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Valerie Godoshian Date

Predictors of Prenatal Care Among Case & Control Mothers
in the National Birth Defects Prevention Study, 1997-2009

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Predictors of Prenatal Care Among Case & Control Mothers in the National Birth Defects Prevention Study, 1997-2009

By

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2013

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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2015

Abstract

Predictors of Prenatal Care Among Case & Control Mothers
in the National Birth Defects Prevention Study, 1997-2009
By Valerie Godoshian

Background: Prenatal care, one of the most highly utilized health care services in the United Sates, is associated with positive pregnancy outcomes among women and their babies. The majority of pregnant women obtain prenatal care at some point during their pregnancy. However, annually 1.5-2.0% of pregnant women are not receiving prenatal care. Women who give birth without having had prenatal care at any point during their pregnancy put their baby's health at risk.

Methods: This study analyzed data from the National Birth Defects Prevention Study (NBDPS); a population based multi-center case control study, to assess predictors of prenatal care among 37,816 women (27,673 cases and 10,143 controls). Crude and adjusted odds ratios (ORs), as well as corresponding 95% confidence intervals (CIs), were calculated for newly proposed predictor variables (i.e. previous pregnancy outcomes, maternal health and stress/social support). Known predictor variables from the literature were used as covariates.

Results: A total of 98.8% (n=37,346) of women reported obtaining prenatal care during pregnancy and 1.2% (n=470) of women reported no prenatal care during pregnancy. Compared with women reporting no prenatal care, women reporting prenatal care were more likely to: be non-Hispanic white; have an educational attainment beyond high school; have a household income of >$40,000; want to be pregnant at the time of conception; and report alcohol use from B3 to P9. These women were less likely to: be multiparous; report tobacco use from B3 to P9; and less likely to report illicit drug use from B3 to P9. Significant associations were found for history of miscarriage(s), morning sickness, emotional support, financial help and low stress/low support.

Conclusions: The data suggest that history of miscarriage(s), morning sickness, emotional support, financial help and low stress/low support may be associated with prenatal care utilization among women. Future research should continue to examine potential predictors of prenatal care, to help inform interventions targeted at increasing use among pregnant women in the United States.

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CHAPTER I: INTRODUCTION

Problem Definition

Prenatal care, one of the most highly utilized health care services in the United States (Kogan et al., 1998), has been associated with positive pregnancy outcomes among women and their babies (Cha & Masho, 2014; Goldenberg, Patterson, & Freese, 1992; Phillippi, 2009). Prenatal care is the medical care that a woman receives for her pregnancy (March of Dimes, 2014), and involves conducting a history intake and physical exam, screening and diagnostic testing, ongoing examinations throughout pregnancy to observe the progression of both the mother and fetus' health, and providing maternal education (Phelan, 2008). Fortunately, the majority of pregnant women obtain prenatal care at some point during their pregnancy (Healthy People, 2014). However, annually 1.5-2.0% of women are receiving no prenatal care (Elam-Evans, Gargiullo, & Marks, 1996; Taylor, Alexander & Hepworth, 2005). Women who give birth without having had prenatal care at any point during their pregnancy, put their baby's health at risk; their babies are three times more likely to be born at low birth weight and five times more likely die (U.S. Department of Health and Human Services, n.d.a).

Prenatal care is deemed a public health intervention (Alexander & Kotelchuck, 2001), as recommended use can reduce overall rates of mortality and morbidity for both the infant and mother (CDC, 2008). The United States is regarded as having one of the highest infant mortality rates in comparison to other developed nations (Guadagno, Mackert, & Rochlen, 2013). In 2011, an estimated 24,000 infants died (Centers for Disease Control and Prevention (CDC), 2014b) and two-thirds of infant deaths are among infants born preterm (Callaghan, MacDorman, Rasmussen, Qin, & Lackritz, 2006). The

CDC estimates that in 2005 the U.S. health care system spent $26 billion on preterm births (CDC, 2014c). Prenatal care has also been associated with a reduced risk of preterm births, as well as low birthweight (Brady, Visscher, Feder, & Burns, 2003; Friedman, Heneghan, & Rosenthal, 2009; Kotelchuck, 1994; Vintzileos, Ananth, Smulian, Scorza, & Knuppel, 2002). An estimated 8% of all preterm births result in a birth defect (The American Congress of Obstetricians and Gynecologists (ACOG), 2012). However, prenatal care is also associated with a reduction in rates of infant disability, most likely related to prenatal diagnosis of fetal anomalies (Fuchs & Peipert, 2005).

In addition to infant health outcome improvements, it has also been shown that prenatal care benefits mothers' behavioral outcomes, and in turn their baby's health. For example, studies have documented prenatal care associations with decreased rates of post-partum smoking, as well as increased well-baby vists among mothers (Riechman, Corman, Noonan, & Schwartz-Soicher, 2010). Additionally, prenatal care often motivates women to change unhealhty behaviors during pregnancy, such as alcohol use, drug use and poor nutrition (Hauser, Brown & Prosser, 1997).

