007 *PRAMS-GRAM* reports, because they analyze OPRAMS data, focus on a sample of Native American

women, and include three of the four behavioral variables that are examined in the current study (including tobacco use, alcohol use, and prenatal care utilization), are particularly noteworthy to discuss here.

The 1994 *PRAMS-GRAM*, entitled "A Comparison of Prenatal Characteristics between Native American and White Women in Oklahoma," draws on data collected by OPRAMS between April 1988 and March 1993. Only women that indicated their race/ethnicity as either Native American or white were included in this analysis. Measures of the maternal, demographic, socioeconomic, and behavioral characteristics of the women in the sample, including income; type of residence (urban/rural); education; age; marital status; confirmation of pregnancy (trimester); pregnancy intendedness; prevalence of physical violence; and utilization of/barriers to prenatal care are analyzed in order to evaluate the maternal health disparities between Native American and white women in the state of Oklahoma. 1,078 Native American and 8,644 white women that gave birth in the state of Oklahoma were sampled. 65.7% of those Native American women sampled and 75.7% of the white women sampled responded to either the mail or telephone OPRAMS survey questionnaire (Oklahoma State Department of Health 1994).

Approximately one-half of Native American women giving birth in Oklahoma between April 1988 and March 1993 earned incomes at or below the Federal Poverty Level, compared to 28.5% of white women. Three-quarters of Native American women in Oklahoma resided in rural areas with a population of less than 10,000 during the study's time frame. Nearly a quarter of Native American women had not yet earned a high school education and were about half as likely to earn a college education when compared to white women (10.1% and 20.4, respectively). At a rate of 1.5 times higher

than that among white women, nearly 19.8% (about one in five) of Native American births were to mothers younger than twenty. Native American women are also less likely than white women to be married at the time of conception (56.8% and 72.8, respectively). It must be recognized when considering these statistics that Native American women, as well as other minorities including African American, Native Hawaiian, and Hispanic women, tend to begin childbearing at an earlier age that white women (CDC 1993; Oklahoma State Department of Health 1994; Rutman et al. 2008) which would explain both the young age and low level of education, as well as the marital status, apparent among Native American women. In fact, Native American teenage mothers numbered twice that of white teenage mothers in 1990 (CDC 1993). Although the teen birthrate has declined since the early nineties, teenage pregnancy in the United States, particularly among minority women and among women living in southern states (including Oklahoma), continues to be as much as nine times higher than in other developed nations (CDC 2011b). Children born to teenage mothers are at a greater risk for low birthweight, preterm birth, and death in infancy (CDC 2011b; Martin et al. 2010; Matthews and MacDorman 2010). According to the CDC (2011b:414), "teen childbearing also perpetuates a cycle of disadvantage; teen mothers are less likely to finish high school, and their children are more likely to have low school achievement, drop out of high school, and give birth themselves as teens" (Manlove, Terry-Humen, Mincieli, and Moore 2008; Perper, Peterson, and Manlove 2010). The association among teenage pregnancy, low socioeconomic status, and complications surrounding labor and delivery should not be ignored. "Teenage mothers are overwhelmingly concentrated below the poverty line, both before and after their pregnancies, and poverty often plays a crucial role in a young

woman's chances of becoming pregnant and bringing a baby to term" (Conley et al. 2003:78). Young childbearing age may also be correlated with a relative lack of knowledge regarding proper maternal health, including prenatal care utilization, multivitamin use, tobacco or alcohol use, and understanding the pregnancy risks associated with certain preexisting health conditions.

The Oklahoma State Department of Health (1994) found that Native American women were less likely than white women to acquire a confirmation of pregnancy from a medical professional during the first trimester of pregnancy (88.7% and 94.3%, respectively). Furthermore, a higher frequency of pregnancy unintendedness was identified among Native American women (50.4%) when compared to white women (41.5%). Though Native American women were less likely than white women to drink alcohol while pregnant (5.7% and 8.4%, respectively), incidents of physical violence in the home during the 12 months prior to delivery were experienced far more often among Native American women (19.6%) compared to white women (8.4%).

According to the Oklahoma State Department of Health (2007), early prenatal care utilization is less often reported among Native American women (74.2%) than among white women (83.7%). Early prenatal care is defined as receiving the first prenatal care visit within the first trimester, or within the first three months of pregnancy. Adequate prenatal care is defined as pregnancy-related care by a physician that encompasses both first trimester care and having received the appropriate amount of prenatal care visits (Oklahoma State Department of Health 2007; U.S. Department of Health and Human Services 2000). Native American respondents were 1.3 times more likely than white respondents to report that they did not visit a physician for prenatal care

as early as they had desired. In order to explore potential explanations, the authors investigate the barriers to prenatal care that Native American women most often experience. This study revealed that Native American women most often report (in order of frequency) the following barriers to prenatal care: (1) inability to get an appointment; (2) late recognition of pregnancy; (3) lack of transportation; (4) lack of child care; and (5) not knowing where to go for care. Late pregnancy recognition, lack of transportation, and lack of child care were reported more often among Native American women than among white women when inquiring about why proper prenatal care was delayed. Maternal age, level of education, socioeconomic status, and rural residence undoubtedly have an effect on access to prenatal care.

Reiterating the appeals of numerous maternal health researchers focusing on the significant racial and ethnic disparities in health and well-being, the Oklahoma State Department of Health (1994) calls for "family planning and maternity services [that] provide opportunities for interventions aimed at reducing factors of particular risk for Native American women" (4). The implementation of maternal health services that take into consideration the often unique needs of women from high-risk subpopulations are necessary, as is gathering data concerning the overall maternal health and wellbeing of women from diverse backgrounds, if the health of these mothers and infants are to be improved.

The 2007 *PRAMS-GRAM* that focused on the maternal health of Native Americans, entitled "Native American Perinatal Health Disparities," examines OPRAMS data collected by the Oklahoma State Department of Health between the years 2000 through 2005 and is used to measure any change in the maternal health among Native

American women in Oklahoma from the 1994 *PRAMS-GRAM* report. Like the 1994 study, only women that indicated their race/ethnicity as either Native American or white were included in this analysis. 1,544 Native American women and 11,029 white women that gave birth in the state of Oklahoma were sampled. 73.2% of those Native American women sampled and 80.4% of the white women sampled responded to either the mail or telephone OPRAMS survey questionnaire (Oklahoma State Department of Health 2007).

The 2007 report found that Native American women were just as likely to confirm their pregnancy in the first trimester (95.7%) as white women (97.0%), an improvement from the 1994 report. Native American women were again just as likely as white women to receive first trimester prenatal care (76.7% and 78.8%, respectively), another improvement from the 1994 report. However, a substantial number of both Native American and white women reported obtaining prenatal care as early as they wanted (46% of Native American and 40.7% of white women), though many did not actually receive care until the second or third trimester. This finding suggests that the lack of education regarding proper maternal care and the importance of receiving prenatal care early in the pregnancy is prevalent among many Oklahoma women regardless of race or ethnicity. Interestingly, for those Native American mothers reporting that they had not received prenatal care as early as they had desired, the primary reason for not visiting a physician was because they were unaware they were pregnant, a barrier not reported by most women responding to the 1994 *PRAMS-GRAM* survey questionnaire.

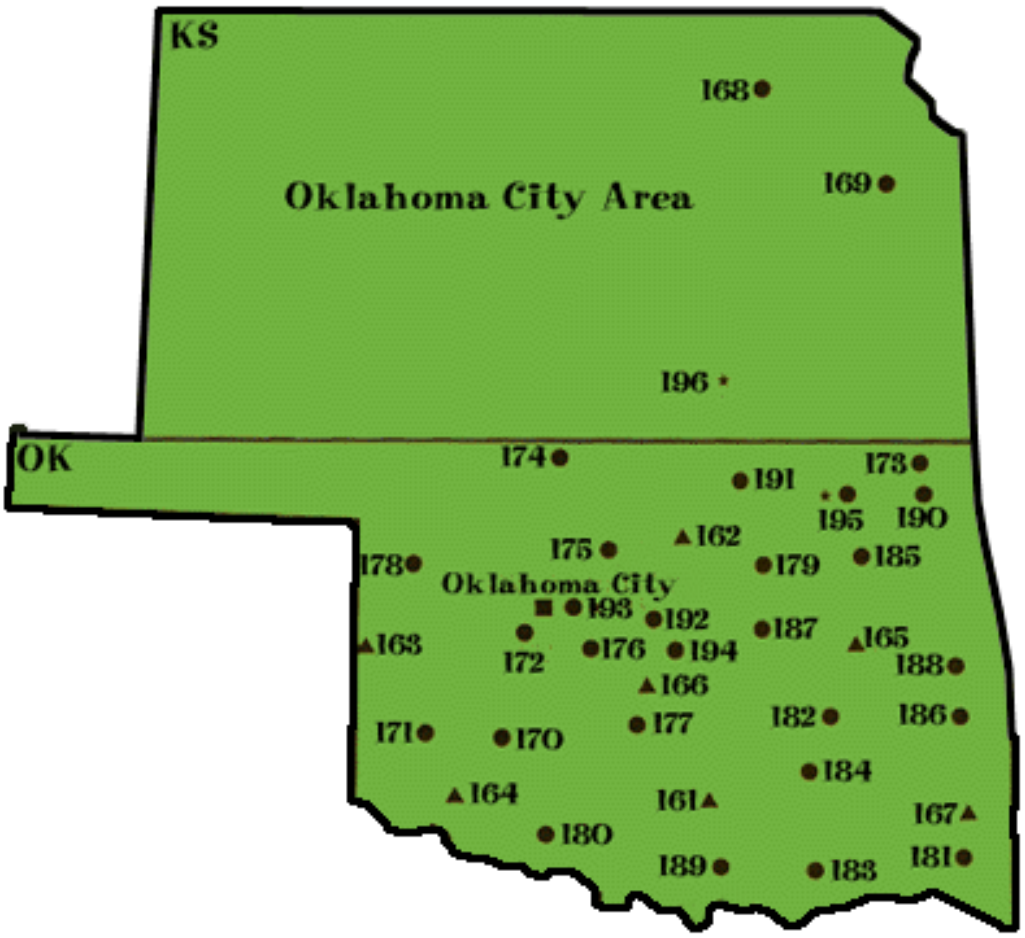
The CDC, through their Behavioral Risk Factor Surveillance System (BRFSS) (2000-2005), has documented relatively high tobacco use rates among Native American women in Oklahoma (32.8% for Native Americans vs. 24% for whites) (CDC 2011b).

Supporting the CDC's findings, more Native American women included in the more recent *PRAMS-GRAM* report smoked before pregnancy compared to white women (38.7% and 31.8%, respectively); however, Native American women were more likely than white women to quit during pregnancy (Oklahoma State Department of Health 2007). Tobacco use was not included in the 1994 *PRAMS-GRAM* report, so a comparison cannot be made. Native American women in Oklahoma were more likely to have their first baby before the age of 18 compared to white women (24.5% and 14.3%, respectively) (Oklahoma State Department of Health 2007). This disparity has increased by 2.2% compared to the 1994 report, meaning Native American mothers are even more likely than in 1994 to give birth prior to turning 18 when compared to white mothers. This finding is consistent with previous studies that have found Oklahoma to be among the five states, also including Arkansas, Mississippi, New Mexico, and Texas, with the highest teenage birth rates (CDC 2011b).

It should be noted here that 46.4% of Native American women stated in the 2007 report that they received prenatal care services through the IHS, while nearly 63% received IHS care in 1994. The significant change over time could be attributed to a number of explanations. Only 33 of Oklahoma's 77 counties operate an IHS clinic or hospital, though a substantial number of citizens in each county are Native American. Therefore, for a number of Oklahoma women seeking prenatal care at an IHS facility, transportation cost or time may very well be an issue. Without an IHS facility nearby, many Native American women are forced to find prenatal care from public hospitals, private medical doctors, or county health departments, many of which are have been deemed by patients at culturally incompatible or not culturally safe (Browne and Fiske

2001; Walters and Simoni 2002). Some women may also opt to seek prenatal care elsewhere due to the type or quality of care offered at available healthcare centers.

FIGURE 4.1. OKLAHOMA CITY AREA INDIAN HEALTH SERVICE FACILITIES



SOURCE: WWW.IHS.GOV

▲ HOSPITALS

161. Ada, OK

162. Claremore, OK

163. Clinton, OK

● HEALTH CENTERS

168. Holton, KS

169. Lawrence, KS

170. Anadarko, OK

★ URBAN PROGRAMS

193. Oklahoma City, OK

195. Tulsa, OK

164. Lawton, OK

165. Tahlequah, OK

166. Okemah, OK

167. Talihina, OK

171. Carnegie, OK

172. El Reno, OK

173. Miami, OK

174. Pawhuska, OK

175. Pawnee, OK

176. Shawnee, OK

177. Wewoka, OK

178. Watonga, OK

179. Ponca City, OK

180. Ardmore, OK

181. Broken Bow, OK

182. Eufaula, OK

183. Hugo, OK

184. McAlester, OK

185. Salina, OK

186. Sallisaw, OK

187. Sapulpa, OK

188. Stilwell, OK

189. Tishomingo, OK

190. Jay, OK

191. Nowata, OK

192. Okemah, OK

193. Oklahoma City, OK

194. Stroud, OK

195. Tulsa, OK

196. Wichita, KS

197. Dallas, TX

Figure 4.1 illustrates the location of Oklahoma City area Indian Health Service Facilities, including hospitals, health centers, and urban programs. The Oklahoma City Area serves Native American populations living in the states of Kansas, Oklahoma, and portions of Texas. Though the Oklahoma City Area hospitals deliver over 2,700 babies a year (IHS 2015), not all of the IHS healthcare facilities are equipped to deliver infants. Therefore, these locations must contract services with local healthcare facilities, such as county hospitals, for instance.

The 1994 OPRAMS report found that Native American women are less likely than white women to drink alcohol while pregnant, but more likely to receive late or no prenatal care. Both of these findings parallel the hypotheses of the present study. However, data analysis results from the 2007 OPRAMS and the CDC BRFSS reports both show higher rates of smoking during pregnancy among Native Americans compared to whites, a finding that does not support the hypotheses of the present study. It will be interesting to compare the results of the current study in order to see if smoking rates have continued to remain high among the Native American population in Oklahoma.

The Oklahoma State Department of Health has focused on the maternal health and wellness of African Americans in the state of Oklahoma three times by utilizing OPRAMS data, including two reports that are applicable to the present study. The Summer 2008 *PRAMS-GRAM* report (Oklahoma State Department of Health 2008) entitled "African American Perinatal Health Disparities" concentrated on the maternal, demographic, socioeconomic, and behavioral characteristics of African American women compared to white women. The Spring 2009 *PRAMS-GRAM* report (Oklahoma State Department of Health 2009) entitled "Stressors, Social Support, and Pregnancy Outcomes

Among African American and White Mothers" highlighted the impact stress can have on maternal health, echoed by more current research (Lu et al. 2010). Only women that indicated their race/ethnicity as either African American or white were included in both analyses. Racial disparities between African American and white mothers do not completely mirror those between Native Americans and whites, but are equally crucial to the understanding of maternal health inequalities according to race and ethnicity.

Though most women included in the 2008 report were between the ages of 20 and 29, regardless of race or ethnicity, African American mothers were significantly more likely than whites to give birth as a teenager (21.1% and 11.5%, respectively) and have an unintended pregnancy. It seems that teenage pregnancy is a chief issue of concern among both Native Americans and African Americans. There were also statistically significant racial disparities regarding educational achievement. "Among women over 22 years of age, a significantly higher percentage of white women had graduated college than their African American counterparts (26.8% vs. 16%)" (Oklahoma State Department of Health 2008). Among women over the age of 18, a higher percentage of African American women had not graduated high school when compared to white women (59.5% and 55%, respectively). The educational findings regarding African Americans reported in the 2008 *PRAMS-GRAM* are comparable to the educational achievement and attainment rates among Native Americans when compared to whites. Educational achievement among pregnant women certainly influences their exposure to and knowledge and understanding of proper maternal health and well-being, including adequate prenatal care. Educational achievement for certain minority women, in general, is systematically lower than among white women, and general education and maternal

education is predictably correlated. Furthermore, educational achievement and attainment is inextricably linked to annual earnings; therefore, it is reasonable to expect that an inadequate knowledge of prenatal health and insufficient financial resources to access prenatal care, especially early on in the pregnancy, is more likely to be found among minority women.

Despite these reasonable expectations and the fact that the CDC's 2005 National Vital Statistics Reports reported a significant racial disparity between African Americans and whites regarding early prenatal care utilization (76.5% for African Americans and 88.9% of whites), as well as prenatal care utilization at any time during pregnancy (5.6% of African Americans received late or no prenatal care, compared to 2.2% of whites) (Martin et al. 2007), the Oklahoma State Department of Health in the 2008 *PRAMS-GRAM* report found that African American women were just as likely as whites to receive adequate levels of prenatal care. However, African American mothers were less likely than whites to receive prenatal care as early in their pregnancy as they would have liked (69.3% and 79.7%, respectively), most often citing the inability to get an appointment when desired as the barrier to early prenatal care, which was also the barrier identified most often among native American mothers.

African American women were significantly less likely than white women to smoke cigarettes or drink alcohol while pregnant, an OPRAMS finding that has remained the same since 1996. However, what has alarmed the CDC and the Oklahoma State Department of Health is that the gap between African American and white mothers regarding tobacco use during pregnancy has narrowed in the decade between 1996 and 2006. This means that although African American mothers are still less likely than white

mothers to smoke while pregnant, rates of tobacco use are on the rise among pregnant African American women. The 2009 *PRAMS GRAM* associated high levels of stress among African Americans with increased likelihood of maternal smoking and drinking. Stressors that were more common among African American mothers than for white mothers included homelessness, job loss, arguments with their partners, and/or having their partner or themselves spend time in jail (Oklahoma State Department of Health 2009). Tobacco use is a well-known risk factor for low birthweight (Aliyu et al. 2011b; Conley et al. 2003; Hellerstedt et al. 1997; Meis et al. 1997; Oklahoma State Department of Health 1997, 2006, 2008, 2009; Pollack et al. 2000; Salihu et al. 2003; Suellentrop et al. 2006; Wang et al. 1997), and low birthweight is already a substantial concern for African American women, even among those who do not smoke. The documented increase of tobacco use among a population already at risk for low birthweight is a frightening discovery because not only is tobacco use during pregnancy linked to low birthweight, but also to preterm birth (Berkowitz and Papiernik 1993; Cnattingius, Granath, Peterson, and Harlow 1999; Pollack et al. 2000); premature rupture of membranes (Ananth et al. 2004; Hadley, Main, and Gabbe 1990; Kyrklund-Blomberg and Cnattingius 1998); placental abruption (Ananth et al. 1999; Cnattingius, Mills, Yuen, Eriksson, and Salonen 1997; Meyer and Tonascia 1976; Naeye 1980; Oklahoma State Department of Health 2009); placenta previa (Aliyu et al. 2011b; Meyer and Tonascia 1976; Monica and Lilja 1995; Naeye 1980; Oklahoma State Department of Health 2009; Williams et al. 1991); preeclampsia (Aliyu et al. 2011b; Engel, Janevic, Stein, and Savitz 2008); ectopic pregnancy (Roelands, Jamison, Lyerly, and James 2009); infant mortality (Salihu et al. 2003; Wisborg, Kesmodel, Henriksen, Olsen, and Secher 2001); sudden

infant death syndrome (Blair et al. 1996; Hoo, Henschen, Dezateux, Costeloe, and Stocks 1998; Lavezzi et al. 2010; Tuthill, Stewart, Coles, Andrews, and Cartlidge 1999), as well as hypertension and congenital birth defects (Oklahoma State Department of Health 2009).

In response to the findings illustrated by the Summer 2008 *PRAMS GRAM* focusing on African American health disparities, the Oklahoma State Department of Health has recommended that African American mothers be targeted for tobacco cessation programs in order to circumvent the many adverse pregnancy outcomes associated with tobacco use during pregnancy. Similar programs have been created to address tobacco use among Native American women, including the pan-tribal smoking cessation programs established by the University of Kansas Medical Center (KUMC), the Oklahoma Area IHS, and the Muscogee Nation of Oklahoma (Daley et al. 2006). In addition, continued research should be conducted that addresses the racial disparities in maternal health, particularly focusing on racial and ethnic minority stressors, poverty, and discrimination. Moreover, culturally-sensitive and appropriate evidence-based preconception care tools, media messages, health practices, and programs should be designed specifically for African American and Native American women in order to take into account the often unique experiences of minority women.

III. *The Current Study*

This study consists of a secondary analysis of a set of existing OPRAMS data collected by the Oklahoma State Department of Health on high-risk maternal behavior during the period 2004-2011, a seven year interval. The study examines high-risk

maternal behaviors among a sample of Native American, African-American, and white women living in the state of Oklahoma. The study builds on previous research that utilizes OPRAMS data by including three racial/ethnic groups: Whites, African Americans, and Native Americans, rather than just comparing two. Focusing on how race and socioeconomic status impact labor and delivery outcomes, the current study also considers four maternal risk behaviors and their impact on maternal and infant outcomes:

- smoking cigarettes,
- drinking alcohol,
- failing to take multivitamins or prenatal vitamins, and/or
- failing to visit a physician for prenatal care.

High-risk health behaviors such as these can lead to detrimental health problems for the child, which are measured in the current study as placental issues (*PLAC*), premature rupture of membranes (*PROM*), low birth weight (*LBW*), and child placement in an intensive care unit (*ICU*) for additional supervision and care immediately after birth. Adverse health conditions of the mother occurring during pregnancy, including diabetes (*DIAB*) and high blood pressure/hypertension (*HBP*), are also taken into account. Health problems such as these can have detrimental effects on the health of the child. Therefore, these variables will also be measured in order to examine the effect they have on pregnancy outcomes when high-risk maternal health behaviors are avoided.

