INTERCONCEPTION CARE UTILIZATION: PREDICTORS, BARRIERS AND BIRTH OUTCOMES

A Dissertation

by

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ABSTRACT

After decades of focusing solely on prenatal care interventions; the CDC and the March of Dimes convened a national summit in 2006 to discuss an agenda for preconception care programs, research, and policy. During this discussion, one of the noted recommendations highlighted that "the interconception period should be used to provide additional intensive interventions to women who have had a previous pregnancy that ended in an adverse outcome." However, despite national recommendations regarding the use of interconception care, many high risk women do not receive the health services, care and counseling needed during the interconception period.

To add to the literature on how interconception care is measured, its use among those who most need it, possible barriers to care and its association with subsequent birth outcome; this dissertation was divided into three studies with each study focusing on one research question. Study 1 question: What risk factors are associated with self-reported receipt of interconception care? Study 2 question: What risk factors are associated with health insurance coverage during the interconception period? Study 3 question: What is the association between interconception care and subsequent birth outcome? These studies are relevant because of gaps in the literature regarding the utilization of interconception care at a population level. They are also relevant because current maternal and child health data show that women who experience noted risk factors (including having a previous adverse birth outcome) are significantly more likely to have adverse birth outcomes in future pregnancies.

The Pregnancy Response Assessment Monitoring System (PRAMS) national dataset was used in all three studies. The data used in this dissertation was collected from 2009 to 2013, and 33 states participated during this data collection period. In the first study, multivariate logistic regression models were used. The models showed that high risk women including those who reported that they were African American, diabetic, hypertensive, obese, and had a previous adverse birth outcome were more likely to receive interconception care. Multinomial regression models were used in studies' 2 and 3. Results from study 2 showed that high risk women including those who reported that they were African American, hypertensive, diabetic and had a previous adverse birth outcome were more likely to be on Medicaid than to be uninsured. And results from study 3 showed that women who adhered to interconception care recommendations regarding a healthy diet and regular exercise were less likely to have a premature and low birth weight infant than a healthy infant.

Overall, these three studies confirm that women who report noted risk factors are more likely to experience repeat adverse birth outcomes if these factors are not addressed. This emphasizes the importance of interconception care for high risk women in the form of tailored care/services that can tackle the socioeconomic and health problems that increase their risk for adverse birth outcomes. Furthermore, the three studies highlight that targeted interventions must also address systemic barriers to care if they are to reduce national rates of adverse birth outcomes and infant mortality.

DEDICATION

This dissertation is dedicated to my mom – Anicia Cynthia Eugene. Thank you for your unending support and encouragement. None of this would be possible without you.

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CHAPTER I

INTRODUCTION

This dissertation focused on interconception care receipt, barriers and association with subsequent birth outcome. It consisted of three studies. Study 1 examined risk factors that were associated with receipt of interconception care (chronic disease screening/treatment and health counseling). Study 2 analyzed health insurance coverage (no insurance, private insurance and Medicaid) among women at risk for adverse birth outcomes during the interconception period. Study 3 investigated how interconception care (receipt of chronic disease screening/treatment and health counseling) and adherence to interconception care recommendations regarding diet and exercise) were associated with subsequent birth outcomes.

There are six chapters in this dissertation. Chapter 1 gives a brief introduction of public health problems addressed in this dissertation. Chapter 2 summarizes the literature on interconception care – what it is, how it came about, why it is needed, who needs it, current interventions and possible barriers to care. Chapter 3 lays out the research questions, study methodology, (including a description of study population, the data source, key measures), and the statistical analysis plans for each of the three studies. Chapters 4 through 6 lay out the overview, introduction, methods, results and discussion for Studies 1-3. And Chapter 7 summarizes key findings from the three studies, limitations, and the overall conclusion.

STATEMENT OF THE PROBLEM

Despite advancements and breakthroughs in medical and health interventions, infant mortality continues to be a significant public health problem in the United States (Guillory et al. 2015). Maternal and child health statistics show that improvements in pregnancy outcomes in the United States have slowed down significantly; and in some cases, the outcomes have deteriorated (Atrash et al. 2006). The researchers note that the slowing rate of improvements in birth outcomes is associated with a change in the leading causes of infant mortality; where, by 2002, congenital abnormalities, low-birth weight, preterm delivery, and pregnancy-related maternal complications accounted for 46.4% of all infant deaths (Atrash et al. 2006). In addition, current trends show that low birth weight and prematurity are associated with about 70% of all cases of infant mortality in the United States (Badura et al. 2008; Guillory et al. 2015; Livingood et al. 2010; Masho et al. 2011; Tierney-Gumaer & Reifsnider, 2008). Furthermore, both prematurity and low birth weight carry a very high risk of reoccurring in subsequent pregnancies and have been identified as being the strongest predictors of a woman having a subsequent low birth weight (Biermann et al. 2006; Dunlop et al. 2008; Tierney-Gumaer & Reifsnider, 2008; Zhang et al. 2011) and premature infant (Badura et al. 2008; Johnson et al. 2015; Loomis et al. 2000; Lu et al. 2006; Malnory et al. 2011; Tierney-Gumaer & Reifsnider, 2008; Varner et al. 2016; Zhang et al. 2011).

Recommendations from the Centers for Disease Control and Prevention and the March of Dimes stress the importance of maximizing care for high risk women during the interconception period – the interconception period should be used to provide

additional intensive interventions to women who have had a previous pregnancy that ended in an adverse birth outcome (Floyd et al. 2013; Posner et al. 2006). Despite these recommendations, many women most in need of interconception care do not know about it, are not informed about it by their health care provider, and/or do not have the resources to access care during the interconception period. Thus, the goal of this dissertation is to examine those risk factors associated with interconception care, examine how these risk factors are associated with the type of health insurance coverage a woman has during the interconception period and to investigate how receipt of interconception care and adherence to interconception care recommendations is associated with subsequent birth outcomes. These studies address a gap in the literature by increasing our understanding of interconception care utilization in the United States. This study is very relevant because there are still very few studies available in this area, and most do not explore interconception care at a population level.

SIGNIFICANCE OF THIS DISSERTATION

Study #1: Many studies note the associations between different risk factors and adverse birth outcomes. Noted risk factors include diabetes, hypertension, obesity, and having a previous birth outcome (Badura et al. 2008; Batra et al. 2016; Biermann et al. 2006; Burris et al. 2010; Dunlop et al. 2008; Johnson et al. 2015; Loomis et al. 2000; Lu et al. 2006; Malnory et al. 2011; Tierney-Gumaer & Reifsnider, 2008; Varner et al. 2016; Zhang et al. 2011). They also acknowledge that these risk factors are often most prevalent among African American and low income mothers (Borrell et al. 2016;

Dominguez, 2010; Loggins et al. 2014; Loomis et al. 2000; Lu et al. 2006; Meng et al. 2013; Simon et al. 2008; Steel et al. 2015; Wallace et al. 2016; Zhang et al. 2011). The goal of this study is to examine how these risk factors are associated with self-reported receipt of interconception care. Current studies on interconception care highlight the importance of targeting women in this population because they are most at risk for repeated adverse birth outcomes. However, the literature is still limited on how these factors are associated with receipt of interconception care. Furthermore, no studies have explored this relationship at a population level.

Study #2: The lack of health insurance coverage is a noted barrier regarding receipt of health care and services. Studies show that women who do not have health insurance are more likely to: experience poor health and birth outcomes, be noncompliant to medical treatment, have fewer preventive screenings, delay diagnosis and treatment of serious conditions, experience an increase in late stage diagnoses, have higher rates of avoidable hospitalizations, and experience poor overall (health-related) quality of life (Ayanian et al. 2000; Zhao et al. 2017). Furthermore, low income women are most at risk of being uninsured or underinsured and thus, are disproportionately more likely to face the outcomes noted above. For many low income women who do not have health insurance, Medicaid is their primary source of health care coverage – at least 60% of the women on Medicaid are of childbearing age (Atrash et al. 2006; Bryant et al. 2006; Dunlop et al. 2008). Thus, one of the key provisions of the Patient Protection and Affordable Care Act (ACA) is the expansion of Medicaid to cover more low income women. This study is very relevant because it encompasses data collected pre and post

implementation of ACA. And while many of the Act's provisions were not fully implemented during this study period, this study allows us to explore the health insurance coverage of at risk women during the early years post implementation. In addition, this study focuses on health insurance coverage during the interconception period. This is critical because many low income women of childbearing age only qualify for Medicaid when they are pregnant and this coverage typically ends 60 days postpartum (Atrash et al. 2006; Badura et al. 2008; Bryant et al. 2006; Dunlop et al. 2008; Lu et al. 2010; Rankin et al. 2016; Rosenbach et al. 2010). Thus, women who have had a previous adverse birth outcome but do not have health insurance coverage during the interconception period will lack the resources to address/prevent subsequent/repeat adverse birth outcomes and related health issues.

Study #3: There have been multiple efforts to identify the most effective adverse birth outcome prevention methods and for more than two decades; prenatal care was the primary prevention method used/promoted (Lu et al. 2003; Lu et al. 2006; Pies et al. 2012). However, researchers now acknowledge that the rates of low birth weight and premature births cannot be reduced solely by improving access to prenatal care (Bernstein et al. 2010; Lu et al. 2006; Oza-Frank et al. 2014). This acknowledgement stems from a growing recognition that birth outcomes are the product of the mother's entire lifespan leading up to her pregnancy – i.e. to improve birth outcomes, the woman's health before and between pregnancies must be considered (Lu et al. 2006). Interconception care is defined as care, counseling and auxiliary services that are provided to a woman and her family between pregnancies (Badura et al. 2008; Biermann

et al. 2006; Dunlop et al., 2008; Hussaini et al. 2013; Lu et al. 2006; Malnory et al. 2011; Rosenbach et al. 2010). Interconception care is important because it is used to ensure that women who have had a prior adverse birth outcome receive tailored care and services that can address the risks and complications associated with the previous adverse pregnancy, improve overall health before future pregnancies and reduce the risk of a subsequent adverse birth outcome (Badura et al. 2008; Johnson et al. 2015). Despite noted evidence of its need and importance, research on the effectiveness of interconception care at improving birth outcomes is still very limited. Thus, this study examines how interconception care is associated with subsequent birth outcomes. It adds to the literature because while a few small scale intervention-focused studies have been published, no study has assessed the associations between interconception care and birth outcomes on a population level.

CHAPTER II

LITERATURE REVIEW

INTERCONCEPTION CARE

Interconception care is defined as care, counseling and auxiliary services that are provided to a woman and her family from the delivery of one newborn until the conception of the next, where the information learned during her previous pregnancy is incorporated into and/or addressed in her care (Badura et al. 2008; Biermann et al. 2006; Dunlop et al., 2008; Hussaini et al. 2013; Lu et al. 2006; Malnory et al. 2011; Rosenbach et al. 2010). One of the most important aspects of interconception care is identification and reduction of the health issues that arose during a prior adverse birth outcome. Biermann et al. (2006) and Rosenbach et al. (2010) note that interconception care is a subset of preconception care and that it should be provided between pregnancies, should address the risks associated with a previous adverse birth outcome, should provide preventive health services and should encourage birth intervals of two or more years between pregnancies. There are different terms used synonymously with the term interconception care including inter-natal care and inter-pregnancy care. Lu et al. (2006) notes that the term inter-natal care is more inclusive than interconception care because inter-natal care by definition is an extension of prenatal care; thus inter-natal care begins at the birth of one child and ends with the birth of the next child. However, despite the differences in the terms used, the aim of interconception care (inter-pregnancy care or inter-natal care) is to ensure that women who have had a prior adverse birth outcome

receive tailored care and services that can address the risks and complications associated with the previous adverse pregnancy, improve overall health before future pregnancies and reduce the risk of a subsequent adverse birth outcome (Badura et al. 2008; Johnson et al. 2015). The interconception period is an ideal time to reduce risk factors – diseases, unhealthy behaviors, environmental hazards – that are associated with infant mortality and other adverse birth outcomes (Badura et al. 2008). Interconception care and services should include discussions on pregnancy spacing and healthy behaviors – e.g. a healthy body mass index, taking vitamins, cutting out smoking and drinking; assessments of chronic health conditions – e.g. diabetes and hypertension; and getting needed vaccinations and screenings – e.g. sexually transmitted infections and genetic predispositions (Malnory et al. 2011; Waggoner, 2013). However, despite these advances and the emphasis placed on the importance of interconception health, the interconception period continues to be one of the most ignored aspects in patient counseling and care (Malnory et al. 2011).

Interconception Care and The Life Course Theory

Interconception care stems from a new approach to health which explores how a person's exposures across their lifespan can impact their health. This new approach is referred to as Life Course Theory or a Life Course Approach/Perspective. It began with the call for longitudinal studies on the life history of polish peasants between 1918 and 1920; however, by the 1930s, German and British physicians had already accumulated evidence which showed that a person's health during childhood affected their health later on in life (Russ et al. 2014). The physicians' data showed that life quality

expectations were directly related to the conditions experienced during early childhood years (Russ et al. 2014). In addition, their data showed that the health of the mother was strongly associated with infant mortality rates. Despite the strong evidence supporting these findings, life course theory remained unheeded until the groundbreaking work by British epidemiologist Dr. David Barker in the 1980s (Callahan et al. 2015; Hogan et al. 2012; Russ et al. 2014). Dr. Barker's research was able to show a strong correlation between fetal origins and adult disease; e.g. he found associations between high rates of infant mortality and specific chronic diseases (Callahan et al. 2015; Hogan et al. 2012; Russ et al. 2014). According to the Barker Hypothesis, there are two very important changes that happen in utero that can lead to poor health outcomes later in life: 1) plasticity – when fetal organs adapt to stressors within its environment, and 2) epigenetics – when gene expressions are altered due to external environmental stressors - these gene expressions may be protective at first but may prove to be maladaptive later in life (Bernstein et al. 2010; Hogan et al. 2012; Russ et al. 2014).

According to the life course theory, health outcomes across an individual's life span and their future generations are influenced by a complex interplay of biological, social, environmental, behavioral and psychological risk factors (Malnory et al. 2011). Life course theory takes into account all possible factors that can influence an individual's health at different stages of life (infancy, childhood, adolescence, adulthood, older adulthood) as well as the individual's external environment (where they were born, grew up, live and work) and it identifies cumulative exposures during those critical periods of risk (Bernstein et al. 2010; Brady et al. 2014; Callahan et al. 2015; Hogan et

al. 2012; Pies et al. 2012; Russ et al. 2014; Shrimali et al. 2014). In addition, the life course theory expounds on the underlying causes (including social, economic and environmental causes) of health disparities across populations and over time (Callahan et al. 2015). To this end, Lu and Halfon developed a life course health development model which has been used to understand existing racial disparities in birth outcomes within the field of maternal and child health (Brady et al. 2014; Callahan et al. 2015; Fraser 2013; Malnory et al. 2011). According to their model, inequalities in birth outcomes including low birth weight and infant mortality are as a result of differences in the interplay of protective and risk factors (e.g. behavioral, psychological, environmental, and social factors) experienced by women across their lifespan (Brady et al. 2013; Fraser 2013; Pies et al. 2012).

Interconception Care and Preconception Care

Preconception care and interconception care are both described as life course approaches with the primary aim of improving perinatal outcomes. Interconception care is actually a subset of preconception care. Preconception care is defined "as a set of interventions that aim to identify and modify biomedical, behavioral, and social risks to a women's health or pregnancy outcome through prevention and management, emphasizing those factors which must be acted on before conception or early in pregnancy to have maximal impact" (Floyd et al. 2013; Liu, 2014; Posner et al. 2006). Preconception care as an idea, has been around since the 1960s (Harelick et al. 2011; Waggoner, 2013). In addition, maternal and child health experts have made recommendations that the pregnancy risk period be expanded to include the period

before pregnancy since the 1980s (Harelick et al. 2011; Waggoner, 2013). Despite this, preconception health received very little attention until the Centers for Disease Control and Prevention (CDC) and the March of Dimes convened a national summit in June of 2006 to discuss an agenda for preconception care programs, research, and policy (Floyd et al. 2013; Harelick et al. 2011; Posner et al. 2006).

As a result of this summit, 10 recommendations were developed which centered on goals that could help women achieve optimal reproductive and overall health (Johnson et al. 2015; Posner et al. 2006). The four overarching goals are as follows: 1) to improve knowledge, attitudes, and behaviors related to preconception health; 2) to ensure that all United States' women of childbearing age receive preconception care services including screening, health promotion, and interventions that will enable them to begin pregnancy in optimal health; 3) to reduce risks indicated by a prior adverse pregnancy outcome through interventions during the interconception (inter-pregnancy) period that can prevent or minimize health problems for a mother and her future children; and 4) to reduce the health disparities in adverse pregnancy outcomes (Floyd et al. 2013; Posner et al. 2006). The ten recommendations are as follows: 1) each woman, man, and couple should be encouraged to have a reproductive life plan; 2) increase public awareness of the importance of preconception health behaviors and preconception care services using information and tools appropriate across various ages, literacy, and cultural/linguistic contexts; 3) as a part of primary care visits, provide risk assessment, education and health promotion counseling to all women of childbearing age to reduce reproductive risks and improve pregnancy outcomes; 4) increase the proportion of

women who receive interventions as follow-up to preconception risk screening, focusing on high priority interventions; 5) use the interconception period to provide additional intensive interventions to women who have had a previous pregnancy that ended in an adverse outcome; 6) offer, as a component of maternity care, one pre-pregnancy visit for couples and persons planning pregnancy; 7) increase public and private health insurance coverage for women with low incomes to improve access to preventive women's health and preconception and interconception care; 8) integrate components of preconception health into existing local public health and related programs, including emphasis on interconception interventions for women with previous adverse outcomes; increase the evidence base and promote the use of the evidence to improve preconception health; and 10) maximize public health surveillance and related research mechanisms to monitor preconception health (Floyd et al. 2013; Posner et al. 2006). Since the 2005 summit, there has been considerable planning, research and development regarding interventions, public policies and screenings that can help to improve the health of women of child-bearing age before pregnancy and decrease the rate of adverse birth outcomes.

NEED FOR INTERCONCEPTION CARE

Various researchers have highlighted the need for interconception care. They discuss the current rate of infant mortality and associated adverse birth outcomes as well as the limitations of current infant mortality prevention interventions. The paragraphs below summarize these discussions.

Infant Mortality

Infant mortality rate is often used as a proxy measure for how a nation cares for and treats its future generations (Bodnar et al. 2016; Li et al. 2011; Waggoner, 2013). It is defined as the number of deaths for infants younger than one (1) year of age per 1000 births (Bodnar et al. 2016; Li et al. 2011). Guillory et al. (2015) and Bodnar et al. (2016) note that in 2010, the United States infant mortality rate of 6.1 deaths per 1,000 live births was still more than twice that of many developed countries. However, the United States has seen great improvements in its infant mortality rate over time; whereby, these improvements are noted as one of the ten "great public health achievements" of the 20th century. Atrash et al. (2006) notes that from 1960 to 1980 the infant mortality rate dropped by 51.5% from 26.0 to 12.6 per 1,000 live births and from 1980 to 2000 the infant mortality rate dropped by 45.2% from 12.6 to 6.9 infant deaths per 1,000 live births. Much of the improvements seen in infant mortality can be attributed to changes in social and living conditions as well as the advancement and delivery of more effective medical and health interventions (Atrash et al. 2006). Despite these advancements and breakthroughs in medical and health interventions, infant mortality continues to be a significant public health problem in the United States (Guillory et al. 2015). Maternal and child health statistics show that improvements in pregnancy outcomes in the United States have slowed down significantly; in some cases, the outcomes have deteriorated (Atrash et al. 2006). Atrash et al. (2006) highlights statistics that show that from 1980 to 2000, babies born preterm has increased by 26%, babies born very preterm has increased by 8.2%, low birth weight births has increased by 14.7% and very low birth weight

births has increased by 25.9%. The researchers go on to explain that the slowing rate of improvements in birth outcomes in the United States is associated with a change in the leading causes of infant mortality; where, by 2002, congenital abnormalities, low-birth weight, preterm delivery, and pregnancy-related maternal complications accounted for 46.4% of all infant deaths (Atrash et al. 2006).

Current national data trends show that low birth weight and prematurity are associated with about 70% of all cases of infant mortality and they are an on-going health challenge in the United States (Badura et al. 2008; Guillory et al. 2015; Livingood et al. 2010; Masho et al. 2011; Tierney-Gumaer & Reifsnider, 2008). Data from the National Center for Health Statistics shows that prematurity and low birth weight is the second and third leading causes of infant death in the United (Masho et al. 2011). Low birth weight neonates are those born weighing less than 2500 grams because they were either born premature –less than 37 weeks' gestational age or they were growth restricted prior to birth –birth weight that is less than the 10th percentile for that gestational age (Guillory et al. 2015; Masho et al. 2011; Tierney-Gumaer & Reifsnider, 2008; Witt et al. 2014). The association between low birth weight and infant mortality originated with the work of the Finish pediatrician Yllpo in 1930 (Guillory et al. 2015). Yllpo advocated for the current threshold that we use to identify a low birth weight infant (<2500 grams) because his evidence showed that these infants were most at risk for adverse neonatal outcomes (Guillory et al. 2015). It was through his work that low birth weight began to be seen as a public health indicator of a nation's health and also what led to low birth weight being accepted as a predictor of infant mortality by the

World Health Organization in 1948 (Guillory et al. 2015). Despite the tremendous improvements in the care available to low birth weight infants, infant mortality rates within this population and those infants categorized as very low birth weight, remains very high – low birth weight infants are more likely than normal birth weight infants to die within their first month of life; infant mortality rates are 25 times higher among low birth weight infants when compared to normal weight infants; and for very low birth weight infants, in addition to having an increased risk of dying in their first year of life, they are also at risk for various complications including hypothermia, cerebral palsy, and other neurological problems (Guillory et al. 2015; Masho et al. 2011; Ounpraseuth et al. 2012; Witt et al. 2014).

Inadequacy of Prenatal Care

For more than two decades, prenatal care has been the primary intervention strategy in the reduction of adverse birth outcomes including the infant mortality rate (Lu et al. 2003; Lu et al. 2006; Pies et al. 2012). There is extensive published research on the importance of early entry into quality prenatal care, especially for high risk women (Pies et al. 2012). As a result, large investments have been poured into the various sources of prenatal care to ensure that women have access to quality prenatal care early in their pregnancies (Pies et al. 2012). The 1980s saw a huge increase in the number of women receiving prenatal care in their first trimester (referred to as early prenatal care) so that by the year 2000, 83.2% of women were receiving early prenatal care (Atrash et al. 2006). Prenatal care services focus on screening for infections and chronic conditions like preeclampsia and gestational diabetes with an initial comprehensive visit and then a

series of visits that increase in frequency as the pregnancy progresses (Bernstein et al. 2010). In the past, the success of prenatal care was measured by the degree to which it impacted the rates of premature and low birth weight infants; however, as the rates of entry into early, consistent and adequate prenatal care continue to increase, it does not appear to be having an impact on the worsening rates of these two adverse birth outcomes (Bernstein et al. 2010; Coffey et al. 2014; Lu et al. 2003; Lu et al. 2006; Livingood et al. 2010; Pies et al. 2012).

As a result, there are many who have now begun to question the effectiveness of prenatal care (Lu et al. 2006). There is a growing consensus that the rates of low birth weight and premature births in the US cannot be reduced solely by improving access to prenatal care (Bernstein et al. 2010; Lu et al. 2006; Oza-Frank et al. 2014). Researchers acknowledge that it is unrealistic to expect prenatal care to address these adverse birth outcomes when by the time the woman has her first visit; organogenesis in the embryo is already underway (Atrash et al. 2006; Bernstein et al. 2010; Biermann et al. 2006; Dhakal, 2016; Loomis et al. 2000; Lu et al. 2003). Thus, researchers emphasize that the primary limitation regarding the effectiveness of prenatal care is its timing (Biermann et al. 2006; Coffey et al. 2014; Dunlop et al. 2008; Hussaini et al. 2013; Lu et al. 2006; Oza-Frank et al. 2014). They explain that many of the patho-physiological processes that contribute to various adverse birth outcomes begin very early on in pregnancy or even before implantation; thus, by the time prenatal care is initiated, it is often already too late to alter the pregnancy outcome (Atrash et al. 2006; Biermann et al. 2006; Coffey et al. 2014; Dhakal, 2016; Dunlop et al. 2008; Hussaini et al. 2013; Lu et al. 2006; Oza-Frank

et al. 2014). These factors have led to a growing recognition that birth outcomes are the product of the mother's entire lifespan leading up to her pregnancy (Lu et al. 2006). Thus, to improve birth outcomes, the woman's health before and between pregnancies and ultimately across her lifespan must be considered.

INTERCONCEPTION CARE AND ASSOCIATED RISK FACTORS

Interconception care interventions have been developed in response to the number of women who experience repeat adverse pregnancy outcomes. Some of the risks associated with repeat adverse birth outcomes include previous adverse birth outcomes, current health status – presence of chronic diseases/conditions, short pregnancy intervals, socioeconomic status, race/ethnicity and substance use.

History of Prior Adverse Birth Outcome

Interconception care and services should be provided to all women between pregnancies; however, it is especially important for high risk women – e.g. those who have had a previous adverse birth outcome (Lu et al. 2006). Interconception care is especially important for this group of high risk women because many adverse birth outcomes, for example prematurity and low birth weight; carry a very high risk of reoccurring in subsequent pregnancies (Lu et al. 2006). In fact, the strongest predictors of a woman having a low birth weight or premature infant is her history of experiencing a previous low birth weight (Biermann et al. 2006; Dunlop et al. 2008; Tierney-Gumaer & Reifsnider, 2008) or premature infant (Badura et al. 2008; Johnson et al. 2015; Loomis et al. 2000; Lu et al. 2006; Malnory et al. 2011; Tierney-Gumaer & Reifsnider,

2008; Varner et al. 2016) during her previous pregnancy. Researchers are still trying to understand the reasons for the increased occurrence and recurrence of adverse birth outcomes; however, existing data shows that these adverse birth outcomes can be linked to a woman's poor health, chronic stress and depression, and short inter-pregnancy intervals (Biermann et al. 2006; Dunlop et al. 2008). Research has also shown that factors that contributed to the first adverse pregnancy and remain unaddressed are likely to persist and influence subsequent pregnancies (Biermann et al. 2006; Dunlop et al. 2008; Lu et al. 2006). Varner et al. (2016) notes that another contributing factors is that some women at risk of adverse pregnancies are unaware of their heightened risk. However, because women with prior adverse birth outcomes can be easily identified, interventions can be developed that address their specific health needs and can be delivered during the interconception period to help decrease the possibility of repeat adverse birth outcomes (Badura et al. 2008; Malnory et al. 2011).

History of Chronic Disease

Many chronic diseases affecting women are also risk factors for adverse birth outcomes (Johnson et al. 2015; Masho et al. 2011). These factors may be rooted in the woman's genetic make-up and or her environmental exposures (Masho et al. 2011). There is considerable evidence to support the relationship between different chronic diseases and adverse birth outcomes including: associations between fetal/placental size and hypertension; associations with birth weight, hypertension and insulin resistance; and associations between premature birth and stress (Masho et al. 2011). While there has been extensive research on the impact of these chronic diseases on birth outcomes, many

diagnosed with these conditions remain underserved during the interconception period, especially if they have given birth to a previously healthy infant (Lu et al. 2006).

Hypertensive disorders are the most frequently reported chronic condition during pregnancy (Lu et al. 2006). Of the 4 million women who delivered a live birth in the United States in 2002, over 150,000 reported gestational hypertension, over 3,000 had chronic hypertension, and almost 13,000 had eclampsia (Lu et al. 2006). Women who have chronic hypertension (whether or not it is controlled) are more likely to experience pregnancy complications including fetal growth restriction, stillbirth, preterm birth and preeclampsia (Callegari et al. 2015). The second most frequently reported chronic condition during pregnancy is diabetes (Lu et al. 2006). In the United States, in 2002, over 130,000 women reported having diabetes during pregnancy and this number continues to rise with the high rate of obesity in the United States (Callegari et al. 2015; Lu et al. 2006). Women who have gestational diabetes during one of their pregnancies have a 30–70% chance of it reoccurring in their next pregnancy and are also at an increased risk of developing Type II diabetes later in life (Callegari et al. 2015; Lu et al. 2006; Steel et al. 2015). For women with pre-gestational diabetes, their fetuses are at increased risk for stillbirth, congenital anomalies, macrosomia, birth trauma, and newborn hypoglycemia (Callegari et al. 2015; Lu et al. 2006; Steel et al. 2015). As noted earlier, a growing number of women of child-bearing age in the United States are overweight or obese - defined as a body mass index of 30 kg/m2 and greater (Callegari et al. 2015; Lu et al. 2006). According to a1997 National Health Interview Survey, 30% of women between the ages of 18 and 24 and 43% of women between the ages of 25 and

44 are overweight (Callegari et al. 2015; Lu et al. 2006). Similar to other chronic conditions, maternal obesity poses a threat to subsequent birth outcomes and overall maternal health (Callegari et al. 2015; Lu et al. 2006; Steel et al. 2015). However, compared to other chronic conditions, pregnancy itself is a risk factor for maternal obesity as according to 2003 Pregnancy Nutrition Surveillance System data, over 44% of pregnant women gained more than the recommended weight and many retained the weight post pregnancy (Lu et al. 2006). Obese women are at increased risk for a variety of adverse pregnancy outcomes including gestational diabetes mellitus, preeclampsia, preterm delivery, large for gestational age infant, fetal and infant death, and congenital anomalies (Bodnar et al. 2016; Callegari et al. 2015). Depression is a highly prevalent chronic condition among women in the United States. It is also common among pregnant women where between 11 to 32% of women experience depression somewhere between conception and three months postpartum (Callegari et al. 2015). Current research is showing that depressive symptoms during pregnancy are associated with adverse pregnancy outcomes including low birth weight, preterm delivery, and postpartum depression (Callegari et al. 2015).