As made evident, prenatal care not only decreases the risk of pregnancy complications and poor birth outcomes, but also helps to improve maternal behavior during pregnancy. Consequently, Healthy People 2020 aims to improve participation in prenatal care among pregnant women in the United States by 2020 using a target of 10% improvement (Healthy People, 2014). The goal is to increase the number of pregnant women obtaining early and adequate prenatal care from 70.5% to 77.6%. (Healthy People, 2014). Fortunately, there have been numerous studies examining predictors of prenatal care utilization to assess why pregnant women are or are not seeking necessary

treatment. The literature has shown associations between a variety of prenatal care predictors, including maternal age, race-ethnicity, education, income, parity, pregnancy intention, substance use, stress and social support. Results consistently indicate that pregnant women who are not receiving prenatal care are likely to: be younger, a member of a minority race-ethnicity, be multiparious, have low educational attainment, have a low income, have an unplanned or unwanted pregnancy, use substances such as alcohol, tobacco and illicit drugs, experience high levels of stress and experience low levels of social support. (Brady, Visscher, Feder, & Burns, 2003; Bryant, Worjoloh, Cougher, & Washington, 2010; Cheng, Schwarz, Douglas, & Horon, 2009; Child Trends Data Bank, 2014; Kost & Lindberg, 2015; Daniels, Noe, & Mayberry, 2006; Feijen-de Jong et al., 2011; Friedman, Hengan, & Rosenthal, 2009; Huston, Geese, & Diaz, 2008; Johnson et al., 2007; Nothnagle, Marchi, Egerter, & Bravemen, 2000; Maupin et al., 2004; Phillippi, Myers, & Schorn, 2014; Schetter & Glynn, 2011; Riechman, Corman, Noonan, & Schwartz-Soicher, 2010).

While this information is crucial to understanding charactersitics of non-prenatal care users, as well as potential populations to target interventions, there are additional areas that should be assessed to continue to look at predictors of prenatal care. The Health Belief Model helped to guide the selection of new potential predictor variables for this study.

Theoretical Framework

The Health Belief Model (HBM) guided this study of understanding prenatal care utilization among pregnant women in the United States. In the 1950's, the HBM was developed by the U.S. Public Health Service task force to provide a framework for

increasing the use of preventative health services, and to assist in understanding why some individuals fail to use these services. The HBM posits that the utilization of preventative health services is motivated by individuals' perceived threat and fear of disease. Other factors that contribute to the individuals' perceptions that influence health behaviors were also incorporated, such as sociodemographic characteristics. Constructs of the HBM include: perceived susceptibility, perceived severity, perceived threat, perceived benefits, perceived barriers, cues to action and self-efficacy (Figure 1). (Glanz, Rimer, & Viswanath, 2008)