OPRAMS data provides an adequate sample of Native American respondents, one that meets issues of sample size and low response rates raised by Dalla and Gamble (1997), Eriksen (1997), Kim et al. (2008), Rochat (2008), and Ronsaville and Hakim

(2000), as well as the selected variables for this study. Using these previously-collected data, the present study will examine how low socioeconomic status and increased social disadvantages, measured by income and education levels as controlled by race and ethnicity, is related to risky and unhealthy behaviors while pregnant, a pattern of behavior which can lead to labor and delivery complications and problematic health conditions for the mother and newborn child.

A. *Independent Variables: Race/Ethnicity & the Sociodemographic Variables*

The data analysis measures and compares the following variables: sociodemographic data that include age (1=<20; 2=20-=29; 3=>30; treated as a continuous variable), marital status (0=not married and 1=married), education (1=< High School, 2=HS Graduate, 3=>High School; treated as a continuous variable), income (1=< $10,000, 2=$10,000-14,999, 3=$15,000-19,999, 4=$20,000-24,999, 5=$25,000-34,999, 6=$35,000-49,999, 7=$50,000 or more; treated as a continuous variable), and race/ethnicity (1=white, 2=African American, 3=Native American, 4=Other). Race was recoded into two dummy variables (Black and Native). Black is coded as African American=1 and Others=0. Native is coded as Native American=1 and Others=0. The income variable comes from the OPRAMS survey questionnaires, while the race/ethnicity, age, education, and marital status variables comes from birth certificate data, which was added to the OPRAMS data by the Oklahoma State Department of Health.

The race or ethnicity of infants is most likely reported on the birth certificate to correspond with the mother's race or ethnicity (Waters 2002). Native American mothers

included in this analysis come from one or more of several tribal nations and communities in Oklahoma. Most likely the respondent mothers are of mixed ancestry, possibly including one or more Native American tribes, along with another race or ethnicity (U.S. Census Bureau 2012; National Congress of American Indians [NCAI] 2015), but self-report "Native American" as their racial category.

Within the state of Oklahoma, there are 38 federally-recognized tribes and one state-recognized tribe, including the following tribes and tribal communities: Absentee-Shawnee Tribe of Indians, Alabama-Quassarte Tribal Town, Apache Tribe, Caddo Nation of Oklahoma, Cherokee Nation, Cheyenne-Arapaho Tribes of Oklahoma, Chickasaw Nation, Choctaw Nation of Oklahoma, Citizen Potawatomi Nation, Comanche Nation, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, Euchee (Yuchi) Tribe of Indians, Fort Sill Apache Tribe of Oklahoma, Iowa Tribe of Oklahoma, Kaw Nation, Kialegee Tribal Town, Kickapoo Tribe of Oklahoma, Kiowa Indian Tribe of Oklahoma, Miami Tribe of Oklahoma, Modoc Tribe of Oklahoma, Muscogee (Creek) Nation, Osage Tribe, Ottawa Tribe of Oklahoma, Otoe-Missouria Tribe of Indians, Pawnee Nation of Oklahoma, Peoria Tribe of Indians of Oklahoma, Ponca Tribe of Indians of Oklahoma, Quapaw Tribe of Indians, Sac and Fox Nation, Seminole Nation of Oklahoma, Seneca-Cayuga Tribe of Oklahoma, Shawnee Tribe, Thlopthlocco Tribal Town, Tonkawa Tribe of Indians of Oklahoma, United Keetoowah Band of Cherokee Indians in Oklahoma, Wichita and Affiliated Tribes (Wichita, Keechi, Waco and Tawakonie), and Wyandotte Nation (National Conference of State Legislatures 2015).

The 39 tribal nations and communities listed above only represent those tribes that are located in the state of Oklahoma. Therefore, respondents to the OPRAMS survey questionnaire, if racially self-classified as "Native American," may be a member of Native American tribe(s) or nation(s) located in Oklahoma, a member of Native American tribe(s) or nation(s) located in another state but be a resident of Oklahoma, a member of Native American tribe(s) or nation(s) along with another race or ethnicity, or may consider themselves and/or their child as being Native American, but not actually meet the minimum blood-quantum or lineal descendancy requirements for membership in a specific tribe or nation.

Blood quantum is the tribal membership requirement that most contemporary tribes rely on in order to recognize or enroll tribal members. Blood quantum is customarily established by tracing one's ancestry back to a relative on an earlier tribal roll or census that recorded that relative's proportion of Native American blood. Though the blood quantum requirement for membership in a tribe or nation is often one-quarter Indian blood, requirements vary from tribe to tribe and have often changed for individual tribes over time. For example, the Comanche Nation voted to change the minimum blood quantum requirements for membership from one-quarter to one-eighth in February 2002 (Comanche Nation 2002), resulting in an increase in the tribal population, whereas the Salish-Kootenai constricted membership to one-quarter in 1960 (Confederated Salish and Kootenai Tribes 1960). Many tribes do not require a minimum blood quantum, including the Cherokee Nation of Oklahoma, but instead require only a documented tribal lineage (Cherokee Nation 2015). As Thornton (1997) describes, there are many different criteria

by which tribal nations and communities define membership and enroll members, which are usually set forth and outlined in tribal constitutions:

> Language, residence, cultural affiliation, recognition by a community, degree of [Native] 'blood,' genealogical lines of descent, and self-identification have all been used at some point in the past to define both the total Native American population and specific tribal populations. Of course, each measure produces a different population, and the decision about which variables to use in defining a given population is an arbitrary one (35).

Enrolled members in federally recognized tribes typically receive a membership certificate or card, called a Certificate Degree of Indian Blood (CDIB) from the Bureau of Indian Affairs (BIA) or from their specific tribal nation, which serves as documented proof of tribal membership. For an individual to be identified by the BIA as Native American, a blood quantum definition is used – commonly one-quarter Native American blood and/or tribal membership based on a different degree of Indian blood (such as one-eighth or one-half) or other criteria.

Various tribal membership requirements, the twentieth-century population recovery of Native Americans, and the potential threats that tribes may face in the twenty-first century attributable to urbanization, intermarriage, and the changing definitions of the Native American population from the United States Census and tribal enrollment data has been discussed in depth by Snipp (1997) and Thornton (1997). Though there has been some degree of stigma attached to being Native American, the:

> political mobilization of Native Americans in the 1960s and 1970s, along with other ethnic pride movements, may have removed some of the stigma attached to a Native American racial identity. This would be especially true for persons of mixed ancestry, who formerly may have declined to disclose their Native American background for this reason (Thornton 1997:34).

Therefore, Native American population growth may be due to an increase in Native American self-identification among individuals who had previously not disclosed their Native American heritage or among individuals "with only minimal Native

American background [that] may have identified themselves as Native American out of a desire to affirm a marginal ethnic identity and their 'romanticized' notion of being Native American" (Thornton 1997:34-35). Racial and ethnic self-reporting changes of individuals (Eschbach, Supple, and Snipp 1998; Horse 2005; Snipp 1997; Thornton and Sanchez 2010), as well as membership requirements of specific tribes, may have an effect on the racial and ethnic make-up of this study's sample, especially due to the fact that the race or ethnicity of infants in the study sample is reported on the birth certificate and usually coincides with the self-reported race or ethnicity of the mother.

Snipp (1989) has argued that socioeconomic measures of Native American well-being are affected by the changing definitions of Native American identity for two reasons: (1) variations in how the Native American population is identified [self-report or verified federally-recognized tribal membership]; and (2) the type(s) of individuals that are claiming Native American identification [Native race, Native ancestry, socioeconomic status, increased affluence]. Moreover, almost 60 percent of all Native Americans are married to non-Native partners (Eschbach 1995; Sandefur and McKinnell 1986; Snipp 1989, 1997; Thornton 1987; Thornton 1997). Studies have also shown that married couples often simplify their ancestries, especially among individuals with numerous racial or ethnic backgrounds, to parallel with those of their spouse (Leiberson and Waters 1988, 1993), which unquestionably affects how an infant's racial or ethnic classification is reported on the birth certificate. It is also highly probable that some individuals that identify themselves as Native American are not, in fact, enrolled members of a federally- or state-recognized tribe, but feel as though they are, possibly due to changes in the requirements for tribal membership, adoption, or participation in

tribal cultural activities. This phenomenon, however, varies from tribe to tribe and has changed over time as the social construction of race and ethnicity, particularly of Native American race and ethnicity, has changed.

Waters (2002) examined the social construction of race and ethnicity and the effect the theoretical notion of its stability and permanence has on demographic and quantitative research. Waters provides an example of how our notions of race and ethnicity is "subject to a great deal of flux and change – both intergenerationally, over the life course, and situationally" – from her own experience as an instructor of an introductory race and ethnic relations course (2002:25). A multiracial student in one of her classes, during the college admissions process, explained that she had checked multiple boxes corresponding to her multiracial and multiethnic identity in a variety of combinations and was now being pursued by an African American student organization for membership in their group, while her identical twin sister was being lobbied by a Native American student organization. It was evident to this student that she had already been assigned a racial classification by the university, while it seemed that her multiracial and multiethnic consciousness, which also included Native American, Irish, and Scottish heritages, was being disregarded or overlooked by both college administrators and some fellow students, particularly those in the student organizations. As illustrated by Waters, race is indeed a social construction, not a set biological difference between peoples. Furthermore, the racial or ethnic identity of an individual is not necessarily a reflection of their total racial or ethnic background due to the multiracial and multiethnic society in which we live.

However, it cannot be denied that although race and ethnicity is social constructed and differences cannot be biologically tested or determined, race and ethnicity is a significant factor when measuring social inequality. Moreover, racial and ethnic classification has been and continues to be a key component in sociological research, including the present study. For the purposes of this study, it is acknowledged that race and ethnicity is a socially-constructed notion and that no real biological difference exists between racial and ethnic categories, but differential treatment, power, health, socioeconomic well-being, and other social circumstances that exist due to these imagined racial and ethnic boundaries are very real in the lives of racial and ethnic minorities. The differential social status and circumstances experienced by racial and ethnic minorities when compared to whites has been shown to have an effect on overall health and well-being, including maternal health and behaviors during pregnancy.

B. *Intervening & Dependent Variables: Health, Behaviors, and Outcomes*

The behavioral variables that are measured in this analysis include smoking cigarettes/*SMOKE* (Did you smoke during the last three months of pregnancy?-[0=No, 1=Yes] dichotomous categorical variable), drinking alcohol/*DRINK* (Did you drink alcohol in the last three months of pregnancy?-[0=No, 1=Yes]- dichotomous categorical variable), prenatal care/*PNC* (When did you receive prenatal care [1=1st trimester, 2=2nd/3rd Trimesters, 3=No PNC]?-categorical variable), and multivitamin use/*MV* (Did you take multivitamins in the month before pregnancy?-[1=1-3 times per week, 2=4-6 times per week, 3=every day, 4=none]-categorical variable). Prenatal care is recoded into two dummy variables. PNC2 is coded as 1st Trimester Prenatal Care=1 and Other=0.

PNC3 is coded as 1st, 2nd, or 3rd Trimester Prenatal Care=1 and No Care=0. Multivitamin use was recoded as well. *MV* is coded as multivitamins=1 and no multivitamins=0. Each of the behavioral variables comes from the OPRAMS survey questionnaires.

The maternal health condition variables that are used in this analysis include gestational diabetes/*DIAB* and hypertension/*HBP* - (0=No, 1=Yes). The maternal health variables come from the OPRAMS survey questionnaires.

The pregnancy outcome variables that are used in this analysis include birth weight/*LBW* (1=very low birth weight [<1500g], 2=low birth weight [1500-2499g], 3=normal birth weight [2500-4999g], 4=high birth weight [5000 and over]); placental problems/*PLAC* (0=No, 1=Yes); premature rupture of membranes/*PROM* (0=No, 1=Yes); and placement in an intensive care unit after birth/*ICU* (0=No, 1=Yes). LBW is recoded as LBW=1 [very low birth weight and low birth weight] and No LBW=0 [normal birth weight and high birth weight). All outcome variables, with the exception of *LBW* which was derived from birth certificate data, come from the OPRAMS survey questionnaires. Descriptive statistics of both *PRAMS V* and *PRAMS VI* study samples can be found in Tables 4.1 and 4.2 below.

C. *Descriptive Statistics of the Study Samples*

Table 4.1. Descriptive Statistics of the Study Sample, *Oklahoma PRAMS V* (2004-2008)

	White N=9973		Black N=1775		Native N=1545	
Sociodemographic Variables	N	%	N	%	N	%
MATERNAL AGE						
<20	1301	13.0	335	18.9	266	17.0
20-29	5884	59.0	1076	60.6	977	63.0
>30	2788	28.0	364	20.5	302	20.0
MATERNAL EDUCATION						
< High School	2337	23.4	421	23.7	429	27.7
HS Graduate	3651	36.6	801	45.1	688	44.5
>High School	3985	40.0	553	31.2	428	27.8
MATERNAL INCOME						
< $10,000	1438	14.4	425	23.9	291	18.8
$10,000-14,999	806	8.1	129	7.3	123	8.0
$15,000-19,999	606	6.1	78	4.4	110	7.1
$20,000-24,999	687	6.9	69	3.9	102	6.6
$25,000-34,999	839	8.4	87	4.9	113	7.3
$35,000-49,999	847	8.5	60	3.4	107	6.9
$50,000 or more	1907	19.1	86	4.8	131	8.5
Don't know or remember	2843	28.5	841	47.4	568	36.8
MARITAL STATUS						
Yes	6271	62.9	413	23.3	698	45.2
No	3702	37.1	1362	76.7	847	54.8
Maternal Behavior Variables						
SMOKE						
No	5968	59.8	815	45.9	779	50.4
Yes	1517	15.2	185	10.4	243	15.7
Didn't Answer	2488	25.0	775	43.7	523	33.9
DRINK						
No	7104	71.2	947	53.3	986	63.8
Yes	347	3.5	53	3.0	34	2.2
Didn't Answer	2522	25.3	775	43.7	525	34.0
MULTIVITAMIN USE						
None	4565	45.8	708	39.9	732	47.4
1-3 times per week	657	6.6	87	4.9	75	4.8
4-6 times per week	383	3.8	38	2.1	41	2.7
Everyday	1924	19.3	179	10.1	179	11.6
Didn't Answer	2444	24.5	763	43.0	518	33.5
PRENATAL CARE						
1st Trimester	6082	61.0	712	40.1	788	51.0
2nd/3rd Trimester	1235	12.4	253	14.3	193	12.5
No Prenatal Care	111	1.1	33	1.8	24	1.6
Didn't Answer	2545	25.5	777	43.8	540	34.9
Maternal Health Variables						
GESTATIONAL DIABETES						
No	6724	67.5	894	50.4	876	56.7
Yes	752	7.5	108	6.1	146	9.4
Didn't Answer	2497	25.0	773	43.5	523	33.9
HYPERTENSION						
No	5879	58.9	708	39.9	783	50.7
Yes	1603	16.1	293	16.5	242	15.7
Didn't Answer	2491	25.0	774	43.6	520	33.6

Table 4.2. Descriptive Statistics of the Study Sample, *Oklahoma PRAMS VI* (2009-2011)

	White N=5954		Black N=990		Native N=904	
Sociodemographic Variables	N	%	N	%	N	%
MATERNAL AGE						
<20	694	11.6	172	17.4	140	15.5
20-29	3433	57.7	570	57.6	571	63.2
>30	1827	30.7	248	25.0	193	21.3
MATERNAL EDUCATION						
< High School	1320	22.2	226	22.8	219	24.2
HS Graduate	1669	28.0	330	33.3	328	36.3
>High School	2965	49.8	434	43.9	357	39.5
MATERNAL INCOME						
< $10,000	764	12.9	194	19.6	147	16.3
$10,000-14,999	389	6.5	70	7.1	80	8.9
$15,000-19,999	347	5.8	56	5.7	51	5.6
$20,000-24,999	347	5.8	65	6.6	51	5.6
$25,000-34,999	451	7.6	54	5.4	73	8.1
$35,000-49,999	487	8.2	44	4.4	42	4.6
$50,000 or more	1268	21.3	49	4.9	92	10.2
Don't know or remember	1901	31.9	458	46.3	368	40.7
MARITAL STATUS						
Yes	3699	62.1	251	25.4	415	45.9
No	2255	37.9	739	74.6	489	54.1
Maternal Health Behaviors						
SMOKE						
No	3417	57.4	457	46.2	432	47.8
Yes	789	13.2	97	9.8	127	14.0
Didn't Answer	1748	29.4	436	44.0	345	38.2
DRINK						
No	4016	67.4	530	53.6	535	59.2
Yes	202	3.4	28	2.8	25	2.8
Didn't Answer	1736	29.2	432	43.6	344	38.0
MULTIVITAMIN USE						
None	2369	39.8	369	37.3	402	44.5
1-3 times per week	322	5.4	53	5.4	50	5.5
4-6 times per week	232	3.9	22	2.2	18	2.0
Everyday	1296	21.8	114	11.5	94	10.4
Didn't Answer	1735	29.1	432	43.6	340	37.6
PRENATAL CARE						
1st Trimester	3469	58.3	393	39.7	408	45.1
2nd/3rd Trimester	693	11.6	148	15.0	135	14.9
No Prenatal Care	32	0.5	8	0.8	14	1.6
Didn't Answer	1760	29.6	441	44.5	347	38.4
Maternal Health Variables						
GESTATIONAL DIABETES						
No	3836	64.4	504	50.9	495	54.8
Yes	389	6.6	55	5.6	69	7.6
Didn't Answer	1729	29.0	431	43.5	340	37.6
HYPERTENSION						
No	3319	55.7	391	39.5	407	45.0
Yes	891	15.0	162	16.4	153	16.9
Didn't Answer	1744	29.3	437	44.1	344	38.1

D. *Methods of Analysis*

For each OPRAMS study phase, 40 logistic regression models are run. **Models 1-4** regress each maternal health behavior variable (*SMOKE, DRINK, PNC,* and *MV*) on race/ethnicity alone. **Models 5-8** regress each maternal health behavior variable (*SMOKE, DRINK, PNC,* and *MV*) on race/ethnicity, along with the additional sociodemographic control variables age, education, income, and marital status. Models 1-8 are illustrated in Tables 5.1-5.4 for *PRAMS V* results and Tables 5.9-5.12 for *PRAMS VI* results. **Models 9-12** regress each outcome variable (*PLAC, PROM, LBW,* and *ICU*) on race/ethnicity alone. **Models 13-16** regress each outcome variable (*PLAC, PROM, LBW,* and *ICU*) on race/ethnicity, along with the additional sociodemographic control variables age, education, income, and marital status. **Models 17-20** regress each outcome variable (*PLAC, PROM, LBW,* and *ICU*) on race/ethnicity, the additional sociodemographic control variables age, education, income, and marital status, as well as the health variable diabetes (*DIAB*). **Models 21-24** regress each outcome variable (*PLAC, PROM, LBW,* and *ICU*) on race/ethnicity, the additional sociodemographic control variables age, education, income, and marital status, as well as the health variable high blood pressure/hypertension (*HBP*). **Models 25-28** regress each outcome variable (*PLAC, PROM, LBW,* and *ICU*) on race/ethnicity, the additional sociodemographic control variables age, education, income, and marital status, as well as the behavioral variable *SMOKE*. **Models 29-32** regress each outcome variable (*PLAC,PROM, LBW,* and *ICU*) on race/ethnicity, the additional sociodemographic control variables age, education, income, and marital status, as well as the behavioral variable *DRINK*. **Models 33-36** regress each

outcome variable (*PLAC PROM, LBW,* and *ICU*) on race/ethnicity, the additional sociodemographic control variables age, education, income, and marital status, as well as the behavioral variable *PNC*. **Models 37-40** regress each outcome variable (*PLAC, PROM, LBW,* and *ICU*) on race/ethnicity, the additional sociodemographic control variables age, education, income, and marital status, as well as the behavioral variable *MV*. Models 9-40 are illustrated in Tables 5.5-5.8 for *PRAMS V* results and 5.13-5.16 for *PRAMS VI* results. Logistic regression is the proper statistical method to use when analyzing the dependent variables in the study samples because they are categorical variables, rather than being continuous variables (King 2008). The following research questions guide this analysis:

E. *Research Questions*

1. Are minority women (Native Americans and African Americans) more likely than whites to engage in high risk health behaviors while pregnant?

2. Are minority women (Native Americans and African Americans) more likely than whites to experience adverse pregnancy outcomes?

3. Are the differences proposed in Research Questions 1 and 2 due to socioeconomic differences?

4. Are the differences proposed in Research Question 2 due to health-related problems during pregnancy, such as gestational diabetes or hypertension?

5. Has there been any significant change in these differences between the two study cycles (*PRAMS V* [2004-2008] – *PRAMS VI* [2009-2011])?

CHAPTER FIVE:

RESULTS OF THE CURRENT STUDY

I. RESULTS – *PRAMS V* (2004-2008)

A. HYPOTHESIS 1: Minorities engage in risky and unhealthy behaviors while pregnant more often than whites.

Hypothesis 1 is tested using binary logistic regression. Models 1-4 (Tables 5.1-5.4) show the relationship between race and the four maternal behavior variables: *SMOKE, DRINK, PNC,* and *MV.* **Model 1** (Table 5.1) illustrates the relationship between race and smoking (*SMOKE*), including only race. Model 5 adds all the sociodemographic control variables and is discussed in Part C of this section. The results of Model 1 indicate that African American women smoke cigarettes less often than white women while pregnant. However, when only race is taken into account, it seems that Native American women smoke cigarettes more often than whites while pregnant. This finding does not fully support Hypothesis 1; however, it is acknowledged that though minorities were hypothesized to engage in risky maternal behaviors more often than whites, the four risky and unhealthy behaviors included in the analysis could be divided into two groups: those that are more about personal choice and those that are more related to socioeconomic variables education and income. Smoking during pregnancy is categorized as a personal choice along with drinking, rather than being tied to socioeconomic status like prenatal care or multivitamin use. Some previous research has found that Native Americans are more likely than other racial and ethnic groups to smoke while pregnant (Alexander et al. 2008; Castor et al. 2006; Emmanuel 1999; Salihu et al. 2003), while others have found the opposite (Shiao et al. 2005). Previous research has

found African American women to be less likely than whites to smoke during pregnancy (Abma and Mott 1991; Hummer 1993; Oklahoma State Department of Health 2006; Shiao et al. 2005); therefore, the findings of the current study corroborate what is currently known about maternal smoking among African American mothers. Taking into consideration only race, the current study's results support the findings of most published literature on the relationship between race and smoking, though do not coincide with the anticipated results of the current study.