Other High-Risk Factors

The benefits of interconception care are dependent on the risk profile of the individual woman and/or the population because there are various factors that can influence a woman's birth outcome including inter-pregnancy interval, age, socioeconomic status, race/ethnicity and substance abuse. Although there is limited

research on the impact of these factors on the use of interconception care, there are many studies which show how these factors are associated with adverse birth outcomes.

Inter-Pregnancy Interval

Inter-pregnancy interval is defined as the time between one delivery and the next conception (Cheslack et al. 2015). Khoshnood et al., (1998) note that the length of time between pregnancies (the inter-pregnancy interval) can increase the risk of adverse birth outcomes. Studies have found that short inter-pregnancy intervals (less than12 months) and very short inter-pregnancy intervals (less than 6 months) were associated with increased risk of preterm delivery, low birth weight births and/or small for gestational age births (Bryant et al. 2006; Cheslack et al. 2015; Davis et al. 2014; Khoshnood et al. 1998; Tierney-Gumaer & Reifsnider, 2008). In addition, comparisons between mothers with more than twelve month inter-pregnancy intervals and less than six month inter-pregnancy intervals showed that mothers with less than six month inter-pregnancy intervals had an estimated 50 to 80 percent increased risk for very low birth weight births and a 30 to 90 percent increased risk for very preterm delivery (Khoshnood et al. 1998). Other perinatal risk behaviors associated with short and very short inter-pregnancy intervals include unlikely participation in preconception or interconception care, increased exposure of the fetus to harmful substances (including cigarette and alcohol use), lack of pre-pregnancy folic acid intake, delayed prenatal care, and infant mortality (Bryant et al. 2006; Malnory et al. 2011; Varner et al. 2016).

Age

Studies show that child birth at early and advanced maternal ages is associated with adverse birth outcomes. Research has shown that adolescent pregnancy and advanced maternal age were associated with a higher risk of low birth weight, preterm delivery and perinatal mortality (Kinzler et al. 2002; Tierney-Gumaer & Reifsnider, 2008; Zheng et al. 2016). However, Tierney-Gumaer & Reifsnider (2008) note that age is often mediated by other factors including access to care, socioeconomic status, race/ethnicity, and lifestyle habits. In addition, among older women, various physiological changes occur that can expose the fetus to unfavorable birth environments (Zheng et al. 2016). According to Luke et al. (2007), current birth rates for women aged 30 and above are at the highest they have been since the mid 1960s. The researchers note that this shift in women's child bearing age is attributed in part to increased availability and use of fertility enhancing treatments (Luke et al. 2007). Studies on the birth outcomes among women who use fertility enhancing treatments show high rates of unexplained adverse pregnancy outcomes (Luke et al. 2007).

Socio-economic Status

Various studies have found a relationship between an individual's socioeconomic status and their health outcome. Similarly, studies have found a relationship between socioeconomic status and birth outcomes. According to Wallace et al. (2016), preterm birth rates are consistently higher among women who are socio-economically disadvantaged. In addition, preterm birth rates across the states were significantly higher among women with government-sponsored insurance plans compared to those who had

private insurance plans (Wallace et al. 2016). State comparison data also showed that preconception health and preterm birth rates were worse among women who lived in states that had higher rates of inequality (Wallace et al. 2016). Meng et al. (2013) note that at the neighborhood level, socio-economic factors have been consistently associated with the incidence of low birth weight and preterm birth. Their research found that unhealthy neighborhood-level living conditions, hazardous environments, low quality health-related services, scarce resources and ongoing exposure to income inequality are all significantly associated with adverse pregnancy outcomes (Meng et al. 2013). They also explain that higher level/structural socioeconomic factors including welfare and health coverage, and social and economic policies can directly and indirectly affect a mother's birth outcomes.

Overall, women who are socio-economically disadvantaged often have the most to gain from interconception care because they are more likely to be in poorer health and to lack the knowledge and resources needed to improve their pregnancy outcomes (Coffey et al. 2014). Among low income women with higher risk for health problems and chronic diseases, having health insurance before pregnancy is a strong predictor of whether or not they will seek various forms of health care services including prenatal care, interconception care, family planning services and needed health care screenings (Simon et al. 2008; Steel et al. 2015). In addition, many Medicaid-dependent, low income women are unable to access interconception care services because Medicaid programs end pregnancy-related health coverage for most of their low income clients at 60 days postpartum (Loomis et al. 2000; Lu et al. 2006). Thus, most of these women

have no access to health coverage between pregnancies apart from the one recommended postpartum visit. Another challenge faced by low income women has to do with their high rates of unintended/unplanned pregnancies. Since 1994, the average percentage of unintended pregnancies has remained at about 50% (Bryant et al. 2006; Malnory et al. 2011; Lu et al. 2010; Varner et al. 2016). There are many perinatal risk behaviors associated with unplanned pregnancies, the strongest of which is that unplanned pregnancies are more likely to have short intervals between pregnancies (Malnory et al. 2011).

Race/Ethnicity

In the United States, non-Hispanic African American women have repeatedly experienced the worst birth outcomes – e.g. recent national data show that babies of non-Hispanic African American women are more likely than those of non-Hispanic White women to have low birth weight, to be preterm and to have higher rates of infant mortality (Borrell et al. 2016). Thus, despite great advancements and improvements in maternal and child health over the last century, the racial gap in infant mortality has not shown much change (Dominguez, 2010). Loggins et al. (2014) note that the differences in birth outcomes between African American and White women can be attributed to socioeconomic gradients in health. Specifically, compared to African American women, White women have access to more socioeconomic resources including higher levels of educational attainment, income, and employment. In addition, compared to African American mothers, White mothers are more likely to own a car and report that they live in safe neighborhoods. Studies have also found that different socioeconomic factors have

differential effects across racial/ethnic groups (Loggins et al. 2014). For example, the impact of educational attainment had differential effects on White and African American women. Among White women, infant mortality sharply declined as educational attainment increased; whereas among African American women, infant mortality decreased at a much slower rate as educational attainment increased (Loggins et al. 2014).

Substance Use

The effects of alcohol use and smoking on pregnancy have been studied at length. Various studies note that maternal smoking and alcohol use during pregnancy are two of the most critical and preventable factors that adversely affect birth outcomes (Beyerlein et al. 2011; Tierney-Gumaer & Reifsnider, 2008; Tong et al. 2013; Weiss & Chambers, 2013; Witt et al. 2015; Zheng et al. 2016). Smoking and alcohol use during pregnancy are associated with various adverse birth outcomes including low birth weight, preterm birth, restricted fetal growth, sudden infant death syndrome and birth abnormalities (Anderson et al. 2014; Beyerlein et al. 2011; Chen 2012; Tierney-Gumaer & Reifsnider, 2008; Tong et al. 2013; Weiss & Chambers, 2013; Witt et al. 2015; Zheng et al. 2016). Witt et al. (2015) note that despite this, in 2012, about 24.6 % of women aged 15 to 44 reported tobacco use and over 50 % reported alcohol use. In addition, their study found that in the three months prior to pregnancy, 37.9 % of women reported using alcohol and 23.2 % reported using tobacco. These numbers are alarming because statistics show that about half of pregnancies in the United States are unplanned, and as

result; many of these women are likely to use these substances during the early stages of their pregnancy (Chen 2012; Weiss & Chambers, 2013; Witt et al. 2015).

INTERCONCEPTION CARE INTERVENTIONS

Despite noted evidence of its need and importance, research on interconception care is still very limited. Currently, much of the research available is in the form of small-scale intervention and evaluation studies. Many of these studies focus on interventions that are funded by Healthy Start – one of the primary nation-wide federal projects focused on reducing the infant mortality rate.

Healthy Start

The Healthy Start program was started in 1991 to address those factors that contributed to the high rates of infant mortality in the United States, with a focus on vulnerable populations (e.g. low income populations, minority populations) who experienced disproportionately high rates of adverse pregnancy outcomes (Badura et al. 2008; Rosenbach et al. 2010). Healthy Start program services have been tailored to meet the needs of their intended populations and are developed to address the racially, ethnically, and linguistically diverse communities who most need these services (Rosenbach et al. 2010). The program has three primary goals; 1) to use a lifespan approach to reduce racial/ethnic disparities in access to and use of health care services, 2) to improve the quality of services available within the local health care system, and 3) to increase consumers participation in health care decision-making by ensuring that their voices are heard (Badura et al. 2008). Thus, Healthy Start works with communities and

builds on their existing resources (outreach, health education, case management, and prenatal/interconception care) to improve the quality of and access to evidence-based, innovative and community-driven practices, interventions and health care for women and infants at both the service and system levels (Badura et al. 2008).

During project years, 2001 – 2005, the Health Resources and Services Administration's (HRSA) Maternal and Child Health Bureau (MCHB) included interconception care as a core strategy of the Healthy Start program in acknowledgement of the growing evidence supporting its importance (Badura et al. 2008). The interconception care focused elements that were provided by Health Start grants included: 1) outreach for identification of high-risk women and infants during hospitalization; 2) linking high-risk women of reproductive age to primary and specialty care; 3) linking high-risk infants to Maternal and Child Health Services Block Grant (Title V), Medicaid, and other needed intervention services; and 4) providing woman with existing chronic conditions ongoing case management and health education interventions as well as risk reduction activities including smoking cessation (Badura et al. 2008). From 2001–2005, 35 Healthy Start grantees were challenged to develop and enhance their interconception care components and then to pilot test the new components to identify the essential elements of implementing interconception care in Healthy Start (Badura et al. 2008). A review of the work done by the 35 grantees showed that only a few of the grantees incorporated any community-wide barriers and/or an ecological model into their interconception care components. However, all 35 grantees focused their attention on the patients' family planning and well-woman visits during the

postpartum period. Despite these results, by the start of 2005, HRSA–MCHB required all 97 Healthy Start grantees (and the 2 grantees funded in 2007) to include interconception care components into their interventions (Badura et al. 2008). HRSA–MCHB noted that all Healthy Start programs' interconception care elements should include the following: 1) knowledge of what interconception care is and how it relates to different health outcomes; 2) an understanding of the gaps that exist in providing interconception care services; and 3) a record of completed referrals for women needing both interconception and specialty health care services (Badura et al. 2008).

For most grantees, the typical components included (Badura et al. 2008; Lu et al. 2010): 1) a risk assessment; 2) a care/services plan corresponding to identified risks associated with adverse birth outcomes, with regular updates over the 12- to 24-month interconception care service period; 3) referrals and follow-up assistance in linking to other services (e.g., appointments with medical providers, support for completing Medicaid applications, help in finding child care or transportation to medical appointments); 4) health promotion, education, anticipatory guidance, and counseling; 5) behavioral screening (e.g., depression screening); and 6) monitoring milestones for mother and baby (e.g., completion of the 4- to 6-week postpartum visit, selection and use of a family planning method, immunizations). In addition, some of the primary services provided include: family planning, screening for maternal depression and intimate partner violence, assessing social support for the pregnant woman, smoking cessation and substance abuse treatment programs, physical activity and nutritional education and interventions, management of chronic diseases, and education on back-to-sleep and

parenting skills (Lu et al. 2010). Healthy Start is the first nation-wide program to focus systematically on interconception care and there have been several demonstration projects at different Healthy Start program sites, most notably programs in Atlanta, Denver, Jacksonville, and Philadelphia – two of which are described below (Lu et al. 2010; Rosenbach et al. 2010).

Magnolia Project

The Magnolia Project is a federally-funded Healthy Start initiative being delivered in Jacksonville Florida. The program is designed to reduce the risk of adverse pregnancy outcomes through the delivery of social and behavioral interventions among high-risk women (Livingood et al. 2010). The program provides a range of services including case management, risk reduction, social support, health education, and community development (Biermann et al. 2006). The intended population is women of child-bearing age (15-44) who are not currently pregnant but meet one or more of the following criteria: have had a previous adverse birth outcome (infant death, low birth weight infant, premature infant); have had a child as a young teenager (less than 15 years old); do not have access to a regular source of healthcare and/or health coverage; are substance-abusers; have a history of mental health problems (including abuse, depression, anxiety); have a history of high-risk, unprotected sexual relationships; and have been identified as high-risk by child protective services/social service agencies (Livingood et al. 2010). The project uses an empowerment model that promotes improved wellness and health to engage its clients (Biermann et al. 2006). It also provides intensive case management to women who have had a previous infant death or

delivery of a low birth weight/premature infant; repeated STDs; lack of family planning; substance abuse; first pregnancy before age 15; and lack of access to health care (Biermann et al. 2006). Evaluation of the program has shown that when compared to a similar risk-factor comparison group, among the Magnolia Project case management participants, low birth weight decreased 11% with marginal statistical significance at a p-value of 0.06 and the infant mortality rate which was not statistically significant dropped from 81.3 to 35.7 (Livingood et al. 2010).

Grady Memorial Hospital Inter-pregnancy Care Program

The Grady Memorial Hospital inter-pregnancy care program was delivered to African American women in the Atlanta Georgia area (Biermann et al. 2006; Dunlop et al. 2008). The program targeted all African American women who gave birth at Grady Memorial Hospital and met the following criteria: fell under the status of needing indigent care and had recently delivered a very low birth weight baby – an infant who at birth weighed between 500 and 1499 grams (Dunlop et al. 2008). The program provided clients with 24 months of integrated primary health care and dental services through case management with a nurse and community outreach with a resource mother (Biermann et al. 2006; Dunlop et al. 2008). The women who chose to participate in the program received an initial home visit with the resource mother (lay person trained in life skills and health education to support high-risk women) within one to two weeks after they had been discharged from delivery admission and they were scheduled for their initial inter-pregnancy care clinical assessment 4–6 weeks postpartum (Biermann et al. 2006; Dunlop et al. 2008). During the assessment at 4-6 weeks postpartum, the women were

assessed for possible medical, obstetrical, nutritional, psychological, and social problems (Biermann et al. 2006). They also received a tailored care plan for the next 24 months which addressed conditions that have been linked to LBW delivery: 1) pregnancy planning and child-spacing with an emphasis on an 18-month inter-pregnancy interval and assistance with contraceptive method options; 2) management of chronic disease; 3) Screening and treatment for nutritional deficiencies; 4) prevention, screening, and treatment for sexually transmitted infections and reproductive tract infections; 5) treatment and referral for substance abuse including tobacco and alcohol use; 6) screening and treatment/support for depression, psychosocial stressors, and domestic violence; and 7) prevention, screening and treatment for periodontal disease (Biermann et al. 2006; Dunlop et al. 2008). After their initial visit at 4-6 months postpartum, subsequent visits were scheduled every 1–3 months (depending on the severity of each client's health issues) to discuss and monitor the elements noted in the care plan (Biermann et al. 2006). Evaluation of this inter-pregnancy care program showed that when compared to the control cohort, among the clients enrolled in the program, the average number of pregnancies that occurred with pregnancy intervals of less than 18 months decreased by 61% with a statistical significance at p-value 0.02 and the average number of adverse pregnancy outcomes reduced by 72% with a statistical significance at p-value 0.04 (Dunlop et al. 2008).

INTERCONCEPTION CARE OBSTACLES AND BARRIERS

While interconception care projects and interventions are intended to target population health and social problems, the rhetoric used continues to focus solely on individual behavior change (Waggoner, 2013). By focusing on individual behavior change, interconception care projects, interventions and narratives miss the importance and impact of social factors like poverty, health coverage and education – factors that greatly impact women's risk for adverse pregnancy outcomes (Waggoner, 2013). This focus on individual behavior change is highlighted in the categories of preconception and interconception care indicators that the CDC notes should be addressed to prevent adverse birth outcomes: category one – behaviors and experiences including tobacco use, alcohol use, multivitamin use, contraception use, dental check-ups, health counseling, physical abuse, and stress; and category two – health conditions including an unhealthy weight; having diabetes, asthma, hypertension, a heart problem, or anemia; or having a previous low birth weight or preterm birth (Livingood et al. 2010). Current interconception care efforts correspond with the growing public health trend towards the individualization and medicalization of social and health problems including adverse pregnancy outcomes, health disparities, and women's health care access (Waggoner, 2013). In addition, clinicians and public health professionals often lack the knowledge and training to address those social and environmental factors which tend to be the strongest predictors of adverse pregnancy health including a lack of standards and guidelines for health care and lack of health coverage outside of pregnancy (Coffey et al. 2014; Pies et al. 2012; Rosener et al. 2016).

Lack of Standard Care

There is now growing evidence which links preconception and interconception care to improved perinatal outcomes; however, both preconception and interconception care services continue to be fragmented and inconsistent, difficult to access, difficult to translate into practice and poorly understood by many women (Coffey et al. 2014; Lu et al. 2006). Coffrey et al. (2014) notes that one of the greatest barriers to widespread implementation of preconception and interconception care is the "absence of agreed upon, uniform guidelines for clinical practice, and the absence of uniform tools for assessing the health of women who would benefit from preconception and interconception care services" (Coffey et al. 2014). Existing interconception and interconception care studies show that there is limited consensus on the type of care that should be offered, when it should be offered, how these services should be funded, who should provide these services and how those who need these services should be targeted (Beckmann et al. 2014). For example, there have been very few intervention studies on interconception care; however, among the most noteworthy studies that have taken place in Denver, Atlanta, and Philadelphia, researchers note that the content of care and intervention approaches have varied greatly across sites (Lu et al. 2006). The little data available and the lack standardized care regarding interconception care makes it difficult to move forward with discussions, research, practice, and policy (Beckmann et al. 2014; Coffey et al. 2014; Lu et al. 2006). Much of the research to date has focused on individual conditions (e.g., hypertension) and risk factors (e.g., alcohol use); but few studies have been able to show the effectiveness of such interventions and their impact

on health and perinatal outcomes (Beckmann et al. 2014; Coffey et al. 2014). With rising healthcare costs and in the wake of the CDC's efforts to create evidence-based guidelines for preconception and interconception care; research is needed that can show the cost-effectiveness and value of adding these services to routine primary care and well-woman visits (Coffey et al. 2014; Lu et al. 2010). Integrating preconception and interconception care into routine health care is defined as an "opportunistic" approach because it takes advantage of every routine visit and encourages ongoing health promotion and disease prevention (Coffey et al. 2014; Lu et al. 2010). Recruiting women into interconception and preconception care programs without a specific problem and time period is difficult; as a result, for maximum effect and engagement, preconception and interconception health promotion and disease prevention should be integrated into a continuum of care throughout the woman's lifespan (Badura et al. 2008; Lu et al. 2010).

Lack of Knowledge and Training among Health Care Providers

Despite the demonstrated inadequacy of using only prenatal care to improve pregnancy outcomes; the shift to include preconception and interconception care services as part of the prevention effort regarding adverse birth outcomes has been slow (Coffey et al. 2014). Studies have found that many clinicians and public health professionals are still attached to focusing on prenatal care; they often view preconception and interconception care services as an elective form of care, and they feel that other commitments make the delivery of preconception or interconception care difficult (Hussaini et al. 2013; Pies et al. 2012). Studies also show that very few primary care physicians ask women about their pregnancy intentions and/or discuss with them

how their current health and/or medications can impact their pregnancy outcome (Callegari et al. 2015). Surveys show that roughly 17% of obstetrician/gynecologists/family physicians provided preconception or interconception care to the majority of women that they gave prenatal care and that barely 50% of women at risk for pregnancy and/or at risk for adverse pregnancy received pre-pregnancy or between pregnancy counseling and care (Biermann et al. 2006; Coffey et al. 2014; Malnory et al. 2011). Some of the reasons given by primary care physicians regarding why so many do not incorporate preconception or interconception care into their routine services include: many have inadequate knowledge and training about preconception or interconception care; many felt that the topic was too complex to discuss in the limited time they had with the client; some are not confident about the effects of preconception or interconception care on perinatal outcomes; some noted that there was a lack of reimbursement for counseling; and many believe that women will seek care when they need it (Callegari et al. 2015; Coffey et al. 2014; Malnory et al. 2011; Oza-Frank et al. 2014).

Lack of Health Coverage

Work done by Rosenbach et al. (2010) in eight different communities found that infants had better access to care than their mothers, where, most of the mothers had lower rates of insurance coverage and health care check-ups and higher rates of unmet health needs. Statistics show that many women of child bearing age are uninsured where 40% of poor women are uninsured, 30% of women with incomes between 100% and 200% of the federal poverty level are uninsured, 50% of women with disabilities are

uninsured, and 29% of young women ages 19–24 years are uninsured (Atrash et al. 2006; Simon et al. 2008). For many low income women who do not have health insurance, Medicaid is their primary source of health care coverage – at least 60% of the women on Medicaid are of childbearing age (Atrash et al. 2006; Bryant et al. 2006; Dunlop et al. 2008). However, there are many low-income women who do not qualify for Medicaid because they are not over the age of 65, they are undocumented and/or they do not have children who are under the age of 18 (Atrash et al. 2006). In addition, under some state eligibility requirements, many low income women of childbearing age only qualify for Medicaid coverage when they are pregnant and this coverage typically ends 60 days postpartum (Atrash et al. 2006; Badura et al. 2008; Bryant et al. 2006; Dunlop et al. 2008; Lu et al. 2010; Rankin et al. 2016; Rosenbach et al. 2010). As a result, many low income women of childbearing age do not have access to health coverage and/or primary health care between pregnancies and thus, many are not able to access interconception care and/or preventive health care visits (Atrash et al. 2006; Badura et al. 2008; Bryant et al. 2006; Dunlop et al. 2008; Lu et al. 2010; Rankin et al. 2016; Rosenbach et al. 2010). In addition to barriers regarding health care coverage, connecting low-income and uninsured women of childbearing age with an ongoing source of primary care continues to be a major challenge (Badura et al. 2008). Many of the local health departments and publicly available family planning clinics do not have the capacity to provide ongoing primary care for these populations (Badura et al. 2008). As a result, many low-income and uninsured women of childbearing age who suffer from mental health conditions and various chronic conditions, have difficulty accessing

health care during the interconception period (Badura et al. 2008). The lack of access to preventive and primary care among these populations contributes to delayed diagnosis and treatment of chronic diseases (e.g. hypertension and diabetes), increased engagement in risky behaviors (e.g. cigarette smoking, poor nutrition) and ultimately results in increased risk of adverse pregnancy outcomes (Lu et al. 2010).

Expanding health care coverage for low-income women, through Medicaid, Medicaid waivers and other similar state-sponsored insurance programs is a very important strategy for increasing health care coverage and access to low income families (Atrash et al. 2006; Lu et al. 2010). While States have many options to expand Title XIX Medicaid coverage for low income and uninsured populations, there is limited funding available for these expansions (Lu et al. 2010). Since 1995, twenty-two states have developed special programs using their federal waiver authority to extend services including family planning and interconception care to women who would not otherwise qualify for Medicaid and/or those who would typically lose coverage after the birth of their baby (Atrash et al. 2006; Dunlop et al. 2008). An evaluation of the "family planning waiver" Medicaid expansion projects has shown extensive savings to both state and federal governments (Atrash et al. 2006). However, there would be even greater potential savings if states offered more preconception and interconception risk screenings, interventions, and health promotion (Atrash et al. 2006). Continuing Medicaid coverage through the interconception period is very important because it can help reduce differences in health care access and, ultimately, improve perinatal health outcomes (Rosenbach et al. 2010). However, for states to include these prevention

services in their waivers, they need permission from the federal government and/or for Congress to approve interconception care as an optional benefit (Atrash et al. 2006). Affordability of health care is an on-going problem for many women of child bearing age; thus, efforts to increase healthy behaviors among women of child bearing age must be accompanied by improvements in health care coverage and affordability (Atrash et al. 2006; Rosenbach et al. 2010).

CHAPTER III

METHODS

DATA SOURCE BACKGROUND

Pregnancy Risk Assessment Monitoring System (PRAMS) is a joint research venture between the state departments of health and the Centers for Disease Control and Prevention (CDC), Division of Reproductive Health (CDC, 2016). This monitoring system was started in 1987 by the CDC based on research the following behaviors were contributing to the slow rate of decline: 1) the infant mortality rate in the United States was no longer decreasing as rapidly as it had in past years; 2) the prevalence of low birth weight was showing little change; 3) unhealthy behaviors including alcohol and tobacco use; and 4) limited use of prenatal care and pediatric care (CDC, 2016). PRAMS is an ongoing, population-based surveillance system designed to identify and monitor selected experiences, behaviors and access to care before, during and after pregnancy as well as during the child's early infancy (CDC, 2016). The PRAMS sample is randomly selected from all women who had a live birth recently. Women from some groups are sampled at a higher rate to ensure adequate data are available in smaller but higher risk populations – e.g. most states oversample low weight births and many stratify by mother's race or ethnicity (CDC, 2016). Currently, PRAMS provides data on about 83% of all live births in the United States (CDC, 2016). Data is collected from 47 states, New York City, Puerto Rico, the District of Columbia and the Great Plains Tribal Chairmen's Health Board (CDC, 2015).

One of the major strengths of the PRAMS surveillance system is the standardized data collection methodology being used (CDC, 2016). This standardized approach allows for comparisons among states and for optimal use of the data for single-state or multistate analysis. Each state follows the protocol, but also has the opportunity to customize some portions of it to tailor the procedures to the needs of that state. PRAMS uses two modes of data collection; a mailed survey and a telephone survey (telephone survey only used after multiple failed attempts of the mailed survey). The principles and practices of mail/telephone survey methodology used by CDC are based primarily on the research of Don Dillman (CDC, 2016). A key aspect of his approach is to make numerous and varied contacts with sampled mothers. Contact begins about 2 to 4 months after delivery (to ensure that the surveys also capture the early postpartum period) and can last anywhere from 60 to 95 days (CDC, 2016). Each month, a stratified sample is drawn from the current birth certificate file and the contact series is attempted (CDC, 2016). The CDC uses a web-based customized tracking system -the PRAMS Integrated Data System (PIDS), to help with managing all aspects of data collection (CDC, 2016). PIDS is designed to schedule and track data collection activities, record data on mail and telephone responses, generate reports to summarize operational data, manage call attempts for telephone interviews, prepare letters, and record survey responses and comments (CDC, 2016).

Each participating state draws a stratified systematic sample of 100 to 250 new mothers every month from a frame of eligible birth certificates with annual sample sizes ranging from 1000 to 3400 (CDC, 2016). Typically, the annual sample is large enough

for estimating statewide risk factor proportions within 3.5% at 95% confidence. The mothers' responses are linked to extracted birth certificate data items for analysis and thus, the PRAMS data set also contains a wealth of demographic and medical information collected through the state's vital records system (CDC, 2016). The availability of this information for all sampled women; whether they responded or not, is used to derive non-response weights (CDC, 2016). For each respondent, the initial sampling weight is the reciprocal of the sampling fraction applied to the stratum - sampling fractions in PRAMS range from 1 in 1 for very low birth weight strata in small states to about 1 in 211 for normal birth weight, nonminority strata in populous states (CDC, 2016). Thus, corresponding sampling weights range from 1 to 211 (CDC, 2016). Non-response adjustment factors attempt to compensate for the tendency of women having certain characteristics to respond at lower rates than women without those characteristics (CDC, 2016). The rationale for applying non-response weights is the assumption that non-respondents would have provided similar answers, on average, to respondents' answers for that stratum and adjustment category (CDC, 2016). So that cells with few respondents are not distorted by a few women's answers, small categories are collapsed until each cell contains at least 25 respondents (CDC, 2016). The magnitude of the adjustment for non-response depends on the response rate for a category – e.g. if 80% or 4/5 of the women in a category respond, the non-response weight is 1.2 or 5/4 (CDC, 2016). Categories with lower response rates have higher non-response weights (CDC, 2016). Frame omission studies are carried out to look for problems that occur during frame construction. The frame non-coverage weights are

estimated by comparing frame files for a year of births to the calendar year birth tape that states provided to CDC (CDC, 2016). The effect of the non-coverage weights is to bring totals estimated from sample data in line with known totals from the birth tape (CDC, 2016). In the mail and telephone surveillance, the magnitude of non-coverage is small (typically between 1% and 5%), so the adjustment factor for non-coverage is not much greater than 1 (CDC, 2016). Multiplying together the sampling, non-response, and non-coverage components of the weight yields the analysis weight (CDC, 2016). The weight can be understood to mean the number of women like herself in the population that each respondent represents (CDC, 2016).