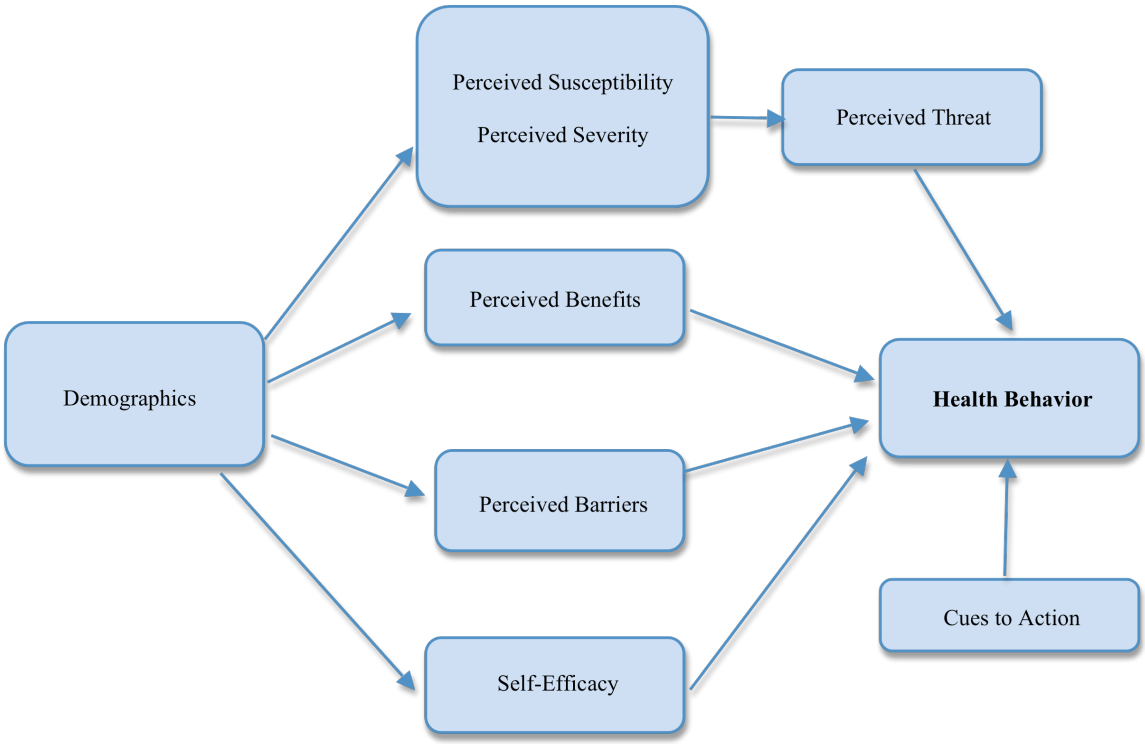

Figure 1. Health Belief Model (Glanz, Rimer, Viswanath, 2008)

Perceived susceptibility is defined as an individual's perception of his or her own risk of disease or condition (Glanz, Rimer, & Viswanath, 2008). In pregnancy, perceived susceptibility would be the woman's perception of her risk of having a poor birth outcome (e.g. stillbirth, miscarriage, etc.). Perceived severity is defined as whether or not an individual perceives the risk of disease or condition as severe, especially if action is not taken (Glanz, Rimer, & Viswanath, 2008). In other words, this would be a pregnant woman's perception of having a pregnancy complication or poor birth outcome if prenatal care is not sought. Together, perceived susceptibility and perceived severity make up perceived threat (Glanz, Rimer, & Viswanath, 2008).

Perceived benefits refer to the individual's perceived positive value that carrying out the specific health behavior will have (Glanz, Rimer, & Viswanath, 2008). Therefore, this would involve a woman's perception of the benefits that would arise from seeking prenatal care during pregnancy. Perceived barriers refer to the individual's perceived costs that carrying out the specific health behavior would have (Glanz, Rimer, & Viswanath, 2008), or in other words, a woman's perception of barriers to seeking prenatal care during pregnancy.

Self-efficacy refers to the confidence that an individual has in regards to his or her ability to successfully carry out the health behavior (Glanz, Rimer, & Viswanath, 2008). A woman may or may not feel confident in herself to obtain prenatal care during pregnancy. Lastly, cues to action are internal or external triggers that prompt an individual to initiate the health behavior (Glanz, Rimer, & Viswanath, 2008), or in this case, triggers that prompt a woman to seek prenatal care.

The Health Belief Model predicts that women will be more likely to utilize prenatal care during pregnancy if they feel susceptible to pregnancy complications or poor birth outcomes, think that not obtaining prenatal care can lead to serious consequences for the health of themselves or their baby, perceive benefits to prenatal care as outweighing the barriers, have high self-efficacy for obtaining prenatal care, and receive a cue to action. As a result, the HBM informed new, understudied exposure areas to examine in relation to prenatal care utilization in order to continue to understand women's motivations to seek care.

Purpose & Justification

The purpose of this study was to utilize the National Birth Defects Prevention Study (NBDPS) and the Health Belief Model to examine associations between proposed predictor variables and prenatal care utilization. Proposed predictors included variables known to be associated with prenatal care from the literature: maternal age, race-ethnicity, education, income, parity, pregnancy intention and substance use (alcohol, tobacco and illicit drugs), as well as three newer, understudied exposure areas: previous pregnancy outcomes (i.e. stillbirth, miscarriage, induced abortion), maternal health (i.e. diabetes, high blood pressure, seizures, morning sickness, fertility procedures/medications) and the relationship between stress and social support.

New exposure variables, determined through utilization of the Health Belief Model (Figure 2), specifically addressed perceived threat, perceived barriers and cues to action. In terms of perceived threat, it was hypothesized that a woman with a previous poor birth outcome (e.g. stillbirth, miscarriage) might perceive her fetus as susceptible to that same outcome if prenatal care is not sought. It was also hypothesized that a woman

facing health concerns of her own (e.g. diabetes, high blood pressure, morning sickness) might envision serious consequences to the health of her fetus if her health condition is not properly controlled. Therefore, a woman with a current medical condition might be more inclined to seek prenatal care for treatment options and to keep her medical condition under control. An urgent medical condition that requires prompt treatment, might act as a cue to action to seek prenatal care. Potential perceived barriers include social support and stress. A woman that is single, unmarried or has no social support network might perceive this lack of support as a barrier to accessing care (e.g. nobody to take the woman to an appointment or to encourage the woman to seek care). Additionally, a woman that frequently experiences stressful life events, such as financial problems, might perceive prenatal care as too costly or inconvenient.