Table 5.1. Binary Logistic Regression for the Relationship between Race and SMOKING (*SMOKE*)

Sociodemographic Variables	**Model 1**	**Model 5**
MATERNAL RACE		
Black	-0.267 *** (0.020)	-0.771 *** (0.021)
Native	0.182 *** (0.015)	-0.101 *** (0.017)
MATERNAL AGE		0.130 *** (0.010)
MARRIED		0.771 *** (0.013)
EDUCATION		-0.388 *** (0.008)
INCOME		-0.181 *** (0.003)
Chi-Square	366.839	23095.323
N	9507	8970

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses)
Source: *PRAMS V* 2004-2008

Model 2 (Table 5.2) illustrates the relationship between race and drinking (*DRINK*), including only race. Model 6 adds all the sociodemographic control variables and is discussed in Part C of this section. The results of Model 2 indicate that African

American women are more likely to drink than white women during pregnancy, while Native American women are less likely than white women to drink during pregnancy. These results directly contradict previous research findings that have indicated Native Americans are more likely to drink during pregnancy (Alexander et al. 2008; Harrison and Sidebottom 2009; Castor et al. 2006), as well as those that show whites are more likely than African Americans to drink during pregnancy (Abma and Mott 1991; Shiao et al. 2005; Hummer 1993).

Table 5.2. Binary Logistic Regression for the Relationship between Race and DRINKING (*DRINK*)

Sociodemographic Variables	**Model 2**	**Model 6**
MATERNAL RACE		
Black	0.250 *** (0.030)	0.188 *** (0.032)
Native	-0.517 *** (0.036)	-0.473 *** (0.037)
MATERNAL AGE		0.272 *** (0.018)
MARRIED		0.374 *** (0.024)
EDUCATION		0.332 *** (0.016)
INCOME		-0.007 (0.006)
Chi-Square	328.091	1336.317
N	9471	8931

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses)
Source: *PRAMS V* 2004-2008

However, the results do not fully contradict the hypotheses of the present study. It was expected that minority women would engage in risky and unhealthy maternal behaviors more often than white women, but personal health choices such as smoking

and drinking, as mentioned above, may be an exception. Furthermore, socioeconomic status was not considered in this analysis. Socioeconomic characteristics, especially education and income, are expected to explain the discrepancies between minority women and whites regarding alcohol consumption during pregnancy.

Model 3 (Table 5.3) illustrates the relationship between race and prenatal care utilization (*PNC*), including only race. Model 7 adds all the sociodemographic control variables and is discussed in Part C of this section. The results of Model 3 indicate that both African American and Native American women are far less likely than whites to receive prenatal care, including both first trimester care and any prenatal care throughout the duration of pregnancy. These results correspond with previous findings that suggest minority women are far less likely to utilize preventive care services (Abma and Mott 1991; Bengiamin et al. 2010; Baldwin et al. 2002; Castor et al. 2006; Emmanuel 1999; Hummer 1993; Oklahoma State Department of Health 1995a; Remez 2003; Shiao et al. 2005). It was expected that minority women, including both Native Americans and African Americans, would be less likely to utilize prenatal care – both first trimester care and care at any time during pregnancy; therefore, Hypothesis 1 is supported by the results of Model 3. Socioeconomic conditions may have an effect on the negative relationship for both groups of women, but it is suspected that such characteristics will not fully explain the differences.

Table 5.3. Binary Logistic Regression for the Relationship between Race and PRENATAL CARE (*PNC*)

1st Trimester Prenatal Care	**Model 3**	**Model 7**
MATERNAL RACE		
Black	-0.515*** (0.016)	-0.128*** (0.018)
Native	-0.153*** (0.016)	0.020 (0.017)
MATERNAL AGE		-0.024* (0.010)
MARRIED		-0.448*** (0.013)
EDUCATION		0.303*** (0.0080
INCOME		0.189*** (0.003)
Chi-Square	1014.655	17967.208
Some Prenatal Care		
MATERNAL RACE		
Black	-0.677*** (0.047)	-0.126* (0.053)
Native	-0.896*** (0.040)	-0.597*** (0.043)
MATERNAL AGE		0.128*** (0.030)
MARRIED		-0.795 (0.044)
EDUCATION		0.215*** (0.026)
INCOME		0.194*** (0.011)
Chi-Square	545.293	2503.740
N	9431	8902

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses)
Source: *PRAMS V* 2004-2008

Model 4 (Table 5.4) illustrates the relationship between race and multivitamin use (*MV*), including only race. Model 8 adds all the sociodemographic control variables and is discussed in Part C of this section. The results of Model 4 indicate that both African American and Native American women are more likely than whites to take multivitamins when only race is considered. This finding contradicts Hypothesis 1, as well as previous research findings (Williams et al. 2003) that indicate minority women living in Oklahoma are less likely than whites to take multivitamins. Minority women were expected to be less likely than whites to use multivitamins or prenatal vitamins, though socioeconomic variables education and income should explain some of the disparity.

5.4. Binary Logistic Regression for the Relationship between Race and MULTIVITAMIN USE (*MV*)

Sociodemographic Variables	**Model 4**	**Model 8**
MATERNAL RACE		
Black	0.513 *** (0.017)	0.003 (0.021)
Native	0.443 *** (0.019)	0.300 *** (0.018)
MATERNAL AGE		-0.209 *** (0.010)
MARRIED		0.415 *** (0.014)
EDUCATION		-0.318 *** (0.009)
INCOME		-0.151 *** (0.003)
Chi-Square	1405.139	18247.897
N	9568	9019

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses)
Source: *PRAMS V* 2004-2008

B. HYPOTHESIS 2: Minorities have unfavorable health problems and labor/delivery complications more often than whites.

Hypothesis 2 is tested using binary logistic regression. Models 9-12 (Tables 5.5-5.8) show the relationship between race and the four labor and delivery outcome variables: *PLAC, PROM, LBW,* and *ICU.* **Model 9** (Table 5.5) illustrates the relationship between race and placental issues (*PLAC*), including only race. Model 13 adds all the sociodemographic control variables and is discussed in Part C of this section. Model 17 tests the effect of gestational diabetes and Model 21 tests the effect of hypertension during pregnancy; both models take into account race and the sociodemographic control variables. The relationship between labor and delivery outcomes and both health-related variables is discussed in Part D of this section. The results of Model 9 indicate that African American women are less likely than white women to experience placental issues, while Native Americans are more likely than white women to experience placental issues when only race is taken into account. These results do not fully support Hypothesis 1. However, previous research has uncovered a correlation between maternal smoking and placental issues (Oklahoma State Department of Health 2006, 2011; Salihu et al. 2003). Considering the results of the current study regarding maternal smoking among Native American women, it makes sense that Native Americans may experience placental issues more frequently than white women.

Table 5.5. Binary Logistic Regression for the Relationship between Race and PLACENTAL ISSUES (*PLAC*)

Sociodemographic Variables	**Model 9**	**Model 13**	**Model 17**	**Model 21**	**Model 25**	**Model 29**	**Model 33**	**Model 37**
MATERNAL RACE								
Black	-0.322*** (0.037)	-0.339*** (0.041)	-0.336*** (0.041)	-0.350*** (0.041)	-0.305*** (0.041)	-0.340*** (0.041)	-0.316*** (0.041)	-0.332*** (0.041)
Native	0.082** (0.028)	0.098*** (0.029)	0.069* (0.029)	0.082** (0.029)	0.096** (0.029)	0.090** (0.029)	0.119*** (0.029)	0.101*** (0.029)
MATERNAL AGE		0.128*** (0.018)	0.088*** (0.018)	0.131*** (0.018)	0.136*** 0.018)	0.134*** (0.018)	0.117*** (0.018)	0.142*** (0.018)
MARRIED		0.060* (0.024)	0.069** (0.024)	0.054* (0.024)	0.037 (0.024)	0.064** (0.024)	0.052* (0.025)	0.061* (0.024)
EDUCATION		0.123*** (0.015)	0.129*** (0.015)	0.115*** (0.015)	0.130*** (0.016)	0.117*** (0.015)	0.144*** (0.016)	0.124*** (0.016)
INCOME		0.038*** (0.005)	0.046*** (0.006)	0.038*** (0.005)	0.044*** (0.006)	0.041*** (0.005)	0.039*** (0.006)	0.048*** (0.006)
Maternal Health Variables								
DIABETES			0.524*** (0.027)					
HYPERTENSION				0.224*** (0.025)				
Maternal Behavior Variables								
SMOKING					0.228*** (0.025)			
DRINKING						0.212*** 0.039		
PRENATAL CARE								
1st Trimester Prenatal Care							0.195*** (0.027)	
Some Prenatal Care							0.044 (0.092)	
MULTIVITAMINS								0.227*** (0.024)
Chi-Square	98.909	499.40	828.105	571.481	574.116	547.995	676.466	592.418
N	9463	8935	8905	8916	8869	8830	8804	8913

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses) Source: *PRAMS V* (2004-2008)

Model 25 tests the effect of race on *PLAC* while taking into account *SMOKE* and the sociodemographic control variables. **Model 29** tests the effect of race on *PLAC* while taking into account *DRINK* and the sociodemographic control variables. The statistical significance does not disappear among Native American women when maternal behavior variables are considered in Models 25 and 29. While smoking and drinking have strong positive effects on *PLAC*, the variables do not have an effect on either African American or Native American outcomes. In other words, women that smoke or drink during pregnancy are far more likely to experience placental issues, as expected, but even when maternal smoking and drinking are held constant, African American women are still far less likely to experience placental issues and Native Americans are still more likely to experience placental issues. Because the statistical significance between the race coefficient for Native Americans and *PLAC* decreases slightly when *SMOKE* and *DRINK* are added to the equation, these results suggest that there is a correlation between the maternal behaviors smoking and drinking and placental issues among Native Americans. In other words, smoking and drinking while pregnant account for some of the disparity between Native Americans and whites concerning placental issues. These findings confirm the results of previous findings that have established a positive relationship between maternal alcohol consumption and placental issues (Aliyu et al. 2011a), as well as maternal smoking and placental issues (Aliyu et al. 2011b; Daskalakis et al. 2011). Additional variables, including *DIAB*, *HBP*, and *MV*, have a similar effect on the race coefficient for Native Americans, which indicate that they too explain part of the difference between Native American and white women. For African Americans, on the other hand, the disparity remains unexplained.

Model 33 tests the effect of race on *PLAC* while taking into account *PNC* and the sociodemographic control variables. Women who receive 1st trimester prenatal care are more likely to experience placental issues. However, there is no effect on placental issues among those that receive prenatal care at any point during their pregnancy. This finding suggests that women who are more prone to placental issues are more likely to seek early prenatal care because they possibly experienced adverse outcomes in a previous pregnancy. Unfortunately, this data does not take into account parity (the number of times a woman has given birth) in order to confirm this supposition. Interestingly, there is no difference between women that see a physician for prenatal care at some point during their pregnancy and those that do not regarding the occurrence of placental issues. Taking into account prenatal care utilization has no effect on the race coefficients. African American women are still far less likely to experience placental issues, while Native American women are still far more likely to experience placental issues when compared to white women. It was expected that minority women would be more likely to experience adverse pregnancy outcomes like placental issues; hence Hypothesis 2 is supported by the results for Native Americans but not for African Americans. Prenatal care utilization does not explain the disparities in between Native Americans and whites or African Americans and whites concerning the incidence of placental issues.

Model 37 tests the effect of race on *PLAC* while taking into account *MV* and the sociodemographic control variables. Women who take multivitamins are far more likely to experience placental issues. It seems that an effect similar to prenatal care utilization is occurring whereby women who understand that they may be at risk for experiencing placental issues, possibly from a previous birth experience, are more likely to take

multivitamins in order to guard against adverse pregnancy outcomes. Taking into account multivitamin use has no effect on the race coefficients. African American women are still far less likely to experience placental issues, while Native American women are still far more likely to experience placental issues when compared to white women. Because the statistical significance of the race coefficients did not dissipate when considering any of the maternal health behavior variables *SMOKE*, *DRINK*, *PNC*, or *MV* it seems that an unobserved variable is causing the significant discrepancies between minority and white women concerning placental issues. Possible explanations are discussed in Section I of Chapter 6.

Model 10 (Table 5.6) illustrates the relationship between race and premature rupture of membranes (*PROM*), including only race. Model 14 adds all the sociodemographic control variables and is discussed in Part C of this section. Model 18 tests the effect of gestational diabetes and Model 22 tests the effect of hypertension during pregnancy; both models take into account race and the sociodemographic control variables. The relationship between labor and delivery outcomes and both health-related variables is discussed in Part D of this section. The results of Model 10 indicate that African American women are more likely than white women to experience PROM, while Native Americans are less likely than white women to experience PROM when only race is taken into account. The results of this analysis support Hypothesis 2 for African Americans but not for Native Americans. They also support the findings of previous research (Shiao et al. 2005; Whitehead, Callaghan, Johnson, and Williams 2009) that has suggested a higher likelihood of PROM among African American women compared to whites.

Table 5.6. Binary Logistic Regression for the Relationship between Race and PREMATURE RUPTURE OF MEMBRANES (*PROM*)

Sociodemographic Variables	**Model 10**	**Model 14**	**Model 18**	**Model 22**	**Model 26**	**Model 30**	**Model 34**	**Model 38**
MATERNAL RACE								
Black	0.724** (0.026)	0.881*** (0.028)	0.892*** (0.028)	0.915*** (0.028)	0.909*** (0.029)	0.882*** (0.028)	0.860*** (0.029)	0.883*** (0.028)
Native	-0.136*** (0.032)	-0.098** (0.032)	-0.123*** (0.32)	-0.091** (0.032)	-0.091** (0.032)	-0.101** (0.032)	-0.154*** (0.034)	-0.099** (0.032)
MATERNAL AGE		-0.109*** (0.018)	-0.144*** (0.018)	-0.110*** (0.018)	-0.119*** (0.018)	-0.109*** (0.018)	-0.177*** (0.018)	-0.107*** (0.018)
MARRIED		-0.070** (0.024)	-0.067** (0.024)	0.070** (0.024)	-0.175*** (0.024)	-0.071*** (0.024)	0.025 (0.025)	-0.079*** (0.024)
EDUCATION		-0.273*** (0.015)	-0.266*** (0.015)	-0.266*** (0.015)	-0.219*** (0.015)	-0.275*** (0.015)	-0.232*** (0.016)	-0.261*** (0.015)
INCOME		0.056*** (0.005)	0.061*** (0.006)	0.056*** (0.005)	0.067*** (0.006)	0.055*** (0.005)	0.081*** (0.006)	0.059*** (0.006)
Maternal Health Variables								
DIABETES			0.444*** (0.028)					
HYPERTENSION				-0.351*** (0.030)				
Maternal Behavior Variables								
SMOKING					0.643*** (0.022)			
DRINKING						-0.289*** (0.050)		
PRENATAL CARE								
1st Trimester Prenatal Care							0.204*** (0.027)	
Some Prenatal Care							-0.479*** (0.073)	
MULTIVITAMIN USE								0.144*** (0.025)
Chi-Square	746.623	1234.157	1482.399	1401.726	1854.879	1278.476	1245.704	1257.024
N	9493	8963	8931	8941	8898	8859	8828	8941

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses) Source: *PRAMS V* (2004-2008)

Model 26 tests the effect of race on *PROM* while taking into account *SMOKE* and the sociodemographic control variables. **Model 30** tests the effect of race on *PROM* while taking into account *DRINK* and the sociodemographic control variables. The significance does not disappear among Native American or African American women when maternal behavior variables are considered in Models 26 and 30. *SMOKE* has a strong positive effect on *PROM*, while *DRINK* has a strong negative effect. This means that women who smoke during pregnancy are far more likely to experience PROM. Women who drink during pregnancy are far less likely to experience PROM. Neither variable has an effect on the race coefficients. In other words, even when maternal smoking and drinking are held constant, African American women are still more likely to experience PROM and Native Americans are still less likely to experience PROM when compared to white women.

Model 34 tests the effect of race on *PROM* while taking into account *PNC* and the sociodemographic control variables. Women who receive 1st trimester prenatal care are more likely to experience PROM. However, women that receive prenatal care at any point during their pregnancy are less likely to experience PROM. This finding again suggests that women who are more prone to adverse labor and delivery outcomes like PROM are more likely to seek early prenatal care because they possibly experienced a problematic outcome in a previous pregnancy. The finding regarding overall prenatal care utilization is expected. Women that seek at least some prenatal care are less likely than women who never see a physician for prenatal care to experience PROM. Taking into account prenatal care utilization has no effect on the race coefficients. African American

women are still far more likely to experience PROM, while Native American women are still far less likely to experience PROM when compared to white women.

Model 38 tests the effect of race on *PROM* while taking into account *MV* and the sociodemographic control variables. Women who take multivitamins are far more likely to experience PROM. The effect that was observed with prenatal care utilization and placental issues seems to be happening with *PROM* as well. It is possible that women who understand that they may be at risk for experiencing PROM, perhaps from a previous birth experience, are more likely to take multivitamins in order to guard against adverse pregnancy outcomes. Taking into account multivitamin use has no effect on the race coefficients. African American women are still far more likely to experience PROM, while Native American women are still far less likely to experience PROM when compared to white women. Again, because the statistical significance of the race coefficients did not dissipate when considering any of the maternal health behavior variables *SMOKE, DRINK, PNC,* or *MV* it seems that an unobserved variable is causing the significant discrepancies between minority and white women concerning PROM. Possible explanations are discussed in Section I of Chapter 6.

Model 11 (Table 5.7) illustrates the relationship between race and low birth weight (*LBW*), including only race. Model 15 adds all the sociodemographic control variables and is discussed in Part C of this section. Model 19 tests the effect of gestational diabetes and Model 23 tests the effect of hypertension during pregnancy; both models take into account race and the sociodemographic control variables. The relationship between labor and delivery outcomes and both health-related variables is discussed in Part D of this section. The results of Model 11 indicate that African American women are more likely

than white women to have underweight babies, while Native Americans are less likely than white women to have underweight babies when only race is taken into account. This finding is expected and is supported by previous research (Chao et al. 2010; Conley et al. 2003; Emmanuel et al. 1999; Hummer 1993; Kallan 1993; Lu and Halfon 2003; Lu et al. 2010; Mustillo et al. 2004; Odell et al. 2006; Remez 2003; Shiao et al. 2005; Sparks 2009; Zhang et al. 2011) that reveals African Americans are far more likely than whites to give birth to babies who have low birth weight. Research suggests that it is not as common among Native Americans to birth significantly underweight babies, though some research has uncovered a higher likelihood among Native American women (Alexander et al. 2008; Vanlandingham, Buehler, Hogue, and Strauss 1988). Hypothesis 2 is only partially supported by the findings illustrated in Model 11.

Model 27 tests the effect of race on *LBW* while taking into account *SMOKE* and the sociodemographic control variables. **Model 31** tests the effect of race on *LBW* while taking into account *DRINK* and the sociodemographic control variables. The significance does not change among Native American or African American women when maternal behavior variables are considered in Models 27 and 31. *SMOKE* has a strong positive effect on *LBW*, while *DRINK* has a strong negative effect. This means that women who smoke during pregnancy are far more likely to give birth to underweight babies, a finding that is well supported by previous research (Alexander et al. 2008; Aliyu et al. 2011b; Conley et al. 2003; D'Angelo et al. 2007; Hellerstedt et al. 1997; Meis et al. 1997; Oklahoma State Department of Health 1997, 2006, 2008, 2009; Pollack et al. 2000; Salihu et al. 2003; Sparks 2009; Suellentrop et al. 2006; Wang et al. 1997). However, women who drink during pregnancy are far less likely to give birth to underweight babies. Neither

variable has an effect on the race coefficients. In other words, even when maternal smoking and drinking are held constant, African American women are still more likely to give birth to underweight babies and Native Americans are still less likely to give birth to underweight babies when compared to white women. Considering the strong positive relationship between maternal smoking and low birth weight, this finding is quite telling because Model 1 (Table 5.1) shows that African American women are far less likely than white women to smoke during pregnancy. It seems that an unobserved variable is causing a significant disparity between African American and white women concerning the birthing of low birth weight babies.

Model 35 tests the effect of race on *LBW* while taking *PNC* into account and the sociodemographic control variables. Women who receive 1st trimester prenatal care are more likely to have babies who have a low birth weight. However, there is no statistical difference between women that receive prenatal care at any point during their pregnancy and women who do not receive any prenatal care. Once again this finding suggests that women who are aware that their child may be at risk for low birth weight are more likely to seek early prenatal care. Taking into account prenatal care utilization has no effect on the race coefficients. African American women are still far more likely to have low birth weight babies, while Native American women are still far less likely to have babies that have a low birth weight when compared to white women. These results support the findings of Kallan (1993) who found no significant relationship between prenatal utilization and low birth weight, but contradict the findings of Sparks (2009) who found that women receiving no prenatal care were at higher odds for giving birth to low birth weight babies.