DATA DESCRIPTION

The 2009 to 2013 PRAMS national dataset was used in this analysis – this is data collected during two different phases of the PRAMS questionnaire. Phase 6 includes data collected from 2009 to 2011 and Phase 7 includes data collected from 2012 onwards.

Table III.1: Distribution of Population from 2009 to 2013

Year	**Frequency**	**Subpop Frequency**
2009	40,388	22, 298
2010	39,831	22, 124
2011	37,848	21, 045
2012	32,239	18, 162
2013	31,764	18, 014

Thirty-three states participated in the data collected from 2009 to 2013: Arkansas, Colorado, Delaware, Georgia, Hawaii, Iowa, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming.

Table III.2: Distribution of Population per State

State	Frequency	Subpop Frequency
AK	4,624	2, 654
AR	5,923	3, 353
CO	8,661	4, 755
DE	4,277	2, 378
GA	5,447	2, 792
HI	6,223	3, 261
IA	1,168	730
IL	7,096	3, 959
MA	7,517	3, 920
MD	6,798	3, 878
ME	4,816	2, 351
MI	6,726	3, 803
MN	6,406	3, 733

Table III.2 Continued

State	Frequency	Subpop Frequency
MO	6,185	3, 409
MS	1,406	764
NE	8,129	4, 900
NH	639	325
NJ	6,372	3, 616
NM	4,022	2, 445
NY	7,691	3,800
OH	4,404	2, 520
OK	9,765	5, 575
OR	7,504	4, 242
PA	5,031	2, 710
RI	6,241	3, 265
TN	2,353	1, 281
TX	3,291	1, 902
UT	7,749	4, 972
VT	5,187	2, 615
WA	6,416	3, 652
WI	5,623	3, 404

Table III.2 Continued

State	Frequency	Subpop Frequency
WV	4,655	2, 443
WY	3,825	2, 236

While this study is focused on interconception care, the PRAMS survey does not specifically ask participants whether they received interconception care. However, for the purposes of this dissertation, interconception care has been operationalized into two categories that are measured through three distinct variables. The first category is receipt of interconception care services which is measured through the following two variables: inter-pregnancy chronic disease screenings/treatment (diabetes and/or hypertension) and inter-pregnancy health counseling. The second category is adherence to interconception care recommendations which is measured through the following variable: inter-pregnancy health behaviors (healthy diet and exercise). All three variables will be used in this dissertation because they align with the CDC's defined preconception and interconception care indicators (Livingood et al. 2010).

STATA 14 was used to analyze this dataset. In addition, due to the uniqueness of this study sample, specific STATA commands and methodology was used. First, STATA's SVY commands were used in all analyses. The following SVY set command was used to set the data: *svyset _n [pweight=wtanal], strata(sud_nest) fpc(totcnt)* and account for the sampling weights, clustering and stratification. The SVY package was developed specifically to handle survey data analysis in STATA; thus, it allows for

accurate estimations with this type of dataset. Second, the study population is women who had a previous birth. To this end, subpopulation command estimations for survey data were used. Subpopulation estimation commands allow for analysis that includes only the population of interest without having to drop data and/or variables from the dataset. It involves computing point and variance estimates for part of the population. The svy prefix command *subpop()* option performs subpopulation estimation. To specify this subpopulation, the variable "previous birth" was created and measured as "*0 – no*" and "*1 – yes*". Thus, the following command was used to estimate the needed subpopulation "*subpop (previous birth)*". This subpopulation estimation allowed participants' responses regarding pre-pregnancy care and services to be operationalized to mean inter-pregnancy care and services.

Table III.3: Distribution of Population who had Previous Birth

Previous Birth	**Total**
Yes	101, 643
No	78, 021

Missing Data Analysis

Table III.4: Distribution of Observations in each Variable

Variables	**Total in Subpop**	**Total Missing**
Receipt of ICC – Health Counseling	100725	918
Receipt of ICC – Health Checks	101113	530

Table III.4 Continued

Variables	Total in Subpop	Total Missing
Adherence to ICC Recommendations	101264	379
Maternal Age	101639	4
Maternal Race/Ethnicity	98552	3091
Marital Status	101546	97
Maternal Education	100245	1398
Trying to get Pregnant	100586	1057
Pregnancy Interval (Years since last live birth)	95861	5782
Inter-Pregnancy Health Ins	100307	1336
Inter-pregnancy Health Ins2	95580	6063
Inter-Pregnancy Teeth Cleaning	101008	635
Previous Birth Status	99028	2615
Smoking in last 3 months of pregnancy	100250	1393
Alcohol in last 3 months of pregnancy	100204	1439
Inter-pregnancy BMI	96046	5597
Current Birth Status	101250	393
Inter-Pregnancy Hypertension	100981	662
Inter-Pregnancy Diabetes	101025	618
Years	101643	0

Table III.4 Continued

Variables	Total in Subpop	Total Missing
Region	101643	0
Total missing		34007
Subpop Total cells - Previous Birth		101643
Total cells (21 columns)		2134503
Percent missing		1.5932

The percentage of missing data was calculated by dividing the total missing cells by the total number of cells. To determine the total number of missing cells the total number of cells from each variable within the subpopulation was combined. The total number of cells was 2,134,503 while the total number of missing cells was 34,007. Using the calculation noted above, the total percentage of missing data among the variables being used in this study is 1.6%. Based on this missing data percentage, list-wise deletion will be allowed to handle the missing data in this study.

Table III.5: Overview of Three Studies

Paper 1: Factors associated with Receipt of Interconception Care	
Dependent Variables	**Independent Variables**
Receipt of inter-pregnancy chronic disease screening/treatment Receipt of inter-pregnancy health counseling	*Control Variables* Age Race/Ethnicity Marital status Education

Table III.5 Continued

Paper 1: Factors associated with Receipt of Interconception Care	
Dependent Variables	**Independent Variables**
Receipt of inter-pregnancy chronic disease screening/treatment Receipt of inter-pregnancy health counseling	*Risk Factors* Health insurance coverage Diabetes Hypertension Body Mass Index (BMI) Previous birth outcome Dental Visit
Paper 2: Health Insurance Coverage during the Interconception Period	
Dependent Variables	**Independent Variables**
Inter-pregnancy health insurance coverage	*Control Variables* Age Race/Ethnicity Marital status Education Region Years *Risk Factors* Diabetes Hypertension Body Mass Index (BMI) Previous birth outcome
Paper 3: Interconception Care and Subsequent Birth Outcome	
Dependent Variables	**Independent Variables**
Current birth outcome	*Control Variables* Age Race/Ethnicity Marital status Education

Table III.5 Continued

Paper 3: Interconception Care and Subsequent Birth Outcome	
Dependent Variables	**Independent Variables**
Current birth outcome	*Risk Factors* Pregnancy planned Pregnancy interval Diabetes Hypertension Body Mass Index (BMI) Previous birth outcome Smoked during pregnancy Drank during pregnancy *Interconception Care* Receipt of health checks Receipt of health counseling Adherence to recommendations

Paper 1: Risk Factors and Receipt of Interconception Care

Goal: This paper is developed around the research question: What risk factors are associated with self reported receipt of interconception care*?*

Study Population: All women who had a previous birth and responded to the PRAMS survey during the years 2009 through 2013. And those who lived in the following 33 states: Alaska, Arkansas, Colorado, Delaware, Georgia, Hawaii, Iowa, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming.

Variables: The breakdown of each of the variables used in this study can be found in Table III.6. While this study is focused on interconception care, PRAMS'

surveys do not specifically ask participants whether they received interconception care. However, participants are asked "*about their pregnancy readiness behavior during the 12 months before they became pregnant with their new baby*." Behaviors include the following: "*I was dieting (changing my eating habits) to lose weight, I was exercising 3 or more days of the week, I visited a health care worker to be checked or treated for diabetes, I visited a health care worker to be checked or treated for high blood pressure, and I talked to a health care worker about my family medical history*." These variables have been identified by the Institute of Medicine and the Centers for Disease Prevention and Control as preconception and interconception care indicators (Johnson and Gee, 2015; Livingood et al. 2010). For the purposes of this study, these behaviors were used to operationalize interconception care by focusing on the population that had a previous birth and ultimately focusing on pregnancy preparation behaviors during the interconception period.

Table III.6: Paper 1 Variable Breakdown

Variables		Measurement
Dependent Variables		
	Receipt of ICC – Chronic Disease Screenings/Treatment	No – 0 Yes – 1
	Receipt of ICC – Health Counseling	No – 0 Yes – 1
Independent Variables		
Control Variables		
	Age	<19 – 0 20 to 24 – 1 25 to 29 – 2 30 to 34 – 3 35 plus – 4

Table III.6 Continued

Control Variables	
Variables	**Measurement**
Race/Ethnicity	White – 0 Black – 1 Hispanic – 2 Other – 3
Marital Status	Not Married – 0 Married – 1
Education	<HS – 0 HS – 1 >HS – 2
Risk Factors	
Inter-Pregnancy Health Ins	No Ins – 0 Has Ins – 1
Inter-Pregnancy Dental Check	No – 0 Yes – 1
Diabetes	No – 0 Yes – 1
Hypertension	No – 0 Yes – 1
Inter-Pregnancy BMI	<18.5 (underwt) – 0 18.5-24.9 (normal) – 1 25-29.9 (overwt) – 2 30+ (obese) – 3
Previous Birth Outcome	Healthy birth – 0 Adverse Birth – 1

For this research question there were two dependent variables of interest: receipt of interconception care – chronic disease screenings/treatment, and receipt of interconception care – health counseling. The receipt of inter-pregnancy chronic disease screenings/treatment variable was created using the following measures: *did you receive an inter-pregnancy diabetes screening/treatment and/or did you receive an inter-pregnancy hypertension screening/treatment*. This variable is measured as yes – I

received one or both noted health services and no – I did not receive any of the noted health services. The receipt of inter-pregnancy health counseling variable was created using the following measures: *did a health care provider talk to you about how your family medical history can influence your pregnancy and provide health advice*. This variable is measured as yes – I received the noted health counseling and no – I did not receive the noted health counseling.

Demographic variables were as follows: age, maternal race/ethnicity, marital status, and education. Age is categorized into 5 groups: less than 19 years old, 20 to 24 years, 25 to 29 years, 30 to 34 years and 35 years and above. Race/ethnicity is categorized into 4 groups –White, African American, Hispanic and other (other Asian, American Indian, Chinese, Japanese, Filipino, Hawaiian, Native American and mixed race). The racial groups other Asian, American Indian, Chinese, Japanese, Filipino, Hawaiian, Native American and mixed race were collapsed into one group because their numbers were very small. Marital status has 2 categories – married and not married. Maternal education is categorized into 3 groups – less than a high school education, high school education and more than a high school education.

The following variables were assessed for their noted association with adverse birth outcomes: inter-pregnancy health insurance, diabetic, hypertensive, body mass index (BMI), and previous birth outcome. Hypertension and diabetes were created based on the question "*Before you got pregnant with your new baby, did a doctor, nurse, or other health care worker tell you that you had type 1 or type 2 diabetes or hypertension*" and was categorized as yes and no. Inter- pregnancy health insurance was created based

on the question "*During the month before you got pregnant with your new baby, were you covered by any health insurance plans*?" and it was categorized into 2 categories – mothers who had at least one type of insurance during the month before they became pregnant and mothers who did not have any form of health insurance during the month before they became pregnant. BMI was created based on the question "*Just before you got pregnant with your new baby, how much did you weigh*" and was categorized into 4 groups: underweight (<18.5), normal 18.5-24.9), overweight (25-29.9), and obese (30+). Previous birth outcome was created using the survey questions "*Did the baby born just before your new one weigh 5 pounds, 8 ounces (2.5 kilos) or less at birth*?" and "*Was the baby just before your new one born earlier than 3 weeks before his or her due date*?" The responses to these questions were used to categorize the variable previous birth outcome into 2 groups –healthy birth and adverse birth. Dental visit was included in this analysis because of its noted association with whether or not women receive preconception and prenatal care. Dental visit was created using the survey question "*At any time during the 12 months before you got pregnant with your new baby, did you have your teeth cleaned by a dentist or dental hygienist*" and was categorized as yes and no.

Analytic Methods: STATA 14 was used to analyze this dataset. Descriptive statistics were used to provide a quantitative summary of the dataset being used in this study, including demographic characteristics and/or risk factors. Since the dependent variables of interest are binary, multivariate logistic regression models were estimated. Exponents of the coefficients (odds ratios) and 95% confidence intervals were reported.

All statistical tests were two-sided, and findings were considered statistically significant at $p < 0.05$.

Paper 2: Health Insurance Coverage during the Interconception Period

Goal: This paper is developed around the research question: What risk factors are associated with health insurance coverage during the interconception period*?*

Study Population: All women who had a previous birth and responded to the PRAMS survey during the years 2009 through 2013. And those who lived in the following 33 states: Alaska, Arkansas, Colorado, Delaware, Georgia, Hawaii, Iowa, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming.

Variables: The breakdown of each of the variables used in this study can be found in Table III.7. This study focused on the type of health insurance held by respondents during the interconception period; thus, for the purposes of this paper, the study sample was restricted to women with a previous birth. The dependent variable was created using the PRAMS question: "*During the month before you got pregnant with your new baby, were you covered by any of these health insurance plans*?" The following options were noted: "*health insurance from your job or the job of your partner or parents, health insurance that you or someone else paid for (not from a job), Medicaid (or state Medicaid name), TRICARE or other military health care, other source(s), and/or I did not have any health insurance before I got pregnant*." Categories

used in this study were patterned after work done by D'Angelo et al. (2015). Women who reported that they were enrolled in Medicaid or selected a state-named Medicaid program (e.g., RIte Care in Rhode Island) were categorized as Medicaid recipients (D'Angelo et al. 2015). Women who reported private insurance coverage through their job, a partner's job, or insurance that was not job-related that they or someone else paid for were categorized as having private insurance (D'Angelo et al. 2015). Women who reported TRICARE or other military insurance were categorized as having private insurance (D'Angelo et al. 2015). Respondents could also provide insurance coverage options that were not included on the survey list; these options were categorized as other (D'Angelo et al. 2015). Thus, the dependent variable inter-pregnancy health insurance coverage had four categories: private insurance, Medicaid, no insurance, or other insurance.

Demographic variables were as follows: age, race/ethnicity, marital status, education, region, and year. Age was categorized into 5 groups: less than 19 years old, 20 to 24 years, 25 to 29 years, 30 to 34 years and 35 years and above. Race/ethnicity was categorized into 4 groups: White, African American, Hispanic and other (other Asian, American Indian, Chinese, Japanese, Filipino, Hawaiian, Native American and mixed race). Marital status has two categories: married and not married. Maternal education was categorized into 3 groups: less than a high school education, high school education, and more than a high school education. Region was categorized into 4 groups: Northeast, Midwest, South and West. Year was categorized into 5 groups: 2009, 2010, 2011, 2012 and 2013.

Table III.7: Paper 2 Variable Breakdown

Variables		Measurement
Dependent Variable		
	Inter-Pregnancy Insurance Coverage	Private – 0 Medicaid – 1 Uninsured – 2 Other – 3
Independent Variables		
Control Variables		
	Age	<19 – 0 20 to 24 – 1 25 to 29 – 2 30 to 34 – 3 35 plus – 4
	Race/Ethnicity	White – 0 Black – 1 Hispanic – 2 Other – 3
	Marital Status	Not Married – 0 Married – 1
	Education	<HS – 0 HS – 1 >HS – 2
	Region	Northeast – 0 Midwest – 1 South – 2 West – 3
	Years	2009 – 0 2010 – 1 2011 – 2 2012 – 3 2013 – 4
Risk Factors		
	Diabetes	No – 0 Yes – 1
	Hypertension	No – 0 Yes – 1

Table III.7 Continued

Variables		Measurement
Independent Variables		
Risk Factors		
	Inter-Pregnancy BMI	<18.5 (underwt) – 0 18.5-24.9 (normal) – 1 25-29.9 (overwt) – 2 30+ (obese) – 3
	Previous Birth Outcome	Healthy birth – 0 Adverse Birth – 1

The following variables were assessed for their noted association with adverse birth outcomes: hypertension, diabetes, body mass index (BMI) and previous birth outcome. Hypertension and diabetes were created based on the question "*Before you got pregnant with your new baby, did a doctor, nurse, or other health care worker tell you that you had type 1 or type 2 diabetes or hypertension*" and was categorized as yes and no. Body mass index (BMI) was created based on the question "*Just before you got pregnant with your new baby, how much did you weigh*" and was categorized into 4 groups: underweight (<18.5), normal 18.5-24.9), overweight (25-29.9), and obese (30+). Previous birth outcome is categorized into 2 groups –healthy birth and adverse birth.

Analytic Methods: STATA 14 was used to analyze this dataset. Descriptive statistics were used to provide a quantitative summary of the dataset being used in this study, including demographic characteristics, and risk factors. Since the dependent variable is categorical, a multinomial logistic regression model was estimated. Relative risk ratios and 95% confidence intervals were reported. All statistical tests were two-sided, and findings were considered statistically significant at $p < 0.05$.

Paper 3: Interconception Care and Birth Outcomes

Goal: This paper is developed around the research question: What is the association between interconception care and subsequent birth outcome*?*

Study Population: All women who had a previous birth and responded to the PRAMS survey during the years 2009 through 2013. And those who lived in the following 33 states: Alaska, Arkansas, Colorado, Delaware, Georgia, Hawaii, Iowa, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming.

Variables: The breakdown of each of the variables used in this study can be found in Table III.8. This study focused on participants' subsequent birth outcome; thus, for the purposes of this paper, the study sample was restricted to women with a previous birth. This variable was created using the following questions: "1) *Did your baby weigh 5 pounds, 8 ounces (2.5 kilos) or less at birth*, 2) *Was your baby born earlier than 3 weeks before his or her due date* and 3) *Is your baby alive now*." The responses to these questions were used to categorize this variable into 5 groups: healthy birth, low birth weight, preterm birth, low birth weight and preterm birth and baby died (during first year of life).

Table III.8: Paper 3 Variable Breakdown

Variables		Measurement
Dependent Variables		
	Current Birth Outcome	Healthy Birth – 0 Low Birth Weight – 1 Preterm Birth – 2 LBW & Preterm – 3 Dead – 4
Independent Variables		
Control Variables		
	Age	<19 – 0 20 to 24 – 1 25 to 29 – 2 30 to 34 – 3 35 plus – 4
	Race/Ethnicity	White – 0 Black – 1 Hispanic – 2 Other – 3
	Marital Status	Not Married – 0 Married – 1
	Education	<HS – 0 HS – 1 >HS – 2
Risk Factors		
	Pregnancy Planned	No – 0 Yes – 1
	Pregnancy Interval	0-1 year – 0 2-5 years – 1 6+ years – 2
	Diabetes	No – 0 Yes – 1
	Hypertension	No – 0 Yes – 1
	Inter-Pregnancy BMI	<18.5 (underwt) – 0 18.5-24.9 (normal) – 1 25-29.9 (overwt) – 2 30+ (obese) – 3
	Previous Birth Outcome	Healthy birth – 0 Adverse Birth – 1

Table III.8 Continued

Variables		Measurement
Independent Variables		
Control Variables		
	Smoked During Pregnancy	No – 0 Yes – 1
	Drank During Pregnancy	No – 0 Yes – 1
Interconception care		
	Receipt of Chronic Disease Screening/Treatment	No – 0 Yes – 1
	Receipt of Health Counseling	No – 0 Yes – 1
	Adherence to Recommendations	No – 0 Yes – 1

Demographic variables were as follows: age, race/ethnicity, marital status, and education. Age was categorized into 5 groups: less than 19 years old, 20 to 24 years, 25 to 29 years, 30 to 34 years and 35 years and above. Race/ethnicity was categorized into 4 groups: White, African American, Hispanic and other (other Asian, American Indian, Chinese, Japanese, Filipino, Hawaiian, Native American and mixed race). Marital status has two categories: married and not married. Maternal education was categorized into 3 groups –have less than a high school education, high school education and more than a high school education.

The following variables were assessed for their noted association with adverse birth outcomes: pregnancy planned, pregnancy interval, hypertension, diabetes, body mass index (BMI), smoked last 3 months of pregnancy, drank last 3 months of pregnancy, and previous birth outcome. Inter-pregnancy interval (years since last pregnancy) was created using the survey question "*How many years since your last live*

birth?" and was categorized into three groups: 0 to 1 year since last pregnancy, 2 to 5 years since last pregnancy, and 6+ years since last pregnancy. Pregnancy planned was created using the survey question "*When you got pregnant with your new baby, were you trying to get pregnant*" and was categorized as yes and no. Hypertension and diabetes were created based on the survey question "*Before you got pregnant with your new baby, did a doctor, nurse, or other health care worker tell you that you had type 1 or type 2 diabetes or hypertension*" and was categorized as yes and no. Body mass index (BMI) was created based on the survey question "*Just before you got pregnant with your new baby, how much did you weigh*" and was categorized into 4 groups: underweight (<18.5), normal 18.5-24.9), overweight (25-29.9), and obese (30+). Previous birth outcome was created using the survey questions "*Did the baby born just before your new one weigh 5 pounds, 8 ounces (2.5 kilos) or less at birth*?" and "*Was the baby just before your new one born earlier than 3 weeks before his or her due date*?" The responses to these questions were used to categorize this variable into 4 groups: healthy birth, low birth weight, preterm birth, and low birth weight and preterm birth. Substance abuse during pregnancy variables were created using the questions "*did you smoke during the last 3 months of your pregnancy*" and "*did you drink during the last 3 months of your pregnancy*" and the two variables were categorized as yes and no.

While this study is focused on interconception care, PRAMS surveys do not specifically ask participants whether they received interconception care. However, participants are asked about "*their pregnancy readiness behavior during the 12 months before they became pregnant with their new baby*." Behaviors include the following: "*I*

was dieting (changing my eating habits) to lose weight, I was exercising 3 or more days of the week, I visited a health care worker to be checked or treated for diabetes, I visited a health care worker to be checked or treated for high blood pressure, and I talked to a health care worker about my family medical history." These variables have been identified by the Institute of Medicine and the Centers for Disease Prevention and Control as preconception and interconception care indicators (Johnson and Gee, 2015; Livingood et al. 2010). For the purposes of this study, these behaviors were used to operationalize interconception care by focusing on the population that had a previous birth and ultimately focusing on pregnancy preparation behaviors during the interconception period.

Three indicators of interconception care were assessed in this study: receipt of inter-pregnancy chronic disease screenings/treatment, receipt of inter-pregnancy counseling on family medical history and adherence to interconception care recommendations. The receipt of interconception care health checks variable was created using the following measures: *did you receive an inter-pregnancy diabetes screening/treatment and/or did you receive an inter-pregnancy hypertension screening/treatment*. This variable is measured as yes – I received one or both noted health services and no – I did not receive any of the two noted health services. The receipt of interconception care health counseling variable was created using the following measures: *did a health care provider talk to you about how your family medical history can influence your pregnancy and provide health advice*. This variable is measured as yes – I received the noted health counseling and no – I did not receive the

noted health counseling. Adherence to interconception care recommendations was created using the following measures: *did you eat a healthy diet and/or did you exercise at least 3 times a week during the interconception period*. This variable is measured as yes – I adhered to interconception care recommendations regarding a healthy diet and regular exercise and no – I did not adhere to interconception care recommendations regarding a healthy diet and regular exercise.

Analytic Methods: STATA 14 was used to analyze this dataset. Descriptive statistics were used to provide a quantitative summary of the dataset being used in this study, including demographic characteristics and/or risk factors. Since the dependent variable is categorical, a multinomial logistic regression model was estimated. Relative risk ratios and 95% confidence intervals were reported. All statistical tests were two-sided, and findings were considered statistically significant at $p < 0.05$.

CHAPTER IV

FACTORS ASSOCIATED WITH RECEIPT OF INTERCONCEPTION CARE

OVERVIEW

Introduction: Studies have looked at the associations between risk factors for adverse birth outcomes and receipt of preconception care; however, there is limited research available on the association between these noted risk factors and interconception care.

Goal: This study identifies which adverse birth outcome risk factors are associated with self-reported receipt of interconception care among women of child bearing age in the United States. It summarizes data collected from 2009 to 2013 across 33 different states.

Methods: Two binary dependent variables were analyzed in this study: receipt of inter-pregnancy chronic disease screenings/treatment and receipt of inter-pregnancy health counseling. Demographic variables included age, race/ethnicity, marital status, and education. High risk variables included inter-pregnancy health insurance coverage, hypertension, diabetes, body mass index, previous birth outcome, and dental visit. Since the dependent variables are binary, multivariate logistic regression models were estimated.

Main Findings: Study results showed that overall, less than a third of mothers reported receipt of both types of interconception care services where 15.1% reported receipt of inter-pregnancy health checks/treatment and 27.9% reported receipt of

counseling on their family medical history. In addition, across the various risk factors (diabetes, hypertension, obesity, previous adverse birth outcome), over 80% of those who reported these risk factors did not receive either form of interconception care.

Conclusion: Many high risk women experience multiple barriers to care which impact their receipt of interconception care and its affect on their overall health and birth outcomes. Thus, this study emphasizes the need for research that explores how these systemic factors influence receipt of interconception care and adherence to noted health care recommendations. It also emphasizes the need for health policies that can target these systemic barriers and increase women's access to quality and affordable health care services.

INTRODUCTION

There is growing recognition that birth outcomes are the product of the mother's entire lifespan leading up to her pregnancy; i.e. to improve birth outcomes, the woman's health before and between pregnancies and ultimately across her lifespan must be considered (Bernstein et al. 2010; Lu et al. 2006; Oza-Frank et al. 2014). Thus, after decades of focusing solely on prenatal care interventions; the Centers for Disease Control and Prevention and the March of Dimes convened a national summit in 2006 to discuss an agenda for preconception care programs, research, and policy. At this summit, 10 recommendations were developed which centered on 4 goals that could help women achieve optimal reproductive and overall health (Johnson et al. 2015; Posner et al. 2006; Rosener et al. 2016). The four overarching goals are as follows: 1) to improve

knowledge, attitudes, and behaviors related to preconception health; 2) to ensure that all women of childbearing age receive preconception care services; 3) to reduce risks indicated by a prior adverse pregnancy outcome through interventions during the interconception (inter-pregnancy) period that can prevent or minimize health problems for the mother and her future pregnancies; and 4) to reduce health disparities in adverse pregnancy outcomes (Floyd et al. 2013; Posner et al. 2006). Of the 10 recommendations, recommendation #5 speaks specifically to the importance of maximizing care for high risk women during the interconception period – the interconception period should be used to provide additional intensive interventions to women who have had a previous pregnancy that ended in an adverse outcome (Floyd et al. 2013; Posner et al. 2006).

Interconception care is a subset of preconception care and can be defined as care, counseling and auxiliary services provided to a woman and her family from the delivery of one newborn until the conception of the next (Badura et al. 2008; Biermann et al. 2006; Dunlop et al., 2008; Hussaini et al. 2013; Lu et al. 2006; Malnory et al. 2011; Rosenbach et al. 2010; Rosener et al. 2016). It addresses the risks and complications associated with a previous adverse pregnancy, encourages inter-pregnancy intervals of two or more years, improves overall health before future pregnancies and reduces the risk of subsequent adverse birth outcomes (Badura et al. 2008; Biermann et al. 2006; Dunlop et al., 2008; Hussaini et al. 2013; Lu et al. 2006; Malnory et al. 2011; Rosenbach et al. 2010). According to the Institute of Medicine, the leading recommendation regarding preconception and interconception care delivery coverage is as follows: “At

least one well-woman preventive care visit annually for adult women to obtain the recommended preventive services, including preconception and prenatal care. The committee also recognizes that several visits may be needed to obtain all necessary recommended preventive services, depending on a woman's health status, health needs, and other risk factors" (Johnson and Gee, 2015). Such visits should include: reproductive planning; contraceptive methods and counseling; counseling and screening for STIs and HIV; screening and counseling for domestic violence; and preventive services including immunizations, hypertension and diabetes screening, depression screening, substance use screening and cessation, and obesity screening and counseling (Johnson and Gee, 2015).