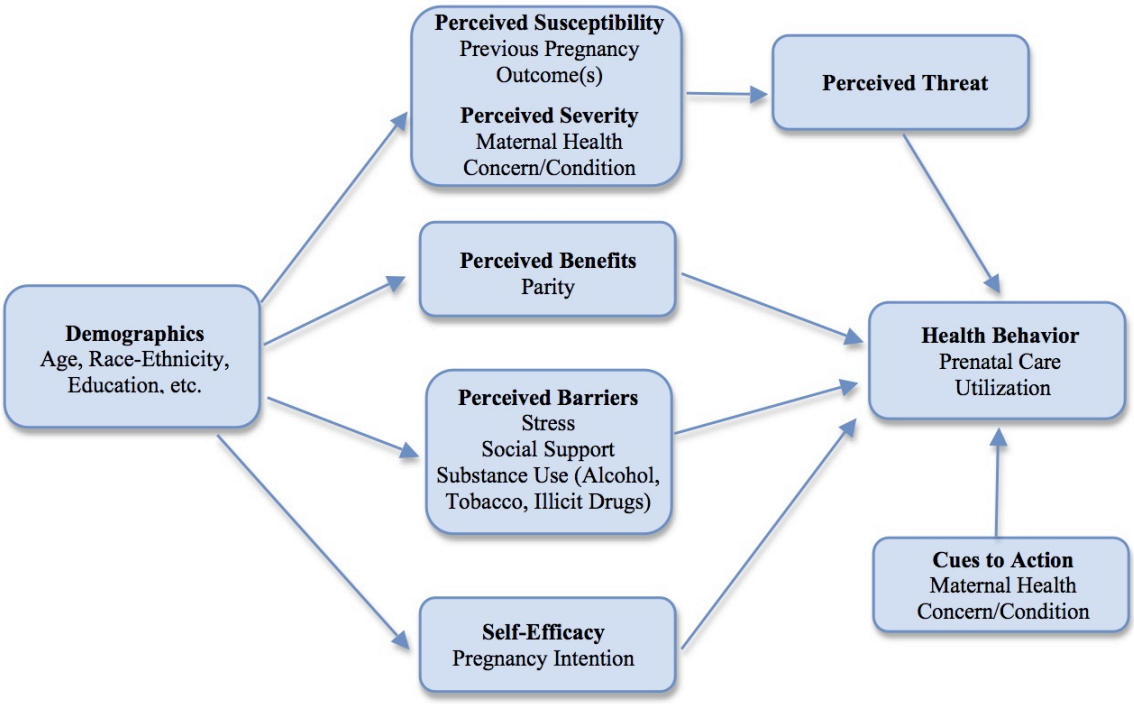

Figure 2. Health Belief Model, Adapted for Prenatal Care Utilization

This study's purpose arose from the need to further examine individual and environmental factors influencing or prohibiting prenatal care use among women in the United States. Although several research studies have looked at various predictors associated with prenatal care, new exposure areas such as previous pregnancy outcomes, maternal health and the relationship between stress and social support are lacking in the literature. It is important to further understand what factors make a woman more or less likely to receive prenatal care during pregnancy, so that future interventions can be targeted to increase use. As a result, this study explored this further through the following research questions:

1. Are women more likely to report any prenatal care during pregnancy if they had a previous pregnancy that did not end in a live birth (i.e. stillbirth, miscarriage, induced abortion)?
2. Are women more likely to report any prenatal care during pregnancy if they were dealing with a current or pre-existing health condition during that time?
3. Does stress and social support, when analyzed together, influence report of any prenatal care utilization?

CHAPTER II: LITERATURE REVIEW

Prenatal care is an essential component of ensuring the health of the mother and fetus during pregnancy. However, due to varying circumstances, including personal choice and other perceived, and or real barriers, some pregnant women still obtain no care, inadequate care (i.e. do not receive the recommended number of prenatal care visits during pregnancy) or late care (i.e. after first trimester). In 2013, nearly 6% of pregnant women received care late or not at all (Child Trends Data Bank, 2014). In addition, it has been estimated that annually 1 million women in the United States deliver babies without having had adequate prenatal care (U.S. Department of Health and Human Services, n.d.a). Studies, assessing prenatal care utilization, have looked at a variety of characteristics associated a lack of prenatal care utilization amongst various population demographics. Although this study focused specifically on whether or not any prenatal care was sought during pregnancy, this review of the literature aimed to provide a more detailed assessment of prenatal care, which encompassed adequacy and timing of care, in association with known factors.

Demographics

Common demographic variables, including age, race-ethnicity, education and income are known predictors of prenatal care utilization among women. A woman's age is likely to impact if, and when, she utilizes prenatal care services. Younger women (i.e. teenagers) are at an increased likelihood of receiving inadequate care, initiating care late (i.e. third trimester), or receiving no care (Brady, Visscher, Feder, & Burns, 2003; Elam-Evans, Adams, Gargiullo, Kiel & Marks, 1996; Feijen-de Jong et al., 2011; Goldenberg,

Patterson, & Freese, 1992; Hueston, Geese, & Diaz, 2008; Institute of Medicine, 1988; McDonald & Coburn, 1988; Perloff & Jaffee, 1999; Philippi, 2009; Riechman, Corman, Noonan, & Schwartz-Soicher, 2010; Singh, Torres & Forrest, 1985; Young, McMahon, Bowman, & Thompson, 1989). Various explanations for why younger women have poorer prenatal care utilization behaviors include, not wanting the pregnancy, fear of disclosing the pregnancy to others, lack of finances, lack of transportation and fear of health care procedures (Philippi, 2009; Teagle & Brindis, 1998).