Table 5.7. Binary Logistic Regression for the Relationship between Race and LOW BIRTH WEIGHT (*LBW*)

Sociodemographic Variables	**Model 11**	**Model 15**	**Model 19**	**Model 23**	**Model 27**	**Model 31**	**Model 35**	**Model 39**
MATERNAL RACE								
Black	0.842*** (0.021)	0.788*** (0.024)	0.799*** (0.024)	0.708*** (0.024)	0.856*** (0.024)	0.788*** (0.024)	0.775*** (0.024)	0.788*** (0.024)
Native	-0.096*** (0.026)	-0.153*** (0.027)	-0.169*** (0.028)	-0.213*** (0.028)	-0.156*** (0.028)	-0.163*** (0.028)	-0.158*** (0.028)	-0.141*** (0.028)
MATERNAL AGE		0.079*** (0.015)	0.062*** (0.015)	0.080*** (0.015)	0.064*** (0.015)	0.089*** (0.015)	0.085*** (0.015)	0.071*** (0.015)
MARRIED		0.080*** (0.020)	0.069*** (0.020)	0.062** (0.020)	0.011 (0.20)	0.088*** (0.020)	0.089*** (0.020)	0.087*** (0.020)
EDUCATION		-0.205*** (0.013)	-0.206*** (0.013)	-0.235*** (0.013)	-0.178*** (0.013)	-0.208*** (0.013)	-0.208*** (0.013)	-0.205*** (0.013)
INCOME		-0.033*** (0.005)	-0.032*** (0.005)	-0.035*** (0.005)	-0.019*** (0.005)	-0.031*** (0.005)	-0.035*** (0.005)	-0.036*** (0.005)
Maternal Health Variables								
DIABETES			0.084*** (0.026)					
HYPERTENSION				0.903*** (0.018)				
Maternal Behavior Variables								
SMOKING					0.517*** (0.019)			
DRINKING						-0.236*** (0.040)		
PRENATAL CARE								
1st Trimester Prenatal Care							0.114*** (0.021)	
Some Prenatal Care							-0.051 (0.064)	
MULTIVITAMINS								-0.120*** (0.020)
Chi-Square	1420.317	1998.388	2015.207	4143.080	2710.576	1979.877	1912.470	2004.183
N	9597	9041	8967	8979	8970	8931	8902	9019

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses)
Source: *PRAMS V* (2004-2008)

Model 39 tests the effect of race on *LBW* while taking into account *MV* and the sociodemographic control variables. Women who take multivitamins are far less likely to have babies with low birth weight. This finding is logical, considering multivitamins have been shown to improve fetal growth and increase weight for gestational age (Catov, Bodnar, Ness, Markovic, and Roberts 2007), reduce the risk of preterm birth (Vahratian, Siega-Riz, Savitz, and Thorp, Jr. 2004), and reduce the risk of low birth weight (Scholl et al. 1997). However, taking into account multivitamin use has no measurable effect on the race coefficients. African American women are still far more likely to have babies with low birth weight, while Native American women are still far less likely to have babies with low birth weight when compared to white women. Again, because the statistical significance of the race coefficients did not dissipate when considering any of the maternal health behavior variables *SMOKE, DRINK, PNC*, or *MV* it seems that an unobserved variable or variables is causing the significant discrepancies between minority and white women concerning birth weight. Possible explanations are discussed in Section I of Chapter 6.

Model 12 (Table 5.8) illustrates the relationship between race and intensive care placement (*ICU*) including only race. Model 16 adds all the sociodemographic control variables and is discussed in Part C of this section. Model 20 tests the effect of gestational diabetes and Model 24 tests the effect of hypertension during pregnancy; both models take into account race and the sociodemographic control variables. The relationship between labor and delivery outcomes and both health-related variables is discussed in Part D of this section. The results of Model 12 indicate that African American women are more likely than white women to place their newborns in an

intensive care unit, while Native Americans are less likely than white women to do so when only race is taken into account. This finding is expected due to this study's findings on low birth weight. Considering the high likelihood of African American women giving birth to low birth weight babies, it was anticipated that African American women would also be far more likely than white women to place their child in ICU. Native Americans, according to the present study's findings, are less likely than whites to birth underweight babies; therefore, the findings regarding ICU placement are also expected, though don't completely support Hypothesis 2.

Model 28 tests the effect of race on *ICU* while taking into account *SMOKE* and the sociodemographic control variables. **Model 32** tests the effect of race on *ICU* while taking into account *DRINK* and the sociodemographic control variables. The significance does not change among Native American or African American women when maternal behavior variables are considered in Model 28 and Model 32. *SMOKE* has no effect on *ICU*, while *DRINK* has a strong negative effect. This means that women who smoke during pregnancy are no more likely to have a newborn placed in ICU. Women who drink during pregnancy are far less likely to have a newborn placed in ICU. Neither variable has an effect on the race coefficients. In other words, even when maternal smoking and drinking are held constant, African American women are still more likely to have a newborn placed in ICU and Native Americans are still less likely to have a newborn placed in ICU when compared to white women. The results of *SMOKE* on *ICU* are unanticipated due to the relationship between smoking and low birth weight and the correlation between low birth weight and ICU placement.

Table 5.8. Binary Logistic Regression for the Relationship between Race and INTENSIVE CARE (*ICU*)

Sociodemographic Variables	**Model 12**	**Model 16**	**Model 20**	**Model 24**	**Model 28**	**Model 32**	**Model 36**	**Model 40**
MATERNAL RACE								
Black	0.284*** (0.021)	0.342*** (0.022)	0.354*** (0.023)	0.298*** (0.023)	0.358*** (0.023)	0.365*** (0.023)	0.350*** (0.023)	0.342*** (0.022)
Native	-0.334*** (0.023)	-0.368*** (0.024)	-0.400*** (0.024)	-0.404*** (0.024)	-0.370*** (0.024)	-0.365*** (0.024)	-0.420*** (0.025)	-0.360*** (0.024)
MATERNAL AGE		-0.005 (0.012)	-0.054*** (0.013)	-0.005*** (0.012)	-0.008 (0.013)	-0.006 (0.013)	-0.002 (0.013)	-0.010 (0.012)
MARRIED		0.063*** (0.017)	0.067*** (0.017)	0.054*** (0.017)	0.043* (0.017)	0.038* (0.017)	0.042* (0.017)	0.068*** (0.017)
EDUCATION		-0.090*** (0.011)	-0.092*** (0.011)	-0.113*** (0.011)	-0.097*** (0.011)	-0.096*** (0.011)	-0.091*** (0.011)	-0.090*** (0.011)
INCOME		0.024*** (0.004)	0.033*** (0.004)	0.025*** (0.004)	0.022*** (0.004)	0.020*** (0.004)	0.027*** (0.004)	0.022*** (0.004)
Maternal Health Variables								
DIABETES			0.522*** (0.020)					
HYPERTENSION				0.621*** (0.016)				
Maternal Behavior Variables								
SMOKING					0.034 (0.017)			
DRINKING						-0.311*** (0.034)		
PRENATAL CARE								
1st Trimester Prenatal Care							-0.002 (0.018)	
Some Prenatal Care							-0.296*** (0.052)	
MULTIVITAMINS								-0.086*** (0.016)
Chi-Square	450.180	625.119	1314.005	1998.666	649.389	726.825	721.146	640.408
N	9479	8953	8880	8893	8886	8847	8816	8931

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses)
Source: *PRAMS V* (2004-2008)

Model 36 tests the effect of race on *ICU* while taking into account *PNC* and the sociodemographic control variables. There is no difference between women who receive 1st trimester prenatal care and those that do not see a physician for early prenatal care regarding child placement in ICU. However, women that receive prenatal care at any point during their pregnancy are far less likely than women who do not receive any prenatal care to be required to place their newborn in ICU. This finding is expected given that prenatal care utilization at any point during pregnancy provides an opportunity to detect the possibility of treatable conditions or alleviate the potential for adverse labor and delivery outcomes. Taking into account prenatal care utilization has no effect on the statistical significance of the race coefficients. African American women are still far more likely to place their newborns in ICU, while Native American women are still far less likely to have to do so when compared to white women.

Model 40 tests the effect of race on *ICU* while taking into account *MV* and the sociodemographic control variables. Women who take multivitamins are far less likely to place their newborns in ICU. This outcome is expected, especially considering this study's findings regarding the negative effect of *MV* on *LBW*. However, taking into account multivitamin use does not change the effects of the race coefficients. African American women are still far more likely to place their newborn in ICU, while Native American women are still far less likely to do so when compared to white women. Once again, because the statistical significance of the race coefficients did not dissipate when considering any of the maternal health behavior variables *SMOKE, DRINK, PNC*, or *MV* it seems that an unobserved variable or variables is causing the significant discrepancies

between minority and white women concerning child ICU placement. Possible explanations are discussed in Section I of Chapter 6.

C. HYPOTHESIS 3: The differences proposed in Hypotheses 1 and 2 are due in part to racial differences in socioeconomic characteristics.

i. Maternal Behavior Variables

Hypothesis 3 is tested using binary logistic regression. It was expected that higher levels of education and income would likely decrease risky health behaviors for pregnant minority women, but the socioeconomic variables would not entirely close the disparity between whites and minorities in this respect. **Models 5-8** (Tables 5.1-5.4) regress the maternal behavior variables *SMOKE, DRINK, PNC,* and *MV* on race along with the sociodemographic control variables age, marital status, education, and income.

Model 5 (Table 5.1) illustrates the relationship between race and *SMOKE*, while taking into account sociodemographic characteristics. African American women are still less likely to smoke cigarettes while pregnant, even when the sociodemographic variables are included in the equation. The statistical significance does not decrease. However, Native American women, instead of being more likely than white women to smoke during pregnancy as illustrated in Model 1, are less likely than white women to smoke during pregnancy when sociodemographic variables are held constant. Women with higher levels of education and income are less likely to smoke during pregnancy, supporting previous research findings (Abma and Mott 1991; Hummer 1993; Salihu et al. 2003). Older women and married women are more likely to smoke while pregnant, contradicting findings of previous research (Roelands et al. 2009; Salihu et al. 2003;

Tong et al. 2011). Among Native American women, Hypothesis 3 is supported. The results of Model 5 indicate that the socioeconomic variables education and income explain the difference between Native American and white women previously illustrated in Model 1 when only race was considered.

Model 6 (Table 5.2) illustrates the relationship between race and *DRINK*, while taking into account sociodemographic characteristics. African American women are still more likely to drink alcohol while pregnant, even when the sociodemographic variables are included in the equation. The statistical significance does not decrease. However, Native American women are less likely than white women to drink during pregnancy when sociodemographic variables are held constant. Therefore, Hypothesis 3 is confirmed among Native American women, but not among African American women in the current study Oklahoma *PRAMS V* study sample. Women with higher levels of education are more likely to drink while pregnant, confirming the results of earlier OPRAMS research (Oklahoma State Department of Health 1995b). Women with higher levels of income are less likely to drink during pregnancy. Older women and married women are more likely to drink during pregnancy, both confirming and contradicting the research findings of Harrison and Sidebottom (2009), who found that older age and being unmarried predicted alcohol use during pregnancy. OPRAMS (Oklahoma State Department of Health 1995b) has also uncovered a positive relationship between age and alcohol consumption during pregnancy among women in Oklahoma.

Model 7 (Table 5.3) illustrates the relationship between race and *PNC*, while taking into account sociodemographic characteristics. African American women are still less likely to seek prenatal care while pregnant, even when the sociodemographic

variables are included in the equation. The statistical significance does not decrease when considering first trimester prenatal care. This means that African American women, even when socioeconomic variables education and income are held constant, are still far less likely to receive first trimester prenatal care when compared to white women. However, the statistical significance disappears for Native American women. In other words, there is no difference between Native American and white women concerning first trimester prenatal care utilization when socioeconomic variables education and income are held constant. This finding supports Hypothesis 3 that socioeconomic characteristics explain the disparity in prenatal care utilization between whites and minorities. More educated women and women with higher levels of income are more likely to receive first trimester prenatal care, which is consistent with previous research findings (Abma and Mott 1991; Hummer 1993; Oklahoma State Department of Health 2005). Interestingly, a negative relationship was discovered between first trimester prenatal care utilization and age, as well as marital status, whereby older women and married women were less likely to receive early prenatal care.

Considering prenatal care utilization at *any time* during pregnancy (including first, second, or third trimester care), women with higher levels of education and income are still more likely to seek prenatal care, as are older women. These results were anticipated in the current study. However, both African American and Native American women are less likely than whites to seek prenatal care at some point during their pregnancies. In the case of African American women and overall prenatal utilization, the statistical significance decreased when taking into consideration socioeconomic characteristics, supporting Hypothesis 3, though there is still a discernable difference when compared to

whites. Among Native American women, however, the statistical significance did not decrease, meaning Native American women continue to be far less likely than white women to receive at least some prenatal care during their pregnancy, even when socioeconomic status is taken into account. Although this finding does not support Hypothesis 3, it is supported by previous research (Baldwin et al. 2002; Castor et al. 2006; Emmanuel et al. 1999; Shiao et al. 2005).

Model 8 (Table 5.4) illustrates the relationship between race and *MV*, while taking into account sociodemographic characteristics. Native American women are still more likely to take multivitamins while pregnant, even when the socioeconomic variables education and income are included in the equation. The statistical significance does not decrease. However, the statistical significance disappears among African American women. When socioeconomic characteristics are held constant, there is no difference between African Americans and whites concerning multivitamin use. Surprisingly, women with higher levels of education and income are less likely to take multivitamins. The results of Table 5.4 do not support the hypotheses of the current study, nor the findings of previous research (Catov et al. 2007; Scholl et al. 1997; Vahratian et al. 2004; Williams et al. 2003). It should be noted, however, that multivitamin use among women in Oklahoma has been found to be the lowest of 19 states (including Alabama, Alaska, Arkansas, Colorado, Florida, Hawaii, Illinois, Louisiana, Maine, Nebraska, New Mexico, New York, North Carolina, Ohio, Oklahoma, South Carolina, Utah, Washington, and West Virginia), from which PRAMS data was compared (Williams et al. 2003).

ii. Labor and Delivery Outcome Variables

Models 13-16 (Tables 5.5-5.8) regress the labor and delivery outcome variables *PLAC, PROM, LBW,* and *ICU* on race along with the sociodemographic control variables age, marital status, education, and income. It was expected that higher levels of education and income would likely decrease, along with the risky health behaviors, the adverse labor and delivery outcomes for pregnant minority women. However, the socioeconomic variables would not entirely close the disparity between whites and minorities possibly due to unobserved variables.

Model 13 (Table 5.5) illustrates the relationship between race and *PLAC*, while taking into account sociodemographic variables. African American women are still less likely to experience placental issues, even when the socioeconomic variables income and education are included in the equation. The statistical significance does not decrease. However, Native American women are more likely than white women to experience placental issues when socioeconomic variables are held constant. In fact, the statistical significance increases for Native American women. Interestingly, women with higher levels of education and income are more likely to experience placental issues. The socioeconomic variables education and income may be correlated with age and marital status. Older women and women who are married are more likely to experience placental issues. With age comes the ability to gain more education and earn more income. Health-related problems are also more common as one grows older; therefore, it makes sense that education and income have a positive effect on *PLAC*. The results of Model 13 do not support Hypothesis 3.

Model 14 (Table 5.6) illustrates the relationship between race and *PROM*, while taking into account sociodemographic variables. African American women are still more likely to experience PROM, even when the socioeconomic variables education and income are included in the equation. The statistical significance does not decrease but rather increases, challenging Hypothesis 3. Native American women are less likely than white women to experience PROM when socioeconomic variables are held constant. However, the statistical significance decreases for Native American women, suggesting socioeconomic characteristics account for at least some of the difference between Native American and white women regarding PROM, which corresponds with Hypothesis 3. Women with higher levels of education are less likely to experience PROM. Again, education may be correlated with age and marital status, since the results suggest older women and women who are married are less likely to experience PROM. Women with higher levels of income, though, are more likely to experience PROM. Previous research suggests that women between the ages of 20-34 years of age tend to be at a higher risk for PROM, though higher parity is also correlated with an increased risk (Ananth et al. 2004). Parity could have an effect on PROM in the current analysis and somehow correlated with the variables in the equation, but is not measured here.

Model 15 (Table 5.7) illustrates the relationship between race and *LBW*, while taking into account sociodemographic variables. African American women are still more likely than white women to give birth to low birth weight babies, even when the socioeconomic variables education and income are considered. The statistical significance does not decrease. Native American women, on the other hand, are less likely than white women birth to low birth weight babies when socioeconomic variables are taken into

account. The statistical significance does not decrease, suggesting for both African American and Native American women that something other than socioeconomic status is causing the significant discrepancies. This finding does not support Hypothesis 3, which stated the socioeconomic variables education and income would explain at least some of the disparities between minorities and whites regarding low birth weight. Women with lower levels of education and income, as well as older women and unmarried women, are more likely to have underweight babies, which is congruent with current literature (Alexander et al. 2008; Conley et al. 2003; Remez 2003).

Model 16 (Table 5.8) illustrates the relationship between race and *ICU*, while taking into account sociodemographic variables. African American women continue to be more likely than whites to place their child in intensive care, even when the socioeconomic variables education and income are considered. Native American women, however, remain far less likely than white women to place their newborn in ICU. The statistical significance does not decrease for either minority group. The results of Model 16 do not support Hypothesis 3, that socioeconomic conditions are the cause of the discrepancies in ICU placement between racial and ethnic groups. However, considering the effects of the race coefficients for both African Americans and Native Americans on *LBW*, the results of Model 16 are expected. There is no statistical relationship between age and intensive care placement. Married women and women with lower levels of education are more likely to be required to place their newborn in ICU. Women with higher levels of income are also more likely to place their child in intensive care.

D. HYPOTHESIS 4: The differences proposed in Hypothesis 2 are due in part to health-related problems during pregnancy.

Hypothesis 4 is tested using binary logistic regression. The health conditions of the mother during pregnancy that are taken into account, including gestational diabetes (*DIAB*) and hypertension (*HBP*), were expected to have an effect on whether or not the mother experienced labor and delivery complications, as well as the health of the infant at birth. If the mother experienced either of these conditions during pregnancy, it was expected that she would be more likely to suffer adverse labor and delivery outcomes, including placental issues, premature rupture of membranes (PROM), low birth weight, and child placement in an intensive care unit. When the effect of gestational diabetes on *PLAC* is taken into account in **Model 17** (Table 5.5), the discrepancies between both minority groups and whites can still be seen. However, the statistical significance for Native American women decreases from p=.001 to p=.05. *DIAB* has a strong positive effect on the labor and delivery outcome variable *PLAC*. This suggests that though Native American women experience placental issues more often than whites, gestational diabetes can in part explain the difference. There is no significant change in the experiences of African American women regarding placental issues when gestational diabetes is considered. Nor is there a significant change among African Americans when hypertension is considered in **Model 21**. African American women are still far less likely to experience placental issues when the maternal health variables *DIAB* and *HBP* are taken into account. Previous research (Ananth et al. 2004) has found no difference between African Americans and other racial and ethnic groups regarding placental abruption, though no significant relationship was uncovered for mothers diagnosed with gestational

diabetes or hypertension either. The statistical significance again decreases among Native American women when hypertension is added to the equation though it is not as strong (from p=.001 to p=.01). This indicates that having been diagnosed with gestational diabetes better explains the difference in the prevalence of placental issues between Native Americans and whites than having been diagnosed with pregnancy-induced hypertension, though hypertension is still a risk factor among Native American mothers. Considering the high prevalence of gestational diabetes among Native American mothers (Oklahoma State Department of Health 2012), this finding was expected. The strong positive effects of *DIAB* and *HBP* on *PLAC* support Hypothesis 4. In addition, because the statistical significant relationship of the race coefficient for Native Americans decreases when both variables are considered, Hypothesis 4 is confirmed.

When the effect of *DIAB* on *PROM* is taken into account in **Model 18** (Table 5.6), the discrepancies between both minority groups and whites do not disappear. A similar occurrence happens when *HBP* is considered in **Model 22**. *DIAB* has a strong positive effect on the labor and delivery outcome variable *PROM*. This means that women diagnosed with gestational diabetes are more likely to experience premature rupture of membranes, which supports previous research (Xiong, Saunders, Wang, and Demianczuk 2001). *HBP* has a strong negative effect on *PROM*, suggesting that women diagnosed with pregnancy-induced hypertension are less likely to experience premature rupture of membranes. The effect of *DIAB* on *PROM* is expected and supports Hypothesis 4, while the effect of *HBP* on *PROM* is unexpected and does not. Interestingly, Native American women are less likely to experience PROM and African Americans are more likely to experience PROM even when diabetes and hypertension are taken into account. Because

the statistically significant positive effect of the race coefficient for African Americans does not dissipate when either maternal health variable is considered, Hypothesis 4 is not supported by the results of Models 18 and 22. However, among Native Americans, the statistically significant negative effect of the race coefficient actually grew stronger (from p=.01 to p=.001), suggesting Native American women diagnosed with gestational diabetes are far less likely to experience PROM even compared to white women diagnosed with the same condition.

When the effect of *DIAB* on *LBW* is taken into account in **Model 19** (Table 5.7), the discrepancies between both minority groups and whites does not change. African Americans are still far more likely to give birth to underweight babies, while Native American women are far less likely to do so. Both *DIAB* and *HBP* have strong positive effects on the labor and delivery outcome variable *LBW*. This suggests, interestingly, that women diagnosed with gestational diabetes are more likely to give birth to underweight babies. Though it may be more common to give birth to macrosomic (large for gestational age) babies (Oklahoma State Department of Health 2012), women diagnosed with gestational diabetes have also been shown to give birth to babies with low birth weights (Vambergue and Fajardy 2011). *HBP* has a similar effect. Women experiencing hypertension during pregnancy are far more likely to give birth to underweight babies, a finding supported by previous research (Fang, Madhavan, and Alderman 1999). The strong positive effects of *DIAB* and *HBP* illustrated in Models 19 and 23 are expected and support Hypothesis 4, women diagnosed with detrimental maternal health problems are more likely to experience adverse labor and delivery outcomes. However, it was anticipated that the effects of the maternal health variables *DIAB* and *HBP* would explain,

in part, the differences in the prevalence of low birth weight between racial and ethnic groups. Because the statistical significance of the race coefficients does not decrease when *DIAB* and *HBP* are added to the equation, the results of Models 19 and 23 do not support Hypothesis 4.

When the effect of *DIAB* on *ICU* is taken into account in **Model 20** (Table 5.8), the discrepancies between both minority groups and whites, like those found when maternal health variables are regressed on *LBW*, do not disappear. African Americans are still far more likely to place their newborns in an intensive care unit, while Native American women are far less likely to do so. This undoubtedly has to do with the previous findings regarding low birth weight. Because African Americans are more likely to birth underweight babies, it is logical that they might be required to place their babies in ICU. Both *DIAB* and *HBP* (**Model 24**) have strong positive effects on the labor and delivery outcome variable *ICU*. This means that women diagnosed with gestational diabetes or hypertension are more likely to place their babies in intensive care, results that support Hypothesis 4. Like the results illustrated above for *LBW*, the statistical significance of the race coefficients does not decrease when *DIAB* and *HBP* are added to the equation; therefore, the results of Models 20 and 24 do not support Hypothesis 4.