Providing preventive care during the interconception period is an ideal time to reduce risk factors – diseases, chronic conditions (hypertension, diabetes, obesity), and unhealthy behaviors – that are associated with repeat adverse birth outcomes specifically low birth weight and premature birth (Badura et al. 2008). Both low birth weight and premature birth are of particular importance because current maternal and child health statistics show that they are associated with about 70% of all cases of infant mortality (Badura et al. 2008; Guillory et al. 2015; Livingood et al. 2010; Masho et al. 2011; Tierney-Gumaer & Reifsnider, 2008). In addition, prematurity and low birth weight carry a very high risk of reoccurring in subsequent pregnancies and have been identified as being the strongest predictors of a woman having a subsequent low birth weight (Biermann et al. 2006; Dunlop et al. 2008; Tierney-Gumaer & Reifsnider, 2008; Zhang et al. 2011) or premature infant (Badura et al. 2008; Johnson et al. 2015; Loomis et al.

2000; Lu et al. 2006; Malnory et al. 2011; Tierney-Gumaer & Reifsnider, 2008; Varner et al. 2016; Zhang et al. 2011). Within the United States, African American women (Borrell et al. 2016; Burris et al. 2010; Dominguez, 2010; Loggins et al. 2014; Ruiz et al. 2014; Zhang et al. 2011), teens (Kinzler et al. 2002; Tierney-Gumaer & Reifsnider, 2008; Xie et al. 2015; Zheng et al. 2016), and women from lower socioeconomic backgrounds (Coffey et al. 2014; Loggins et al. 2014; Loomis et al. 2000; Lu et al. 2006; Meng et al. 2013; Simon et al. 2008; Steel et al. 2015; Wallace et al. 2016; Zhang et al. 2011) face the greatest risk of repeat adverse birth outcomes. National statistics consistently show that Non-Hispanic African American women experience the worst birth outcomes – i.e. African American infants are more likely than White infants to be premature, low birth weight, and to die in the first year of birth (Borrell et al. 2016; Burris et al. 2010; Ruiz et al. 2014). However, overall, women who are socio-economically disadvantaged are more likely to be in poorer health and to lack the knowledge and resources needed to improve current and future pregnancy outcomes (Coffey et al. 2014; Zhang et al. 2011).

Studies have looked at the associations between risk factors for adverse birth outcomes and receipt of preconception care (D'Angelo et al. 2007; Batra et al. 2016; Oza-Frank et al. 2014); however, there is limited research available on the association between these noted risk factors and interconception care. Furthermore, much of the research available regarding interconception care is in the form of small-scale intervention studies (Beckmann et al. 2014; Coffey et al. 2014; Lu et al. 2006; Malnory et al. 2011; Rosener et al. 2016). Thus, this paper adds to the literature by examining

receipt of inter-pregnancy chronic disease screenings/treatment and receipt of inter-pregnancy health counseling on family medical history among women at high risk of adverse pregnancy outcomes. Studies show that despite extensive research on the associations between various risk factors and adverse birth outcomes, many of those at risk remain underserved during the interconception period (Batra et al. 2016; Lu et al. 2006). Thus, the goal of this paper is to identify which adverse birth outcome risk factors are associated with self-reported receipt of interconception care among women of child bearing age in the United States.

METHODS

Data Description

To identify the adverse birth outcome risk factors associated with self-reported receipt of interconception care among women of child bearing age in the United States, the Pregnancy Response Assessment Monitoring System (PRAMS) national dataset was used. PRAMS is an ongoing, population-based surveillance system designed to identify and monitor selected self-reported maternal experiences, behaviors and access to care before, during and after pregnancy as well as during the child's early infancy among women who have had a recent live birth (CDC, 2016; Oza-Frank et al. 2014). PRAMS stratified systematic sampling method is used to over-sample mothers with adverse birth outcomes and racial/ethnic minority groups (CDC, 2016; Oza-Frank et al. 2014). Respondents are randomly selected 2 to 6 months after giving birth from a frame of state's birth certificate files (CDC, 2016; Oza-Frank et al. 2014). Currently, PRAMS

provides data on about 83% of all live births in the United States (CDC, 2016). The data used in this study was collected over a five year period -2009 to 2013. The five years of data was collected during two different phases of the PRAMS questionnaire – phase 6 includes data collected from 2009 to 2011 and Phase 7 includes data collected from 2012 onwards (only 2012 and 2013 data is used in this dataset). Thirty-three states participated in the data collected from 2009 to 2013: Alaska, Arkansas, Colorado, Delaware, Georgia, Hawaii, Iowa, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming. For the purposes of this study, variables included were collected over all 5 years and from the 33 noted states.

Variables

While this study is focused on interconception care, PRAMS surveys do not specifically ask participants whether they received interconception care. However, participants are asked "*about their pregnancy readiness behavior during the 12 months before they became pregnant with their new baby*." Behaviors include the following: "*I was dieting (changing my eating habits) to lose weight, I was exercising 3 or more days of the week, I visited a health care worker to be checked or treated for diabetes, I visited a health care worker to be checked or treated for high blood pressure, and I talked to a health care worker about my family medical history*." These variables have been identified by the Institute of Medicine and the Centers for Disease Prevention and

Control as preconception and interconception care indicators (Johnson and Gee, 2015; Livingood et al. 2010). For the purposes of this study, these behaviors were used to operationalize interconception care by focusing on the population that had a previous birth and ultimately focusing on pregnancy preparation behaviors during the interconception period.

For this research question there are two dependent variables of interest: receipt of interconception care – chronic disease screenings/treatment, and receipt of interconception care – health counseling. The receipt of interconception care chronic disease screenings/treatment variable was created using the following measures: *did you receive an inter-pregnancy diabetes screening/treatment and/or did you receive an inter-pregnancy hypertension screening/treatment.* This variable is measured as yes – I received one or both noted health services and no – I did not receive any of the noted health services. The receipt of interconception care health counseling variable was created using the following measures: *did a health care provider talk to you about how your family medical history can influence your pregnancy and provide health advice*. This variable is measured as yes – I received the noted health counseling and no – I did not receive the noted health counseling.

Demographic variables were as follows: age, maternal race/ethnicity, marital status, and education. Age is categorized into 5 groups: less than 19 years old, 20 to 24 years, 25 to 29 years, 30 to 34 years and 35 years and above. Race/ethnicity is categorized into 4 groups –White, African American, Hispanic and other (other Asian, American Indian, Chinese, Japanese, Filipino, Hawaiian, Native American and mixed

race). The racial groups other Asian, American Indian, Chinese, Japanese, Filipino, Hawaiian, Native American and mixed race were collapsed into one group because their numbers were very small. Marital status has 2 categories – married and not married. Maternal education is categorized into 3 groups – less than a high school education, high school education and more than a high school education. The distribution of demographic characteristics for this study population is found in Table IV.1.

The following variables were assessed for their noted association with adverse birth outcomes: inter-pregnancy health insurance, diabetic, hypertensive, body mass index (BMI), and previous birth outcome. Hypertension and diabetes were created based on the question "*Before you got pregnant with your new baby, did a doctor, nurse, or other health care worker tell you that you had type 1 or type 2 diabetes or hypertension*" and was categorized as yes and no. Inter- pregnancy health insurance was created based on the question "*During the month before you got pregnant with your new baby, were you covered by any health insurance plans*?" and it was categorized into 2 categories – mothers who had at least one type of insurance during the month before they became pregnant and mothers who did not have any form of insurance during the month before they became pregnant. BMI was created based on the question "*Just before you got pregnant with your new baby, how much did you weigh*" and was categorized into 4 groups: underweight (<18.5), normal 18.5-24.9), overweight (25-29.9), and obese (30+). Previous birth outcome was created using the survey questions "*Did the baby born just before your new one weigh 5 pounds, 8 ounces (2.5 kilos) or less at birth*?" and "*Was the baby just before your new one born earlier than 3 weeks before his or her due date*?"

The responses to these questions were used to categorize this variable into 2 groups – healthy birth and adverse birth. Dental visit was included in this analysis because of its noted association with whether or not women receive preconception and prenatal care. Dental visit was created using the survey question "*At any time during the 12 months before you got pregnant with your new baby, did you have your teeth cleaned by a dentist or dental hygienist*" and was categorized as yes and no.

Data Analysis

STATA 14 was used to analyze this dataset. Descriptive statistics were used to provide a quantitative summary of the dataset being used in this study, including demographic characteristics and/or risk factors. Since the dependent variables of interest are binary, multivariate logistic regression models were estimated. Exponents of the coefficients (odds ratios) and 95% confidence intervals were reported. All statistical tests were two-sided, and findings were considered statistically significant at $p < 0.05$.

In addition, due to the uniqueness of this study sample, specific STATA commands and methodology were used. First, STATA's SVY set commands was used with all analysis. The following command was used to set the data *svyset _n [pweight=wtanal], strata(sud_nest) fpc(totcnt)* and account for the sampling weights, clustering and stratification. The SVY package was developed specifically to handle survey data analysis in STATA; thus, it allows for accurate estimations with this type of dataset. Second, the study population for this dissertation is restricted to women who have had a previous birth; thus, subpopulation command estimations for survey data were used. Subpopulation estimation focuses on part of the population and allows the

researcher to focus on this population without having to drop data and/or observations from the dataset. It involves computing point and variance estimates for part of the population. The *svy* prefix command *subpop()* option performs subpopulation estimation. To specify this subpopulation, the variable "*previous birth*" was created and measured as "*0 – no*" and "*1 – yes*". Thus, the following command was used to estimate the needed subpopulation "*subpop (previous birth)*". A breakdown for this subpopulation shows that 101,643 women in the dataset had a previous birth. This subpopulation estimation allows me to operationalize participants' responses regarding pre-pregnancy care and services (operationalized as inter-pregnancy care and services).

The percentage of missing data was calculated by dividing the total missing cells by the total number of cells. To determine the total number of missing cells the total number of cells from each variable within the subpopulation was combined. The total number of cells was 2,134,503 while the total number of missing cells was 34,007. Using the calculation noted above, the total percentage of missing data among the variables being used in this study is 1.6%. Based on this missing data percentage, list-wise deletion will be allowed to handle the missing data in this study.

RESULTS

Table IV.1 shows the distribution for each predictor within the subpopulation – *I had a previous birth*. Data on demographic variables showed that at least 60% of the sample reported that they were between the ages of 25 and 34 years old, 66% reported that they were married, almost 43% reported that they had a high school education or

less, and about 22% reported that they were uninsured. Data on at-risk variables showed that about 5% of the sample had either diabetes or hypertension, about 50% were either overweight or obese, 17% reported that they had a previous adverse birth outcome, and almost 50% reported that they did not have a dental visit during the interconception period.

Table IV.1: Weighted Distribution of Control and High Risk Variables, PRAMS 2009-2013

Demographic Variable	Number (%)
Age	
<19	2,417 (2.3)
20 to 24	18,539 (17.5)
25 to 29	30,109 (30.2)
30 to 34	30,228 (30.9)
35+	20,346 (19.1)
Race	
White	49,523 (58.0)
Black	16,344 (13.6)
Hispanic	18,193 (20.7)
Other	14,492 (7.7)
Marital Status	
Unmarried	36,036 (33.9)
Married	65,510 (66.1)
Education	
<HS	17,052 (17.5)
HS	26,958 (25.9)
>HS	56,235 (56.6)
Health Ins	
No Ins	20,252 (21.9)
Has Ins	89,055 (78.0)
Diabetes	
No	95,058 (94.6)
Yes	5,967 (5.4)

Table IV.1 Continued

Demographic Variable	Number (%)
Hypertension	
No	94,036 (95.0)
Yes	6,945 (4.9)
Inter-Pregnancy BMI	
<18.5	3,855 (3.6)
18.5-24.9	43,870 (46.8)
25-29.9	24,683 (25.8)
30+	23,638 (23.9)
Previous Birth Out	
Healthy Birth	77,929 (82.6)
Adverse Birth	21,099 (17.4)
Dental Visit	
No	47,400 (46.5)
Yes	53,608 (53.6)

Chart IV.1: Distribution of Risk Factors across Race Ethnicity

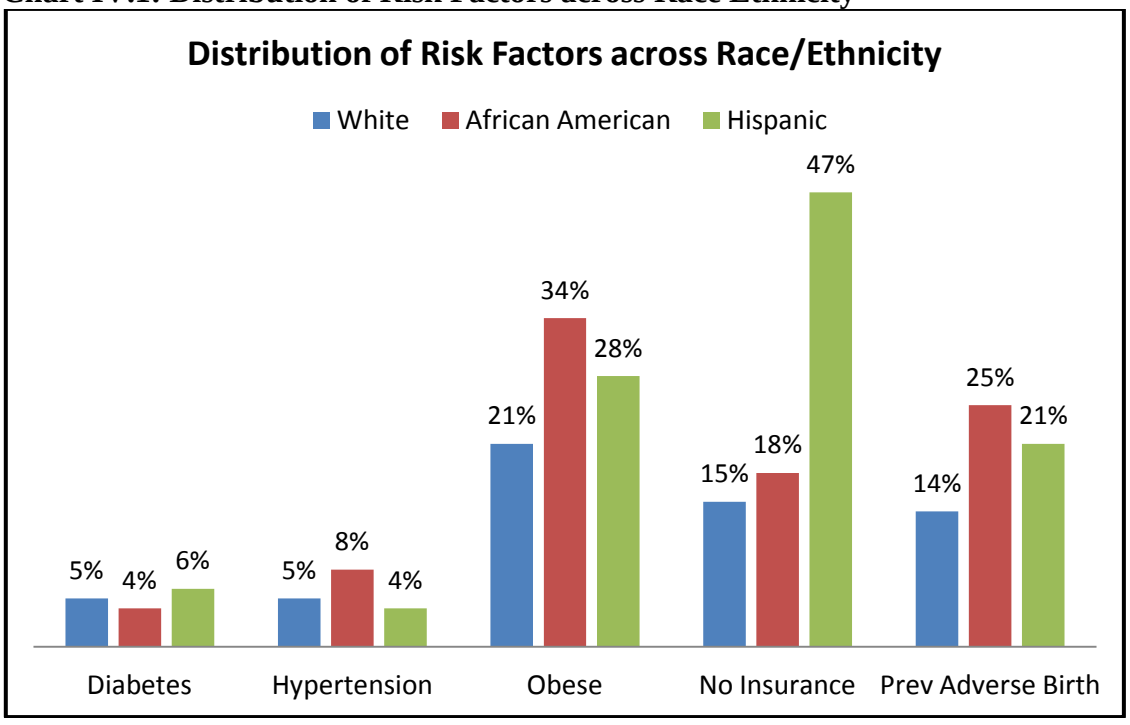

Chart IV.1 shows that across noted risk factors, African American women have the highest percentages of self-reported hypertension at 8%, obesity at 34% and previous adverse birth at 25%; whereas Hispanics have the highest rate of self-reported diabetes at 6% and being uninsured at 47%.

Table IV.2 is a tabulation of participants' demographic information and those factors associated with having an adverse birth outcome. The SVY command *SVY: tabulate* specifies that counts be cell totals of each variable and that proportions (or percentages) be relative to (that is, weighted by) each variable. Overall, 15.1% of mothers reported receipt of inter-pregnancy chronic disease checks and/or treatment while 27.9% reported receipt of inter-pregnancy health counseling on their family medical history. Demographic variables showed that among those 35years old and above 18.9% reported receiving chronic disease screenings/treatment and 31.9% reported receiving health counseling on their family medical history. Among African American women, 25.3% reported receiving chronic disease screenings/treatment and 31.8% reported receiving health counseling on their family medical history. Among married women, 18.9% reported receiving chronic disease screenings/treatment and 27.9% receiving health counseling on their family medical history.

Table IV.2: Weighted Distribution of Demographic and Risk Factor Variables by Receipt of Interconception Care, PRAMS 2009-2013

Measures	ICCCHECKS		ICCCOUNSELING	
	Yes: 16,999 (15.1)	**No: 84,114 (84.1)**	**Yes: 29,578 (27.9)**	**No: 71,147 (72.0)**
Age				
<19	487 (18.4)	1920 (81.6)	673 (27.1)	1,724 (72.9)
20 to 24	2,899 (14.6)	15,516 (85.4)	4,832 (24.1)	13,515 (75.9)
25 to 29	4,436 (12.7)	25,537 (87.3)	8,298 (25.8)	21,558 (74.2)
30 to 34	5,012 (15.0)	25,064 (84.9)	9,146 (29.7)	20,834 (70.3)
35+	4,165 (18.9)	16,073 (81.0)	6,629 (31.9)	13,512 (68.1)
Race				
White	6,351 (12.4)	43,012 (87.6)	14,277 (27.9)	34,983 (72.0)
Black	4,393 (25.3)	11,863 (74.7)	5,428 (31.8)	10,762 (68.2)
Hispanic	3,292 (15.2)	14,715 (84.8)	5,097 (25.7)	12,738 (74.3)
Other	2,566 (16.9)	11,845 (83.0)	3,859 (26.3)	10,510 (73.7)
Marital Status				
Unmarried	7,525 (18.9)	28,300 (81.0)	10,790 (27.9)	24,856 (72.0)
Married	9,453 (13.1)	55,738 (86.9)	18,766 (27.9)	46,216 (72.1)
Education				
<HS	3,741 (18.6)	13,124 (81.4)	4,943 (26.0)	11,756 (73.9)
HS	4,670 (15.5)	22,155 (84.5)	7,205 (25.0)	19,521 (74.9)
>HS	8,316 (13.8)	47,716 (86.2)	16,998 (29.8)	38,915 (70.2)
Health Ins				
No Ins	2,417 (9.9)	17,712 (90.1)	3,955 (17.7)	16,085 (82.3)
Has Ins	14,347 (16.5)	65,370 (83.5)	25,298 (30.8)	54,144 (69.2)
Dental Visit				
No	6,808 (12.5)	40,581 (87.5)	11,051 (21.5)	36,173 (78.5)
Yes	10,133 (17.3)	43,355 (82.7)	18,461 (33.5)	34,844 (66.5)

Table IV.2 Continued

Measures	ICCCHECKS		ICCCOUNSELING	
	Yes: 16,999 (15.1)	**No: 84,114 (84.1)**	**Yes: 16,999 (15.1)**	**No: 84,114 (84.1)**
Diabetes				
No			27,400 (27.7)	66,795 (72.3)
Yes			2,001 (31.7)	3,920 (68.3)
Hypertension				
No			26,820 (27.5)	66,364 (72.5)
Yes			2,567 (36.9)	4,321 (63.1)
Inter-Pregnancy BMI				
<18.5	533 (12)	3,309 (88)	1,074 (26.1)	2,751 (73.9)
18.5-24.9	5,718 (12.1)	37,976 (87.9)	11,915 (26.3)	31,639 (73.8)
25-29.9	4,166 (15.6)	20,396 (84.4)	7,277 (28.5)	17,197 (71.5)
30+	5,493 (20.6)	18,045 (79.4)	7,865 (31.8)	15,613 (68.2)
Previous Birth Out				
Healthy Birth	11,796 (13.8)	65,768 (86.2)	21,834 (27.0)	55,466 (72.9)
Adverse Birth^	4,704 (20.6)	16,265 (79.4)	6,968 (32.1)	13,902 (67.9)

Analysis of noted risk factors showed that among women who had inter-pregnancy health insurance, 16.5% reported receiving chronic disease screenings/treatment and 30.8% reported receiving health counseling on their family medical history. Among women with a body mass index above 30, 20.6% reported receiving chronic disease screenings/treatment and 31.8% reported receiving health counseling on their family medical history. And among those who had a previous adverse birth, 20.6% reported receiving chronic disease screenings/treatment and 32.1% reported receiving health counseling on their family medical history.

Chart IV.2: Receipt of Interconception Care from 2009 to 2013

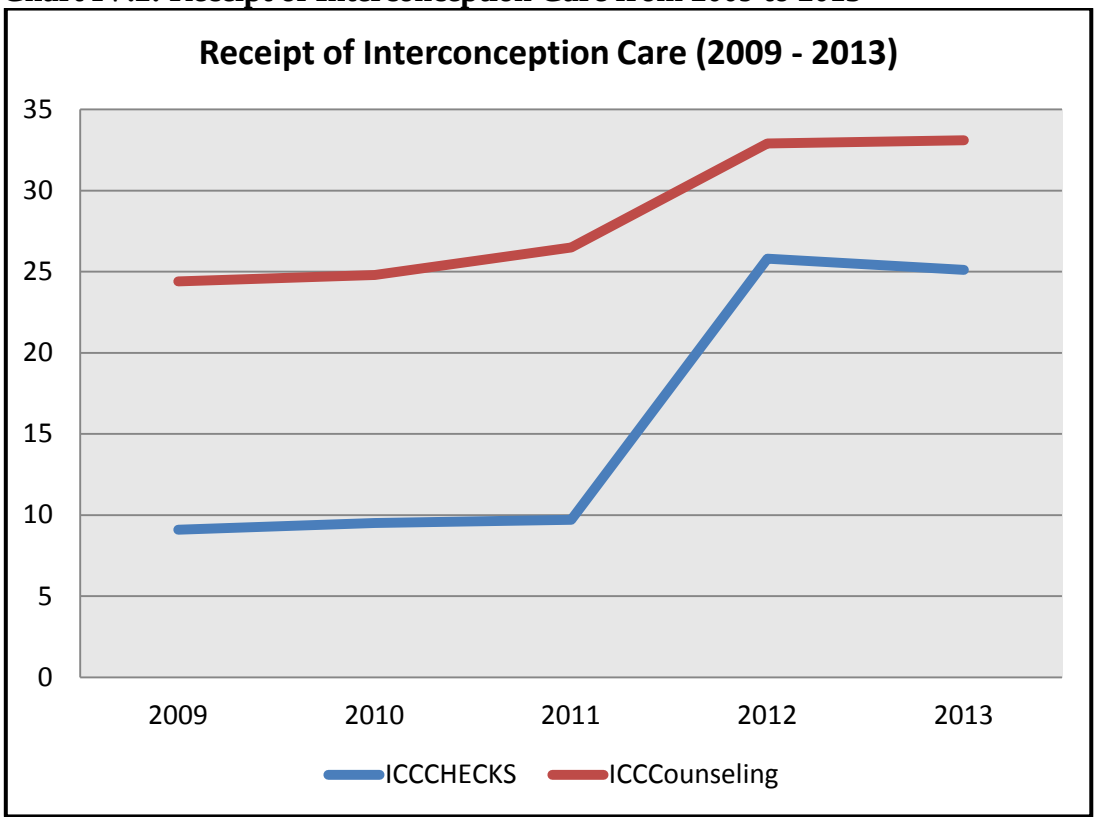

Chart IV.2 shows the distribution of self-reported receipt of interconception care from 2009 to 2013. From 2009 to 2011, about 10% of the study sample reported that they received chronic disease screenings/treatment during the interconception period and 25% reported received counseling on their family medical history. However, in 2012, the percentage of the study sample who reported receiving chronic disease screenings/treatment increased from about 10% to 25% and those who reported receiving counseling on their family medical history increased from about 26% to 33%.

Table IV.3 shows the multivariate logistic regression results for the dependent variables: receipt of interconception care – chronic disease screenings/treatment, and receipt of interconception care – health counseling. It showed varied results regarding women who were classified as high risk for adverse pregnancy outcomes. Demographic characteristics showed that teen mothers were 38% (*OR – 0.62*) less likely to receive inter-pregnancy chronic disease screenings/treatment and 21% (*OR – 0.79*) less likely to receive counseling on their family medical history compared to mothers who were 35 years old and above. When compared to White mothers, African American mothers were almost 2 times more likely (*OR – 1.92*) to receive inter-pregnancy chronic disease screenings/treatment and 18% (*OR – 1.18*) more likely to receive counseling on their family medical history. Married mothers were 45% (*OR – 1.45*) more likely to receive inter-pregnancy chronic disease checks and about 19% (*OR – 1.19*) more likely to receive counseling on their family medical history. And mothers who did not have a high school education were 61% (*OR – 1.61*) more likely to receive inter-pregnancy chronic disease screenings/treatment.

Table IV. 3: Factors Associated with Self-Reported Receipt of Interconception Care, PRAMS 2009-2013

Measures	ICCCHECKS	ICCCOUNSELING
	OR (CI)	OR (CI)
Age		
<19	**0.62 (0.49, 0.77)**	**0.79 (0.53, 0.83)**
20 to 24	**0.62 (0.55, 0.68)**	**0.78 (0.72, 0.85)**
25 to 29	**0.58 (0.53, 0.63)**	**0.82 (0.76, 0.88)**
30 to 34	**0.76 (0.69, 0.82)**	**0.93 (0.87, 0.99)**
35+	Ref	Ref
Race		
White	Ref	Ref
Black	**1.92 (1.76, 2.09)**	**1.18 (1.09, 1.27)**
Hispanic	**1.20 (1.08, 1.32)**	**1.12 (1.03, 1.22)**
Other	**1.40 (1.27, 1.54)**	0.94 (0.87, 1.02)
Marital Status		
Unmarried	Ref	Ref
Married	**1.45 (1.33, 1.56)**	**1.19 (1.12, 1.27)**
Education		
<HS	**1.61 (1.46, 1.78)**	1.07 (0.98, 1.17)
HS	**1.18 (1.09, 1.27)**	**0.90 (0.84, 0.96)**
>HS	Ref	Ref
Dental Visit		
No	Ref	Ref
Yes	**1.57 (1.47, 1.68)**	**1.67 (1.59, 1.77)**
Diabetes		
No		Ref
Yes		1.07 (0.96, 1.19)
Hypertension		
No		Ref
Yes		**1.32 (1.18, 1.46)**
Health Insurance		
No Ins	Ref	Ref
Has Ins	**1.95 (1.76, 2.15)**	**1.93 (1.78, 2.09)**
Inter-Pregnancy BMI		
<18.5	1.00 (0.84, 1.19)	1.06 (0.93, 1.22)
18.5-24.9	Ref	Ref
25-29.9	**1.28 (1.19, 1.38)**	**1.15 (1.08, 1.21)**
30+	**1.82 (1.69, 1.96)**	**1.34 (1.26, 1.43)**
Previous Birth Out		
Healthy	Ref	Ref
Adverse	**1.49 (1.37, 1.60)**	**1.31 (1.23, 1.39)**

****Bold font indicates statistical significance p-value <0.05**

Among women at risk for adverse birth outcomes, the data showed that women who reported that they were hypertensive were 32% (*OR – 1.32*) more likely to receive counseling on their family medical history compared to mothers who did not report having hypertension. Those who had health insurance were almost 2 times (*OR – 1.95 and OR – 1.93*) more likely to receive both forms of interconception care services compared to mothers who did not have health insurance. When compared to mothers who had a previous healthy birth, mothers with a previous adverse birth were 49% (*OR – 1.49*) more likely to receive inter-pregnancy chronic disease screenings/treatment and about 31% (*OR – 1.31*) more likely to receive counseling on their family medical history. Other results showed that when compared to mothers who did not have a dental visit before this pregnancy; mothers who had a dental visit were about 57% (*OR – 1.57*) more likely to receive inter-pregnancy chronic disease screenings/treatment and about 67% (*OR – 1.67*) more likely to receive counseling on their family medical history.

DISCUSSION

To my knowledge, this is one of the first studies to explore how noted risk factors for adverse birth outcomes are associated with receipt of interconception care at a population level. Overall, the results showed that less than a third of mothers reported receipt of both types of interconception care services where 15.1% reported receipt of inter-pregnancy chronic disease screenings/treatment and 27.9% reported receipt of counseling on their family medical history. In addition, the data showed that in 2012, the percentage of the study sample who reported receipt of interconception care

increased by 15% (increased to 25%) for those who reported receiving chronic disease screenings and by about 7% (increased to 33%) for those who reported receiving counseling on their family medical history. One explanation for this increase is the implementation of the Patient Protection and Affordable Care Act (ACA). Studies have shown that the lack of access to health insurance coverage between pregnancies is one of the primary barriers regarding the receipt of interconception care (Atrash et al. 2006; Badura et al. 2008; Bryant et al. 2006; Dunlop et al. 2008; Lu et al. 2010; Rankin et al. 2016; Rosenbach et al. 2010). Thus, many of the provisions of ACA particularly the Medicaid expansion provision; work to increase women's access to health insurance coverage before, during, after and between pregnancies.

Connecting low-income and uninsured women of childbearing age with an ongoing source of health care services –in the form of primary and dental care– continues to be a major challenge (Badura et al. 2008). Many high risk women do not have access to a primary care practitioner because local health departments and publicly available clinics do not have the capacity to provide ongoing primary care for these populations (Badura et al. 2008). In addition, statistics show that about 40% of poor women of child bearing age are uninsured (Atrash et al. 2006; Simon et al. 2008). As a result, many low-income and uninsured women at risk of repeat adverse pregnancies do not have access to health coverage and/or primary health care between pregnancies and are not able to access interconception care and/or preventive health care visits (Atrash et al. 2006; Badura et al. 2008; Bryant et al. 2006; Dunlop et al. 2008; Lu et al. 2010; Rankin et al. 2016; Rosenbach et al. 2010). The lack of access to preventive and primary

care among these populations contributes to delayed diagnosis and treatment of chronic diseases (e.g. hypertension and diabetes), increased engagement in risky behaviors (e.g. cigarette smoking, poor nutrition) and ultimately results in increased risk of adverse pregnancy outcomes (Lu et al. 2010). This study confirmed this and showed that mothers who had insurance were almost 2 times more likely to receive both forms of interconception care services compared to mothers who did not have insurance.