A study examining pregnant teenagers' birth certificate data—collected by the National Center for Health Statistics—found that younger adolescents had higher rates of late initiation and inadequate use of prenatal care (Hueston, Geese, & Diaz, 2008). For example, 4.7% of adolescents 10-14 years, 2.4% of adolescents 15-16 years and 1.7% of adolescents 17-19 years never initiated prenatal care during pregnancy (Hueston, Geese, & Diaz, 2008). It was also found that within the same age group categories, the youngest group (10-14 years) was more likely to initiate care during the third trimester (11.1%) compared to the other age groups (6.7% of 15-16 year olds; 4.5% of 17-19 year olds) (Hueston, Geese, & Diaz, 2008).

Research consistently suggests that prenatal care utilization varies by race and ethnicity (Brady, Visscher, Feder, & Burns 2003; Bryant, Worjoloh, Cougher, & Washington, 2010; Daniels, Noe, & Mayberry, 2006; Goldenberg, Patterson, & Freese, 1992; Institute of Medicine, 1988). Minority women, particularly Native American/Alaskan Native, Black and Hispanic, are more likely to initiate prenatal care late or not at all during pregnancy (Brady, Visscher, Feder, & Burns, 2003; Daniels, Noe, & Mayberry, 2006; Elam-Evans, Adams, Gargiullo, Kiel & Marks, 1996; Feijen-de Jong

et al., 2011; Goldenberg, Patterson, & Freese, 1992; Institute of Medicine, 1988; Taylor, Alexander, & Hepworth, 2005). According to 2012 data, the percentage of pregnant women receiving late or no prenatal care was highest among American Indian or Alaskan Native women (11.0%), followed by Non-Hispanic black women (9.9%), Hispanic women (7.5%), Asian or Pacific Islander women (5.0%) and Non-Hispanic white women (4.3%) (Child Trends Data Bank, 2014).

Commonly expressed barriers of prenatal care among African American women of low socioeconomic status participating in focus groups included insensitivity of healthcare staff and consequential dissatisfaction of clinical experiences, lack of knowledge about pregnancy, stress, lack of social support and multiparty (Daniels, Noe, & Mayberry, 2006). For Hispanic women in particular, there are cultural and physical barriers that prevent them from obtaining prenatal care while pregnant. In a study assessing perceived barriers and benefits of prenatal care among low-income Hispanic women, in a postpartum clinic of a public hospital in Houston, Texas, it was determined that cultural factors influence a Hispanic woman's likelihood to seek care during pregnancy (Byrd, Mullen, Selwyn & Lorimor, 1996). These cultural factors that influence Hispanic women's likelihood to seek care include, difficulty understanding health care providers who do not speak Spanish, feeling that the health care provider lacks cultural sensitivity or feeling embarrassed during physical exams (Byrd, Mullen, Selwyn & Lorimor, 1996). Additionally, lack of transportation to appointments and long wait times to see a physician also play a role (Byrd, Mullen, Selwyn & Lorimor, 1996).

Education has also been shown to be a predictor of prenatal care utilization. No prenatal care is associated with a lower level of educational attainment (Brady, Visscher,

Feder, & Burns (2003); Elam-Evans, Adams, Gargiullo, Kiel & Marks, 1996; Feijen-de Jong et al., 2011; Goldenberg, Patterson, & Freese, 1992; Institute of Medicine, 1988; Perloff & Jaffee, 1999). The likelihood that a woman will receive care late or not at all increases as education level decreases (Institute of Medicine, 1988). According to data from 2011, approximately 86% of women with a bachelor's degree or higher received prenatal care within the their first trimester of pregnancy, while only 58% of women with less than a high school diploma received care early (U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau, 2013).

A woman's income level has been shown to a predictor of prenatal care utilization. Women with low income levels are less likely to obtain prenatal care (Institute of Medicine, 1988; Lia-Hoagberg et al., 1990; Nothnagle, Marchi, Egerter, & Bravemen, 2000; Sword, 1999). Numerous studies examining prenatal care utilization among women have focused specifically on perceived barriers faced by low-income populations (Aved, Irwin, Cummings, & Findeisen, 1993; Daniels, Noe, & Mayberry, 2006; Lia-Hoagberg et al., 1990). Explanations as to why low-income women are less likely to access prenatal care include transportation issues and limited resources (i.e. a lack of money or insurance to pay for prenatal care visits) (Lathrop & Pritham, 2014; U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau, 2013).