II. RESULTS – *PRAMS VI* (2009-2011)

A. HYPOTHESIS 1: Minorities engage in risky and unhealthy behaviors while pregnant more often than whites.

Hypothesis 1 is tested using binary logistic regression. Models 1-4 (Tables 5.9-5.12) show the relationship between race and the four maternal behavior variables:

SMOKE, *DRINK*, *PNC*, and *MV*. **Model 1** (Table 5.9) illustrates the relationship between race and smoking (*SMOKE*), including only race. Model 5 adds all the sociodemographic control variables and is discussed in Part C of this section. The results of Model 1 indicate that African American women smoke cigarettes less often than white women while pregnant, supporting previous research findings (Abma and Mott 1991; Hummer 1993; Oklahoma State Department of Health 2006; Shiao et al. 2005). However, when only race is taken into account, it seems that Native American women smoke cigarettes more often than whites while pregnant, also supporting previous research (Alexander et al. 2008; Castor et al. 2006; Emmanuel 1999; Salihu et al. 2003).

Table 5.9. Binary Logistic Regression for the Relationship between Race and SMOKING (*SMOKE*)

Sociodemographic Variables	**Model 1**	**Model 5**
MATERNAL RACE		
Black	-0.847*** (0.033)	-1.615*** (0.038)
Native	0.131*** (0.022)	-0.215*** (0.024)
MATERNAL AGE		0.425*** (0.014)
MARRIED		1.014*** (0.018)
EDUCATION		-0.305*** (0.010)
INCOME		-0.206*** (0.004)
Chi-Square	868.405	15745.285
N	5319	5082

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses)
Source: *PRAMS VI* 2009-2011

Though the results of Model 1 corroborate published literature on the relationship between race and smoking, they do not fully support Hypothesis 1. Comparisons of *PRAMS V* and *PRAMS VI* results on maternal smoking are discussed in Part A of Section III of this chapter.

Model 2 (Table 5.10) illustrates the relationship between race and drinking (*DRINK*), including only race. Model 6 adds all the sociodemographic control variables and is discussed in Part C of this section. The results of Model 2 indicate that African American women are no more likely to drink during pregnancy than white women, while Native American women are far less likely than white women to drink during pregnancy.

Table 5.10. Binary Logistic Regression for the Relationship between Race and DRINKING (*DRINK*)

Sociodemographic Variables	**Model 2**	**Model 6**
MATERNAL RACE		
Black	0.045 (0.045)	-0.363*** (0.054)
Native	-0.265*** (0.046)	-0.347*** (0.049)
MATERNAL AGE		0.754*** (0.025)
MARRIED		0.321*** (0.032)
EDUCATION		-0.059** (0.019)
INCOME		-0.009 (0.008)
Chi-Square	38.682	1121.539
N	5336	5097

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses)
Source: *PRAMS VI* 2009-2011

These results challenge previous research findings that indicate a higher likelihood of maternal alcohol consumption among Native Americans when compared to whites (Alexander et al. 2008; Harrison and Sidebottom 2009; Castor et al. 2006), as well as those that show whites are more likely than African Americans to drink during pregnancy (Abma and Mott 1991; Shiao et al. 2005; Hummer 1993). The results do not fully contradict Hypothesis 1 of the current study, however. Comparisons of *PRAMS V* and *PRAMS VI* results on maternal drinking are discussed in Part A of Section III of this chapter.

Model 3 (Table 5.11) illustrates the relationship between race and prenatal care utilization (*PNC*), including only race. Model 7 adds all the sociodemographic control variables and is discussed in Part C of this section. The results of Model 3 indicate that both African American and Native American women are far less likely than whites to receive first trimester prenatal care, though receiving some prenatal care at any point during pregnancy was higher among African Americans than whites. Previous studies have found that minority women are far less likely to utilize preventive care services (Abma and Mott 1991; Baldwin et al. 2002; Castor et al. 2006; Emmanuel 1999; Hummer 1993; Oklahoma State Department of Health 1995a; Remez 2003; Shiao et al. 2005), and the results associated with early prenatal care correspond with those findings. However, at least for African Americans, the findings regarding some prenatal care directly contradict what is known about the utilization of preventive care services among minority women.

Table 5.11. Binary Logistic Regression for the Relationship between Race and PRENATAL CARE (*PNC*)		
1ST TRIMESTER PRENATAL CARE		
Sociodemographic Variables	**Model 3**	**Model 7**
MATERNAL RACE		
Black	-0.597*** (0.022)	-0.167*** (0.025)
Native	-0.814*** (0.019)	-0.538*** (0.021)
MATERNAL AGE		0.244*** (0.013)
MARRIED		-0.343*** (0.017)
EDUCATION		0.270*** (0.010)
INCOME		0.242*** (0.004)
Chi-Square	2113.205	15430.571
SOME PRENATAL CARE		
*Sociodemographic Variable*s		
MATERNAL RACE		
Black	1.180*** (0.213)	2.075*** (0.262)
Native	-0.958*** (0.074)	-0.573*** (0.077)
MATERNAL AGE		-0.342*** (0.059)
MARRIED		-0.496*** (0.077)
EDUCATION		-0.357*** (0.045)
INCOME		0.468*** (0.042)
Chi-Square	206.359	1104.602
N	5300	5062

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses)
Source: *PRAMS VI* 2009-2011

It was expected, due to previous research results, that minority women, including both Native Americans and African Americans, would be less likely to utilize prenatal care – both first trimester care and care at any time during pregnancy. Comparisons of *PRAMS V* and *PRAMS VI* results on prenatal care utilization are discussed in Part A of Section III of this chapter.

Model 4 (Table 5.12) illustrates the relationship between race and multivitamin use (*MV*), including only race. Model 8 adds all the sociodemographic control variables and is discussed in Part C of this section. The results of Model 4 indicate that both African American and Native American women are more likely than whites to take multivitamins when only race is considered.

Table 5.12. Binary Logistic Regression for the Relationship between Race and MULTIVITAMIN USE (*MV*)

Sociodemographic Variables	**Model 4**	**Model 8**
MATERNAL RACE		
Black	0.410*** (0.025)	-0.154*** (0.027)
Native	0.693*** (0.024)	0.366*** (0.025)
MATERNAL AGE		-0.348*** (0.013)
MARRIED		0.634*** (0.018)
EDUCATION		-0.249*** (0.011)
INCOME		-0.175*** (0.004)
Chi-Square	1147.406	14850.315
N	5341	5097

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses)
Source: *PRAMS VI* 2009-2011

This finding is contradictory to the results of previous research (Williams et al. 2003). Moreover, it does not support Hypothesis 1. It was hypothesized that minority women would be less likely than whites to use multivitamins or prenatal vitamins due to socioeconomic disadvantages associated with education and income; therefore, Model 8 may offer some explanation of these findings when socioeconomic variables are taken into consideration. Comparisons of *PRAMS V* and *PRAMS VI* results on multivitamin use are discussed in Part A of Section III of this chapter.

B. HYPOTHESIS 2: Minorities have unfavorable health problems and labor/delivery complications more often than whites.

Hypothesis 2 is tested using binary logistic regression. Models 9-12 (Tables 5.13-5.16) show the relationship between race and the four labor and delivery outcome variables: *PLAC, PROM, LBW,* and *ICU.* **Model 9** (Table 5.13) illustrates the relationship between race and placental issues (*PLAC*), including only race. Model 13 adds all the sociodemographic control variables and is discussed in Part C of this section. Model 17 tests the effect of gestational diabetes and Model 21 tests the effect of hypertension during pregnancy; both models take into account race and the sociodemographic control variables. The relationship between labor and delivery outcomes and both health-related variables is discussed in Part D of this section. The results of Model 9 indicate that there is no difference between African American and white women regarding placental issues, meaning African American women are no more likely than whites to experience placental issues. Native Americans, on the other hand, are less likely than white women to experience placental issues when only race is taken into account. These results do not

support Hypothesis 2. It could be, once again, the effect of maternal smoking among white women in the study sample that is causing a higher likelihood of placental issues.

Model 25 tests the effect of race on *PLAC* while taking into account *SMOKE* and the sociodemographic control variables. **Model 29** tests the effect of race on *PLAC* while taking into account *DRINK* and the sociodemographic control variables. The statistical significant negative relationship does not disappear among Native American women when maternal behavior variables are considered in Models 25 and 29. While smoking and drinking have strong positive effects on *PLAC*, the variables do not have an effect on either African American or Native American outcomes. Women that smoke or drink during pregnancy are far more likely to experience placental issues than those that do not, as expected, but even when maternal smoking and drinking are held constant, Native Americans are still less likely than whites to experience placental issues. Furthermore, there continues to be no measurable difference regarding the experience of placental issues between African American and white women.

Model 33 tests the effect of race on *PLAC* while taking into account *PNC* and the sociodemographic control variables. Women who receive prenatal care (first, second, or third trimester care) are more likely to experience placental issues. This finding again suggests that women who are more prone to placental issues are more likely to seek prenatal care because they possibly experienced adverse outcomes in a previous pregnancy. Taking into account prenatal care utilization has no effect on the race coefficients. There is still no statistical difference between African American and white women concerning placental issues, while Native American women are still far less likely to experience placental issues when compared to white women.

Table 5.13. Binary Logistic Regression for the Relationship between Race and PLACENTAL ISSUES (*PLAC*)

Sociodemographic Variables	**Model 9**	**Model 13**	**Model 17**	**Model 21**	**Model 25**	**Model 29**	**Model 33**	**Model 37**
MATERNAL RACE								
Black	-0.036 (0.045)	-0.024 (0.046)	-0.007 (0.046)	-0.054 (0.046)	0.027 (0.047)	-0.013 (0.046)	0.032 (0.046)	-0.034 (0.046)
Native	-0.254*** (0.043)	-0.252*** (0.043)	-0.234*** (0.044)	-0.297*** (0.044)	-0.245*** (0.044)	-0.247*** (0.044)	-0.189*** (0.044)	-0.243*** (0.044)
MATERNAL AGE		0.316*** (0.022)	0.351*** (0.023)	0.317*** (0.022)	0.295*** (0.022)	0.303*** (0.022)	0.350*** (0.023)	0.306*** (0.022)
MARRIED		0.294*** (0.030)	0.294*** (0.030)	0.291*** (0.030)	0.247*** (0.031)	0.282*** (0.030)	0.310*** (0.030)	0.317*** (0.030)
EDUCATION		-0.231*** (0.018)	-0.240*** (0.018)	-0.236*** (0.018)	-0.222*** (0.018)	-0.239*** (0.018)	-0.220*** (0.018)	-0.244*** (0.018)
INCOME		0.037*** (0.007)	0.031*** (0.007)	0.038*** (0.007)	0.045*** (0.007)	0.037*** (0.007)	0.033*** (0.007)	0.030*** (0.007)
Maternal Health Variables								
DIABETES			-0.815*** (0.063)					
HYPERTENSION				0.584*** (0.029)				
Maternal Behavior Variables								
SMOKING					0.240*** (0.031)			
DRINKING						0.465*** (0.047)		
PRENATAL CARE								
1st Trimester Prenatal Care							0.214*** (0.034)	
Some Prenatal Care							0.839*** (0.244)	
MULTIVITAMINS								-0.218*** (0.029)
Chi-Square	37.036	443.125	667.365	798.715	501.918	548.200	522.870	508.471
N	5298	5062	5046	5054	5039	5039	5004	5040

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses) Source: *PRAMS VI* 2009-2011

It was expected that minority women would be more likely to experience adverse pregnancy outcomes like placental issues. The results illustrated in Table 5.13 have not yet supported Hypothesis 2. Prenatal care utilization does not explain the disparities between Native Americans and whites, even when socioeconomic characteristics are taken into account.

Model 37 tests the effect of race on *PLAC* while taking into account *MV* and the sociodemographic control variables. Women who take multivitamins are far less likely to experience placental issues. This result was expected, given that multivitamins are used to guard against adverse pregnancy outcomes. Taking into account multivitamin use has no effect on the race coefficients, however. Native American women are still less likely to experience placental issues when compared to white women. There remains no difference between African American and white women. Because the statistical significance of the race coefficients did not dissipate when considering any of the maternal health behavior variables *SMOKE, DRINK, PNC,* or *MV* it seems that an unobserved variable is causing the significant disparity between Native American and white women concerning placental issues. Possible explanations are discussed in Section I of Chapter 6. Comparisons of *PRAMS V* and *PRAMS VI* results on placental issues are discussed in Part B of Section III of this chapter.

Model 10 (Table 5.14) illustrates the relationship between race and premature rupture of membranes (*PROM*), including only race. Model 14 adds all the sociodemographic control variables and is discussed in Part C of this section. Model 18 tests the effect of gestational diabetes and Model 22 tests the effect of hypertension during pregnancy; both models take into account race and the sociodemographic control

variables. The relationship between labor and delivery outcomes and both health-related variables is discussed in Part D of this section. The results of Model 10 indicate that both African American and Native American women are more likely than white women to experience PROM when only race is taken into account. The results of Model 10 support Hypothesis 2 for both minority groups, as well as the findings of previous research (Shiao et al. 2005; Whitehead et al. 2009) that found a higher likelihood of PROM among African American women compared to whites. Comparisons of *PRAMS V* and *PRAMS VI* results on PROM are discussed in Part B of Section III of this chapter.

Model 26 tests the effect of race on *PROM* while taking into account *SMOKE* and the sociodemographic control variables. **Model 30** tests the effect of race on *PROM* while taking into account *DRINK* and the sociodemographic control variables. The strong positive significance does not disappear among African American women when maternal behavior variables are considered in Models 26 and 30. The significant relationship between the Native American race coefficient and PROM has disappeared, though it is due to the sociodemographic variables that were added to the equation in Model 14, most likely education and income. The effect of these variables is discussed below. *SMOKE* has a strong positive effect on *PROM*, while there is no measurable effect of *DRINK*. This means that women who smoke during pregnancy are far more likely to experience PROM. However, women who drink during pregnancy are no more likely to experience PROM than those who do not. Neither variable has an effect on the race coefficients for African Americans. African American women are still more likely than whites to experience PROM even when maternal smoking and drinking are held constant.

Model 34 tests the effect of race on *PROM* while taking into account *PNC* and the sociodemographic control variables. Women who receive 1st trimester prenatal care are less likely to experience PROM. There is no difference between those that receive at least some prenatal care and those that do not concerning the likelihood of PROM. The finding regarding early prenatal care utilization is expected. Women that seek early prenatal care are less likely than women who never see a physician for prenatal care to experience PROM. However, it was also expected that receiving at least some prenatal care during pregnancy would also have a negative statistical effect on *PROM*. Taking into account prenatal care utilization has no effect on the race coefficient for African American women who are still far more likely than white women to experience PROM. There continues to be no difference between Native Americans and whites regarding PROM, even when prenatal care utilization is considered.

Model 38 tests the effect of race on *PROM* while taking into account *MV* and the sociodemographic control variables. Women who take multivitamins are far less likely to experience PROM, an anticipated result. Taking into account multivitamin use has no effect on the race coefficient for African American women are still far more likely than white women to experience PROM. There continues to be no measurable difference between Native American and white women regarding PROM when multivitamin use is considered. Because the statistical significance of the race coefficient for African American women did not dissipate when considering any of the maternal health behavior variables *SMOKE, DRINK, PNC,* or *MV* it seems that an unobserved variable is causing the significant discrepancy when compared to white women concerning PROM. Possible explanations are discussed in Section I of Chapter 6.

Table 5.14. Binary Logistic Regression for the Relationship between Race and PREMATURE RUPTURE OF MEMBRANES (*PROM*)

Sociodemographic Variables	**Model 10**	**Model 14**	**Model 18**	**Model 22**	**Model 26**	**Model 30**	**Model 34**	**Model 38**
MATERNAL RACE								
Black	0.571*** (0.038)	0.523*** (0.040)	0.523*** (0.040)	0.531*** (0.040)	0.625*** (0.041)	0.521*** (0.040)	0.536*** (0.040)	0.513*** (0.040)
Native	0.105** (0.040)	0.015 (0.041)	0.013 (0.041)	0.023 (0.041)	0.027 (0.041)	0.012 (0.041)	0.007 (0.042)	0.026 (0.041)
MATERNAL AGE		-0.055* (0.023)	-0.043 (0.023)	-0.057* (0.023)	-0.093*** (0.024)	-0.049* (0.023)	-0.062** (0.023)	-0.061** (0.023)
MARRIED		0.031 (0.031)	0.032 (0.031)	0.027 (0.031)	-0.043 (0.031)	0.032 (0.031)	0.047 (0.031)	0.049 (0.031)
EDUCATION		-0.169*** (0.018)	-0.177*** (0.018)	-0.166*** (0.018)	-0.149*** (0.019)	-0.174*** (0.018)	-0.166*** (0.019)	-0.177*** (0.019)
INCOME		-0.062*** (0.007)	-0.063*** (0.007)	-0.062*** (0.007)	-0.046*** (0.007)	-0.061*** (0.007)	-0.054*** (0.007)	-0.066*** (0.007)
Maternal Health Variables								
DIABETES			-0.142** (0.051)					
HYPERTENSION				-0.059 (0.056)				
Maternal Behavior Variables								
SMOKING					0.422*** (0.031)			
DRINKING						-0.004 (0.061)		
PRENATAL CARE								
1st Trimester Prenatal Care							-0.074* (0.031)	
Some Prenatal Care							0.097 (0.144)	
MULTIVITAMINS								-0.188*** (0.031)
Chi-Square	199.464	646.181	666.411	644.698	819.708	648.389	655.581	673.825
N	5318	5078	5061	5067	5056	5055	5020	5057

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses) Source: *PRAMS VI* 2009-2011

Model 11 (Table 5.15) illustrates the relationship between race and low birth weight (*LBW*), including only race. Model 15 adds all the sociodemographic control variables and is discussed in Part C of this section. Model 19 tests the effect of gestational diabetes and Model 23 tests the effect of hypertension during pregnancy; both models take into account race and the sociodemographic control variables. The relationship between labor and delivery outcomes and both health-related variables is discussed in Part D of this section. The results of Model 11 indicate that African American women are more likely than white women to have underweight babies, while there seems to be no difference between Native Americans and white women concerning low birth weight when only race is taken into account. The results of Model 11 regarding the high likelihood of low birth weight for African Americans is expected and is supported by previous research (Chao et al. 2010; Conley et al. 2003; Emmanuel et al. 1999; Hummer 1993; Kallan 1993; Lu and Halfon 2003; Lu et al. 2010; Mustillo et al. 2004; Odell et al. 2006; Remez 2003; Shiao et al. 2005; Sparks 2009; Zhang et al. 2011). The findings regarding African Americans also support Hypothesis 2 of the present study. Comparisons of *PRAMS V* and *PRAMS VI* results on low birth weight are discussed in Part B of Section III of this chapter.

Table 5.15. Binary Logistic Regression for the Relationship between Race and LOW BIRTH WEIGHT (*LBW*)

Sociodemographic Variables	**Model 11**	**Model 15**	**Model 19**	**Model 23**	**Model 27**	**Model 31**	**Model 35**	**Model 39**
MATERNAL RACE								
Black	0.770*** (0.030)	0.690*** (0.032)	0.693*** (0.032)	0.721*** (0.032)	0.856*** (0.033)	0.689*** (0.032)	0.735*** (0.032)	0.700*** (0.032)
Native	-0.004 (0.035)	-0.169*** (0.037)	-0.191*** (0.037)	-0.228*** (0.037)	-0.149*** (0.037)	-0.169*** (0.037)	-0.151*** (0.037)	-0.157*** (0.037)
MATERNAL AGE		0.059** (0.019)	0.045* (0.019)	0.056** (0.020)	0.012 (0.020)	0.064*** (0.019)	0.033 (0.20)	0.040* (0.19)
MARRIED		0.122*** (0.026)	0.126*** (0.026)	0.115*** (0.026)	0.021 (0.026)	0.130*** (0.026)	0.146*** (0.026)	0.153*** (0.026)
EDUCATION		-0.147*** (0.015)	-0.143*** (0.015)	-0.162*** (0.016)	-0.126*** (0.016)	-0.149*** (0.015)	-0.153*** (0.016)	-0.151*** (0.015)
INCOME		-0.050*** (0.006)	-0.048*** (0.006)	-0.047*** (0.006)	-0.031*** (0.006)	-0.050*** (0.006)	-0.050*** (0.006)	-0.054*** (0.006)
Maternal Health Variables								
DIABETES			0.396*** (0.035)					
HYPERTENSION				0.978*** (0.024)				
Maternal Behavior Variables								
SMOKING					0.534*** (0.026)			
DRINKING						-0.069 (0.051)		
PRENATAL CARE								
1st Trimester Prenatal Care							0.166*** (0.028)	
Some Prenatal Care							-0.560*** (0.102)	
MULTIVITAMINS								-0.187*** (0.026)
Chi-Square	594.105	1065.885	1198.113	2594.072	1509.599	1080.959	1138.637	1129.994
N	5371	5121	5104	5084	5082	5097	5062	5097

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses)
Source: *PRAMS VI* 2009-2011

Model 27 tests the effect of race on *LBW* while taking into account *SMOKE* and the sociodemographic control variables. **Model 31** tests the effect of race on *LBW* while taking into account *DRINK* and the sociodemographic control variables. The significance does not change among African American women when maternal behavior variables are considered in Models 27 and 31. *SMOKE* has a strong positive effect on *LBW*, while *DRINK* has no statistically significant effect. This means that women who smoke during pregnancy are far more likely to give birth to underweight babies, a finding that is well documented in the published literature (Alexander et al. 2008; Aliyu et al. 2011b; Conley et al. 2003; D'Angelo et al. 2007; Hellerstedt et al. 1997; Meis et al. 1997; Oklahoma State Department of Health 1997, 2006, 2008, 2009; Pollack et al. 2000; Salihu et al. 2003; Sparks 2009; Suellentrop et al. 2006; Wang et al. 1997). However, women who drink during pregnancy are no more likely to give birth to underweight babies than women who do not consume alcohol during pregnancy. Neither variable has an effect on the race coefficients. African American women are still far more likely to give birth to underweight babies when maternal smoking and drinking are held constant. When only race was considered, there was no significant difference between Native Americans and whites concerning the likelihood of birthing a low birth weight baby. However, the results now suggest that Native Americans are far less likely to give birth to underweight babies when compared to white women. The significant disparity appeared in Model 15 when sociodemographic variables were added to the equation. The effect of these variables is discussed below.