Regarding dental health services, this study showed that when compared to mothers who did not have a dental visit before this pregnancy; mothers who had a dental visit were at least 60% more likely to receive both forms of interconception care services. There is increasing evidence regarding the association between periodontal disease and adverse birth outcomes (Albert et al. 2011; Detman et al. 2010; Hart, 2012; and Jiang et al. 2013). The association between periodontal disease and preterm birth was first reported by Offenbacher et al. in 1996 and since then, various studies have highlighted associations between periodontal disease and adverse birth outcomes including preterm birth, low birth weight, early pregnancy loss, gestational diabetes and preeclampsia (Detman et al. 2010; Hart, 2012; and Jiang et al. 2013). Despite these associations, interventions that have sought to reduce the incidence of preterm low birth weight through oral care have not been very successful (Boggess & Edelstein, 2006). However, due to the strong relationship between oral health conditions (including periodontal disease) and general health and well-being, improving oral health care for all individuals is an ongoing goal. To have the greatest impact on pregnancy outcomes, oral health care improvement interventions should be provided before and between

pregnancies. This study showed that about 54% of the study population reported that they had received an inter-pregnancy dental visit (in the form of a teeth cleaning) and of that population. Researchers note that the receipt of oral health-care services is an important indicator of access to preventive services (Conner et al. 2014; D'Angelo et al. 2007). They explain that women who engage in other preventive health behaviors are more likely to seek and receive preventive services (Boggess & Edelstein, 2006; Conner et al. 2014; D'Angelo et al. 2007).

The results showed that women who had a previous adverse birth outcome were over 30% more likely to report receipt of interconception care services than those who were not experiencing these risk factors. This is confirmed in studies by Batra et al. (2016) which found that in Los Angeles County, women who had a previous adverse birth outcome were more likely to receive inter-pregnancy health counseling compared to women who did not have previous adverse birth outcomes. The researchers explained that women with a previous adverse birth outcome are more motivated to seek early interventions to prevent reoccurrence. However, they also note that the prevalence of pre-pregnancy health counseling is low across women with different birth outcomes. Studies show that despite calls for primary care physicians to provide universal preconception and interconception care, very few asked women about their pregnancy intentions, provided future pregnancy counseling and/or discuss how family history, current health and/or medications can impact pregnancy outcomes (Batra et al. 2016; Callegari et al. 2015). They also show that roughly 17% of obstetrician/gynecologists/family physicians provided preconception or interconception

care to the majority of women that they gave prenatal care and that barely 50% of women at risk for pregnancy and/or at risk for adverse pregnancy received pre-pregnancy or inter-pregnancy counseling and care (Biermann et al. 2006; Coffey et al. 2014; Malnory et al. 2011). Intervention studies on interconception care highlight that while women with a previous adverse birth outcome are most likely to be the intended population ; more work is needed to increase the rate at which obstetrician/gynecologists/family physicians deliver interconception care services as well as to increase the number of available hospital and clinic-based interconception care interventions.

Analyses on perinatal period of risk for infant mortality among African Americans highlight the need for preconception and interconception care services (Hogan et al. 2012). These analyses continuously identify before and between their pregnancies as the greatest period of infant mortality risk among African American women. According to Burris et al. (2010), African American women in the United States are 2 to 3 times more likely to deliver low birth weight and premature infants than their white counterparts. Explanations for these health disparities note that African American women are disproportionately more likely to be disadvantaged – to lack insurance coverage, to have lower incomes and to have limited access to quality health services (Hogan et al. 2012). In addition, African American women are more likely to experience risk factors for adverse pregnancy outcomes including hypertension, diabetes and obesity (Borrell et al. 2016; Burris et al. 2010; Dominguez, 2010; Loggins et al. 2014; Ruiz et al. 2014; Zhang et al. 2011). This was confirmed by study results which showed

that when compared to Whites and Hispanic women, African American women had the highest rate of hypertension, obesity and previous adverse birth. Researchers exploring the causal linkages between racism and health disparities have often used an intersectional framework to understand how racism impacts African American women's ability to seek and receive preconception and interconception care services (Hogan et al. 2012). These studies show that African American women who report lower or no experience with racism are more likely to participate in various health service programs (Hogan et al. 2012). In addition, Hogan et al. (2012) notes that many vulnerable African American women participate in various health service programs access health services that may otherwise be unattainable due to the many financial, medical and psychological burdens they have to navigate with their families. Current studies show that most interconception care interventions target primarily African American women (Badura et al. 2008; Biermann et al. 2006; Dunlop et al. 2008; Handler et al. 2013; Rosenbach et al. 2009; Rosener et al. 2016). A study by Rosenbach et al. (2009) on 8 healthy start programs across the United States showed that about 70% of all participants were African American and another by Badura et al. (2008) showed that 60% of all the women served by Healthy Start Programs are African American. However, overall, study results showed that compared to White women, African American women were almost 2 times more likely to receive inter-pregnancy chronic disease screenings/treatment and 18% more likely to receive counseling on their family medical history. Studies by Oza-Frank et al. (2014) explain that such results may be because it is easier to identify women at risk for adverse birth outcomes in clinical settings and to

refer them to needed health care and services. However, the provision of chronic disease screenings and treatment and/or health counseling is not sufficient to reduce the rate of adverse birth outcomes within this population. Adverse birth outcomes among African American women are often as a result of exposure to various risk factors across their lifespan including limited access to care, poor nutrition, stress, poor housing, lack of treatment adherence and racial discrimination. Thus, interconception care must be provided in combination with other needed services that can improve a woman's overall health.

Strengths and Limitations

The primary strength of this study is the use of the PRAMS dataset across multiple years. First, many of PRAMS' questions are consistent over the different phases of the survey and this allows tracking of different measures across time periods. This allowed for a larger sample size and increased the generalizability of the study results. Second, PRAMS provided a unique and reliable source of data for the proposed research question. It has been identified as the primary data source to monitor national progress toward preconception and interconception care goals and objectives (Oza-Frank et al. 2014).

The use of this dataset also comes with various limitations. First of which is the lack of a specific question in the PRAMS survey regarding the receipt of interconception care. Measures of interconception care utilization were taken from PRAMS questions on participants' pregnancy readiness behavior during the 12 months before they became pregnant with their new baby. These behaviors were used to operationalize

interconception care by focusing on the population that had a previous birth and thus, allowed for an assessment of participants' pregnancy readiness behaviors during the interconception period. In addition, these measures align with preconception and interconception care indicators that the IOM and CDC note should be addressed during well-woman visits to prevent adverse birth outcomes (Johnson and Gee, 2015; Livingood et al. 2010). Secondly, the measures used to assess interconception care are limited in their ability to measure overall utilization of interconception care; i.e. they are only able to provide information on whether or not women in this study received specific types of interconception care. Thirdly, due to the limited research available on interconception care, much of the literature reviewed focused on preconception care. And while there are many similarities between preconception and interconception care, this gap in the literature limits the inferences that can be made from study results. Thus, much of the research assessed in this study is still exploratory because there isn't sufficient evidence regarding the effectiveness of interconception care services in reducing adverse birth outcomes (and infant mortality rates). Fourth, the variables used to measure interconception care were operationalized by creating a subpopulation of women who had a previous birth. This subpopulation was created using data that corresponded to the question - *did you have a previous live birth*; and as a result, women who experienced a previous miscarriage or stillbirth were not included in this study sample. This exclusion limits the generalizability of interconception care use among women with different adverse birth outcomes. Finally, this study is limited because of the cross-sectional nature of the PRAMS dataset. This study design limited the

inferences that could be made from study results and was susceptible to misclassification due to recall bias.

Conclusion and Implications

This study showed that women who are noted as being high risk for adverse pregnancies were more likely to receive both forms of interconception care when compared to their counterparts. Studies that have examined associations between high risk factors and preconception care have provided possible explanations including that it may be easier to identify high risk women in clinical settings; and as a result, these women are more likely to be referred for needed health care and services. However, the results also show that across the various risk factors (diabetes, hypertension, obesity, previous adverse birth outcome); over 80% of those who fell into those categories reported that they did not receive either form of interconception care. Thus, those most at risk for adverse birth outcomes are still not accessing/receiving needed health care services. This is not surprising as many high risk women face a myriad of barriers to care, most of which are not addressed in this study – barriers including quality of health care, accessibility of health clinics, affordability of services and treatment, attitude and knowledge of health care providers and access to health coverage. Thus, these barriers can impede access to interconception care and its impact on the woman's overall health and birth outcomes. Overall, this study emphasizes the need for research that explores how these systemic factors influence receipt of interconception care and adherence to noted recommendations. It also emphasizes the need for health policies that can target

these systemic barriers and increase women's access to quality, and affordable health care services.

Finally, this study adds to the literature in various ways. It provides a richer understanding on how interconception care can be measured and the rate of utilization among those who need it most. Many of the current studies on interconception care focus on the postpartum visit as the sole measure of utilization /receipt of interconception care. However, this study goes further by assessing receipt of specific behaviors that have been identified by the IOM and CDC in regards to behaviors that should be promoted during well women visits and/or targeted through interconception care interventions to help prevent adverse birth outcomes.

CHAPTER V

HEALTH INSURANCE COVERAGE DURING INTERCONCEPTION PERIOD

OVERVIEW

Introduction: The interconception period is an ideal time to reduce risk factors associated with adverse birth outcomes and infant mortality. However, many low income women, specifically those who are dependent on Medicaid, often lose health insurance coverage after 60 days post partum. Thus, they do not have the coverage needed to seek quality and affordable care that can help them address different health and social factors.

Goal: This study examines factors associated with having insurance during the interconception period among women at risk of repeat adverse birth outcomes. It summarizes data collected across 33 different states from 2009 to 2013 – a time period that allows for an exploration of the impact of the Patient Protection and Affordable Care Act (ACA) on changes in insurance coverage.

Methods: The dependent variable in this study was health insurance coverage and was measured as: private insurance, Medicaid, uninsured and others. Demographic variables included age, race/ethnicity, marital status, education, region, and years. High risk variables included hypertension, diabetes, body mass index, and previous birth outcome. Since the dependent variable is categorical, a multinomial logistic regression model was estimated.

Main Findings: Study results showed that overall, 23% of the study sample reported that they were uninsured, 52% reported that they had private insurance and 22%

reported that they were covered by Medicaid. Among women at risk for repeat adverse birth outcomes, the results showed that when compared to women who did not report that they were hypertensive, those who did were 37% more likely to be on Medicaid than to be uninsured. Women who were obese were 24% more likely to be on Medicaid than to be uninsured compared to women with a normal weight. And when compared to women who reported that they had a healthy previous birth, those who reported that they had a previous adverse birth were 10% less likely to have private insurance than to be uninsured but 27% more likely to be on Medicaid than to be uninsured.

Conclusion: This study confirmed what has been seen in the literature that high risk women are more likely to be on Medicaid; i.e. they are also more likely to be from lower socioeconomic backgrounds. Thus, many of the women most at risk for adverse birth outcomes depend on Medicaid to be covered during the interconception period. This study adds to the literature by highlighting the importance of Medicaid for high risk women who need health insurance coverage to help them access care that can prevent repeat adverse birth outcomes. It also emphasizes the importance of ACA provisions meant to expand Medicaid eligibility and preserve continuity of coverage by helping low-income new mothers maintain their coverage during pregnancy as well as during preconception and interconception periods.

INTRODUCTION

Access to health insurance coverage is a critical measure in public health interventions as it is associated with improved access to health care services and overall

well being of the population (Zhao et al. 2017). On the other hand, lacking or limited access to health insurance coverage has been associated with poor health and birth outcomes, lack of adherence to medical treatment, fewer preventive screenings, delayed diagnosis and treatment of serious conditions, increased late stage diagnoses, higher rates of avoidable hospitalizations, and poor overall (health-related) quality of life (Ayanian et al. 2000; Zhao et al. 2017). Low income women are most at risk of being uninsured or underinsured and thus, are disproportionately more likely to face poor health and birth outcomes. Data collected by the Kaiser Family Foundation in 2011 shows that more than half of uninsured women in the United States are poor or very low income where about 53% of women with incomes that fall under 138% of the federal poverty level are uninsured, 37% of women with incomes that fall between 139% and 399% of the federal poverty level are uninsured (KFF, 2013). Furthermore, work done by Rosenbach et al. (2010) and DeVoe et al. (2014) found that infants had better access to care than their mothers, where, most of the mothers had lower rates of insurance coverage and health care check-ups and higher rates of unmet health needs. For many low income women who do not have health insurance, Medicaid is their primary source of health care coverage – at least 60% of the women on Medicaid are of childbearing age (Atrash et al. 2006; Bryant et al. 2006; Dunlop et al. 2008). However, there are many low-income women who do not qualify for Medicaid because they fall above eligible federal poverty levels, undocumented and/or they do not have children who are under the age of 18 (Atrash et al. 2006). In addition, under some state eligibility requirements, many low income women of childbearing age only qualify for Medicaid coverage when

they are pregnant and this coverage typically ends 60 days postpartum (Atrash et al. 2006; Badura et al. 2008; Bryant et al. 2006; Dunlop et al. 2008; Lu et al. 2010; Rankin et al. 2016; Rosenbach et al. 2010). Thus, for many of these women, interconception care is limited to their postpartum visit (Atrash et al. 2006; Badura et al. 2008; Bryant et al. 2006; Dunlop et al. 2008; Lu et al. 2010; Rankin et al. 2016; Rosenbach et al. 2010).

As a result, many low income women of childbearing age do not have access to health coverage and/or primary health care between pregnancies and thus, many are not able to access interconception care and/or preventive health care visits (Atrash et al. 2006; Badura et al. 2008; Bryant et al. 2006; Dunlop et al. 2008; Lu et al. 2010; Rankin et al. 2016; Rosenbach et al. 2010). Research has shown that the interconception period is an ideal time to reduce risk factors – diseases, unhealthy behaviors, environmental hazards – that are associated with adverse birth outcomes and infant mortality (Badura et al. 2008). The interconception period can be defined as care, counseling and auxiliary services provided to a woman and her family from the delivery of one newborn until the conception of the next (Badura et al. 2008; Biermann et al. 2006; Dunlop et al., 2008; Hussaini et al. 2013; Lu et al. 2006; Malnory et al. 2011; Rosenbach et al. 2010; Rosener et al. 2016). Interconception care is a subset of preconception care and it addresses the risks and complications associated with the previous adverse pregnancy, improves overall health before future pregnancies and reduces the risk of subsequent adverse birth outcomes (Badura et al. 2008; Biermann et al. 2006; Dunlop et al., 2008; Hussaini et al. 2013; Lu et al. 2006; Malnory et al. 2011; Rosenbach et al. 2010). According to the Institute of Medicine the leading recommendation regarding preconception and

interconception care delivery coverage is as follows: "At least one well-woman preventive care visit annually for adult women to obtain the recommended preventive services, including preconception and prenatal care. The committee also recognizes that several visits may be needed to obtain all necessary recommended preventive services, depending on a woman's health status, health needs, and other risk factors" (Johnson and Gee, 2015). Such visits should include: reproductive planning, contraceptive methods and counseling; counseling and screening for STIs and HIV; screening and counseling for domestic violence; and preventive services including immunizations, hypertension and diabetes screening, depression screening, substance use screening and cessation, and obesity screening and counseling (Johnson and Gee, 2015).

The primary goal of Patient Protection and Affordable Care Act (ACA) is to expand health coverage to the uninsured by expanding Medicaid eligibility to 138% of the federal poverty level, prohibit sex rating, extend coverage for young adults below 26 through their parents' insurance, prohibit denial of coverage based on preexisting conditions, ensure that maternity and well baby care is covered, and provide preventive services like contraception without cost sharing (Blumberg & Holahan, 2016; McCarthy, 2015; Salganicoff et al. 2014; Zhao et al. 2017). Providing comprehensive health coverage and quality care to all women of reproductive age is critical to improving birth outcomes and women's overall health (D'Angelo et al, 2015). In 2009, before passage of ACA, about 20% of women between the ages of 18–64 did not have health insurance; however, by 2015, this rate had dropped to 10.5% (D'Angelo et al, 2015; KFF, 2016; Graves & Nikpay, 2017). Furthermore, studies by Zhao et al. (2017) found that among

adults ages 18 to 64, uninsured rates increased from 1993 to 2010 and decreased from 2011 to 2014. Early studies on the impact of ACA has found associations between increased access to health insurance coverage and increased access to a regular primary care provider, medical care and treatment and decreased proportion of reported fair or poor health (Zhao et al. 2017). Since its passage in 2010, a number of the law's provisions have already taken effect; these provisions include expanding Medicaid eligibility for many more low income people (Graves & Nikpay, 2017). However, due to a 2012 Supreme Court ruling, states can choose whether or not they want to expand their Medicaid programs. Thus, as of August 2013, 24 states plus DC have committed to expanding their Medicaid programs, 21 states declined expanding at that time, and 5 states are still undecided – about 45% of women who are currently uninsured live in states that are choosing not to expand their Medicaid programs, 45% live in states that are expanding, and 10% of women live in states that are still undecided (KFF, 2013; McCarthy, 2015). As a result of the lack of expansion in some states, estimates show that about 6.4 million uninsured adults will not gain coverage (KFF, 2013). This paper adds to the literature by examining factors associated with having insurance during the interconception period among women at risk of repeat adverse birth outcomes. It summarizes data collected from 2009 to 2013 – a time period that allows for an exploration of the impact of the Patient Protection and Affordable Care Act (ACA) on changes in insurance coverage.

METHODS

Data Description

To examine factors associated with having insurance during the interconception care period among US women at risk of repeat adverse birth outcomes, 2009 to 2013 Pregnancy Response Assessment Monitoring System (PRAMS) national dataset was used. PRAMS is an ongoing, population-based surveillance system designed to identify and monitor selected self-reported maternal experiences, behaviors and access to care before, during and after pregnancy as well as during the child's early infancy among women who have had a recent live birth (CDC, 2016; Oza-Frank et al. 2014). PRAMS stratified systematic sampling method is used to over-sample mothers with adverse birth outcomes and racial/ethnic minority groups (CDC, 2016; Oza-Frank et al. 2014). Respondents are randomly selected 2 to 6 months after giving birth from a frame of state's birth certificate files (CDC, 2016; Oza-Frank et al. 2014). Currently, PRAMS provides data on about 83% of all live births in the United States (CDC, 2016). The dataset used in this study was collected over a five year period (2009 to 2013) and during two different phases of the PRAMS questionnaire. Phase 6 includes data collected from 2009 to 2011 and Phase 7 includes data collected from 2012 onwards (2012 and 2013). Thirty-three states participated in the data collected from 2009 to 2013: Alaska, Arkansas, Colorado, Delaware, Georgia, Hawaii, Iowa, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Vermont, Washington, West

Virginia, Wisconsin, and Wyoming. For the purposes of this study, variables included were collected over all 5 years and from the 33 noted states.

Variables

This study focused on the type of insurance held by respondents during the interconception period; thus, for the purposes of this paper, the study sample was restricted to women with a previous birth. The dependent variable was created using the PRAMS question: "*During the month before you got pregnant with your new baby, were you covered by any of these health insurance plans*?" The following options were noted: "*health insurance from your job or the job of your partner or parents, health insurance that you or someone else paid for (not from a job), Medicaid (or state Medicaid name), TRICARE or other military health care, other source(s), and/or I did not have any health insurance before I got pregnant*." Categories used in this study were patterned after work done by D'Angelo et al. (2015). Women who reported that they were enrolled in Medicaid or selected a state-named Medicaid program (e.g., RIte Care in Rhode Island) were categorized as Medicaid recipients (D'Angelo et al. 2015). Women who reported private insurance coverage through their job, a partner's job, or insurance that was not job-related that they or someone else paid for were categorized as having private insurance (D'Angelo et al. 2015). Women who reported TRICARE or other military insurance were categorized as having private insurance (D'Angelo et al. 2015). Respondents could also provide insurance coverage options that were not included on the survey list; these options were categorized as other (D'Angelo et al. 2015). Thus, the

dependent variable inter-pregnancy insurance coverage had four categories: private insurance, Medicaid, no insurance, or other insurance.

Demographic variables were as follows: age, race/ethnicity, marital status, education, region, and year. Age was categorized into 5 groups: less than 19 years old, 20 to 24 years, 25 to 29 years, 30 to 34 years and 35 years and above. Race/ethnicity was categorized into 4 groups: White, African American, Hispanic and other (other Asian, American Indian, Chinese, Japanese, Filipino, Hawaiian, Native American and mixed race). Marital status has two categories: married and not married. Maternal education was categorized into 3 groups: less than a high school education, high school education, and more than a high school education. Region was categorized into 4 groups: Northeast, Midwest, South and West. Year was categorized into 5 groups: 2009, 2010, 2011, 2012 and 2013.

The following variables were assessed for their noted association with adverse birth outcomes: hypertension, diabetes, body mass index (BMI) and previous birth outcome. Hypertension and diabetes were created based on the question "*Before you got pregnant with your new baby, did a doctor, nurse, or other health care worker tell you that you had type 1 or type 2 diabetes or hypertension*" and was categorized as yes and no. BMI was created based on the question "*Just before you got pregnant with your new baby, how much did you weigh*" and was categorized into 4 groups: underweight (<18.5), normal 18.5-24.9), overweight (25-29.9), and obese (30+). Previous birth outcome is categorized into 2 groups –healthy birth and adverse birth.

Data Analysis

STATA 14 was used to analyze this dataset. Descriptive statistics were used to provide a quantitative summary of the dataset being used in this study, including demographic characteristics, and risk factors. Since the dependent variable is categorical, a multinomial logistic regression model was estimated. Relative risk ratios and 95% confidence intervals were reported. All statistical tests were two-sided, and findings were considered statistically significant at $p < 0.05$.

In addition, due to the uniqueness of this study sample, specific STATA commands and methodology were used. First, STATA's SVY set commands will be used with all analysis. The following command will be used to set the data *svyset _n [pweight=wtanal], strata(sud_nest) fpc(totcnt)* and account for the sampling weights, clustering and stratification. The SVY package was developed specifically to handle survey data analysis in STATA; thus, it will allow for accurate estimations with this type of dataset. And second, the study population for this dissertation is restricted to women who have had a previous birth. To this end, subpopulation command estimations for survey data will be used. Subpopulation estimation focuses on part of the population and allows researcher to focus on this population without having to drop data and/or observations from the dataset. It involves computing point and variance estimates for part of the population. The *svy* prefix command *subpop()* option performs subpopulation estimation. To specify this subpopulation, the variable "previous birth" will be created and will be measured as "*0 – no*" and "*1 – yes*". Thus, the following command will be used to estimate the needed subpopulation "*subpop (previous birth)*". A breakdown for

this subpopulation shows that 101,643 women in the dataset had a previous birth. This subpopulation estimation will allow me to operationalize participants' responses regarding pre-pregnancy care and services to mean between pregnancy care and services.

The percentage of missing data was calculated by dividing the total missing cells by the total number of cells. To determine the total number of missing cells the total number of cells from each variable within the subpopulation was combined. The total number of cells was 2,134,503 while the total number of missing cells was 34,007. Using the calculation noted above, the total percentage of missing data among the variables being used in this study is 1.6%. Based on this missing data percentage, list-wise deletion will be allowed to handle the missing data in this study.

RESULTS

Table V.1 shows the distribution for each predictor within the subpopulation – I had a previous birth. Data on demographic variables showed that at least 60% of the sample reported that they were between the ages of 25 and 34 years old, 66% reported that they were married, almost 43% reported that they had a high school education or less, and about 22% reported that they were uninsured. Data on at risk variables showed that about 5% of the sample had either diabetes or hypertension, about 50% were either overweight or obese, and 17% reported that they had a previous adverse birth outcome.

Table V.1: Weighted Distribution of Study Population, PRAMS 2009-2013

Demographic Variable	Number (%)
Age	
<19	2,417 (2.3)
20 to 24	18,539 (17.5)
25 to 29	30,109 (30.2)
30 to 34	30,228 (30.9)
35+	20,346 (19.1)
Race	
White	49,523 (58.0)
Black	16,344 (13.6)
Hispanic	18,193 (20.7)
Other	14,492 (7.7)
Marital Status	
Unmarried	36,036 (33.9)
Married	65,510 (66.1)
Education	
<HS	17,052 (17.5)
HS	26,958 (25.9)
>HS	56,235 (56.6)
Region	
Northeast	22,602 (24.6)
Midwest	26,458 (30.6)
South	24,366 (28.2)
West	28,217 (16.5)
Year	
2009	22,298 (23.5)
2010	22,124 (23.4)
2011	21,045 (18.1)
2012	18,162 (19.2)
2013	18,014 (15.8)
Diabetes	
No	95,058 (94.6)
Yes	5,967 (5.4)
Hypertension	
No	94,036 (95.0)
Yes	6,945 (4.9)

Table V.1 Continued

Demographic Variable	Number (%)
Pre Preg BMI	
<18.5	3,855 (3.6)
18.5-24.9	43,870 (46.8)
25-29.9	24,683 (25.8)
30+	23,638 (23.9)
Previous Birth Out	
Healthy Birth	77,929 (82.6)
Adverse Birth	21,099 (17.4)

Chart V.1 shows the insurance status of women during the interconception care period from 2009 and 2013. The chart shows that in 2009 and 2010 the percentage of women who were uninsured was greater than the percentage of women on Medicaid by about 5%. However, the percentages changed in 2011 and this change has continued through 2013; where the percentage of women on Medicaid is now greater than the percentage of women who are uninsured.