Parity

Parity, referring to the number of previous pregnancies lasting more than 20 weeks gestation (Bai, Wong, Bauman, Mohsin, 2002) influences prenatal care utilization.

For multiparous women, or women having had one or more previous pregnancies lasting more than 20 weeks gestation, prenatal care initiation is a less frequent behavior compared to nulliparous, or women without a previous pregnancy (Elam-Evans, Adams, Gargiullo, Kiel & Marks, 1996; Friedman, Hengan, & Rosenthal, 2009; Maupin et al., 2004). Many pregnant, multiparous women find it difficult to schedule prenatal care appointments when already having to care for one or more children (Maupin et al., 2004). Additionally, these women often believe that they learned enough about prenatal care during their previous pregnancies, and therefore think that carrying out a successful and healthy pregnancy, without prenatal care, is plausible (Maupin et al., 2004). High parity (i.e. 3 or more previous deliveries) has been associated with inadequate care (Goldenberg, Patterson, & Freese, 1992; Philippi, 2009), as well as late initiation to care (Brady, Visscher, Feder, & Burns, 2003; Perloff & Jaffee, 1999; Philippi, 2009) among pregnant women.

Pregnancy Intention

Whether or not a woman wanted to become pregnant at the time of conception has been shown to be a predictor of prenatal care (Altfeld, Handler, Dee Burton, & Berman, 1998; Cheng, Schwarz, Douglas, & Horon, 2009; Kost, Landry, & Damrosch, 1998; Kost & Lindberg, 2015; Pagnini & Reichman, 2000; Sable & Wilkinson, 1998). In a study examining determinants of prenatal care utilization among postpartum African American women in Washington D.C., it was found that of those women with unplanned pregnancies, 28.5% received inadequate prenatal care during pregnancy, while 18.2% received adequate prenatal care (Johnson et al., 2007). Additionally, 24.3% of those

receiving inadequate prenatal care during pregnancy expressed being unhappy about their pregnancy, while only 10.1% of those receiving adequate prenatal care were unhappy (Johnson et al., 2007). Women that have a planned pregnancy are more likely to initiate prenatal care early (Goldenberg, Patterson, & Freese, 1992), and unplanned pregnancies are often associated with late initiation of prenatal care (Brady, Visscher, Feder, & Burns, 2003; Kost & Lindberg, 2015).

Pregnancy intention is also a predictor of the behaviors that a woman will undertake during the course of her pregnancy (Dott, Rasmussen, Hogue, Reechoes & the National Birth Defects Prevention Study, 2009; Hellerstedt et al., 1998; Kost, Landry, & Damrosch, 1998). These behaviors often determine the birth outcome and the health status of the woman and baby (Hellerstedt et al., 1998). A previous examination of the National Birth Defects Prevention Study, that assessed associations between pregnancy intention and maternal behavior during pregnancy, found that women with unintended pregnancies are at a greater risk of initiating unhealthy behaviors, including substance use and lack of prenatal vitamin intake during pregnancy (Dott, Rasmussen, Hogue, Reechoes & the National Birth Defects Prevention Study, 2009). When assessing prenatal care use as a health behavior using the Health Belief Model, pregnancy intention likely influences overall decision-making in seeking care.

Substance Use (Alcohol, Tobacco and Illicit Drugs)

Studies assessing substance use and utilization of prenatal care among pregnant women have shown that women who drink alcohol, smoke cigarettes or use illicit drugs during pregnancy are at an increased risk of no prenatal care, or inadequate prenatal care (Brady, Visscher, Feder, & Burns, 2003; Friedman, Hengan, & Rosenthal, 2009; Johnson

et al., 2007; Philippi, 2009; Roberts & Pies, 2011; Wu et al., 2013). Researchers who conducted a record review of 211 women who had not received prenatal care with their pregnancy, found that 30% (n=64) of these women had a primary substance use problem (Friedman, Hengan, & Rosenthal, 2009). Studies using focus groups to assess prenatal care perceptions among vulnerable women in urban communities, found that many drug-dependent women expressed that the drug lifestyle took priority over prenatal care and made it difficult to adhere to prenatal care recommendations (Milligan et al., 2002; Roberts & Pies, 2011). Additionally, several of these women expressed that healthcare providers looked down on drug-using mothers and treated them judgmentally during prenatal care appointments (Milligan et al., 2002). Consequently, this inhibited the women's motivations to seek prenatal care while pregnant (Milligan et al., 2002). It has also been argued that drug-using women delay prenatal care utilization in fear that when accessing prenatal care services they will be reported to child protective service for their drug use behavior (Roberts & Pies, 2011; Wu et al., 2013).

In a study assessing prenatal care utilization perceptions through individual interviews with African American women (n=246) in Washington D.C., substance use was higher among the group receiving inadequate prenatal care compared to the group receiving adequate prenatal care. A total of 29.7% of women in the inadequate group smoked cigarettes compared to 15.2% of women in the adequate group; 16.4% of women in the inadequate group consumed alcohol compared to 3.1% of women in the adequate group; 17.8% of women in the inadequate group used drugs compared to 5.1% of women in the adequate group (Johnson et al., 2007).