Model 35 tests the effect of race on *LBW* while taking *PNC* into account and the sociodemographic control variables. Women who receive 1st trimester prenatal care are

more likely to have babies who have a low birth weight. However, women who receive at least some prenatal care during pregnancy are less likely to birth an underweight baby compared to those that never receive any care. Once again this finding suggests that women who are aware that their child may be at risk for low birth weight are more likely to seek early prenatal care. The finding concerning overall prenatal care utilization is expected given previous research that documents the correlation between the lack of prenatal care utilization and low birth weight (Sparks 2009). Taking into account prenatal care utilization has no effect on the race coefficients. African American women are still far more likely to have low birth weight babies, while Native American women are still far less likely to have babies that have a low birth weight when compared to white women.

Model 39 tests the effect of race on *LBW* while taking into account *MV* and the sociodemographic control variables. Women who take multivitamins are far less likely to have babies with low birth weight. Multivitamin use has been shown to decrease the prevalence of adverse pregnancy outcomes (Catov et al. 2007; Scholl et al. 1997; Vahratian et al. 2004), hence this finding is expected. Taking into account multivitamin use, however, does not alter the effect of the race coefficients for African Americans or for Native Americans. African American women are still far more likely to have babies with low birth weight, while Native American women are still far less likely to have babies with low birth weight when compared to white women. Again, because the statistical significance of the race coefficients did not dissipate when considering any of the maternal health behavior variables *SMOKE, DRINK, PNC,* or *MV* it seems that an unobserved variable or variables is causing the significant discrepancies between

minority and white women concerning birth weight. Possible explanations are discussed in Section I of Chapter 6.

Model 12 (Table 5.16) illustrates the relationship between race and child intensive care placement (*ICU*) including only race. Model 16 adds all the sociodemographic control variables and is discussed in Part C of this section. Model 20 tests the effect of gestational diabetes and Model 24 tests the effect of hypertension during pregnancy; both models take into account race and the sociodemographic control variables. The relationship between labor and delivery outcomes and both health-related variables is discussed in Part D of this section. The results of Model 12 indicate that African American women are more likely than white women to place their newborns in an intensive care unit, while there is no difference between Native Americans and whites when only race is taken into account. This finding is expected due to this study's findings on low birth weight for both minority groups. Considering the high likelihood of African American women giving birth to low birth weight babies, it was anticipated that African American women would also be far more likely than white women to place their child in ICU. Native Americans, according to the present study's findings, are no more likely than whites to birth underweight babies; therefore, the findings regarding ICU placement are also expected, though do not completely support Hypothesis 2. Comparisons of *PRAMS V* and *PRAMS VI* results on ICU placement are discussed in Part B of Section III of this chapter.

Table 5.16. Binary Logistic Regression for the Relationship between Race and INTENSIVE CARE (*ICU*)

Sociodemographic Variables	**Model 12**	**Model 16**	**Model 20**	**Model 24**	**Model 28**	**Model 32**	**Model 36**	**Model 40**
MATERNAL RACE								
Black	0.645*** (0.027)	0.522*** (0.029)	0.524*** (0.029)	0.559*** (0.029)	0.551*** (0.029)	0.522*** (0.029)	0.553*** (0.029)	0.539*** (0.029)
Native	0.040 (0.029)	0.008 (0.030)	-0.027 (0.030)	-0.125*** (0.031)	-0.063* (0.031)	-0.060* (0.030)	0.025 (0.030)	0.007 (0.030)
MATERNAL AGE		0.228*** (0.016)	0.198*** (0.017)	0.226*** (0.017)	0.228*** (0.017)	0.227*** (0.017)	0.225*** (0.017)	0.213*** (0.017)
MARRIED		0.017 (0.022)	0.020 (0.022)	0.002 (0.022)	0.002 (0.022)	0.011 (0.022)	0.052* (0.022)	0.019 (0.022)
EDUCATION		0.059*** (0.013)	0.062*** (0.013)	0.057*** (0.014)	0.059*** (0.013)	0.049*** (0.013)	0.052*** (0.013)	0.083*** (0.013)
INCOME		-0.073*** (0.005)	-0.069*** (0.005)	-0.073*** (0.005)	-0.075*** (0.005)	-0.069*** (0.005)	-0.064*** (0.005)	-0.066*** (0.005)
Maternal Health Variables								
DIABETES			0.577*** (0.029)					
HYPERTENSION				0.907*** (0.021)				
Maternal Behavior Variables								
SMOKING					-0.015 (0.024)			
DRINKING						-0.009 (0.041)		
PRENATAL CARE								
1st Trimester Prenatal Care							-0.024 (0.023)	
Some Prenatal Care							0.668*** (0.129)	
MULTIVITAMINS								0.160*** (0.022)
Chi-Square	534.966	766.900	1156.665	2599.460	813.000	745.279	805.081	817.041
N	5327	5088	5073	5052	5050	5065	5033	5066

*p<.05 **p<.01 ***p<.001
(Standard errors are in parentheses)
Source: *PRAMS VI* 2009-2011

Model 28 tests the effect of race on *ICU* while taking into account *SMOKE* and the sociodemographic control variables. **Model 32** tests the effect of race on *ICU* while taking into account *DRINK* and the sociodemographic control variables. The significance does not change among African American women when maternal behavior variables are considered in Model 28 and Model 32. African American women are still more likely to have a newborn placed in ICU. A statistical significant relationship develops between the race coefficient for Native Americans and whites concerning ICU placement when the maternal behavior variables *SMOKE* and *DRINK* are tested. Native American women are less likely to place their newborn in ICU when maternal smoking and drinking are held constant. Neither *SMOKE* nor *DRINK* has an effect on *ICU*. This means that women who smoke or drink during pregnancy are no more likely to have a newborn placed in ICU than women who do not engage in these so-called "risky" maternal behaviors. The results of *SMOKE* on *ICU* are again unanticipated due to the strong positive relationship between smoking and low birth weight and the correlation between low birth weight and ICU placement.

Model 36 tests the effect of race on *ICU* while taking into account *PNC* and the sociodemographic control variables. There is no difference between women who receive 1st trimester prenatal care and those that do not see a physician for early prenatal care regarding child placement in ICU. However, women that receive prenatal care at any point during their pregnancy are more likely than women who do not receive any prenatal care to be required to place their newborn in ICU. This finding is unexpected given that prenatal care utilization at some point during pregnancy provides expectant mothers an opportunity to consult with a physician about the possibilities of experiencing adverse

pregnancy outcomes, several of which might lead to child placement in ICU. Taking into account prenatal care utilization has no effect on the statistical significance of the race coefficient for African American women, who are still far more likely to place their newborns in ICU. There is no difference between Native American and white women concerning ICU placement when PNC is added to the equation.

Model 40 tests the effect of race on *ICU* while taking into account *MV* and the sociodemographic control variables. Women who take multivitamins are statistically more likely to place their newborns in ICU. This outcome is unexpected, especially considering this study's findings regarding the anticipated negative effect of *MV* on *PLAC, PROM,* and *LBW*. It could be that a similar effect to *PNC* on *PLAC* is occurring here, whereby women who understand that they may be at higher risk for adverse pregnancy outcomes – outcomes that are not measured in the present study – take multivitamins as a preventive measure. Taking into account multivitamin use does not change the effect of the race coefficient for African American women who are still far more likely to place their newborn in ICU. There continues to be no measurable difference between Native American and white women regarding the likelihood of child placement in ICU. Once again, because the statistical significance of the race coefficient for African Americans did not dissipate when considering any of the maternal health behavior variables *SMOKE, DRINK, PNC,* or *MV* it seems that an unobserved variable or variables is causing the significant discrepancy when compared to white women concerning ICU placement. Possible explanations are discussed in Section I of Chapter 6.

C. HYPOTHESIS 3: The differences proposed in Hypotheses 1 and 2 are due in part to racial differences in socioeconomic characteristics.

i. Maternal Behavior Variables

Hypothesis 3 is tested using binary logistic regression. It was expected that higher levels of education and income would likely decrease risky health behaviors for pregnant minority women, but the socioeconomic variables would not entirely close the disparity between whites and minorities in this respect. **Models 5-8** (Tables 5.9-5.12) regress the maternal behavior variables *SMOKE, DRINK, PNC,* and *MV* on race along with the sociodemographic control variables age, marital status, education, and income.

Model 5 (Table 5.9) illustrates the relationship between race and *SMOKE*, while taking into account sociodemographic characteristics. African American women are still less likely to smoke cigarettes while pregnant, even when the sociodemographic variables are included in the equation. The statistical significance does not decrease. However, Native American women, instead of being more likely than white women to smoke during pregnancy as illustrated in Model 1, are less likely than white women to smoke during pregnancy when sociodemographic variables are held constant. Women with higher levels of education and income are less likely to smoke during pregnancy, supporting previous research findings (Abma and Mott 1991; Hummer 1993; Salihu et al. 2003). Older women and married women are more likely to smoke while pregnant, contradicting findings of previous research (Roelands et al. 2009; Salihu et al. 2003; Tong et al. 2011). Among Native American women, Hypothesis 3 is supported. The results of Model 5 indicate that the socioeconomic variables education and income

explain the difference between Native American and white women previously illustrated in Model 1 when only race was considered. Comparisons of *PRAMS V* and *PRAMS VI* results concerning the effect of socioeconomic variables on maternal smoking are discussed in Part A of Section III of this chapter.

Model 6 (Table 5.10) illustrates the relationship between race and *DRINK*, while taking into account sociodemographic characteristics. Both African American and Native American women are less likely than white women to drink during pregnancy when sociodemographic variables are held constant, which supports Hypothesis 3. Women with higher levels of education are less likely to drink while pregnant. There is no significant relationship between income and maternal drinking. Older women and married women are more likely to drink during pregnancy, both confirming and contradicting previous research (Harrison and Sidebottom 2009; Oklahoma State Department of Health 1995b). Comparisons of *PRAMS V* and *PRAMS VI* results concerning the effect of socioeconomic variables on maternal drinking are discussed in Part A of Section III of this chapter.

Model 7 (Table 5.11) illustrates the relationship between race and *PNC*, while taking into account sociodemographic characteristics. Both African American and Native American women are still less likely to seek early prenatal care while pregnant, even when the socioeconomic variables education and income are held constant. The statistical significance does not decrease for either minority group when considering first trimester prenatal care. This finding does not support Hypothesis 3 that socioeconomic characteristics explain the disparity in prenatal care utilization between whites and minorities. More educated women and women with higher levels of income are more likely to receive first trimester prenatal care, which is expected and is consistent with

previous research findings (Abma and Mott 1991; Hummer 1993; Oklahoma State Department of Health 1995). Older women are more likely to receive early prenatal care, while married women are less likely to receive early prenatal care.

Considering prenatal care utilization at any time during pregnancy (including first, second, or third trimester care), interesting and unanticipated effects were discovered for the variables race, age, marital status, and education. African Americans are far more likely than whites to receive prenatal care at some point during pregnancy, even when socioeconomic variables are taken into consideration. A negative relationship between the race coefficient for Native Americans and prenatal care continues to be evident in Model 7, meaning Native Americans are far less likely than whites to receive prenatal care at any time during pregnancy. Older women, married women, and women with higher levels of education are less likely to receive prenatal care at some point during pregnancy. Women with higher levels of income, however, are more likely to utilize prenatal care services. Hypothesis 3 is not supported by the results for overall prenatal care utilization illustrated in Model 7. Comparisons of *PRAMS V* and *PRAMS VI* results concerning the effect of socioeconomic variables on maternal prenatal care utilization are discussed in Part A of Section III of this chapter.

Model 8 (Table 5.12) illustrates the relationship between race and *MV*, while taking into account sociodemographic characteristics. Native American women are still more likely than whites to take multivitamins while pregnant, even when the socioeconomic variables education and income are included in the equation. The statistical significance does not decrease. However, the statistical significant effect reverses among African American women. When socioeconomic characteristics are held constant, African

Americans are far less likely than whites to use multivitamins, rather than being more likely when only race was considered. Surprisingly, women with higher levels of education and income are less likely to take multivitamins. Older women are less likely to take multivitamins, while married women are more likely to do so. The results of Model 8 do not support the hypotheses of the current study because it was expected that minorities would be less likely to take multivitamins, but socioeconomic status, measured by education and income, would explain the disparities between minorities and whites. The results illustrated here in Model 8 are similar to the results of the *PRAMS V* data analysis of the present study, illustrated in Model 8 of Table 5.8. Comparisons of *PRAMS V* and *PRAMS VI* results concerning the effect of socioeconomic variables on multivitamin use are discussed in Part A of Section III of this chapter.

ii. Labor and Delivery Outcome Variables

Models 13-16 (Tables 5.13-5.16) regress the labor and delivery outcome variables *PLAC, PROM, LBW,* and *ICU* on race along with the sociodemographic control variables age, marital status, education, and income. It was expected that higher levels of education and income would likely decrease, along with the risky health behaviors, the adverse labor and delivery outcomes for pregnant minority women. However, the socioeconomic variables would not entirely close the disparity between whites and minorities possibly due to unobserved variables.

Model 13 (Table 5.13) illustrates the relationship between race and *PLAC*, while taking into account sociodemographic variables. There is no difference between African

American and whites women regarding placental issues in pregnancy; however, for Native American women, there remains a significant difference when compared to whites. Native American women are less likely to experience placental issues when sociodemographic variables are taken into account. Older women, married women, and women with higher levels of income are more likely to experience placental issues in pregnancy, while women with higher levels of education are less likely to have an adverse pregnancy outcomes related to placental issues. These results are all anticipated. The researcher suspects that the variables age, marital status, and income are correlated in this analysis. It would reasonable to assume that older women, who are more often married and more economically established, would be more likely to experience labor and delivery complications like placental issues. Though the effects of the sociodemographic variables on *PLAC* are anticipated, the effects on both race coefficients do not support Hypothesis 3. Comparisons of *PRAMS V* and *PRAMS VI* results concerning the effect of socioeconomic variables on the prevalence of placental issues are discussed in Part B of Section III of this chapter.

Model 14 (Table 5.14) illustrates the relationship between race and *PROM*, while taking into account sociodemographic variables. African American women are still more likely to experience PROM, even when the socioeconomic variables education and income are included in the equation. The statistical significance does not decrease, contradicting Hypothesis 3. However, the results of Model 14 show that the sociodemographic variables explain the disparity between Native Americans and whites regarding PROM that was evident in the previous model (Model 10, Table 5.14) because the statistical significance disappears. These results for Native Americans support

Hypothesis 3. Women with higher levels of education and income are less likely to experience PROM, an anticipated result. There is no difference in the prevalence of PROM on the basis of marital status. Interestingly, however, older women are less likely to experience PROM, contradictory to the findings regarding *PLAC* but corresponding to PRAMS V findings. Comparisons of *PRAMS V* and *PRAMS VI* results concerning the effect of socioeconomic variables on the premature rupture of membranes are discussed in Part B of Section III of this chapter.

Model 15 (Table 5.15) illustrates the relationship between race and *LBW*, while taking into account sociodemographic variables. African American women are still more likely than white women to give birth to low birth weight babies, even when the socioeconomic variables are considered. The statistical significance does not decrease. Native American women, on the other hand, are less likely than white women birth to low birth weight babies when sociodemographic variables are taken into account. When only race was considered, there was no difference between Native Americans and whites concerning low birth weight. However, when sociodemographic variables are added to the equation, Native American women seem to be less likely than whites to birth underweight babies. It is suspected, since both education and income have a negative relationship with *LBW*, the statistical significance for the Native American race coefficient is due to these variables, which supports Hypothesis 3. Women with higher levels of education and income are less likely to birth low birth weight babies, findings that were expected. Older women and women that are married are more likely to have babies with low birth weight. These findings are similar to those uncovered in *PRAMS V* data analysis in the current study. Comparisons of *PRAMS V* and *PRAMS VI* results concerning the effect of

socioeconomic variables on the prevalence of low birth weight are discussed in Part B of Section III of this chapter.

Model 16 (Table 5.16) illustrates the relationship between race and *ICU*, while taking into account sociodemographic variables. African American women continue to be more likely than whites to place their child in intensive care, even when the socioeconomic variables education and income are considered. The statistical significance does not decrease for African Americans. There is no difference; however, between Native American and white women regarding child placement in ICU. The results of Model 16 do not support Hypothesis 3, that socioeconomic conditions are the cause of the discrepancies between racial and ethnic groups. However, considering the effects of the race coefficients for both African Americans and Native Americans on *LBW*, the results of Model 16 are expected. There is no measurable difference in the prevalence of child intensive care placement according to marital status. However, older women, those with more education, and those with lower levels of income are more likely to place their newborn in an intensive care unit. The effects of the age and income variables on *ICU* correspond with the effects of the same variables on *LBW*, so it is reasonable to conclude that there is some correlation, as there seems to be with the race coefficients, between low birth weight and ICU placement. However, the effect of the education variable on ICU was unanticipated, especially considering the results of the earlier *PRAMS V* data analysis. Comparisons of *PRAMS V* and *PRAMS VI* results concerning the effect of socioeconomic variables on the likelihood of child placement in intensive care are discussed in Part B of Section III of this chapter.

D. HYPOTHESIS 4: The differences proposed in Hypothesis 2 are due in part to health-related problems during pregnancy.

Hypothesis 4 is tested using binary logistic regression. The health conditions of the mother during pregnancy that are taken into account, including gestational diabetes (*DIAB*) and hypertension (*HBP*), were expected to have an effect on whether or not the mother experienced labor and delivery complications, as well as the health of the infant at birth. If the mother experienced either of these conditions during pregnancy, it was expected that she would be more likely to suffer adverse labor and delivery outcomes, including placental issues, premature rupture of membranes (PROM), low birth weight, and child placement in an intensive care unit. When the effect of gestational diabetes on *PLAC* is taken into account in **Model 17** (Table 5.13), the discrepancy between Native Americans and whites can still be seen. The statistical significance for Native American women does not decrease. Native American women are still less likely than white women to experience placental issues during pregnancy when maternal health variables are considered. *DIAB* has a negative effect on the labor and delivery outcome variable *PLAC*. This suggests, unexpectedly, that women diagnosed with gestational diabetes are less likely to experience placental issues. There is no significant difference in the experiences of African American women and white women regarding placental issues when gestational diabetes is considered. Nor is there a significant difference between African Americans and whites when hypertension is considered in **Model 21**, which is consistent with previous research (Ananth et al. 2004). The negative statistical relationship between the race coefficient for Native Americans and *PLAC* is still clear in Model 21. HBP, however, has a strong positive effect on PLAC, meaning that women diagnosed with

hypertension are more likely to experience placental issues during pregnancy, an anticipated outcome. The strong positive effects of *HBP* on *PLAC* support Hypothesis 4, though the strong negative effect of DIAB does not. Comparisons of *PRAMS V* and *PRAMS VI* results on the effect of maternal health variables on placental issues are discussed in Part C of Section III of this chapter.

When the effect of *DIAB* on *PROM* is taken into account in **Model 18** (Table 5.14), the disparity between African Americans and whites does not disappear. The significance for African Americans also remains strong when *HBP* is considered in **Model 22**. African American women are more likely than white women to experience PROM, even when the maternal health variables gestational diabetes and hypertension are considered. When only race was considered, there was a statistical significant difference between Native Americans and whites. When sociodemographic variables were added to the equation in Model 14, the statistical significance disappeared, suggesting the difference between racial and ethnic groups had been explains by the sociodemographic variables. There continues to be no difference between Native American and white women concerning PROM when either maternal health variable is added to the equation. *DIAB* has a negative effect on the labor and delivery outcome variable *PROM*. Women diagnosed with gestational diabetes are less likely to experience PROM, challenging previous research findings (Xiong et al. 2001) and the hypotheses of the current study. *HBP* has no measurable statistical effect on *PROM*, suggesting that women diagnosed with pregnancy-induced hypertension are no more likely than those that are not to experience premature rupture of membranes. The results of Model 18 and 22 in Table 5.14 do not fully support Hypothesis 4. Comparisons of *PRAMS V* and *PRAMS VI* results on

the effect of maternal health variables on PROM are discussed in Part C of Section III of this chapter.

When the effect of *DIAB* on *LBW* is taken into account in **Model 19** (Table 5.15), the discrepancies between both minority groups and whites does not change. African Americans are still far more likely to give birth to underweight babies, while Native American women are far less likely to do so. Both *DIAB* and *HBP* have strong positive effects on the labor and delivery outcome variable *LBW*. This suggests that women diagnosed with either gestational diabetes or hypertension are more likely to give birth to underweight babies results that correspond with the findings of the earlier *PRAMS V* data analysis of the current study, as well as some of the published literature (Fang et al. 1999; Vambergue and Fajardy 2011). The strong positive effects of *DIAB* and *HBP* illustrated in Models 19 and 23 are expected and support Hypothesis 4. However, it was also anticipated that by adding the maternal health variables *DIAB* and *HBP* would explain, in part the discrepancy in low birth weight between racial and ethnic groups. Because the race coefficient for African Americans does not decrease when these variables are added to the equation, Hypothesis 4 is not fully supported by the results of Models 19 and 23. Comparisons of *PRAMS V* and *PRAMS VI* results on the effect of maternal health variables on low birth weight are discussed in Part C of Section III of this chapter.