Chart V.1: Health Insurance Coverage during Interconception Period

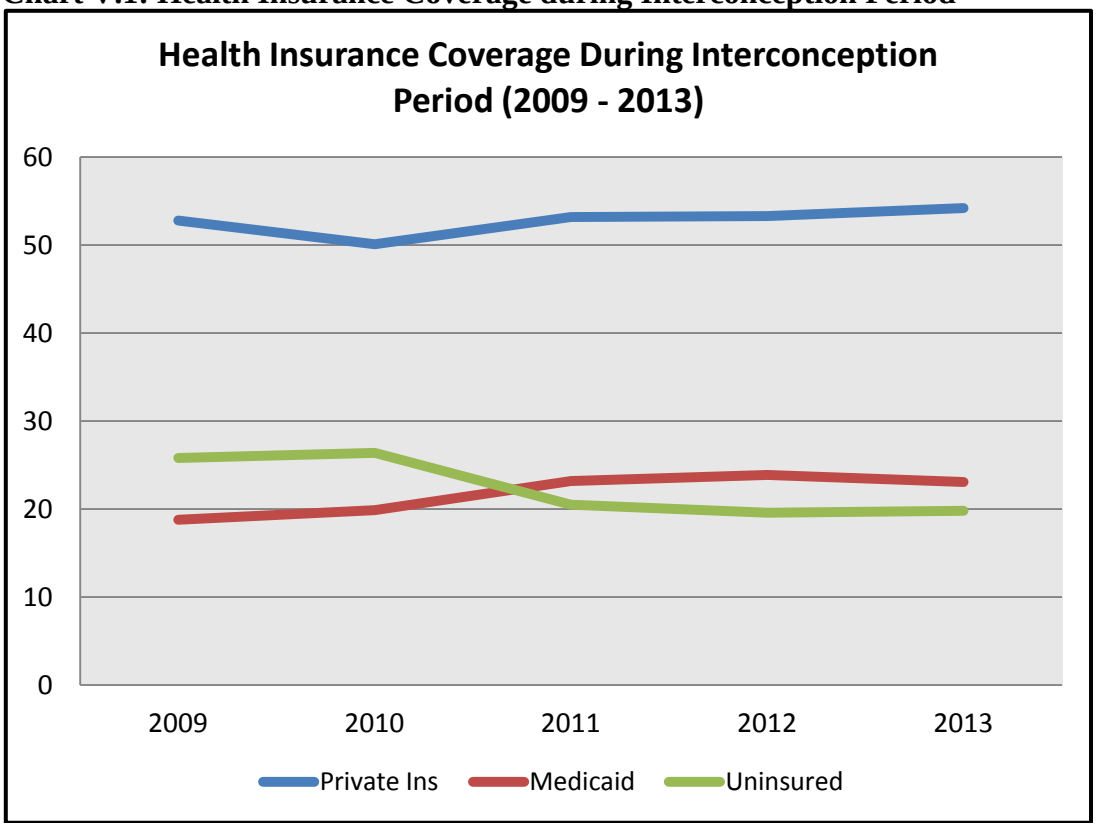

Table V.2: Weighted Distribution of Demographic and Risk Factor Variables by Health Insurance Coverage, PRAMS 2009-2013

Measures	Private	Medicaid	Uninsured	Other
	48,915 (52.6)	**23,789 (21.5)**	**20,261 (22.8)**	**2,615 (3.1)**
Age				
<19	321 (12.6)	1,381 (57.6)	468 (24.9)	102 (4.8)
20 to 24	3,992 (22.3)	7,622 (40.1)	5,232 (33.1)	636 (4.5)
25 to 29	13,092 (47.1)	7,655 (23.8)	6,730 (26.1)	734 (3.0)
30 to 34	18,415 (66.9)	4,628 (12.9)	4,774 (17.7)	643 (2.5)
35+	13,093 (70.7)	2,502 (10.5)	3,056 (16.3)	500 (2.5)
Race				
White	30,234 (65.9)	7,858 (16.5)	8,029 (15.9)	804 (1.8)
Black	5,130 (33.7)	7,342 (43.9)	2,669 (18.3)	634 (4.0)
Hispanic	4,631 (25.1)	4,151 (20.5)	7,442 (48.6)	823 (5.8)
Other	7,350 (59.1)	3,714 (22.6)	1,834 (15.2)	296 (3.1)
Marital Status				
Unmarried	6,800 (20.2)	15,899 (41.9)	9,641 (32.8)	1,416 (5.0)
Married	42,084 (69.2)	7,863 (11.1)	10,593 (17.7)	1,194 (2.1)
Education				
<HS	1,976 (10.9)	6,568 (35.5)	6,544 (46.6)	851 (6.9)
HS	8,355 (33.5)	9,213 (32.1)	6,883 (30.7)	832 (3.7)
>HS	38,077 (74.2)	7,653 (12.4)	6,456 (11.9)	880 (1.5)
Region				
Northeast	11,519 (55.0)	6,081 (25.1)	2,539 (15.0)	856 (4.8)
Midwest	12,897 (54.7)	7,429 (26.1)	4,481 (17.4)	563 (1.9)
South	10,593 (45.6)	4,776 (15.9)	6,973 (35.5)	548 (2.9)
West	13,906 (56.9)	5,503 (16.9)	6,268 (23.5)	648 (2.8)

Table V.2 Continued

Measures	Private	Medicaid	Uninsured	Other
	48,915 (52.6)	**23,789 (21.5)**	**20,261 (22.8)**	**2,615 (3.1)**
Year				
2009	11, 015 (52.8)	4,566 (18.8)	4,771 (25.4)	476 (2.6)
2010	10,738 (50.2)	4,729 (19.9)	4,814 (26.4)	587 (3.5)
2011	10,130 (53.3)	5,138 (23.2)	4,154 (20.5)	518 (2.9)
2012	8,577 (53.3)	4,800 (23.9)	3,101 (19.6)	554 (3.2)
2013	8,455 (54.2)	4,556 (23.1)	3,421 (19.8)	480 (2.9)
Hypertension				
No	45,241 (52.5)	21,842 (21.3)	18,892 (23.1)	2,428 (3.1)
Yes	3,382 (53.6)	1,768 (24.4)	1,247 (19.1)	169 (2.9)
Diabetes				
No	45,743 (52.7)	22,278 (21.5)	18,946 (22.8)	2,423 (2.9)
Yes	2,902 (50.9)	1,338 (21.5)	1,201 (23.5)	176 (4.0)
Inter-Pregnancy BMI				
<18.5	1526 (45.3)	1,127 (27.2)	844 (24.2)	120 (3.2)
18.5-24.9	23,727 (59.9)	8,917 (18.6)	7,546 (18.9)	944 (2.6)
25-29.9	12,087 (53.4)	5,759 (21.1)	4,900 (22.9)	592 (2.5)
30+	10,366 (46.9)	6,674 (26.7)	4,656 (22.9)	681 (3.5)
Previous Birth Out				
Healthy Birth	39,560 (54.9)	16,751 (19.9)	15,076 (22.4)	1,836 (2.8)
Adverse Birth	8,214 (41.9)	6,338 (28.7)	4,680 (25.0)	702 (4.3)

Table V.2 is a tabulation of participants' demographic information as well as those factors associated with having adverse birth outcomes. The SVY command *SVY: tabulate* specifies that counts be cell totals of each variable and that proportions (or percentages) be relative to (that is, weighted by) each variable. The data showed that over the five years, about 52% of the study sample reported that they had private insurance, 22% reported that they had Medicaid, 23% reported that they were uninsured and 3% reported that they had another form of insurance.

Demographic data showed that among women aged 35 and above, 70.7% reported having private insurance; while among those 20 to 24 years old, 40.1% reported that they were covered by Medicaid coverage and 33.1% reported that they were uninsured. Among White women 65.9% reported that they had private insurance, among African American women 43.9% reported that they were covered by Medicaid; and among Hispanic women 48.6% reported that they were uninsured. Among married women, 69.2% reported that they were covered by private insurance; while among unmarried women, about 42% reported that they were covered by Medicaid and 33% reported that they were uninsured. 74.2% of women with more than a high school education reported being covered by private insurance while 35.5% of women with less than a high school education reported being on Medicaid and 46.6% reported being uninsured. Across the United States, 56.9% of women who live in the West reported the health coverage under private insurance, 26.1% of those who live in the Midwest reported Medicaid coverage and 35.5% of those who live in the South reported being uninsured. The study data was collected from 2009 to 2013, across the five years, 54.2%

of respondents in 2013 reported being covered by private insurance, 23.9% of respondents in 2012 reported Medicaid coverage (23.9%), and 26.4% of respondents in 2010 reported being uninsured.

Data on the 4 high risk factors showed that among women who reported being hypertensive; 53.6% reported private health insurance coverage, 24.4% reported Medicaid coverage while 19.1% reported being uninsured. Among women who reported that they were diabetic; 50.9% reported private health insurance coverage, 21.5% reported Medicaid coverage while 23.5% reported being uninsured. The data showed that among women who reported having a BMI below 18.5 during the interconception period, 45.3% reported having private insurance, 27% reported having Medicaid, and 24% reported being uninsured. While among women who reported having a BMI above 30 during the interconception period, 47% reported having private insurance, 27% reported having Medicaid and 23% reported being uninsured. 42% of women who had a previous birth outcome reported having private insurance, 29% reported having Medicaid, and 23% reported being uninsured.

Table V.3: Factors Associated with Self-Reported Health Insurance Coverage, PRAMS 2009-2013

Measures	Private	Medicaid	Other
	RRR (CI)	RRR (CI)	RRR (CI)
Age			
<19	0.90 (0.63, 1.28)	**5.37 (4.08, 7.07)**	**1.96 (1.25, 3.11)**
20 to 24	**0.33 (0.29, 0.38)**	**1.98 (1.74, 2.26)**	1.07 (0.83, 1.37)
25 to 29	**0.54 (0.49, 0.60)**	**1.48 (1.31, 1.68)**	0.86 (0.68, 1.09)
30 to 34	**0.87 (0.79, 0.98)**	**1.21 (1.07, 1.38)**	1.02 (0.80, 1.30)
35+	Ref	Ref	Ref
Race			
White	Ref	Ref	Ref
Black	0.93 (0.82, 1.04)	**2.18 (1.96, 2.44)**	**1.92 (1.55, 2.37)**
Hispanic	**0.34 (0.30, 0.37)**	**0.52 (0.47, 0.58)**	0.96 (0.79, 1.16)
Other	0.94 (0.83, 1.06)	**1.46 (1.28, 1.65)**	**1.47 (1.12, 1.91)**
Marital Status			
Unmarried	Ref	Ref	Ref
Married	**3.66 (3.36, 3.99)**	**0.59 (0.54, 0.64)**	**0.84 (0.70, 0.99)**
Education			
<HS	**0.09 (0.08, 0.11)**	0.93 (0.84, 1.03)	**1.24 (1.02, 1.49)**
HS	**0.32 (0.29, 0.35)**	0.96 (0.88, 1.05)	0.98 (0.81, 1.17)
>HS	Ref	Ref	Ref
Region			
Northeast	Ref	Ref	Ref
Midwest	**0.73 (0.67, 0.81)**	**0.75 (0.68, 0.83)**	**0.30 (0.25, 0.37)**
South	**0.45 (0.41, 0.50)**	**0.22 (0.20, 0.26)**	**0.23 (0.18, 0.29)**
West	**0.63 (0.57, 0.69)**	**0.48 (0.43, 0.53)**	**0.38 (0.31, 0.46)**

***Bold font indicates statistical significance p-value <0.05**
+RRR – Relative Risk Ratios

Table V.3 Continued

Measures	Private	Medicaid	Other
	RRR (CI)	**RRR (CI)**	**RRR (CI)**
Year			
2009	Ref	Ref	Ref
2010	**0.82 (0.74, 0.92)**	1.03 (0.91, 1.16)	1.16 (0.88, 1.51)
2011	**0.86 (0.77, 0.96)**	**1.29 (1.16, 1.46)**	1.09 (0.86, 1.39)
2012	0.93 (0.83, 1.03)	**1.43 (1.27, 1.60)**	**1.46 (1.15, 1.87)**
2013	**0.89 (0.79, 0.99)**	**1.39 (1.24, 1.57)**	1.15 (0.89, 1.48)
Hypertension			
No	Ref	Ref	Ref
Yes	**1.18 (1.01, 1.38)**	**1.37 (1.15, 1.64)**	1.20 (0.82, 1.75)
Diabetes			
No	Ref	Ref	Ref
Yes	0.93 (0.79, 1.08)	1.07 (0.90, 1.26)	1.18 (0.83, 1.69)
BMI			
<18.5	**0.76 (0.63, 0.93)**	1.09 (0.90, 1.33)	0.96 (0.66, 1.41)
18.5-24.9	Ref	Ref	Ref
25-29.9	**0.89 (0.82, 0.97)**	0.99 (0.90, 1.09)	0.82 (0.67, 1.00)
30+	**0.84 (0.76, 0.92)**	**1.24 (1.13, 1.37)**	1.12 (0.93, 1.37)
Previous Birth Out			
Healthy Birth	Ref	Ref	Ref
Adverse Birth	**0.90 (0.82, 0.99)**	**1.27 (1.16, 1.40)**	**1.45 (1.19, 1.76)**

***Bold font indicates statistical significance p-value <0.05**
+RRR – Relative Risk Ratios

Table V.3 demographic data shows that women age 20 to 34 are less likely to have private insurance than to be uninsured when compared to women age 35 and above. However, women less than 19 years old to 34 years old are more likely to be on Medicaid than to be uninsured when compared to women age 35 and above; e.g. women less than 19 years old were more than 5 times (*RRR – 5.37*) as likely to be on Medicaid than to be uninsured when compared to women age 35 and above. When compared to White mothers, Black mothers were about 2 times (*RRR – 2.18*) more likely to be on Medicaid than to be uninsured and Hispanic mothers were about 66% (*RRR – 0.34*) less likely to have private insurance than to be uninsured and about 50% (*RRR – 0.52*) less likely to be on Medicaid than to be uninsured. Mothers who were married were almost 4 times (*RRR – 3.66*) more likely to have private insurance than to be uninsured; however, they were about 40% (*RRR – 0.59*) less likely to be on Medicaid than to be uninsured. When compared to mothers with more than a high school education, mothers with less than a high school education were almost 90% (*RRR – 0.09*) less likely to have private insurance than to be uninsured and mothers with a high school education were about 70% (*RRR – 0.32*) less likely to have private insurance than to be uninsured. Across the United States, the data showed that women who lived in the Midwest, South and West were less likely to have private insurance and Medicaid than those who lived in the Northeast; e.g. women who lived in the South were 55% (*RRR – 0.45*) less likely to have private insurance than to be uninsured and almost 80% (*RRR – 0.22*) less likely to be on Medicaid than to be uninsured. Across the five years of data for this study sample, the data showed than respondents from years 2010 to 2013 were less likely to have private

insurance than those from 2009; however, respondents from years 2011 to 2013 were more likely to have Medicaid than those from 2009. In addition, respondents in 2011 were about 30% (*RRR – 1.29*) more likely to be on Medicaid than to be uninsured, respondents in 2012 were 43% (*RRR – 1.43*) more likely to be on Medicaid than to be uninsured and respondents in 2013 were 39% (*RRR – 1.39*) more likely to be on Medicaid than to be uninsured.

Among women at risk for repeat adverse birth outcomes, those who reported that they were hypertensive were 18% (*RRR – 1.18*) more likely to have private insurance than to be uninsured and 37% (*RRR – 1.37*) more likely to be on Medicaid than to be uninsured compared to the women who were not hypertensive. Women who were underweight, overweight and obese were less likely to have private insurance compared to those who had a normal weight. However, women who were obese were 24% (*RRR – 1.24*) more likely to be on Medicaid than to be uninsured compared to women with a normal weight. Among women with a previous adverse birth outcome, compared to women who had a healthy previous birth, those who had a previous adverse birth were 10% (*RRR – 0.90*) less likely to have private insurance and 27% (RRR – 1.27) more likely to be on Medicaid.

DISCUSSION

To my knowledge, this is one of the first studies to explore factors associated with having insurance during the interconception period among women at risk of repeat adverse birth outcomes. This study is especially important because various studies have

noted that being uninsured or underinsured between pregnancies is one of the primary barriers to utilization of interconception care, counseling and services (Atrash et al. 2006; Badura et al. 2008; Bryant et al. 2006; Dunlop et al. 2008; Lu et al. 2010; Rankin et al. 2016; Rosenbach et al. 2010). Studies by D'Angelo et al. (2015) found that in the month before pregnancy, 23.4% of the study sample reported that they were uninsured. The authors note that findings from other surveys have also showed similar results including data taken from the 2008 Kaiser Family Foundation Women's Health Survey as well as data taken from the 2009 U.S. Census Bureau and the U.S. Bureau of Labor Statistic's Current Population Survey. Results from this study corroborated these results; where overall, 23% of the study sample reported that they were uninsured. In addition, the results also showed that about 52% of the study sample reported that they had private insurance and 22% reported that they were covered by Medicaid.

Lack of and/or limited access to preventive and primary care among high risk populations is associated with delayed diagnosis and treatment of chronic diseases (e.g. hypertension and diabetes), increased engagement in risky behaviors (e.g. cigarette smoking, poor nutrition) and ultimately results in increased risk of adverse pregnancy outcomes (Ayanian et al. 2000; Lu et al. 2010). Data from the Centers for Medicare and Medicaid Services, highlights that women and children on Medicaid are usually at higher risk of pregnancy complications and adverse birth outcomes compared to women with employee-based or private insurance (Zhang et al. 2013). Study results confirm this and show that women who reported that they were hypertensive were 37% more likely to be on Medicaid compared to the women who were not hypertensive; those who were

underweight, overweight and obese were less likely to have private insurance compared to those who had a normal weight; and compared to women with a previous healthy birth, those with a previous adverse birth outcome were 27% more likely to be on Medicaid. Studies by Brandon et al. (2009) found similar results; i.e. that mothers on Medicaid are at higher risk for having adverse birth outcomes including preterm and low birth weight. The researchers used Medicaid receipt as an indicator of socio-economic status and highlighted other studies which note significant associations between a lower socioeconomic status and premature and low birth weight infants.

Chart V.1 shows that from 2011 through 2013, the rate of Medicaid surpassed the rate of uninsured by about 5%. While the current dataset does not explain this positive change, we can infer that there may be associations between these changes and the implementation of the Patient Protection and Affordable Care Act (ACA). Study results showed that respondents in 2011 were about 30% more likely to be on Medicaid than those from 2009, respondents in 2012 were 43% more likely to be on Medicaid than those from 2009 and respondents in 2013 were 39% more likely to be on Medicaid than those from 2009. This was consistent with work done by Jones and Sonfield (2016) which found that due to Medicaid expansions post ACA implementation, there has been a significant decline in the proportion of women who were uninsured in states that have expanded their Medicaid programs. As noted in the introduction, one of the primary goals of the ACA is to expand coverage to the uninsured. To do this, ACA provisions include expanding health care coverage through Medicaid, Medicaid waivers and other similar state-sponsored insurance programs; all of which are strategies needed to help

increase health care coverage to low income women and their families (Atrash et al. 2006; Lu et al. 2010). Affordability of health care is an on-going problem for many women of child bearing age; thus, efforts to increase healthy behaviors among women of child bearing age must be accompanied by improvements in health care coverage and affordability (Atrash et al. 2006; Rosenbach et al. 2010). According to KFF (2013) as of 2013, over 1 million young women below the age of 26 had accessed health insurance due to the extension of dependent coverage; in addition, 24 states plus Washington DC have committed to expanding their Medicaid program.

Study results showed that across the four United States' regions (Northeast, Midwest, South and West); women who lived in the Midwest, South and West were less likely to have private insurance and Medicaid than those who lived in the Northeast. According to Blumberg and Holahan (2016), those women who live in the Western region of the United States are more likely to gain insurance compared to those who live in the South. The researchers explain that this is because Southern states are less likely to expand Medicaid eligibility under ACA – limiting the ability of ACA to expand insurance coverage in that region. And according to studies done by Jones and Sonfield (2016), women who live in states that have chosen not to expand their Medicaid programs have twice the odds of being uninsured. In addition to higher rates of uninsured, women who live in the South also experience higher rates of adverse birth outcomes and infant mortality and consistently rank poorly in various health status indicators (Zhang et al. 2013). Study results confirm current research which note that of the four regions, women who live in the South are least likely to have private insurance

and Medicaid – where women who lived in the South were 55% less likely to have private insurance than to be uninsured and almost 80% less likely to be on Medicaid than to be uninsured.

Results across race/ethnicity showed that when compared to White mothers, African American mothers were about 2 times more likely to be on Medicaid than to be uninsured and Hispanic mothers were about 66% less likely to have private insurance and about 50% less likely to be on Medicaid. Although this study did not separate Hispanic populations according to citizenship; studies done by Jones and Sonfield (2016) note that the odds of being uninsured are twice as high among immigrant Hispanic women compared to those who were born in the United States. Rosenbaum (2008) notes that these racial disparities in health coverage can be explained by the disproportionately high levels of poverty among women of color. Her study results showed that women of Hispanic origin were 3 times more likely to be completely uninsured when compared to White non-Hispanic women; and that African-American, Hispanic, and American Indian/Alaska Native women are 2-3 times more likely to need Medicaid when compared to non-Hispanic White women. Her results also showed that access to employer-based or private insurance was reported by 80% of the White non-Hispanic women in their sample, 60% of the African-American women and less than 50% of the Hispanic and Native American women in their sample. Rosenbaum (2008) explains that while poverty is not the sole predictor of insurance coverage, 4 in 10 women in poverty are at risk of being uninsured. Furthermore, women who are in certain racial/ethnic minority groups, those who are single parents, have limited education

and/or are foreign born are at an elevated risk of falling into this group of uninsured. This study is consistent with these results as it showed that when compared to mothers with more than a high school education, mothers with less than a high school education were almost 90% less likely to have private insurance than to be uninsured and mothers with only a high school education were about 70% less likely to have private insurance than to be uninsured.

Strengths and Limitations

The primary strength of this study is the use of the PRAMS dataset across multiple years. This allowed for a larger sample size and increased the generalizability of the study results. In addition, PRAMS provided a unique and reliable source of data for the proposed research question. It has been identified as the main data source to monitor national progress toward preconception and interconception care goals and objectives (Oza-Frank et al. 2014).

The use of this dataset also comes with various limitations. The variable used to measure insurance status during the interconception period assessed whether respondents had insurance in the month before they got pregnant. It does not account for whether the respondents' insurance status changed, it does not include all possible forms of insurance and it does not account for respondents who had multiple forms of insurance. As a result, this variable only provides information at one point in time during the interconception care period and ultimately limits the conclusions that can be inferred from this study. Secondly, to identify individuals who would fall into the interconception care period a subpopulation of women who had a previous birth was created. This subpopulation was

created using data that corresponded to the question-did you have a previous live birth- as a result, women who experienced a previous miscarriage or stillbirth were not included in this study sample. This exclusion limits the generalizability of interconception care use among women with different adverse birth outcomes. Finally, there are limitations to these studies because of the cross-sectional nature of the PRAMS dataset. This study design limited the inferences that could be made from study results and was susceptible to misclassification due to recall bias.

Conclusion and Implications

This research is timely and relevant to Patient Protection and Affordable Care Act (ACA) provisions that are still being implemented as well as health insurance policy updates that may result from on-going political changes. This study confirmed what has been seen in the literature that high risk women are more likely to be on Medicaid; i.e. they are more likely to be from lower socioeconomic backgrounds. Thus, many of the women most at risk for adverse birth outcomes depend on Medicaid to be covered during the interconception period. Current interconception care interventions focus on individual behaviors and health conditions that can help reduce rates of repeat adverse birth outcomes; however, such interventions will not be successful if they are not delivered in combination with health policy changes that can alleviate systemic barriers related to access to health insurance coverage, availability and affordability of quality care and treatment, and attitudes of health care professionals towards Medicaid recipients. For example, studies done by DeVoe et al. (2014) predict that full implementation of ACA provisions could reduce the uninsured rates by about 50–70 %

for adults and 40 % for children; e.g. implementation of Medicaid expansions that will provide coverage to Americans earning less than 138 % of the federal poverty level and tax credits that help middle class families buy insurance. In addition, Medicaid expansions will preserve continuity of coverage by helping low-income new mothers maintain their coverage during pregnancy as well as during preconception and interconception periods. Thus, this study adds to the literature by highlighting that many high risk women are dependent on Medicaid to help them access care that can prevent repeat adverse birth outcomes; i.e. many high risk women are dependent on Medicaid to access needed care and services during the interconception period. This study is especially important because policy changes to the Affordable Care Act may result in a loss of these expansions and lead to higher percentages of high risk women who have no access to health coverage and thus limited access to needed health care and services.

CHAPTER VI

INTERCONCEPTION CARE AND SUBSEQUENT BIRTH OUTCOME

OVERVIEW

Introduction: Maternal and child health statistics show that improvements in pregnancy outcomes have slowed down significantly and in some cases, the outcomes have deteriorated. They also show that the slowing rate in pregnancy improvements is associated with a change in the leading causes of infant mortality; where, currently low birth weight and prematurity are associated with about 70% of all cases of infant mortality. To address this need, adverse birth outcome prevention methods need to encompass more than just prenatal care, they need to also address the woman's health before and between pregnancies.

Goal: This study examines whether there is a positive association between receipt and adherence of interconception care and current birth outcome among women of child bearing age in the United States while controlling for noted risk factors of adverse birth outcomes. It summarizes data collected across 33 different states from 2009 to 2013.

Methods: The dependent variable in this study was current birth outcome and was measured as: healthy, low birth weight, preterm birth, low birth weight and preterm birth, and infant died. Demographic variables included age, race/ethnicity, marital status, and education. High risk variables included pregnancy planned, pregnancy interval, hypertension, diabetes, body mass index (BMI), smoked last 3 months of pregnancy, drank last 3 months of pregnancy, and previous birth outcome. And interconception care

indicators included receipt of inter-pregnancy chronic disease screenings/treatment, receipt of inter-pregnancy health counseling and adherence to interconception care recommendations. Since the dependent variable is categorical, a multinomial logistic regression model was estimated.

Main Findings: Study results showed that overall, during the interconception care period about 15% of the study sample reported that they were screened for diabetes and/or hypertension, 28% reported that they received health counseling on their family medical history, and 51% reported that they adhered to interconception care recommendations regarding engagement in exercise at least 3 times a week and/or maintaining a healthy diet. Study results also showed that many of those noted risk factors were statistically significant predictors of adverse birth outcomes in this study – e.g. race/ethnicity (being African American), short inter-pregnancy intervals, history/presence of chronic conditions, substance abuse and previous adverse birth outcome.

Conclusion: There is growing evidence which links interconception care to improved perinatal outcomes; however, despite national recommendations, study results showed that 85% of the study sample reported that they did not receive inter-pregnancy health screenings/treatment, 72% reported that they did not receive inter-pregnancy health counseling, and 49% reported that they did not adhere to the noted interconception care recommendations. Thus, despite calls for primary care physicians to provide universal preconception and interconception care, very few asked women about their pregnancy intentions, provided future pregnancy counseling and/or discuss how

family history, current health and/or medications can impact pregnancy outcomes. Recruiting women into interconception and preconception care programs without a specific problem and time period is difficult; thus, preconception and interconception health promotion and disease prevention should be integrated into a continuum of care throughout the woman's lifespan.

INTRODUCTION

Maternal and child health statistics show that improvements in pregnancy outcomes have slowed down significantly and in some cases, the outcomes have deteriorated (Atrash et al. 2006). These statistics show that from 1980 to 2000, premature births increased by 26%, very premature births increased by 8.2%, low birth weight births increased by 14.7%, and very low birth weight births have by 25.9% (Atrash et al. 2006). The researchers go on to explain that the slowing rate of improvements in birth outcomes in the United States is associated with a change in the leading causes of infant mortality; where, by 2002, congenital abnormalities, low-birth weight, preterm delivery, and pregnancy-related maternal complications accounted for 46.4% of all infant deaths (Atrash et al. 2006). However, current national trends show that low birth weight and prematurity are associated with about 70% of all cases of infant mortality (Badura et al. 2008; Guillory et al. 2015; Livingood et al. 2010; Masho et al. 2011; Tierney-Gumaer & Reifsnider, 2008). Despite tremendous improvements in the care available to low birth weight infants, infant mortality rates within this population (those categorized as low birth weight and very low birth weight), remains

very high – low birth weight infants are more likely than normal birth weight infants to die within their first month of life; infant mortality rates are 25 times higher among low birth weight infants when compared to normal weight infants; and for very low birth weight infants, in addition to having an increased risk of dying in their first year of life, they are also at risk for various complications including hypothermia, cerebral palsy, and other neurological problems (Guillory et al. 2015; Masho et al. 2011; Ounpraseuth et al. 2012).

There have been multiple efforts by public health professionals and researchers to identify the most effective adverse birth outcomes prevention methods and for more than two decades, prenatal care was the primary prevention method (Lu et al. 2003; Lu et al. 2006; Pies et al. 2012). However, researchers now agree that the rates of low birth weight and premature births cannot be reduced solely by improving access to prenatal care (Bernstein et al. 2010; Lu et al. 2006; Oza-Frank et al. 2014). They acknowledge that it is unrealistic to expect prenatal care to address these adverse birth outcomes when by the time the woman has her first visit; organogenesis in the embryo is already underway (Atrash et al. 2006; Bernstein et al. 2010; Biermann et al. 2006; Dhakal, 2016; Loomis et al. 2000; Lu et al. 2003). Furthermore, many of the patho-physiological processes that contribute to various adverse birth outcomes begin very early on in pregnancy or even before implantation; thus, by the time prenatal care is initiated, it is often already too late to alter the pregnancy outcome (Atrash et al. 2006; Biermann et al. 2006; Coffey et al. 2014; Dhakal, 2016; Dunlop et al. 2008; Hussaini et al. 2013; Lu et al. 2006; Oza-Frank et al. 2014). Thus, the primary limitation regarding the effectiveness

of prenatal care is its timing (Biermann et al. 2006; Coffey et al. 2014; Dunlop et al. 2008; Hussaini et al. 2013; Lu et al. 2006; Oza-Frank et al. 2014). This acknowledgement, has led to a growing recognition that birth outcomes are the product of the mother's entire lifespan leading up to her pregnancy (Lu et al. 2006). Thus, to improve birth outcomes, the woman's health before and between pregnancies must be considered.

The Centers for Disease Control and Prevention and the March of Dimes convened a national summit to address this need in 2006. At the summit researchers discussed an agenda for preconception and interconception care programs, research, and policy. At this summit, 10 recommendations were developed which centered on goals that could help women achieve optimal reproductive and overall health (Johnson et al. 2015; Posner et al. 2006; Rosener et al. 2016). One of the primary goals was to reduce risks indicated by a prior adverse pregnancy outcome through interventions during the interconception (inter-pregnancy) period that can prevent or minimize health problems for a mother and her future children. The interconception care period is defined as the time post delivery of one newborn until the conception of the next (Badura et al. 2008; Biermann et al. 2006; Dunlop et al., 2008; Hussaini et al. 2013; Lu et al. 2006; Malnory et al. 2011; Rosenbach et al. 2010; Rosener et al. 2016). Care provided during this period should include: reproductive planning; contraceptive methods and counseling; counseling and screening for STIs and HIV; screening and counseling for domestic violence; and preventive services including immunizations, hypertension and diabetes screening, depression screening, substance use screening and cessation, and obesity

screening and counseling((Badura et al. 2008; Biermann et al. 2006; Dunlop et al., 2008; Hussaini et al. 2013; Johnson and Gee, 2015; Lu et al. 2006; Malnory et al. 2011; Rosenbach et al. 2010; Rosener et al. 2016).