Stress

Stress is a suggested predictor of low prenatal care utilization (Institute of Medicine, 1988; Schetter & Glynn, 2011). For example, researchers suggest that women experiencing chronic stress may face issues with time management, transportation and costs associated with prenatal care services; highly stressed women may show poor compliance with prenatal care behaviors (Schetter & Glynn, 2011). Data from the National Institute of Child Health and Development (NICHD) and the Missouri Maternal and Infant Health Survey (MMIHS) suggests that women receiving inadequate care during pregnancy (27% of respondents) were at an increased likelihood of reporting frequent stress throughout pregnancy (Sable & Wilkinson, 1999). Similarly, Johnson et al. (2007) found that 27.8% of women in the inadequate prenatal care utilization group were under stress, while only 10.1% of women in the adequate prenatal care utilization group were under stress (2007).

Social Support

Research suggests that social support of family and friends during a woman's pregnancy can impact her decision to seek prenatal care (Phillippi, Myers, & Schorn, 2014; Schaeffer & Lia-Hoagberg, 1997). From an assessment of prenatal health questionnaires, completed by low-income pregnant women in Minnesota, researchers found that adequate prenatal care during pregnancy was correlated with the support of a partner (Schaeffer & Lia-Hoagberg, 1997). Additionally, social support of others, not including a woman's partner—such as family and friends—was correlated with a woman's health behaviors during pregnancy (Schaeffer & Lia-Hoagberg, 1997). However, in a study examining partner support of African American women in relation to

pregnancy outcomes and prenatal health behaviors, no associations were found between partner support and adequacy of prenatal care (Straughen, Caldwell, Young, & Mira, 2013).

Social support has benefited pregnant Latina women in the United States. These women have favorable birth outcomes, despite frequently facing socioeconomic disadvantages. This phenomenon, termed the "Latina Paradox", has been attributed to strong social support systems within the Latin communities. These community networks of family, friends, community members and lay health workers provide Latina women with an informal type of prenatal care that is beneficial for the woman and baby. (McGlade, Sasha, & Dahlstrom, 2004)

Some studies have found a woman's marital status to be associated with prenatal care utilization. For example, not being married has been associated with no prenatal care, or late prenatal care, among pregnant women (Brady, Visscher, Feder, & Burns, 2003; D'Ascoli, Alexander, Petersen, & Kogan, 1997; Feijen-de Jong et al., 2011; Institute of Medicine, 1988; Nothnagle, Marchi, Egerter, & Bravemen, 2000; D'Ascoli, Alexander, Petersen, & Kogan, 1997; Dietz et al., 1997; Higgins, Murray, & Williams, 1994). In a study assessing the influence that marital status has on the use of prenatal care among white mothers in Minnesota, it was found that unmarried women had a 10 times greater risk of receiving no prenatal care compared to married women (D'Ascoli, Alexander, Petersen, & Cogan, 1997).

Summary & Need for Further Research

As documented in the literature, there is substantial research on predictors of prenatal care, including, timing and adequacy of care among pregnant women in the United States. Several factors have consistently been shown to be associated with prenatal care including: maternal age, race-ethnicity, education, income, parity, pregnancy intention, substance use, stress and social support. These factors help to explain why some women are more or less inclined to utilize prenatal care during pregnancy.

The Health Belief Model helped to inform three understudied areas in the literature that justified further analysis of potential predictors of prenatal care utilization. First, there is a gap in current literature assessing if a woman's previous pregnancy outcome(s) impacts prenatal care utilization. According to Philippi (2009), some women disregard prenatal care as necessary if they have had a previous uncomplicated pregnancy. Contrary to this however, a secondary analysis of the First Baby Study, a study assessing the mode of first delivery and its effect on subsequent childbearing, demonstrated that women with a history of multiple miscarriages might utilize health care more during subsequent pregnancies (Kinsey, Baptist-Roberts, Zhu, & Kjerulff, 2015). Additionally, these women were shown to initiate prenatal care early during subsequent pregnancies (Kinsey, Baptiste-Roberts, Zhu, & Kjerulff, 2015). Study authors noted that a limitation of their study was that additional past pregnancy outcomes, including stillbirths and abortions, were not assessed and could have increased variability in their sample (Kinsey, Baptist-Roberts, Zhu, & Kjerulff, 2015). As a result, it is important to

further assess the effects that various poor past birth outcome might have on a woman's decision to seek prenatal care.

Second, there is a need to determine whether or not maternal health influences a woman's decision to seek prenatal care. Pre-existing maternal health conditions (e.g. diabetes) might act as potential motivators or cues to action for women to seek prenatal care. According to the CDC, pre-existing maternal conditions such as diabetes and high blood pressure can cause serious complications for the mother and baby if not controlled during pregnancy (2014a), and therefore these women in particular are strongly encouraged to seek prenatal care and to do so promptly. Despite this recommendation, there is minimal research assessing associations between both pre-existing and current maternal conditions and prenatal care utilization. Since women with health concerns are considered high risk during pregnancy, it is important to assess maternal health in relation to prenatal care.