When the effect of *DIAB* on *ICU* is taken into account in **Model 20** (Table 5.16), the discrepancy regarding the prevalence of low birth weight between African Americans and whites is not reduced. African Americans are still far more likely to place their newborns in an intensive care unit. This most likely has to do with this study's findings regarding low birth weight. Because African Americans are far more likely than whites to

birth underweight babies, is a reasonable to assume that newborn ICU placement would also be more likely to occur among African American women. There is no difference between Native American and white women concerning the likelihood of child placement in ICU when gestational diabetes is taken into account. Both *DIAB* and *HBP* (**Model 24**) have strong positive effects on the labor and delivery outcome variable *ICU*. This means that women diagnosed with gestational diabetes or hypertension are more likely to place their babies in intensive care, findings that support Hypothesis 4. The statistical significant positive relationship for African Americans remains strong when *HBP* is considered, though for Native Americans a strong negative relationship appears (p=.001) when no difference existed before. Interestingly, when only race is considered, there is no difference between Native Americans and whites regarding child intensive care placement. When sociodemographic control variables are added to the equation, there continues to be no significant statistical effect. It is not until hypertension is considered that the results indicate Native Americans are far less likely than whites to place their newborn in an intensive care unit at birth. The results suggest that even when HBP is held constant for both racial and ethnic groups, Native Americans are far less likely than whites to have their child placed in ICU. Comparisons of *PRAMS V* and *PRAMS VI* results on the effect of maternal health variables on child intensive care placement are discussed in Part C of Section III of this chapter.

III. HYPOTHESIS 5: The results gleaned from analyzing the Oklahoma PRAMS data from the years 2004-2011 reveal some change over time.

It was expected that the results would reveal some change over time. Two OPRAMS study cycles (*PRAMS V*: 2004-2008 and *PRAMS VI*: 2009-2011) are analyzed. Due to a possible increase over the two study phases in the involvement of federal, tribal, or state programs designed to encourage healthy maternal behaviors and increase knowledge about and access to prenatal care, especially for more vulnerable populations like Native Americans and African Americans, it was hypothesized that risky maternal health behaviors would decline over time and the disparities between minority and white women concerning adverse labor and delivery outcomes would decrease over time as well. There are other considerations that must be taken into account, however, including the state of the economy during the two data collection phases—and the increased lack of access to health care for the working poor. Because there is a high probability that the women represented in Oklahoma PRAMS data have been significantly economically affected, possibly losing their jobs, homes, or insurance, there may be more evidence of this during the *PRAMS VI* (2009-2011) survey cycle. Therefore, this may have an effect on whether or not women were involved in certain risky health behaviors while pregnant, including visiting the physician for proper prenatal care and taking the recommended prenatal multivitamins, both variables that are correlated with socioeconomic status. It may also influence the effect the socioeconomic variables education and income have on both the maternal behavior variables and the labor and delivery outcome variables.

A. *Maternal Behavior Variables*

SMOKE (Tables 5.1 and 5.9). There was no difference between study samples in the prevalence of smoking during pregnancy. African American and Native American women in the more recent PRAMS study sample continued to be less likely than white women to smoke while pregnant when socioeconomic characteristics were taken into account. The results of both *PRAMS V* and *PRAMS VI* show that women with higher levels of education and income are far less likely to smoke during pregnancy. The results regarding maternal smoking in both *PRAMS V* and *VI* study phases support the hypotheses of the current study.

DRINK (Tables 5.2 and 5.10). The results of the earlier *PRAMS V* study phase indicate that when socioeconomic characteristics are taken into account, African American women are more likely to drink and Native American women are less likely to drink while pregnant when compared to white women. However, the more current results from *PRAMS VI* illustrate a significant change. Both African American and Native American women are far less likely than white women to drink during pregnancy when socioeconomic characteristics are considered. The effect of the socioeconomic variable education was altered as well. Women with higher levels of education in the more recent *PRAMS VI* study sample are less likely to drink during pregnancy, though the results from the earlier *PRAMS V* data suggested the opposite. There remained no measurable effect on drinking for the socioeconomic variable income. The significant decline in the prevalence of maternal drinking among minority women compared to white women as illustrated in the more recent *PRAMS VI* data analysis results supports Hypothesis 5 and contradicts

widespread stereotypical notions regarding a high prevalence of problem drinking among minorities.

PNC (Tables 5.3 and 5.11). The results of the earlier *PRAMS V* study phase indicate that when socioeconomic characteristics are taken into account, African American women are less likely than whites to have received any prenatal care, whether first trimester care or otherwise. There is no difference between Native Americans and whites concerning first trimester care, though Native American women are shown to be far less likely than whites to receive prenatal care at any time during pregnancy. More current data illustrates interesting changes. Regarding first trimester prenatal care, both African Americans and Native Americans are less likely than whites to seek early care. Though there was no change regarding Native Americans and overall prenatal care utilization, a significant increase occurred among African Americans. African American women are far more likely than whites to receive prenatal care at some point during pregnancy, especially when socioeconomic characteristics are held constant. The effect of the socioeconomic variable education changed in a significant and perplexing way. Women with higher levels of education are less likely to seek prenatal care at any time during pregnancy, though the results from the earlier *PRAMS V* data suggested the opposite. This finding is not consistent with previous research or the results from *PRAMS V* data in the current study, though the cause may be from an unobserved variable or variables. There was no change in the effect of the socioeconomic variable income. Women with higher levels of income are still more likely to seek prenatal care. Because the negative statistical relationship for first trimester prenatal care among minority women did not change over the course of the two PRAMS study phases, Hypothesis 5 is not supported. However, the more recent

PRAMS V data show that African American women are more likely than white women to receive at least some prenatal care during pregnancy, a finding that supports Hypothesis 5.

MV (Tables 5.4 and 5.8). The results of the earlier *PRAMS V* study phase indicate that when socioeconomic characteristics are taken into account, Native American women are more likely than whites to take multivitamins, though there is no difference between African American and white women. *PRAMS VI* data illustrates a significant change regarding African American multivitamin usage. The more current data shows that while Native American women are still more likely than whites to take multivitamins, African Americans are far less likely than whites to do so. Interestingly, the results of both PRAMS study phases indicate that women with higher levels of education and income are less likely to take multivitamins. The results regarding African American multivitamin use as illustrated in PRAMS data analysis over the two data collection phases support Hypothesis 5. While there was no difference between African American and white women concerning multivitamin use in the earlier *PRAMS V* data analysis, more recent data show that African American women are less likely to take multivitamins.

B. *Labor and Delivery Outcome Variables*

PLAC (Tables 5.5 and 5.13). The results of the earlier *PRAMS V* study phase indicate that when sociodemographic characteristics are taken into account, African American women are less likely than whites to have experienced placental issues, while Native Americans are more likely than whites to experience this adverse labor and delivery outcome. Significant change can be seen in the more current *PRAMS VI* results.

There is no difference between African Americans and whites regarding placental issues when sociodemographic variables are considered. However, Native Americans, instead of being more likely than whites to experience placental issues, the more current results indicate that they are in fact less likely than whites to experience issues with the placenta during pregnancy. The significant changes in the prevalence of placental issues for both African Americans and Native Americans over the course of the two PRAMS study phases, as indicated here, support Hypothesis 5.

Contrary to earlier *PRAMS V* results, Native Americans in the more current *PRAMS VI* data analysis continue to be less likely than whites to experience placental issues and for African Americans there continues to be no significant difference when compared to whites no matter the variables considered, including maternal health variables or maternal behavior variables. There was no change in the positive effect of the maternal health variable *HBP* on *PLAC*, though there was for *DIAB*. Women diagnosed with hypertension have continued to be more likely to experience placental issues. However, the more current *PRAMS VI* data results indicate that women diagnosed with gestational diabetes are less likely, rather than being more likely, to experience placental issues during pregnancy. There was no change in the positive effects of the maternal behavior variables *SMOKE* and *DRINK*. Women who smoke and drink during pregnancy continued to be more likely to experience placental issues during pregnancy. Concerning prenatal care utilization, women who seek prenatal care, either during the first trimester or at some point during pregnancy, are shown to be more likely to have experienced placental issues than those who do not seek prenatal care. It is suspected that this is a spurious relationship and that an unobserved variable or variables is causing the positive

effect of *PNC* on *PLAC*. Earlier *PRAMS V* data showed *MV* to have a positive effect on *PLAC*. More current data indicates a negative effect, whereby women who take multivitamins are less likely to experience placental issues.

PROM (Tables 5.6 and 5.14). The results of the earlier *PRAMS V* study phase show that when sociodemographic characteristics are taken into account, African American women are more likely than whites to experience PROM, while Native Americans are less likely than whites to experience PROM. The more current *PRAMS VI* results regarding the likelihood of PROM among Native American women illustrates a considerable change; there is no difference between Native Americans and whites regarding PROM when the sociodemographic control variables are held constant. However, African Americans are still more likely than whites to experience PROM. Because there is measurable change in the prevalence of PROM among Native American women when compared to white women over the course of the two PRAMS study phases, Hypothesis 5 is supported. However, it was expected that there would be a decrease in the incidence of the adverse labor and delivery outcome PROM for both groups of minority women in the more recent PRAMS VI data analysis results.

There are also significant changes in the effect of both maternal health variables *HBP* and *DIAB* over the course of the two PRAMS study phases. The more recent *PRAMS VI* results indicate that women diagnosed with hypertension are no more likely to experience PROM than those without it, though in the earlier *PRAMS V* results women with hypertension were far less likely to have experienced PROM. Interestingly, women in the more recent *PRAMS VI* study sample that were diagnosed with gestational diabetes are less likely than those without to experience PROM, though in the earlier *PRAMS V*

results, they were far more likely to have experienced PROM. The significant changes in the effects of the maternal health variables on *PROM* over the two PRAMS study phases suggest that some progress has been made in the management of at least gestational diabetes in more recent years. There was no change in the effect of maternal behavior variable *SMOKE*. Women who smoke during pregnancy are far more likely than those who do not to experience PROM. Women who drink during pregnancy, however, are no more likely than those who do not to experience PROM, as indicated by more recent *PRAMS VI* data analysis results. Earlier *PRAMS V* results indicate that women who drink are actually less likely to experience PROM. Concerning prenatal care utilization from the earlier *PRAMS V* results, women who seek prenatal care in the first trimester were shown to be more likely to experience PROM, while women who seek prenatal care at any time during pregnancy were shown to be less likely to have experienced PROM. First trimester prenatal care utilization in the more recent results has a negative effect on *PROM*, meaning that women who seek early prenatal care are actually less likely to experience PROM. There seems to be no difference between women that receive some prenatal care and women that do not receive prenatal care at any time during pregnancy. Earlier *PRAMS V* results showed *MV* to have a positive effect on *PROM*, whereby women that took multivitamins were more likely to have experienced PROM. However, PRAMS VI results actually indicate a negative effect. Women who take multivitamins are less likely to experience PROM. More recent *PRAMS VI* results for both prenatal care utilization and multivitamin use better correspond with the current study's hypotheses.

LBW (Tables 5.7 and 5.15). The results of the earlier *PRAMS V* study phase indicate that when sociodemographic characteristics are taken into account, African

American women are far more likely than whites to have an underweight baby, while Native Americans are less likely than whites to do so. There was no change in the results for either African Americans or Native Americans over the course of the two PRAMS study phases no matter the variables were considered, including maternal behavior variables and maternal health variables. This suggests that an unobserved variable or variables is causing the disparities between racial and ethnic groups. There is no change in the effect of the maternal health variables *HBP* and *DIAB* or the maternal behavior variable *SMOKE* on *LBW*. Women diagnosed with either hypertension or gestational diabetes, and women who smoke during pregnancy, continued to be more likely to birth babies with low birth weight across the two PRAMS study phases. A significant change is noted in the effect of the maternal behavior variable *DRINK*. In the earlier *PRAMS V* results, women who drink while pregnant are less likely than those who do not to have a low birth weight baby. However, *PRAMS VI* results show that there is no difference between women who drink during pregnancy and those that do not regarding the baby's birthweight. Women who seek prenatal care in the first trimester are still more likely to have a baby with low birth weight. However, prenatal care utilization at some time during pregnancy has a strong negative effect on *LBW* according to the *PRAMS VI* results, indicating that women who utilize prenatal care services at some point during pregnancy are far less likely to have a baby with low birth weight. This is a significant change that reveals the importance of seeing a physician for at least some prenatal care and the impact of prenatal care on birth outcomes for women in Oklahoma. Both PRAMS study results indicate a strong negative relationship between *MV* and *LBW*. Women who take

multivitamins have continued to be far less likely to have an underweight baby, as illustrated by the results across both PRAMS study phases.

ICU (Tables 5.8 and 5.16). The results of the earlier *PRAMS V* study phase indicate that when sociodemographic characteristics are taken into account, African American women are far more likely than whites to place their newborn in an intensive care unit, while Native Americans are less likely than whites to do so. There was no change in the results among African Americans over the course of the two PRAMS study phases. There remains a significant difference in the likelihood of ICU placement between African American and white women. Native Americans, while far less likely to place a child in ICU, according to the results of the earlier *PRAMS V* study phase, are no more likely than whites to do so in the more recent *PRAMS VI* study phase. Because there is no measurable change in the effect of the race coefficient for African Americans over the course of the two PRAMS study phases, Hypothesis 5 is not supported. Though a significant change in the prevalence of ICU placement can be seen for Native American women when comparing the results of *PRAMS V* and *VI*, it was expected that the likelihood of adverse pregnancy outcomes like ICU placement would decrease over time rather than the statistical significance disappearing altogether.

As illustrated by the results of both PRAMS study phases, the statistical significant difference between African American and white women regarding child placement in ICU does not dissipate when sociodemographic, maternal health, or maternal behavior variables are taken into account. The earlier *PRAMS V* results indicate that Native Americans are far less likely than whites to place their child in ICU. No matter the variables considered, the negative effect does not disappear or decrease in significance.

However, the more recent *PRAMS VI* data results show the relationship between race and *ICU* for Native Americans varies depending on variables in the equation. For example, there is no difference between the experiences of Native American and white women regarding ICU placement when the sociodemographic variables are taken into account, nor when *DIAB*, *PNC*, or *MV* are considered. However, there is a negative effect between race and ICU for Native Americans when the variables *HBP, SMOKE,* and *DRINK* are considered. The negative effect is strongest when *HBP* is taken into account. This indicates adverse labor and delivery outcomes that warrant a newborn being placed in intensive care more likely occur among white women compared to Native American women when hypertension, maternal smoking, and maternal drinking are taken into account.

Substantial changes have occurred in the maternal health and well-being of Oklahoma mothers over the course of the two PRAMS data collection phases as expected. *PRAMS V* data results indicate that when sociodemographic variables are taken into account, African American women are less likely than white women to smoke during pregnancy or to experience placental issues. However, they are also less likely than white women to receive first trimester prenatal care or prenatal care at any point during pregnancy. African American women are more likely than white women to drink during pregnancy, experience premature rupture of the membranes, have an underweight baby, and to place their baby in ICU. Native American women are less likely than white women to smoke or drink during pregnancy, experience premature rupture of the membranes, have an underweight baby, and to place their baby in ICU and more likely than white women to take multivitamins. However, they are also less likely than white women to

receive at least some prenatal care during pregnancy and more likely to experience placental issues.

PRAMS VI data results indicate that when sociodemographic variables are taken into account, African American women are less likely than white women to smoke or drink while pregnant. However, they are also less likely than white women to receive first trimester prenatal care or to take multivitamins. African American women are more likely than white women to receive at least some prenatal care during pregnancy, though they are more likely to experience premature rupture of the membranes, have an underweight baby, and to place a newborn in ICU. Native American women are less likely than white women to smoke or drink during pregnancy, to experience placental issues, or to have an underweight baby and more likely to take multivitamins. However, they are also less likely than white women to receive first trimester prenatal care or some prenatal care at any point during pregnancy. Comparisons of data analysis results between the two PRAMS study phases for Native Americans can be found in Table 5.17. Comparison results for African Americans can be found in Table 5.18. Conclusions and recommendations based on the results can be found in Section I of Chapter 6.

TABLE 5.17. Pregnancy Risks and Outcome Changes in *PRAMS V* and *PRAMS VI* for Native American and White Women in Oklahoma by SES

	PRAMS V	***PRAMS VI***	***CHANGE***
Behavioral Variables			
SMOKE	LESS	LESS	NONE
DRINK	LESS	LESS	NONE
PNC (1ST TRIMESTER CARE)	------	LESS	**DECREASE**
PNC (SOME PRENATAL CARE)	LESS	LESS	NONE
MV	MORE	MORE	NONE
Labor & Delivery Outcome Variables			
PLAC	MORE	LESS	**DECREASE**
PROM	LESS	------	**INCREASE**
LBW	LESS	LESS	NONE
ICU	LESS	------	**INCREASE**
Source: *PRAMS V* (2004-2008) and *PRAMS VI* (2009-2011)			

TABLE 5.18. Pregnancy Risks and Outcome Changes in *PRAMS V* and *PRAMS VI* for African American and White Women in Oklahoma by SES

	PRAMS V	***PRAMS VI***	***CHANGE***
Behavioral Variables			
SMOKE	LESS	LESS	NONE
DRINK	MORE	LESS	**DECREASE**
PNC (1ST TRIMESTER CARE)	LESS	LESS	NONE
PNC (SOME PRENATAL CARE)	LESS	MORE	**INCREASE**
MV	------	LESS	**DECREASE**
Labor & Delivery Outcome Variables			
PLAC	LESS	------	**INCREASE**
PROM	MORE	MORE	NONE
LBW	MORE	MORE	NONE
ICU	MORE	MORE	NONE
Source: *PRAMS V* (2004-2008) and *PRAMS VI* (2009-2011)			

CHAPTER SIX:

CONCLUSIONS AND RECOMMENDATIONS

I. *Conclusions*

This research examines maternal health behaviors, well-being during pregnancy, and labor and delivery outcomes, while focusing on the differences among certain racial and ethnic groups. The results of this study contribute to our understandings of maternal and child health of women in Oklahoma. The findings of this research illustrate that minority status has a profound effect on maternal health behaviors, as well as labor and delivery outcomes. Furthermore, the influence of socioeconomic status, measured in the present study as education and income, explains some of the disparity between whites and minorities when it comes to maternal health behaviors and labor and delivery outcomes and health of the mother and child. There continue to be, however, some unanticipated and unexplained effects on labor and delivery outcomes.

Overall, minority women, including both Native Americans and African Americans, are less likely than whites to engage in risky maternal behaviors that are considered "personal choices," including smoking and drinking. It seems that minority women, in general, make healthy decisions regarding these risky maternal behaviors, challenging stereotypical ideas related to minority alcohol and substance abuse even during pregnancy. Data also show that women with higher levels of education and income are less likely to engage in these types of risky maternal behaviors. Low socioeconomic status among minorities is well-documented in published literature, as reviewed in Chapter 2. Results of the current study suggest that low socioeconomic

status, measured by education and income, explains the prevalence of maternal smoking among Native Americans. As expected, those with higher levels of education seem to be more aware of the detrimental effects of maternal smoking. The data indicate that Native Americans are less likely than whites to have graduated high school. 27.7% of Native Americans in the *PRAMS V* study sample have less than a high school education, compared to 23.4% of whites. The *PRAMS VI* study sample shows that 24.2% of Native Americans have less than a high school education, compared to 22.2% of whites. The gap widens between Native Americans and whites when higher education is considered. 40% of whites had at least some higher education experience, compared to 27.8% of Native Americans in the earlier *PRAMS V* data collection phase; the more recent *PRAMS VI* data show a comparable disparity (49.8% of whites and 39.5% of Native Americans had higher education experience). It is reasonable from analyzing these data that because Native Americans in general have lower levels of education, they would be more likely to smoke while pregnant, though when education is held constant they are less likely to do so.

The results of the current study also indicate that African American women are less likely than whites to consume alcohol while pregnant in more recent years than they were previously. Earlier *PRAMS V* data analysis results show that African Americans, even when socioeconomic status is taken into account, are more likely than whites to drink during pregnancy. However, the more recent *PRAMS VI* results indicate African Americans are less likely than whites to drink while pregnant. Similarly, the variable education has changed over time. Women with higher levels of education were previously more likely to consume alcohol during pregnancy, but more recent results

suggest that women with higher levels of education are actually less likely to drink while pregnant. Data from the two Oklahoma PRAMS study phases indicate a shift has taken place among both African Americans and women with higher levels of education whereby certain groups of women have modified their unhealthy or risky behavior during pregnancy. This could possibly be due to increased awareness in the community or at the neighborhood level about the detrimental effects of alcohol consumption during pregnancy. Among African Americans the shift could also be due to increased prenatal care utilization. The more recent *PRAMS VI* results indicate a substantial increase in the involvement of African Americans in prenatal care when compared to the earlier *PRAMS V* results. Prenatal care appointments are an opportunity for a physician to explain proper maternal health and behavior, including abstaining from alcohol use during pregnancy.

With the exception of the increase in prenatal care utilization among African American women, minority women in general are far less likely than whites to receive prenatal care. Data show that women with higher levels of education and income are more likely to utilize prenatal services. Even when socioeconomic status is taken into account, there continues to be a significant disparity regarding prenatal care utilization among minority women compared to white women. This finding is consistent with previous research (Abma and Mott 1991; Alexander et al. 2008; Baldwin et al. 2002; Castor et al. 2006; Emmanuel et al. 1999; Remez 2003; Shiao et al. 2005). Possible explanations that have been suggested for the disparity between whites and minorities regarding prenatal care utilization include rural geographic location or lack of access (Baldwin et al. 2002; Grossman et al. 2002; Harrison and Sidebottom 2009); insufficient health resources among urban minorities (Castor et al. 2006); lack of health insurance

(Hummer 1993; Johnson et al. 2010); discriminatory practices (Colen et al. 2006; Hummer 1993; Karlsen and Nazroo 2002; Mustillo et al. 2004; Remez 2003 Ronsaville and Hakim 2000); environmental or psychological stressors (Geronimus et al. 2010; Green and Darity, Jr. 2010; Lu et al. 2010; Walters and Simoni 2002); cultural barriers to seeking preventative care (Doshi and Jiles 2006; Ronsaville and Hakim 2000) and maternal attitude toward childbirth (Ronsaville and Hakim 2000). For Native Americans in Oklahoma, though a number of Indian Health Service or tribally-operated healthcare facilities are located throughout the state, lack of access due to rural geographic location or lack of transportation is most likely the cause for the disparity in prenatal care utilization. For African Americans in Oklahoma, it is suspected that a combination of variables impact the likelihood of prenatal care utilization, including lack of access to due to discrimination, insufficient healthcare resources among urban minorities, and lack of health insurance.