Various studies have found associations between different risk factors and adverse birth outcomes including previous adverse birth outcomes (Badura et al. 2008; Batra et al. 2016; Biermann et al. 2006; Burris et al. 2010; Dunlop et al. 2008; Johnson et al. 2015; Loomis et al. 2000; Lu et al. 2006; Malnory et al. 2011; Tierney-Gumaer & Reifsnider, 2008; Varner et al. 2016; Zhang et al. 2011), history/presence of chronic diseases/conditions – e.g. hypertension, diabetes, obesity (Lu et al. 2008; Masho et al. 2011; Zhang et al. 2011), substance abuse (Anderson et al. 2014; Beyerlein et al. 2011; Chen 2012; Tierney-Gumaer & Reifsnider, 2008; Tong et al. 2013; Weiss & Chambers, 2013; Witt et al. 2015; Zhang et al. 2011; Zheng et al. 2016), unplanned pregnancies (Bryant et al. 2006; Malnory et al. 2011; Lu et al. 2010; Varner et al. 2016), and short pregnancy intervals (Bryant et al. 2006; Cheslack et al. 2015; Davis et al. 2014; Khoshnood et al. 1998; Malnory et al. 2011; Tierney-Gumaer & Reifsnider, 2008; Varner et al. 2016). These studies also highlight that African American women (Borrell et al. 2016; Dominguez, 2010; Loggins et al. 2014; Zhang et al. 2011), teens (Kinzler et al. 2002; Tierney-Gumaer & Reifsnider, 2008; Xie et al. 2015; Zheng et al. 2016), and women from lower socioeconomic backgrounds (Loggins et al. 2014; Loomis et al. 2000; Lu et al. 2006; Meng et al. 2013; Simon et al. 2008; Steel et al. 2015; Wallace et al. 2016; Zhang et al. 2011) are often more likely to experience these risk factors and thus, are disproportionately more likely to have a low birth weight birth, premature birth

and/or perinatal/infant death. However, despite the extensive research on these associations, many of those at risk remain underserved during the interconception period, especially if they have given birth to a previously healthy infant (Lu et al. 2006).

As a result, current interconception care interventions focus on addressing noted modifiable risk factors associated with repeat adverse birth outcomes. In addition, these interventions often target African American women and women from lower socioeconomic backgrounds. Many of the current interconception care interventions are funded by Healthy Start (one of the primary nation-wide federal projects focused on reducing the infant mortality rate). The Health Resources and Services Administration's (HRSA) Maternal and Child Health Bureau (MCHB) included interconception care as a core strategy of the Healthy Start program during project years 2001 – 2005 (Badura et al. 2008). Highlighted interconception care elements included: 1) outreach for identification of high-risk women and infants during hospitalization; 2) linking high-risk women to primary and specialty care; 3) linking high-risk infants to needed intervention services; and 4) providing women with existing chronic conditions ongoing case management and health education interventions (Badura et al. 2008). In addition, HRSA–MCHB noted that Healthy Start programs' interconception care elements should include: 1) knowledge of interconception care and its relation to different health outcomes; 2) an understanding of current gaps in providing interconception care services; and 3) a record of completed referrals for women needing interconception and specialty health care services (Badura et al. 2008). Of those interventions implemented, the Magnolia Project in Florida found that low birth decreased 11% with marginal

statistical significance (Livingood et al. 2010); and the Grady Memorial Hospital inter-pregnancy care program showed a 61% decrease in pregnancies with pregnancy intervals of less than 18 months and a 72% reduction in adverse pregnancy outcomes (Dunlop et al. 2008).

Despite noted evidence of its need and importance, research on the effectiveness of interconception care is still very limited. Currently, much of the research available is in the form of small-scale intervention studies; for example, evaluation studies on Healthy Start Projects in Denver, Atlanta, and Philadelphia which have focused on individual conditions (e.g., hypertension) and risk factors (e.g., alcohol use). However, current studies have not explored the association between interconception care and current birth outcome at a population level. Thus, the goal of this paper is to examine whether there is a positive association between receipt of and adherence to interconception care and subsequent birth outcome among women of child bearing age in the United States (while controlling for noted risk factors of adverse birth outcomes).

METHODS

Data Description

To examine the association between receipt of and adherence to interconception care and susequent birth outcome among women of child bearing age in the United States, 2009 to 2013 Pregnancy Response Assessment Monitoring System (PRAMS) national dataset was used. PRAMS is an ongoing, population-based surveillance system designed to identify and monitor selected self-reported maternal experiences, behaviors

and access to care before, during and after pregnancy as well as during the child's early infancy among women who have had a recent live birth (CDC, 2016; Oza-Frank et al. 2014). PRAMS stratified systematic sampling method is used to over-sample mothers with adverse birth outcomes and racial/ethnic minority groups (CDC, 2016; Oza-Frank et al. 2014). Respondents are randomly selected 2 to 6 months after giving birth from a frame of state's birth certificate files (CDC, 2016; Oza-Frank et al. 2014). Currently, PRAMS provides data on about 83% of all live births in the United States (CDC, 2016). The dataset used in this study was collected over a five year period (2009 to 2013) and during two different phases of the PRAMS questionnaire. Phase 6 includes data collected from 2009 to 2011 and Phase 7 includes data collected from 2012 onwards (2012 and 2013). Thirty-three states participated in the data collected from 2009 to 2013: Alaska, Arkansas, Colorado, Delaware, Georgia, Hawaii, Iowa, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming. For the purposes of this study, variables included were collected over all 5 years and from the 33 noted states.

Variables

In this study, the dependent variable is the participant's current birth outcome. This variable was created using the following questions: "1) *Did your baby weigh 5 pounds, 8 ounces (2.5 kilos) or less at birth*, 2) *Was your baby born earlier than 3 weeks before his or her due date* and 3) *Is your baby alive now*." The responses to these

questions were used to categorize this variable into 5 groups: healthy birth, low birth weight, preterm birth, low birth weight and preterm birth and the baby died.

Demographic variables were as follows: age, race/ethnicity, marital status, and education. Age was categorized into 5 groups: less than 19 years old, 20 to 24 years, 25 to 29 years, 30 to 34 years and 35 years and above. Race/ethnicity was categorized into 4 groups: White, African American, Hispanic and other (other Asian, American Indian, Chinese, Japanese, Filipino, Hawaiian, Native American and mixed race). Marital status has two categories: married and not married. Maternal education was categorized into 3 groups –have less than a high school education, high school education and more than a high school education.

The following variables were assessed for their noted association with adverse birth outcomes: pregnancy planned, pregnancy interval, hypertension, diabetes, body mass index (BMI), smoked last 3 months of pregnancy, drank last 3 months of pregnancy, and previous birth outcome. Inter-pregnancy interval (years since last pregnancy) was created using the survey question "*How many years since your last live birth*?" and was categorized into three groups: 0 to 1 year since last pregnancy, 2 to 5 years since last pregnancy, and 6+ years since last pregnancy. Pregnancy planned was created using the survey question "*When you got pregnant with your new baby, were you trying to get pregnant*" and was categorized as yes and no. Hypertension and diabetes were created based on the survey question "*Before you got pregnant with your new baby, did a doctor, nurse, or other health care worker tell you that you had type 1 or type 2 diabetes or hypertension*" and was categorized as yes and no. BMI was created based on

the survey question "*Just before you got pregnant with your new baby, how much did you weigh*" and was categorized into 4 groups: underweight (<18.5), normal 18.5-24.9), overweight (25-29.9), and obese (30+). Previous birth outcome was created using the survey questions "*Did the baby born just before your new one weigh 5 pounds, 8 ounces (2.5 kilos) or less at birth*?" and "*Was the baby just before your new one born earlier than 3 weeks before his or her due date*?" The responses to these questions were used to categorize this variable into 4 groups: healthy birth, low birth weight, preterm birth, and low birth weight and preterm birth. Substance abuse during pregnancy variables were created using the questions "*did you smoke during the last 3 months of your pregnancy*" and "*did you drink during the last 3 months of your pregnancy*" and the two variables were categorized as yes and no.

While this study is focused on interconception care, PRAMS surveys do not specifically ask participants whether they received interconception care. However, participants are asked about *their pregnancy readiness behavior during the 12 months before they became pregnant with their new baby*. Behaviors include the following: *I was dieting (changing my eating habits) to lose weight, I was exercising 3 or more days of the week, I visited a health care worker to be checked or treated for diabetes, I visited a health care worker to be checked or treated for high blood pressure, and I talked to a health care worker about my family medical history*. These variables have been identified by the IOM and CDC as preconception and interconception care indicators (Johnson and Gee, 2015; Livingood et al. 2010). For the purposes of this study, these behaviors were used to operationalize interconception care by focusing on the population

that had a previous birth and ultimately focusing on pregnancy preparation behaviors during the interconception period.

Three indicators of interconception care were assessed in this study: receipt of interconception care chronic disease screenings/treatment, receipt of counseling on family medical history and adherence to interconception care recommendations. The receipt of interconception care chronic disease screenings/treatment variable was created using the following measures: did you receive an inter-pregnancy diabetes screening/treatment and/or did you receive an inter-pregnancy hypertension screening/treatment. This variable is measured as yes – I received one or both noted health services and no – I did not receive any of the two noted health services. The receipt of interconception care health counseling variable was created using the following measures: did a health care provider talk to you about how your family medical history can influence your pregnancy and provide health advice. This variable is measured as yes – I received the noted health counseling and no – I did not receive the noted health counseling. Adherence to interconception care recommendations was created using the following measures: did you eat a healthy diet and/or did you exercise at least 3 times a week. This variable is measured as yes – I adhered to interconception care recommendations regarding a healthy diet and regular exercise and no – I did not adhere to interconception care recommendations regarding a healthy diet and regular exercise.

Data Analysis

STATA 14 was used to analyze this dataset. Descriptive statistics were used to provide a quantitative summary of the dataset being used in this study, including demographic characteristics and/or risk factors. Since the dependent variable is categorical, a multinomial logistic regression model was estimated. Relative risk ratios and 95% confidence intervals will be reported. All statistical tests were two-sided, and findings were considered statistically significant at $p < 0.05$.

In addition, due to the uniqueness of this study sample, specific STATA commands and methodology will be used. First, STATA's SVY set commands will be used with all analysis. The following command will be used to set the data *svyset _n [pweight=wtanal], strata(sud_nest) fpc(totcnt)* and account for the sampling weights, clustering and stratification. The SVY package was developed specifically to handle survey data analysis in STATA; thus, it will allow for accurate estimations with this type of dataset. And second, the study population for this dissertation is restricted to women who have had a previous birth. To this end, subpopulation command estimations for survey data will be used. Subpopulation estimation focuses on part of the population and allows researcher to focus on this population without having to drop data and/or observations from the dataset. It involves computing point and variance estimates for part of the population. The *svy* prefix command *subpop()* option performs subpopulation estimation. To specify this subpopulation, the variable "previous birth" will be created and will be measured as "*0 – no*" and "*1 – yes*". Thus, the following command will be used to estimate the needed subpopulation "*subpop (previous birth)*". A breakdown for

this subpopulation shows that 101, 643 women in the dataset had a previous birth. This subpopulation estimation will allow me to operationalize participants' responses regarding pre-pregnancy care and services to mean between pregnancy care and services.

The percentage of missing data was calculated by dividing the total missing cells by the total number of cells. To determine the total number of missing cells the total number of cells from each variable within the subpopulation was combined. The total number of cells was 2,134,503 while the total number of missing cells was 34,007. Using the calculation noted above, the total percentage of missing data among the variables being used in this study is 1.6%. Based on this missing data percentage, list-wise deletion will be allowed to handle the missing data in this study.

RESULTS

Table VI.1 shows the distribution for each predictor within the subpopulation – I had a previous birth. Data on demographic variables showed that at least 60% of the sample reported that they were between the ages of 25 and 34 years old, 66% reported that they were married, and almost 43% reported that they had a high school education or less. Data on at risk variables showed that 50.4% reported that their current pregnancy was not planned, 12% got pregnant less than 1 year since their last delivery, about 5% of the sample had either diabetes or hypertension, about 50% were either overweight or obese, about 17% reported that they had a previous adverse birth outcome, 12% reported that they smoked during the last 3 months of their current pregnancy and 7% reported

that they drank during the last 3 months of their current pregnancy. With regards to the three measures of interconception care, the data showed that 15% reported that they received inter-pregnancy chronic disease screenings/treatment, 28% reported that they received inter-pregnancy health counseling and 51% reported that they adhered to interconception care recommendations.

Table VI.1: Weighted Distribution of Study Variables, PRAMS 2009-2013

Demographic Variable	Number (%)
Age	
<19	2,417 (2.3)
20 to 24	18,539 (17.5)
25 to 29	30,109 (30.2)
30 to 34	30,228 (30.9)
35+	20,346 (19.1)
Race	
White	49,523 (58.0)
Black	16,344 (13.6)
Hispanic	18,193 (20.7)
Other	14,492 (7.7)
Marital Status	
Unmarried	36,036 (33.9)
Married	65,510 (66.1)
Education	
<HS	17,052 (17.5)
HS	26,958 (25.9)
>HS	56,235 (56.6)
Preg Planned	
No	51,893 (50.4)
Yes	48,693 (49.6)
Preg Interval	
0-1 year	12,910 (12.4)
2-5 years	61,536 (66.7)
6+ years	21,415 (20.9)
Diabetes	
No	95,058 (94.6)
Yes	5,967 (5.4)

Table VI.1 Continued

Demographic Variable	Number (%)
Hypertension	
No	94,036 (95.0)
Yes	6,945 (4.9)
Pre Preg BMI	
<18.5	3,855 (3.6)
18.5-24.9	43,870 (46.8)
25-29.9	24,683 (25.8)
30+	23,638 (23.9)
Prev Birth Out	
Healthy	77,929 (82.6)
Low Birth Weight	5,503 (4.8)
Preterm	7,975 (7.2)
LBW & Preterm	7,621 (5.4)
Smoked	
No	85,737 (88.1)
Yes	14,513 (11.9)
Drank	
No	93,246 (92.7)
Yes	6,958 (7.3)
ICCChecks	
No	84,114 (84.9)
Yes	16,999 (15.1)
ICCCounseling	
No	71,147 (72.1)
Yes	29,578 (27.9)
ICC Adherence	
No	49,446 (49.1)
Yes	51,818 (50.9)

Table VI.2 is a tabulation of participants' demographic information, those factors associated with having an adverse birth outcome as well as the different interconception care indicators. The SVY command *SVY: tabulate* specifies that counts be cell totals of each variable and that proportions (or percentages) be relative to (that is, weighted by) each variable. While 89% of current births were healthy, about 2% were reported to be a

low birth weight, 4% were reported to be preterm, 4% were both low birth weight and premature and 0.5% were reported to have died during their first year of birth. Demographic data showed that adverse birth outcomes were highest among women who: were less than 19 years old, were African American, unmarried and had a high school education or less. The data also showed that adverse birth outcomes were highest among all risk factors assessed including women who reported that their current pregnancy was unplanned, had an inter-pregnancy interval of less than 1 year, were hypertensive, were diabetic, had a BMI of less than 18.5, smoked and had a previous adverse birth outcome. Regarding the three indictors used to measure interconception care, healthy birth outcomes were highest among women who reported that they did not receive inter-pregnancy chronic disease screenings/treatment, those who reported that they did not receive inter-pregnancy health counseling and those who reported that they did adhere to interconception care recommendations.

Table VI.2: Weighted Distribution of Demographic and Risk Factor Variables by Current Birth Outcome, PRAMS 2009-2013

Measures	Healthy	LBW	Preterm	LBW & Prtrm	Died
	75,055 (89.2)	**6,815 (1.9)**	**3,446 (4.3)**	**14,617 (4.1)**	**1,317 (0.5)**
Age					
<19	1,613 (86.4)	196 (2.5)	83 (3.8)	470 (5.9)	47 (1.3)
20 to 24	13,171 (88.2)	1,520 (2.4)	670 (4.3)	2,811 (4.5)	282 (0.5)
25 to 29	22,634 (89.8)	2,049 (1.9)	968 (4.3)	3,965 (3.6)	376 (0.5)
30 to 34	23,019 (90.0)	1,712 (1.6)	981 (4.2)	4,080 (3.7)	314 (0.4)
35+	14,616 (88.5)	1,337 (2.0)	744 (4.3)	3,290 (4.7)	298 (0.5)
Race					
White	36,336 (90.7)	3,515 (1.6)	1,582 (4.0)	7,278 (3.3)	606 (0.4)
Black	10,812 (82.7)	1,353 (3.3)	612 (5.1)	3,193 (7.8)	325 (1.0)
Hispanic	14,118 (89.6)	994 (1.8)	615 (4.4)	2,220 (3.7)	188 (0.5)
Other	11,467 (88.7)	723 (2.2)	549 (4.4)	1,552 (4.2)	155 (0.5)
Marital Status					
Unmarried	24,968 (86.3)	2,960 (2.6)	1,306 (4.8)	6,081 (5.7)	591 (0.7)
Married	50,028 (90.8)	3,850 (1.6)	2,139 (4.0)	8,511 (3.2)	721 (0.4)
Education					
<HS	11,980 (87.5)	1,415 (2.7)	593 (4.5)	2,757 (4.8)	248 (0.7)
HS	18,935 (87.5)	2,180 (2.3)	969 (4.6)	4,368 (4.9)	409 (0.7)
>HS	43,245 (90.7)	3,117 (1.5)	1,826 (4.1)	7,252 (3.4)	594 (0.4)
Preg Planned					
No	36,961 (87.9)	3,892 (2.2)	1,833 (4.6)	8,257 (4.7)	729 (0.6)
Yes	37,258 (90.5)	2,869 (1.6)	1,580 (4.0)	6,246 (3.4)	570 (0.4)

Table VI.2 Continued

Measures	Healthy	LBW	Preterm	LBW & Prtrm	Died
	75,055 (89.2)	**6,815 (1.9)**	**3,446 (4.3)**	**14,617 (4.1)**	**1,317 (0.5)**
Preg Interval					
0-1 year	8,112 (83.7)	1,003 (2.7)	531 (5.6)	2,974 (7.3)	248 (0.6)
2-5 years	47,948 (90.8)	3,715 (1.6)	1,989 (4.0)	7,044 (3.1)	627 (0.4)
6+ years	15,255 (88.1)	1,643 (2.2)	703 (4.2)	3,483 (4.9)	290 (0.6)
Hypertension					
No	71,333 (90.1)	6,075 (1.8)	3,005 (3.9)	12,097 (3.6)	1,197 (0.5)
Yes	3,354 (73.5)	683 (3.3)	407 (9.6)	2,390 (12.9)	100 (0.6)
Diabetes					
No	70,503 (89.5)	6,411 (1.9)	3,054 (4.1)	13,508 (3.9)	1,256 (0.5)
Yes	4,214 (85.1)	349 (1.9)	363 (7.1)	984 (5.3)	43 (0.5)
Inter-Pregnancy BMI					
<18.5	2,338 (84.3)	506 (3.6)	101 (4.5)	836 (7.1)	61 (0.5)
18.5-24.9	32,578 (89.8)	3,168 (1.9)	1,351 (3.9)	6,089 (3.8)	499 (0.4)
25-29.9	18,511 (89.3)	1,457 (1.7)	900 (4.4)	3,417 (4.1)	303 (0.5)
30+	17,437 (88.8)	1,285 (1.7)	912 (4.8)	3,566 (4.2)	360 (0.6)
Smoked					
No	65,675 (89.9)	4,707 (1.6)	2,960 (4.3)	12,034 (3.7)	1,041 (0.4)
Yes	8,744 (84.1)	1,997 (4.1)	438 (4.2)	3,024 (6.8)	258 (0.8)
Drank					
No	68,427 (89.0)	6,267 (1.9)	3,207 (4.4)	14,166 (4.1)	1,211 (0.5)
Yes	5,396 (91.6)	443 (1.7)	187 (3.2)	811 (3.1)	86 (0.4)

Table VI.2 Continued

Measures	Healthy	LBW	Preterm	LBW & Prtrm	Died
	75,055 (89.2)	**6,815 (1.9)**	**3,446 (4.3)**	**14,617 (4.1)**	**1,317 (0.5)**
Previous Birth Out					
Healthy Birth	62,280 (92.1)	4,255 (1.5)	2,080 (3.2)	8,165 (2.8)	820 (0.4)
LBW Birth	3,244 (82.9)	904 (5.4)	149 (3.9)	1,104 (6.9)	81 (0.7)
Preterm Birth	4,776 (78.2)	556 (2.3)	686 (1.2)	1,776 (6.8)	159 (0.8)
LBW & Preterm Birth	2,924 (66.5)	884 (5.0)	434 (10.5)	3,152 (16.8)	211 (1.1)
ICC Checks					
No	63,010 (89.9)	5,550 (1.8)	2,697 (4.1)	11,494 (3.7)	1,030 (0.5)
Yes	11,644 (85.5)	1,233 (2.4)	730 (5.6)	3,053 (5.9)	279 (0.6)
ICC Counseling					
No	53,212 (89.9)	4,724 (1.8)	2,280 (3.9)	9,780 (3.8)	863 (0.5)
Yes	21,146 (87.6)	2,034 (2.1)	1,139 (5.1)	4,712 (4.7)	446 (0.6)
ICC Adherence					
No	35,396 (88.2)	3,687 (2.2)	1,653 (4.4)	7,801 (4.6)	720 (0.6)
Yes	39,369 (90.2)	3,108 (1.7)	1,780 (4.2)	6,765 (3.5)	592 (0.4)

Table VI.3 demographic data shows that mothers less than 19 years old were less likely to have an adverse birth outcome than a healthy birth outcome when compared to women 35 years old and above – they were 34% (*RRR – 0.66*) less likely to have a low birth weight infant, they were 43% (*RRR – 0.57*) less likely to have a preterm infant, and they were 38% (*RRR – 0.62*) less likely to have a low birth weight and premature infant. Compared to White mothers, African American mothers were more likely to have an adverse birth outcome than a healthy birth outcome – they were almost 2 times (*RRR – 1.87*) more likely to have a low birth weight infant, 25% (*RRR – 1.25*) more likely to have a preterm infant, almost 2 times (*RRR – 1.87*) more likely to have a low birth weight and premature infant, and more than 2 times (RRR – 2.19) more likely to have an infant that died within their first year of birth. Mothers with less than a high school education and only a high school education were more likely to have an adverse birth outcome than a healthy birth outcome when compared to women with more than a high school education – those with less than a high school education were about 30% (*RRR – 1.31*) more likely to have a low birth weight infant and 17% (*RRR – 1.17*) more likely to have a preterm infant while those with a high school education were about 17% (*RRR – 1.17*) more likely to have a low birth weight infant, 21% (*RRR – 1.21*) more likely to have a preterm infant, and 52% (*RRR – 1.52*) more likely to have their infant die in the first year of birth.

Table VI.3: Factors Associated with Current Birth Outcome, PRAMS 2009-2013

Measures	LBW	Preterm	LBW & Preterm	Died
	RRR (CI)	RRR (CI)	RRR (CI)	RRR (CI)
Age				
<19	**0.66 (0.48, 0.92)**	**0.57 (0.35, 0.95)**	**0.62 (0.49, 0.81)**	0.85 (0.36, 1.98)
20 to 24	0.89 (0.75, 1.05)	0.89 (0.71, 1.13)	**0.69 (0.61, 0.78)**	0.73 (0.47, 1.08)
25 to 29	**0.81 (0.69, 0.94)**	0.96 (0.79, 1.16)	**0.66 (0.59, 0.73)**	0.81 (0.57, 1.15)
30 to 34	**0.80 (0.69, 0.92)**	0.95 (0.79, 1.13)	**0.77 (0.69, 0.85)**	0.80 (0.56, 1.16)
35+	Ref	Ref	Ref	Ref
Race				
White	Ref	Ref	Ref	Ref
Black	**1.87 (1.63, 2.14)**	**1.25 (1.04, 1.49)**	**1.87 (1.69, 2.06)**	**2.19 (1.56, 3.08)**
Hispanic	1.03 (0.88, 1.19)	1.13 (0.91, 1.42)	1.04 (0.94, 1.16)	0.97 (0.66, 1.43)
Other	**1.29 (1.11, 1.51)**	1.01 (0.83, 1.24)	**1.23 (1.10, 1.39)**	1.40 (0.92, 2.14)
Marital Status				
Unmarried	Ref	Ref	Ref	Ref
Married	0.94 (0.84, 1.06)	0.91 (0.94, 1.30)	**0.76 (0.69, 0.83)**	0.89 (0.66, 1.21)
Education				
<HS	**1.31 (1.12, 1.53)**	1.03 (0.82, 1.29)	**1.17 (1.05, 1.31)**	1.45 (0.99, 2.13)
HS	**1.17 (1.03, 1.32)**	1.07 (0.91, 1.26)	**1.21 (1.10, 1.32)**	**1.52 (1.13, 2.03)**
>HS	Ref	Ref	Ref	Ref
Preg Planned				
No	Ref	Ref	Ref	Ref
Yes	1.03 (0.93, 1.14)	0.99 (0.87, 1.12)	1.03 (0.95, 1.11)	0.95 (0.71, 1.26)

***Bold font indicates statistical significance p-value <0.05**
+RRR – Relative Risk Ratios

Table VI.3 Continued

Measures	LBW	Preterm	LBW & Preterm	Died
	RRR (CI)	RRR (CI)	RRR (CI)	RRR (CI)
Preg Interval				
0-1 year	**1.71 (1.47, 1.98)**	**1.46 (1.22, 1.74)**	**2.45 (2.22, 2.69)**	**1.64 (1.20, 2.24)**
2-5 years	Ref	Ref	Ref	Ref
6+ years	**1.29 (1.15, 1.46)**	0.93 (0.79, 1.11)	**1.33 (1.21, 1.45)**	1.22 (0.87, 1.69)
Hypertension				
No	Ref	Ref	Ref	Ref
Yes	**2.09 (1.76, 2.49)**	**2.73 (2.18, 3.42)**	**3.70 (3.28, 4.17)**	1.23 (0.85, 1.81)
Diabetes				
No	Ref	Ref	Ref	Ref
Yes	1.13 (0.91, 1.39)	**1.55 (1.24, 1.94)**	**1.21 (1.05, 1.41)**	0.75 (0.33, 1.72)
Inter-Pregnancy BMI				
<18.5	**1.60 (1.32, 1.96)**	1.18 (0.82, 1.68)	**1.77 (1.49, 2.09)**	1.07 (0.62, 1.87)
18.5-24.9	Ref	Ref	Ref	Ref
25-29.9	**0.80 (0.71, 0.91)**	1.02 (0.88, 1.19)	0.97 (0.88, 1.05)	1.10 (0.80, 1.51)
30+	**0.68 (0.59, 0.77)**	0.91 (0.77, 1.07)	**0.81 (0.76, 0.92)**	1.07 (0.79, 1.43)
Smoked				
No	Ref	Ref	Ref	Ref
Yes	**2.43 (2.15, 2.753)**	0.94 (0.78, 1.13)	**1.62 (1.47, 1.79)**	**1.74 (1.24, 2.45)**
Drank				
No	Ref	Ref	Ref	Ref
Yes	0.90 (0.75, 1.09)	**0.71 (0.56, 0.92)**	**0.76 (0.65, 0.88)**	0.98 (0.57, 1.69)

***Bold font indicates statistical significance p-value <0.05**
+RRR – Relative Risk Ratios

Table VI.3 Continued

Measures	LBW	Preterm	LBW & Preterm	Died
	RRR (CI)	**RRR (CI)**	**RRR (CI)**	**RRR (CI)**
Previous Birth Out				
Healthy Birth	Ref	Ref	Ref	Ref
LBW Birth	**3.71 (3.16, 4.36)**	1.19 (0.87, 1.64)	**2.38 (2.07, 2.74)**	1.49 (0.79, 2.78)
Preterm Birth	**1.71 (1.44, 2.04)**	**4.14 (3.50, 4.88)**	**2.50 (2.23, 2.81)**	**1.81 (1.22, 2.68)**
LBW & Preterm Birth	**4.03 (3.46, 4.69)**	**4.14 (3.42, 5.01)**	**6.81 (6.10, 7.59)**	**3.09 (2.22, 4.32)**
ICC Checks				
No	Ref	Ref	Ref	Ref
Yes	1.00 (0.85, 1.17)	0.99 (0.82, 1.19)	1.06 (0.95, 1.15)	0.74 (0.53, 1.05)
ICC Counseling				
No	Ref	**Ref**	Ref	Ref
Yes	1.08 (0.95, 1.23)	**1.23 (1.06, 1.44)**	**1.10 (1.01, 1.21)**	1.22 (0.92, 1.62)
ICC Adherence				
No	Ref	Ref	Ref	Ref
Yes	0.96 (0.87, 1.06)	0.95 (0.83, 1.07)	**0.89 (0.82, 0.96)**	0.88 (0.68, 1.13)

***Bold font indicates statistical significance p-value <0.05**
+RRR – Relative Risk Ratios

Among women with high risk factors for adverse birth outcomes, mothers with an inter-pregnancy interval of less than one year were more likely to have an adverse birth outcome than a healthy birth when compared to mothers who had a pregnancy interval of 2-5 years – they were almost 2 times (*RRR – 1.71*) more likely to have a low birth weight infant, 46% (*RRR – 1.46*) more likely to have a preterm birth, about 2.5 (*RRR – 2.45*) times more likely to have a preterm and low birth weight infant, and 64% (*RRR – 1.64*) more likely to have their infant die in the first year of birth. When compared to mothers who did not have hypertension, mothers who had hypertension were almost 4 times (*RRR – 3.70*) more likely to have a low birth weight and preterm infant than a healthy birth, 2 times (*RRR – 2.09*) more likely to have a low birth weight infant than a healthy birth and almost 3 times (*RRR – 2.73*) more likely to have a preterm infant than a healthy birth. Mothers with diabetes were 55% (*RRR – 1.55*) more likely to have a preterm infant than a healthy birth and 21% (*RRR – 1.21*) more likely to have a preterm and low birth weight infant compared to mothers who did not have diabetes. Mothers who were underweight were 60% (*RRR – 1.60*) more likely to have a low birth weight infant and almost 2 times (*RRR – 1.77*) more likely to have a low birth weight and preterm infant than a healthy birth compared to mothers who had a normal weight. On the other hand, being obese appeared to be protective against having a low birth weight infant (*RRR – 0.68*) and having a low birth weight and preterm birth (*RRR – 0.81*). The data showed that when compared to mothers who did not smoke during the last 3 months of pregnancy, those who did were about 2.5 times (*RRR – 2.42*) more likely to have a low birth weight infant than a healthy birth, about 60% (*RRR – 1.62*)

more likely to have a low birth weight and preterm birth, and 74% (*RRR – 1.74*) more likely to have their infant die in the first year of birth. The data showed that having a previous adverse birth outcome was the strongest predictor of a subsequent adverse birth outcomes where mothers who had a previous low birth weight infant were almost 4 times (*RRR – 3.71*) more likely to report that they their subsequent birth was a low birth weight infant, those who had a previous preterm birth were 4 times (*RRR – 4.14*) more likely to report that they had a subsequent preterm birth, women who reported that their previous birth was both a preterm and low birth weight infant were almost 7 times (*RRR – 6.73*) more likely to report the same for their subsequent birth, and those who reported a previous low birth weight and preterm birth were 3 (*RRR – 3.09*) times more likely to report that their subsequent birth died within the first year of birth.