Native American women have been shown to be more likely than white women to take multivitamins in both Oklahoma PRAMS data collection phases. African American women, on the other hand, are less likely than whites to do so. It was hypothesized that minority women would be more likely to engage in risky maternal health behaviors, behaviors that are more detrimental to the labor and delivery outcomes of the mother and child, especially behaviors that are correlated with socioeconomic status. Therefore, the fact that African American women are not more likely to take multivitamins compared to whites supports this hypothesis. However the experience of Native Americans challenges the hypotheses of the present study. It is suspected that this is due to the utilization of Indian Health Service facilities and pharmacies among Native American women.

Prescriptions are provided at no cost to those Native American women who seek prenatal care at IHS. Consequently, multivitamin use would not be correlated with socioeconomic status in those cases, but rather type of healthcare utilized. Using the current data, this study did not differentiate between the type of prenatal care received, and thus can only speculate as to why there is a positive relationship between the race coefficient for Native Americans and multivitamin use.

Important changes were revealed in the prevalence of placental issues among both groups of minority women. The likelihood of placental issues among Native American women changed significantly over time. The previous *PRAMS V* results show that Native American women are more likely than white women to experience placental issues, whereas the more recent *PRAMS VI* results show the opposite. Native American women are less likely than white women to experience placental issues. The change in the prevalence of placental issues in Native American women may be correlated with the prevalence of gestational diabetes. The change from a positive to a negative relationship for the Native American race coefficient also occurs for the gestational diabetes variable. Women diagnosed with gestational diabetes are more likely in the *PRAMS V* results to experience placental issues. Placental issues were less likely among women diagnosed with gestational diabetes according to more recent *PRAMS VI* results. The high prevalence of diabetes and gestational diabetes among Native Americans is well documented (Acton et al. 2002; Fazzino II 2008; Islam-Zwart and Cawston 2007; Livingston et al. 1993; Oklahoma State Department of Health 2012; Moum et al. 2004; Smith-Morris 2006; U.S. Department of Health and Human Services, Indian Health Service 2007). It is reasonable to conclude, therefore, that due to the high prevalence of

gestational diabetes among the Native American population that the race coefficient for Native Americans is correlated with the variable *DIAB* over the course of both Oklahoma PRAMS study phases.

Significant change also occurred in the likelihood of placental issues among African American women over the course of the two PRAMS study phases. African American women, according to the earlier *PRAMS V* results, are less likely to experience placental issues. However, the more recent *PRAMS VI* results indicate that there is no difference between African American and white women regarding placental issues. The race coefficients were not altered when considering any of the maternal health behavior variables *SMOKE, DRINK, PNC,* or *MV,* leading the researcher to conclude that an unobserved variable is the source of the change. Research has shown that a previous cesarean delivery could lead to higher risk of placenta issues like placenta previa or placental abruption (Getahun, Oyelese, Salihu, and Ananth 2006), a variable not considered in the present study. Because the rate of cesarean delivery has increased considerably among all women in recent years (Barber et al. 2011), this could in part explain the increase in the prevalence of placental issues for African Americans in the more recent *PRAMS VI* results. Previous research has also found that white women are more likely than other racial and ethnic groups, including both Native Americans and African Americans to experience placental issues (Whitehead et al. 2009), despite higher socioeconomic disadvantage among minority women. These results are unanticipated and remain unexplained taking into account only the variables in the current study, especially considering the high prevalence of other adverse labor and delivery outcomes among African American women, though they do correspond with some previous research.

A statistically significant disparity exists between African Americans and whites regarding PROM, low birth weight, and child ICU placement, regardless of the maternal health or maternal behavior variables considered. African Americans continue to be at a higher risk than white women for experiencing these adverse labor and delivery outcomes, despite considerations like early prenatal care access, which is consistent with previous research (Healy et al. 2006). Research has suggested that the substantially higher likelihood of poor maternal outcomes such as these among African American women could be due to differential economic benefits for similar educational attainment, institutional racism, residential segregation, and fewer opportunities for gathering wealth (Colen et al. 2006; Lu et al. 2010; Sparks 2009); high levels of hypertension (Odell et al. 2006; Shiao et al. 2005); urinary tract infection (Remez 1994); biobehavioral and medical risk factors (Reichman, Hamilton, Hummer, and Padilla 2008; Sparks 2009); smoking (Alexander et al. 2008; Aliyu et al. 2011b; Conley et al. 2003; D'Angelo et al. 2007; Hellerstedt et al. 1997; Meis et al. 1997; Oklahoma State Department of Health 1997, 2006, 2008, 2009; Pollack et al. 2000; Salihu et al. 2003; Sparks 2009; Suellentrop et al. 2006; Wang et al. 1997); poor prior pregnancy outcomes (Kallan 1993); decreased adherence to prenatal guidelines, teenage motherhood, and giving birth for the first time (Alexander et al. 2008); and neighborhood disadvantage and limited healthcare access (Kirby et al. 2006; Lu et al. 2010; Remez 2003). Because age, income, education, hypertension, smoking, and prenatal care utilization were taken into account in the present study, it can be assumed that other factors are the cause of the significant disparity in labor and delivery outcomes between African Americans and whites. Like the underutilization of prenatal care among African American women in Oklahoma, it is

suspected that a combination of variables are the cause of poor labor and delivery outcomes like PROM, low birth weight, and child ICU placement among African American mothers in the state. Variables most likely include individual and institutional racism, residential segregation and neighborhood level socioeconomic well-being, and biobehavioral and medical risk factors. Biobehavioral risk factors that were not considered in the current study could include body mass index, waist circumference, exercise, and psychosocial factors like depression behavioral responses to stress. It is noteworthy to recognize, however, that females have a greater chance of being born underweight (Conley et al. 2003). Sex of the newborn child was not considered in the present study. It is also noteworthy to consider the medicalization of birth and the types of women receiving interventions from medical staff. It could be that women that are considered "high risk" for adverse labor and delivery outcomes, like African Americans for PROM and low birth weight (*PRAMS V* and *PRAMS VI*) and Native Americans for placental issues (*PRAMS V*) are more likely to receive an intervention from physicians in order to circumvent possible adverse labor and delivery outcomes. Interventions could include induction, medication, or specialist care and monitoring.

The results of the current study have shown that minority women are at increased risk for poor labor and delivery outcomes due to underutilization of preventive care services, low socioeconomic status, and poor health during pregnancy. Though there continues to be unexplained disparities between minority women and whites concerning certain adverse labor and delivery outcomes. Because of these facts, programs to educate and empower minority women need to be established in order to improve birth outcomes. Adding to the growing literature concerning maternal behavior and health disparities

between minorities and whites, as well as spreading knowledge concerning proper maternal health and possible detrimental consequences at the community level, may aid in this effort. Collaborative efforts at various levels need to be maintained in order to surveil changes and possible improvements in an effort to improve birth outcomes and narrow health disparities (Gaudino, Jr. 2008).

Some discussion on the importance of historical trauma, contemporary discrimination, and cultural buffers is worth mentioning here. It cannot be denied that a certain degree of historical trauma (due to land loss, cultural genocide, boarding school experiences, slavery, and forced migration) exists among certain minority groups. Compounded by experiences of contemporary multi-dimensional discrimination, significant effects on overall health due to stress occur, particularly among Native American women (Walters and Simoni 2002). "Historical trauma and current trauma [are] key stressors in the lives of Native women," however, cultural factors act as buffers for Native American women (Walters and Simoni 2002:520). Cultural factors, including identity attitudes, enculturation, traditional spiritual coping, and traditional health practices, can mitigate the poor health outcomes experienced by Native American women. In other words, Native American women, though they experience historical trauma and contemporary discrimination like other minority women, have the opportunity to better protect themselves from adverse health by being immersed in their own indigenous cultures and communities connected through kinship ties. The utilization of IHS medical facilities is an extension of the communal support within indigenous communities. Research has shown that positive identity attitudes, enculturation, traditional indigenous spiritual methods of coping, and traditional health and healing

practices may have positive effects on self-esteem, aid in the avoidance of psychological distress and depression, decrease the probability of alcohol abuse, and increase the likelihood of adjustment to stressful life events (Buchwald, Beals, and Manson 2000; Marbella, Harris, Diehr, Ignace, and Ignace 1998; Pargament 1999; Simoni, Kerwin, and Martone 2002;Walters 1999; Walters and Simoni 2002. Zimmerman, Washienko, Walter, and Dyer 1996). Cultural buffers such as these may explain the experiences of Native American women in the current study samples, especially when smoking, drinking, multivitamin use, and pregnancy outcomes like placental issues, PROM, low birth weight are considered. Though other minority women like African Americans also experience historical trauma and contemporary discrimination, they lack similar cultural buffers to moderate their vulnerability against poor health outcomes, which may also explain the higher likelihood of adverse labor and delivery outcomes among African American women in the current study. Future research should explore the effect of cultural buffers within indigenous communities and among certain groups of Native American women.

Most research on racial and ethnic health disparities during pregnancy on focus on African Americans and whites. Native Americans are infrequently included in research of this kind. Because there are little useful statistical data regarding the maternal health of Native Americans in the United States due to such small numbers of Native Americans represented in random sampling techniques, the present study sheds more light on the current situation for Native Americans in Oklahoma, and fills an important gap in the literature regarding racial and ethnic differences in maternal health.

II. *Future Studies & Recommendations*

The current study utilized Oklahoma PRAMS data, which have proven to be a rich source of information regarding maternal and child health in the state of Oklahoma – information that can be used to implement programs to educate the public about proper maternal health and well-being. However, future studies can build on the knowledge gleaned from analyzing these data by conducting additional studies of maternal and child health in various geographic areas to use in comparison and to broaden our understanding of the differences in maternal health behaviors and labor and delivery outcomes across the country. The maternal health and well-being of certain racial and ethnic groups or enclaves that are often overlooked, such as Native Americans, should continue to be investigated in studies of this kind in order to recognize the possible cultural differences between populations.

Future studies of maternal health behaviors and outcomes may measure additional indicators of maternal health and well-being, including diet and exercise, prevalence of obesity, pregnancy weight gain, and prior health conditions or conditions that arise during pregnancy. Prior health conditions could include prior diabetes, heart disease, cancer, depression, eating disorders, or sexually-transmitted diseases. Health conditions that arise during pregnancy could include abnormal bleeding, ectopic pregnancy, preeclampsia or toxemia, bacterial infections, or preterm labor. The outcomes of previous pregnancies, such as a previous cesarean delivery or previous complications could also predict subsequent adverse labor and delivery outcomes and would be beneficial to study. Adverse labor and delivery outcomes, such as congenital anomalies (birth defects) of the child, fetal alcohol syndrome, or sudden infant death syndrome could also be predicted

by certain risky and unhealthy maternal behaviors like drinking while pregnant and health conditions like diabetes (Carrapato and Marcelino 2001; Kvigne et al. 2008; Moum et al. 2004; Tenkku, Morris, Salas, and Xaverius 2009) and should be investigated further. Additional variables that affect the prevalence of gestational diabetes or other health conditions during pregnancy, such as maternal nutrition (Fall 2009), arsenic exposure (Ettinger et al. 2009), preventative counselling (Anwar et al. 2011), pregnancy bedrest (Abenhaim, Bujold, Benjamin, and Kinch 2008), obesity (Fitzsimmons, Modder, and Greer 2009) should be studied as correlates of maternal health and well-being.

In addition, attitudes about pregnancy and childbirth or conditions in the home may affect the outcome of a pregnancy. For instance, whether a woman was trying to or wanted to get pregnant (pregnancy wantedness) could influence maternal health and behavior, and thus, the outcome of the pregnancy. Suffering physical or sexual violence or other environmental and psychological stressors during pregnancy likely have an effect on pregnancy-related health and labor and delivery outcomes. The likelihood of adverse outcomes due to such experiences should be investigated in order to determine the effect on outcomes and the prevalence of experiences among certain groups of women.

Discrimination as a barrier to healthcare on the basis of race, class, or nativity has been well-researched (Colen et al. 2006; Karlsen and Nazroo 2002; Mustillo et al. 2004; Remez 2003), though it continues to be experienced among certain groups of women. In order to reverse this trend, we must continue to include discrimination as a barrier to proper maternal health in similar maternal and child health research studies. In addition, healthcare access; type of healthcare access; comparisons of geographic location; area

political economic, or social conditions; more refined measures of poverty and socioeconomic disadvantage; differences in kinship, neighborhood, or community ties; and variations in birthing methods may also play significant roles in both overall maternal health and delivery outcomes.

Although this study includes Native Americans, a racial group often excluded from large-scale quantitative research studies, other racial categories need to be researched and compared in order to improve the health of all mothers and children. Furthermore, comparisons between tribal communities or between various regions of the country could be the focus of additional research, creating tribally-specific research and suggestions for collaboration with other agencies (American Indian Health Commission for Washington State 2010) in order to increase awareness on the community-level of each sovereign nation. Focusing on the often unique circumstances of living in rural or urban areas could affect access to health services (Baldwin et al. 2002), especially for disadvantaged groups or those relying on tribal health service programs that may be geographically or financially difficult to access.

In addition, a stronger emphasis could be placed on personal guidelines, as well as community guidelines, especially in the cases of many tribal nations, and included in future research. In reference to diet and exercise, a comparison between more traditional foods and exercise patterns and the contemporary "American" diet and exercise routines can be examined, focusing on the effect these behaviors can have on maternal health, the delivery process, and the health of the child using, for example, food frequency questionnaires (Baer et al. 2005; Watts et al. 2007). In addition, religious guidelines and

spiritual beliefs may have an effect on the pregnancy-related health and birthing practices among certain individuals.

APPENDIX A:

OKLAHOMA PRAMS DATA SHARING AGREEMENT

AGREEMENT FOR SHARING PRAMS AND TOTS DATA

Oklahoma State Department of Health, Maternal and Child Health Service

I, _____, as principal investigator on this proposed analysis of Pregnancy Risk Assessment Monitoring System (PRAMS) and/or Oklahoma The Oklahoma Toddler Survey (TOTS) data, agree to the following requirements for the use of PRAMS and TOTS data and assure compliance with the requirements.

1 An abstract of the research proposal must be submitted to the Oklahoma MCH PRAMS Project and the Oklahoma TOTS Project (hereafter identified as PRAMS-TOTS) prior to the release of any data. A list of variables to be studied must accompany the proposal. A description of the proposed use of those variables must also be included. The data can be used only for statistical reporting. Any extension to the original research intent must be resubmitted to PRAMS-TOTS for approval as outlined in this Agreement.

2 PRAMS-TOTS retains the right to reserve selected topics for analyses.

3 Individuals or organizations receiving data files must guarantee the protection of confidential data. Confidential data include any information or combination of information and/or data elements that could lead to the identification of a participant in the PRAMS or TOTS surveillance. The data will never be used to learn of the identity of any participant. Incidental identification of a participant during the course of analysis will never be used or shared for any purpose.

4 The data will not be shared with other individuals or entities not part of this specific research request.

5 The proposal must include a time frame for the completion of the analyses of PRAMS and/or TOTS data. All raw data files are the property of the Oklahoma State Department of Health and must be destroyed or returned to PRAMS-TOTS at the completion of the analyses.

6 Any material submitted for publishing, presentation, or distribution must acknowledge:

a. The Centers for Disease Control and Prevention (CDC),
b. The U.S. Department of Health and Human Services, Health Resource Services Administration, Maternal and Child Health Bureau,
c. and the Oklahoma State Department of Health, Maternal and Child Health Service PRAMS Project and/or TOTS Project, as appropriate.

7 Any material prepared for publishing, presentation, or distribution must first be submitted to PRAMS-TOTS for review and comment. If PRAMS-TOTS disagrees with the conclusions, the researcher or organization must allow PRAMS-TOTS to provide comments or a disclaimer that will be distributed with the findings.

8 Issues of ownership for analytic findings and statistical reports produced through contractual relationships will be held consistent with the terms of the contract.

9 A staff member from PRAMS, TOTS, or other MCH program will be assigned as a co-investigator for all research projects and will be so noted on all material distributed or presented.

10 All individuals who will have access to the PRAMS-TOTS data and who participate in the research study will be identified in the Agreement.

My signature indicates compliance with these requirements by all research participants.

Name: _____

Title: _____

Organization: _____

Individuals with access to PRAMS and TOTS Data for this research: _____

_____

Time period requested to access Data:

From: _____ To: _____

Signature: _____ Date: _____

APPENDIX B:

OKLAHOMA *PRAMS V* (2004-2008) QUESTIONNAIRE

I. *Sociodemographic Variables*

1. **During the *12 months before* your new baby was born, what was your total household income before taxes?** Include your income, your husband's or partner's income, and any other income you may have used. (All information will be kept private and will not affect any services you are now getting.) Check ONE answer.
    a. Less than $10,000
    b. $10,000 to $14,999
    c. $15,000 to $19,999
    d. $20,000 to $24,999
    e. $25,000 to $34,999
    f. $35,000 to $49,999
    g. $50,000 or more

II. *Maternal Behavior Variables*

1. **In the *last 3 months* of your pregnancy, how many cigarettes or packs of cigarettes did you smoke on an average day?**
    a. 41 cigarettes or more
    b. 21 to 40 cigarettes
    c. 11 to 20 cigarettes
    d. 6 to 10 cigarettes
    e. 1 to 5 cigarettes
    f. Less than 1 cigarette
    g. None (0 cigarettes)

2. **During the *last 3 months* of your pregnancy, how many alcoholic drinks did you have in an average week?**
    a.14 drinks or more a week
    b.7 to 13 drinks a week
    c. 4 to 6 drinks a week
    d. 1 to 3 drinks a week
    e. Less than 1 drink a week
    f. I didn't drink then

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

   ____ Weeks OR ____ Months

   ____ I didn't go for prenatal care

4. **During the *month before* you got pregnant with your new baby, how many times a week did you take a multivitamin or a prenatal vitamin?** These are pills that contain many different vitamins and minerals.
   a. I didn't take a multivitamin or a prenatal vitamin at all
   b. 1 to 3 times a week
   c. 4 to 6 times a week
   d. Every day of the week

III. *Maternal Health Variables*

1. **Did you have any of these problems during your most recent pregnancy?** For each item, circle Y (Yes) if you had the problem or circle N (No) if you did not.
   a. High blood sugar (diabetes) that started *during* this pregnancy . . . . . N Y

   b. High blood pressure, hypertension (including pregnancy-induced hypertension [PIH]), preeclampsia, or toxemia . . . . N Y

IV. *Labor and Delivery Outcome Variables*

1. **Did you have any of these problems during your most recent pregnancy**? For each item, circle Y (Yes) if you had the problem or circle N (No) if you did not.

   a. Problems with the placenta (such as placental abruption or placenta previa) . . . . N Y

   b. Water broke more than 3 weeks before my baby was due (premature rupture of membranes [PROM]). . . . . N Y

2. **After your baby was born, was he or she put in an intensive care unit?**
    a. No
    b. Yes
    c. I don't know

APPENDIX C:

OKLAHOMA *PRAMS VI* (2009-2011) QUESTIONNAIRE

I. *Sociodemographic Variables*

1. **During the *12 months before* your new baby was born, what was your yearly total household income before taxes?** Include your income, your husband's or partner's income, and any other income you may have received. (All information will be kept private and will not affect any services you are now getting.)
    a. Less than $10,000
    b. $10,000 to $14,999
    c. $15,000 to $19,999
    d. $20,000 to $24,999
    e. $25,000 to $34,999
    f. $35,000 to $49,999
    g. $50,000 or more

II. *Maternal Behavior Variables*

1. **In the *last 3* months of your pregnancy, how many cigarettes did you smoke on an average day? (A pack has 20 cigarettes.)**
    a. 41 cigarettes or more
    b. 21 to 40 cigarettes
    c. 11 to 20 cigarettes
    d. 6 to 10 cigarettes
    e. 1 to 5 cigarettes
    f. Less than 1 cigarette
    g. I didn't smoke then

2. **During the *last 3* months of your pregnancy, how many alcoholic drinks did you have in an average week?**
    a. 14 drinks or more a week
    b. 7 to 13 drinks a week
    c. 4 to 6 drinks a week
    d. 1 to 3 drinks a week
    e. Less than 1 drink a week
    f. I didn't drink then

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

   ____ Weeks OR ____ Months

   __ __ I didn't go for prenatal care

4. **During the *month before* you got pregnant with your new baby, how many times a week did you take a multivitamin, a prenatal vitamin, or a folic acid vitamin?**
   a. I didn't take a multivitamin, prenatal vitamin, or folic acid vitamin at all
   b. 1 to 3 times a week
   c. 4 to 6 times a week
   d. Every day of the week

III. *Maternal Health Variables*

1. **Did you have any of these problems during your pregnancy?** For each item, circle Y (Yes) if you had the problem or circle N (No) if you did not.

   a. High blood pressure, hypertension (including pregnancy-induced hypertension [PIH]), preeclampsia, or toxemia. . . . . N Y

2. **During your most recent pregnancy, were you told by a doctor, nurse, or other health care worker that you gestational diabetes** (diabetes that started during *this* pregnancy)?
   a. No
   b. Yes

IV. *Labor and Delivery Outcome Variables*

1. **Did you have any of the following problems during *your most recent* pregnancy**? For each item, circle Y (Yes) if you had the problem or circle N (No) if you did not.

    a. Problems with the placenta (such as placental abruption or placenta previa) . . . . . N Y

    b. Water broke more than 3 weeks before my baby was due (premature rupture of membranes [PROM]). . . . . N Y

2. **After your baby was born, was he or she put in an intensive care unit?**
    a. No
    b. Yes
    c. I don't know

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