Of the three different interconception care indicators assessed, the data showed that women who reported that they received counseling on their family medical history were 23% (*RRR – 1.23*) more likely to report that they had a preterm infant than a healthy birth and 10% (*RRR – 1.10*) more likely to report that they had a low birth weight and preterm birth than a healthy birth. On the other hand, adhering to interconception care recommendations regarding regular exercise and a healthy diet appeared to be protective against having a low birth weight and preterm birth (*RRR – 0.89*).

DISCUSSION

A review of the current literature shows that this is one of the first studies to explore the association between receipt of and adherence to interconception care and subsequent birth outcome at a population level. This study used three indicators to assess respondents' receipt of and/or adherence to interconception care – inter-pregnancy chronic disease screening/treatment, inter-pregnancy counseling on one's family medical history, and inter-pregnancy exercise and healthy dieting. These indicators were selected because they align with those highlighted by Institute of Medicine and the Centers for Disease Prevention and Control regarding behaviors that should be addressed during well-woman visits to prevent adverse birth outcomes (Johnson and Gee, 2015; Livingood et al. 2010). These behaviors include healthy eating, regular exercise, contraception use, dental check-ups, immunizations; and screenings and treatment that should be provided to help prevent and manage various health conditions including obesity, chronic disease, depression, STIs, and substance abuse (Johnson and Gee, 2015; Livingood et al. 2010). This study found that overall, during the interconception care period about 15% of the study sample reported that they were screened for diabetes and/or hypertension, 28% reported that they received counseling on their family medical history, and 51% reported that they adhered to interconception care recommendations regarding engagement in exercise at least 3 times a week and/or maintaining a healthy diet. Study results also showed that many of those noted risk factors were statistically significant predictors of adverse birth outcomes in this study – e.g. race/ethnicity (being

African American), short inter-pregnancy intervals, history/presence of chronic conditions, substance abuse and having a previous adverse birth outcome.

In the United States, non-Hispanic African American women have repeatedly experienced the worst birth outcomes – e.g. recent national data show that African American infants are more likely than White infants to be premature, low birth weight, and to die in the first year of birth (Borrell et al. 2016; Ruiz et al. 2014). This was confirmed by study results which showed that when compared to White mothers, African American mothers were almost 2 times more likely to have a low birth weight infant, 25% more likely to have a preterm infant, they were almost 2 times more likely to have a low birth weight and premature infant, and more than 2 times more likely to have an infant that died within their first year of birth. Researchers explain that that the differences in birth outcomes between African American and White women can be attributed to socioeconomic gradients in health (Loggins et al. 2014). Specifically, compared to African American women, White women have access to more socioeconomic resources including higher levels of educational attainment, income, and employment (Loggins et al. 2014). Several studies have found a relationship between socioeconomic status and birth outcomes. According to Wallace et al. (2016), preterm birth rates are consistently higher among women who are socio-economically disadvantaged (no insurance coverage and lower levels of educational attainment, income, and employment). Overall, women who are socio-economically disadvantaged often have the most to gain from interconception care because they are more likely to be

in poorer health and to lack the knowledge and resources needed to improve their pregnancy outcomes (Coffey et al. 2014).

Study results showed that when compared to mothers with an inter-pregnancy interval of 2-5 years, mothers with an inter-pregnancy interval of less than one year were almost 2 times more likely to have a low birth weight infant, 46% more likely to have a preterm birth, about 2.5 times more likely to have a preterm and low birth weight infant, and 64% more likely to have their infant die in the first year of birth. A number of studies have examined the association between inter-pregnancy interval and birth outcomes. These studies note that shorter inter-pregnancy intervals are associated with increased risk of adverse birth outcomes (Bryant et al. 2006; Cheslack et al. 2015; Davis et al. 2014; Khoshnood et al. 1998; Tierney-Gumaer & Reifsnider, 2008). For example, studies show that inter-pregnancy intervals of less than 1 year and those of less than 6 months are associated with increased risk of preterm delivery, low birth weight births and/or small for gestational age births (Bryant et al. 2006; Cheslack et al. 2015; Davis et al. 2014; Khoshnood et al. 1998; Tierney-Gumaer & Reifsnider, 2008). In addition, comparisons between mothers with inter-pregnancy intervals of more than 1 year and those with inter-pregnancy intervals of less than 6 months showed that the shorter intervals were associated with an estimated 50-80% increased risk for very low birth weight births and a 30-90% increased risk for very preterm delivery (Khoshnood et al. 1998).

Hypertensive disorders are the most frequently reported chronic condition during pregnancy (Lu et al. 2006). Of the 4 million women who delivered a live birth in the

United States in 2002, over 150,000 reported gestational hypertension, over 3,000 had chronic hypertension, and almost 13,000 had eclampsia (Lu et al. 2006). Women who have chronic hypertension (whether or not it is controlled) are more likely to experience pregnancy complications including fetal growth restriction, stillbirth, preterm birth and preeclampsia (Callegari et al. 2015). The second most frequently reported chronic condition during pregnancy is diabetes (Lu et al. 2006). In the United States, in 2002, over 130,000 women reported having diabetes during pregnancy and this number continues to rise with the high rate of obesity in the United States (Callegari et al. 2015; Lu et al. 2006). For women with pre-gestational diabetes, their fetuses are at increased risk for stillbirth, congenital anomalies, macrosomia, birth trauma, and newborn hypoglycemia (Callegari et al. 2015; Lu et al. 2006; Steel et al. 2015). While there has been extensive research on the impact of these chronic diseases on birth outcomes, many diagnosed with these conditions remain underserved during the interconception period, especially if they have given birth to a previously healthy infant (Lu et al. 2006). These findings were confirmed by study results. This study found that when compared to mothers who did not have hypertension, mothers who had hypertension were almost 4 times more likely to have a low birth weight and preterm infant than a healthy birth, 2 times more likely to have a low birth weight infant than a healthy birth and almost 3 times more likely to have a preterm infant than a healthy birth. This study also found that mothers with diabetes 55% more likely to have a preterm infant than a healthy birth and 21% more likely to have a preterm and low birth weight infant compared to mothers who did not have diabetes.

There have been significant declines in prenatal smoking over the past 10 years; however, about 10-12% of women still smoke during pregnancy (Adams et al. 2013). Various studies note that maternal smoking during pregnancy is one of the most critical and preventable factors that adversely affect birth outcomes (Adams et al. 2013; Beyerlein et al. 2011; Gavin et al. 2012; Tierney-Gumaer & Reifsnider, 2008; Tong et al. 2013; Weiss & Chambers, 2013; Witt et al. 2015; Zheng et al. 2016). Despite this, almost 12% of study participants reported that they smoked during the last three months of pregnancy. Data analyses showed that compared to mothers who did not smoke in the last 3 months of their pregnancy, mothers who did smoke were about 2.5 times more likely to have a low birth weight infant than a healthy birth, about 60% more likely to have a low birth weight and preterm birth, and 74% more likely to have their infant die in the first year of birth. These associations are supported by various studies which highlight that smoking during pregnancy is associated with various adverse birth outcomes including low birth weight, preterm birth, restricted fetal growth, sudden infant death syndrome and birth abnormalities (Adams et al. 2013; Anderson et al. 2014; Beyerlein et al. 2011; Chen 2012; Gavin et al. 2012; Tierney-Gumaer & Reifsnider, 2008; Tong et al. 2013; Weiss & Chambers, 2013; Witt et al. 2015; Zhang et al. 2011; Zheng et al. 2016).

These results confirm the need for a more aggressive approach to increasing interconception care awareness, access and compliance. Interconception care and services should be provided to all women between pregnancies; however, it is especially important for high risk women – e.g. women who suffer from chronic conditions

(including hypertension and diabetes), women who partake in different substances and women who have had a previous adverse birth outcome. Current studies have shown that it is easier to identify women at risk for adverse birth outcomes in clinical settings and to refer them to needed health care and services (Oza-Frank et al. 2014). Interconception care is especially important for these high risk women because many of these conditions/factors can remain unaddressed and are likely to persist and influence future pregnancies – i.e. putting these women at risk for reoccurring adverse pregnancies. Varner et al. (2016) note that many women are unaware of the associations between these risk factors and adverse pregnancy outcomes. However, because women with prior adverse birth outcomes can be easily identified, interventions can be developed that address their specific health needs and can be delivered during the interconception period to help decrease the possibility of repeat adverse birth outcomes (Badura et al. 2008; Malnory et al. 2011). This study showed that women who reported that they received counseling about their family medical history were received counseling on their family medical history were 23% more likely to report that they had a preterm infant than a healthy birth and 10% more likely to report that they had a low birth weight and preterm birth than a healthy birth. These results highlight that many high risk women face multiple factors that put them at risk for adverse birth outcomes including food insecurity; poor living conditions; limited access to quality health care, services and treatment and lack of health coverage. In the absence of interventions that can address these barriers, many of these women will continue to experience adverse birth outcomes. On the other hand, study results also showed that among women who reported that they

adhered to interconception care recommendations regarding regular exercise and a healthy diet, 11% were less likely to report that they had a low birth weight and preterm birth infant compared to those who reported that they did not adhere to these recommendations. Thus, these results confirm the importance of health policies that allow and encourage better healthy living though access to quality food, services and health care specifically for low income women who are often most at risk for noted health concerns.

Strengths and Limitations

The primary strength of this study is the use of the PRAMS dataset across multiple years. First, many of PRAMS' questions are consistent over the different phases of the survey and this allows tracking of different measures across time periods. This allowed for a larger sample size and increased the generalizability of the study results. Second, PRAMS provided a unique and reliable source of data for the proposed research question. It has been identified as the primary data source to monitor national progress toward preconception and interconception care goals and objectives (Oza-Frank et al. 2014).

The use of this dataset also comes with various limitations. First of which is the lack of a specific question in the PRAMS survey regarding utlization of interconception care and the measures used to operationalize interconception care in this study. The measures used to assess interconception care were taken from PRAMS questions that ask about participants' pregnancy readiness behavior during the 12 months before they became pregnant with their new baby. These behaviors were used to operationalize

interconception care by focusing on the population that had a previous birth and thus, allowed an assessment of participants' pregnancy preparation behaviors during the interconception period. They align with the preconception and interconception care indicators that the IOM and CDC notes should be addressed during well-woman visits (Johnson and Gee, 2015; Livingood et al. 2010). Secondly, the measures used to assess receipt of interconception care are very specific and limited in their ability to measure overall receipt of interconception care. While health care screenings and health care counseling are both noted types of care that should be received during the interconception period, they are only able to provide information on whether or not women in this study received these types of interconception care. Thirdly, due to the limited research available on interconception care, much of the literature reviewed has focused on preconception care. And while there are many similarities between preconception and interconception care, it limits the inferences that can be made from study results. Thus, much of the research assessed in this study is still exploratory because there isn't sufficient evidence regarding the effectiveness of interconception care services in reducing adverse birth outcomes (and infant mortality rates). In addition, the variables used to measure interconception care were operationalized by creating a subpopulation of women who had a previous birth. This subpopulation was created using data that corresponded to the question - *did you have a previous live birth*; and as a result, women who experienced a previous miscarriage or stillbirth were not included in this study sample. This exclusion limits the generalizability of interconception care use among women with different adverse birth outcomes. Finally, this study is limited

because of the cross-sectional nature of the PRAMS dataset. This study design limited the inferences that could be made from study results and was susceptible to misclassification due to recall bias.

Conclusions and Implications

There is growing evidence which links interconception care to improved perinatal outcomes; however, despite national recommendations, study results showed that 85% of the study sample reported that they did not receive inter-pregnancy health screenings/treatment, 72% reported that they did not receive inter-pregnancy health counseling, and 49% reported that they did not adhere to interconception care recommendations regarding regular exercise and healthy eating. Thus, despite calls for primary care physicians to provide universal preconception and interconception care, very few asked women about their pregnancy intentions, provided future pregnancy counseling and/or discuss how family history, current health and/or medications can impact pregnancy outcomes (Batra et al. 2016; Callegari et al. 2015). Studies also show that roughly 17% of obstetrician/gynecologists/family physicians provided preconception or interconception care to the majority of women that they gave prenatal care and that barely 50% of women at risk for pregnancy and/or an adverse pregnancy received pre-pregnancy or inter-pregnancy counseling and care (Biermann et al. 2006; Coffey et al. 2014; Malnory et al. 2011). Coffrey et al. (2014) notes that one of the greatest barriers to widespread implementation of care is the "absence of agreed upon, uniform guidelines for clinical practice, and the absence of uniform tools for assessing the health of women who would benefit from preconception and interconception care

services" (Coffey et al. 2014). The researchers note that interconception care services continue to be fragmented and inconsistent, difficult to access, difficult to translate into practice and poorly understood by many women (Beckmann et al. 2014; Coffey et al. 2014; Lu et al. 2006). Thus, current recommendations suggest incorporating these services into routine primary care and well-woman visits to take advantage of every routine visit and encourage ongoing health promotion and disease prevention. Studies are needed to explore how such interventions would affect overall utilization of interconception care as well as its impact on birth outcomes. Recruiting women into interconception and preconception care programs without a specific problem and time period is difficult; thus, preconception and interconception health promotion and disease prevention should be integrated into a continuum of care throughout the woman's lifespan.

CHAPTER VII

SUMMARY AND CONCLUSIONS

OVERVIEW OF FINDINGS

The aims of this dissertation were to 1) to examine the risk factors associated with self reported receipt of interconception care, 2) to identify the risk factors associated with health insurance coverage during the interconception period, and 3) to investigate the association between interconception care and subsequent birth outcome. The Pregnancy Response Assessment Monitoring System (PRAMS) national dataset was used for this analysis. The data was collected over a five year period (2009 to 2013) and 33 states participated during this data collection period

Study 1 results showed that less than a third of mothers reported receipt of both types of interconception care services where 15.1% reported receipt of inter-pregnancy chronic disease checks/treatment and 27.9% reported receipt of inter-pregnancy health counseling on their family medical history. In addition the results showed that across the various risk factors (diabetes, hypertension, obese, previous adverse birth outcome), over 80% of those who fell into those categories reported that they did not receive either form of interconception care.

Study 2 results showed that about 52% of the study sample reported that they had private insurance, 22% reported that they were covered by Medicaid, and 23% reported that they were uninsured. The results confirmed current studies that note that high risk women are more likely to be on Medicaid where women who reported that they were

hypertensive were 37% more likely to be on Medicaid compared to the women who were not hypertensive; those with a previous adverse birth outcome were 27% more likely to be on Medicaid than those with a previous healthy birth; and African American women were 2 times more likely to be on Medicaid than their White counterparts.

This study found that overall, during the interconception period about 15% of the study sample reported that they were screened for diabetes and/or hypertension, 28% reported that they received health counseling on their family medical history, and 51% reported that they adhered to interconception care recommendations regarding engagement in exercise at least 3 times a week and/or maintaining a healthy diet. However, many of the noted risk factors were statistically significant predictors of adverse birth outcomes in this study – e.g. race/ethnicity (being African American), short inter-pregnancy intervals, history/presence of chronic conditions, substance abuse and previous adverse birth outcome. These results confirm the need for a more aggressive approach to increasing interconception care awareness, access and compliance.

CONCLUSION AND IMPLICATIONS

Study results showed that many of those noted risk factors were statistically significant predictors of subsequent adverse birth outcomes – e.g. race/ethnicity (being African American), short inter-pregnancy intervals, history/presence of chronic conditions, substance abuse and previous adverse birth outcome. A summary of the results for Study 3 showed that compared to White mothers, African American mothers were almost 2 times more likely to have a low birth weight infant and a low birth weight

and premature infant, and 2.2 times more likely to have an infant that died within their first year of birth. Compared to mothers who had a pregnancy interval of 2-5 years, mothers with an inter-pregnancy interval of less than one year were about 2.5 times more likely to have a preterm and low birth weight infant than a healthy birth and 64% more likely to have their infant die in the first year of birth. When compared to mothers who did not have hypertension, mothers who had hypertension were almost 4 times more likely to have a low birth weight and preterm infant than a healthy birth. Mothers with diabetes were 55% more likely to have a preterm infant than a healthy birth when compared to mothers who did not have diabetes. When compared to mothers who did not smoke during the last 3 months of pregnancy, those who did were about 2.5 times more likely to have a low birth weight infant than a healthy birth and 74% more likely to have their infant die in the first year of birth. The data showed that having a previous adverse birth outcome was the strongest predictor of a subsequent adverse birth outcomes where mothers who had a previous low birth weight infant were almost 4 more likely to report that they their subsequent birth was also a low birth weight infant, those who had a previous preterm birth were 4 times more likely to report that they also had a subsequent preterm birth, women who reported that their previous birth was both a preterm and low birth weight infant were almost 7 times more likely to report the same for their subsequent birth, and those who reported a previous low birth weight and preterm birth were 3 times more likely to report that their subsequent birth died within the first year of birth. These results highlight what has repeatedly been shown in the literature, that women who experience certain risk factors are high risk for repeat

adverse birth outcomes. In addition, high risk women require tailored interventions that can address these risk factors to prevent/reduce subsequent adverse birth outcomes.

In Study 1 I discuss that one such intervention strategy is to provide these populations with interconception care which is defined as care, counseling and auxiliary services provided to a woman and her family from the delivery of one newborn until the conception of the next. Interconception care interventions are developed to address the risks and complications associated with a previous adverse pregnancy, encourage inter-pregnancy intervals of two or more years, improve overall health before future pregnancies and reduce the risk of subsequent adverse birth outcomes. Care should include: reproductive planning; contraception counseling; STI and HIV/AIDS screening and counseling; domestic violence counseling; immunizations; chronic disease screening; depression screening and counseling, substance use cessation, and nutrition education. Providing preventive care during the interconception period is an ideal time to reduce risk factors because it is easy to identify high risk women in clinical settings and to provide counseling, care and referrals based on needed care and services. Study 1 results confirm that despite low rates of receipt of interconception care within this study sample, high risk women were more likely to receive inter-pregnancy chronic disease screenings/treatment and inter-pregnancy health counseling than their counterparts. For example, Study 1 showed that compared to White mothers, African American mothers were almost 2 times more likely to receive inter-pregnancy chronic disease screenings/treatment and 18% more likely to receive counseling on their family medical history. Mothers who reported that they were hypertensive were 32% more likely to

receive health counseling on their family medical history compared to mothers who did not report having hypertension. And mothers who had a previous adverse birth outcome were over 30% more likely to report receipt of interconception care services than those who reported that their previous birth was a healthy birth. However, despite results that showed that high risk women were more likely to receive interconception care services, both Study 1 and 3 confirm that rates of interconception care were very low within this study sample. Study results showed that overall, 15% of the study sample reported that they received inter-pregnancy chronic disease screenings/treatment, 28% reported that they received inter-pregnancy health counseling and 51% reported that they adhered to interconception care recommendations regarding engagement in exercise at least 3 times a week and having a healthy diet. Thus, these results showed that despite national calls for delivery of interconception care to high risk women, many are not receiving these needed services.

Study 3 highlights that some of the barriers to receipt of interconception care have to do with a lack of standardized care and that many physicians are not delivering these services to their patients. Studies by Batra et al. (2016) and Callegari et al. (2015) note that very few physicians asked their patients about their pregnancy intentions, provided future pregnancy counseling and/or discussed how family history, current health and/or medications can impact pregnancy outcomes. Coffrey et al. (2014) acknowledges that the "absence of agreed upon, uniform guidelines for clinical practice, and the absence of uniform tools for assessing the health of women who would benefit from preconception and interconception care services" is one of the greatest barriers to

widespread implementation of care is. Researchers note that the lack of standard guidelines leads to interconception care services that are fragmented and inconsistent, difficult to access, difficult to translate into practice and poorly understood by many physicians and their patients (Beckmann et al. 2014; Coffey et al. 2014; Lu et al. 2006). Another critical barrier to receipt of interconception care is the lack of health insurance coverage. Study 1 results showed that women who had health insurance coverage were almost 2 times more likely to receive inter-pregnancy chronic disease screening/treatment and inter-pregnancy health counseling compared to mothers who did not have insurance. Despite this, Study 2 results showed that in the month before their current pregnancy, 23% of the study sample reported that they were uninsured, 22% reported that they were covered by Medicaid, and about 52% of the study sample reported that they had private insurance. Thus, over 20% of the study sample did not have any form of insurance during the interconception period; i.e. high risk women within the study sample who did not have any form of insurance would have limited access to quality health care services. The results also showed that over 20% of the study population was dependent on Medicaid for health coverage during the interconception period. Study 2 results regarding Medicaid coverage confirmed studies done by the Centers for Medicare and Medicaid Services – that women and children on Medicaid are usually at higher risk of pregnancy complications and adverse birth outcomes compared to women with employee-based or private insurance (Zhang et al. 2013). Study 2 results showed that women who reported that they were hypertensive were 37% more likely to be on Medicaid compared to the women who were not hypertensive; those who were

underweight, overweight and obese were less likely to have private insurance compared to those who had a normal weight; and compared to women with a previous healthy birth, those with a previous adverse birth outcome were 27% more likely to be on Medicaid. These results highlight the importance of Medicaid coverage among high risk women – that many are only able to access needed health care services because of their access to this coverage. These results also highlight the importance of the Patient Protection and Affordable Care Act (ACA) provisions which are working to expand Medicaid eligibility to all women who fall under 138% of the federal poverty level. This expansion will ensure that women have access to health insurance coverage during their pregnancy and during preconception and interconception periods. As a result of this expansion and other ACA provisions including the preventing sex rating, extending coverage for young adults below 26 through their parents' insurance, prohibiting denial of coverage based on preexisting conditions (Blumberg & Holahan, 2016; McCarthy, 2015; Salganicoff et al. 2014; Zhao et al. 2017); as of 2015, uninsured rates among adults 18-64 have dropped to 10.5% compared to 20% in 2009 (D'Angelo et al, 2015; KFF, 2016; Graves & Nikpay, 2017).

Overall, these three studies have shown that women who experience noted risk factors are high risk for repeat adverse birth outcomes if these factors are not addressed. Fortunately, advancements in medicine and public health have made it easy to identify such women in clinical settings and provide needed care, counseling, treatment and referrals. However, we needed to develop standardized forms of care and we need to train health care providers to ensure that they provide needed services to all their

patients, especially those most vulnerable. We also need to ensure that targeted interventions address the multiple barriers that many high risk women face including access to: quality and affordable health care, clinics, and providers; health coverage; and other socioeconomic factors including healthy food; proper housing; and safe neighborhoods. In the absence of interventions and policies that can address the systemic barriers to care; interventions that focus solely on individual health behaviors will be inadequate to reduce the rates of adverse birth outcomes and infant mortality experienced by high risk women.

LIMITATIONS

The use of this dataset comes with various limitations. The first of which is the lack of a specific question in the Pregnancy Risk Assessment Monitoring System (PRAMS) survey regarding utilization of interconception care. The measures used to assess interconception care were taken from PRAMS questions that ask about participants' pregnancy readiness behavior during the 12 months before they became pregnant with their new baby. These behaviors were used to operationalize interconception care by focusing on the population that had a previous birth and thus, allowed for an assessment of participants' pregnancy preparation behaviors during the interconception period. Second, the measures used to assess interconception care are very specific and can only provide information on whether or not women in this study received these specific types of interconception care. Third, the variable used to measure insurance status during the interconception period assessed whether respondents had

insurance in the month before they got pregnant. It does not account for whether the respondents' insurance status changed, it does not include all possible forms of insurance and it does not account for respondents who had multiple forms of insurance. As a result, this variable only provides information at one point in time during the interconception period and ultimately limits the conclusions that can be inferred from study results. Fourth, due to the limited research available on interconception care, much of the literature reviewed has focused on preconception care. And while there are many similarities between preconception and interconception care, it limits the inferences that can be made from study results. Thus, much of the research assessed in this study is still exploratory because there isn't sufficient evidence regarding the effectiveness of interconception care services in reducing adverse birth outcomes (and infant mortality rates). Fifth, the variables used to measure interconception care and inter-pregnancy health insurance coverage were operationalized by creating a subpopulation of women who had a previous birth. This subpopulation was created using data that corresponded to the question – *did you have a previous live birth; and* as a result, women who experienced a previous miscarriage or stillbirth were not included in this study sample. This exclusion limits the generalizability of interconception care use among women with different adverse birth outcomes. Finally, there are limitations to these studies because of the cross-sectional nature of the PRAMS dataset. This study design limited the inferences that could be made from study results and was susceptible to misclassification due to recall bias.

FUTURE RESEARCH

Due to noted limitations, study results are still exploratory. As a result, further research is needed to examine noted associations and expound on study results. For example, further research is needed to examine the effects of Medicaid expansion provisions on access to health insurance coverage among low income, high risk women during the interconception period. In addition, further research is needed to identify relevant and useful measures of interconception care and explore how various forms of interconception care influence subsequent birth outcomes.

Many low income women lose insurance 6 weeks postpartum and thus, are unable to access needed health care and/or address health conditions during the interconception period. At the time of this research, de-identified, publicly available PRAMS data was not available past 2013and many of the Patient Protection and Affordable Care Act (ACA) provisions (including the Medicaid expansion provisions) were not fully implemented across the United States. As a result, this dissertation was not able to explore the impact of ACA on access to health insurance coverage during the interconception period. Thus, further research is needed to explore access to Medicaid during the interconception period, before the implementation of ACA and upon complete implementation of all ACA provisions. Furthermore, in light of possible changes to current health care policies, research is needed to examine how these changes ultimately affect health insurance coverage among low income women as well as health insurance coverage during the interconception period.

The PRAMS dataset used in this study was based on phase 6 and phase 7 survey instruments. These survey phases do not ask respondents specific questions regarding whether they received interconception care. Thus, for the purposes of this study interconception care was operationalized by creating a subpopulation of women who had a previous birth and using survey questions related to the respondents' pre-pregnancy preparation. More research is needed to explore the usefulness of these interconception care indicators. Furthermore, with current confusion regarding timing for interconception care, it is important to explore the effectiveness of some of the methods being used to increase utilization of interconception care. For example, there is a push towards incorporating interconception care into women's annual well woman exams; thus, studies are needed to explore how this would affect overall utlization of interconception care as well as its impact on birth outcomes.

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