Third, there is a need to further analyze stress and social support and their role in prenatal care utilization during pregnancy. Research has shown that when analyzed separately, stress and social support influence a woman's decision to obtain prenatal care. Nonetheless, some have argued a need for further analysis of stress, to better understand the ways in which stressors act as barriers to prenatal care utilization (Schetter & Glynn, 2011). In other areas of research, social support has been shown to buffer the negative effects of stress (Carmichael, Ma, Tinker, Rasmussen, & Shaw, 2014). However, there is a lack of research examining this phenomenon in prenatal care research. It is important to examine if, or how, the relationship between stress and prenatal care utilization changes with varying levels of social support (e.g. high vs. low).

Through a secondary analysis of data from the National Birth Defects Prevention Study (1997-2009) this study proposed to: 1) utilize the Health Belief Model to guide the study process; 2) examine the associations between previous pregnancy outcomes and prenatal care; 3) examine the association between maternal health and prenatal care; 4) examine the associations between stress and social support (separately and collectively) and prenatal care. Through utilization of variables known to be associated with prenatal care in the literature, as well as new exposure topics (e.g. maternal health, previous pregnancy outcomes), analysis of the NBDPS will help to fill gaps in the literature and take the analysis of prenatal care a step further.

CHAPTER III: METHODS

Study Participants:

This analysis utilized previously collected data from the National Birth Defects Prevention Study (NBDPS), a population based multi-center case control study that began data collection in October 1997 and concluded in March 2014, with the primary goal of investigating risk factors for structural birth defects. Ten Centers for Birth Defects Research and Prevention (CBDRP) collaborated on this study, including Arkansas, California, Georgia, Iowa, Massachusetts, New Jersey, North Carolina, New York, Texas and Utah. The NBDPS received Institutional Review Board (IRB) approval from all centers.

This dataset, chosen for its robust interview instrument with diverse interview topics, is adequate for describing the prevalence of various behaviors among women of reproductive age in the United States (Yoon et al., 2001). Cases, defined as live births, still births or elective terminations diagnosed with one of the 30 major structural birth defects, were first selected through surveillance systems at each study center and then were reviewed by clinical geneticists to ensure that case eligibility was met. Controls, defined as infants without major structural birth defects, were recruited using birth certificates or hospital records from the same geographically defined region as cases. Approximately 68% of eligible cases and 65% of eligible controls completed interviews. Although there was no matching done on key demographics for cases and controls, controls were, again, chosen from the same geographic locations and time periods as cases. No differences were found among cases and controls in reporting of prenatal care in the NBDPS.

Data Collection:

Prior to enrollment in this study, women were mailed an introductory packet that described the scope of the NBDPS and requested participation in the study. Women who consented to participation in the NBDPS completed a one-hour Computer Assisted Telephone Interview (CATI), conducted by a trained interviewer, in English or Spanish. Interviewers asked women questions about various birth defects risk factors and exposures including, but not limited to, maternal health, diet, stress, substance use, occupation, family demographics and medication use. Interviews were completed no earlier than six weeks and no later than two years of the woman's estimated delivery date (EDD). A long time to interview results from inclusion of two years after a woman's EDD, however this allows for a more complete case ascertainment which is ideal for population-based studies (Tinker et al., 2013). The mean time to interview was nine months after birth for cases, and eleven months after birth for controls. Recall aids, including a calendar and a list of specific medication names, were presented to participants for use during the interview.

Over 43,000 women participated in the NBDPS with births from 1997 to 2011. Both cases and controls were utilized for this study. Through utilization of the NBDPS Data Analysis Tools Version 9 (DAT v9.0), data for this analysis were obtained from the NBDPS CATI Version 5. This analysis focused specifically on mothers with EDDs between October 1997 and December 2009. The study population consisted of the 37,816 women (27,673 case women and 10,143 control women) who answered a question about prenatal care during pregnancy. A total of 136 cases and 57 controls were excluded, as they did not answer the prenatal care question. The latest version of the DAT (v10.0), which included women with EDDs from 1997-2011, was not yet available at the time of

this study and therefore the study participation total does not add up to 43,000 women. Approval for conducting this data analysis was given by the Centers for Birth Defects Research and Prevention (CBDRP) Data Sharing Committee, as well as the Emory University Institutional Review Board.

Covariates:

Predictor variables, commonly shown to be associated with prenatal care utilization in the literature, were used as covariates in the data analysis. These variables were categorized as follows: maternal age (<18, 18-24, 25-29, 30-34, and 35+ years), maternal race-ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, Asian/Pacific Islander, Native American/Alaskan Native, Other), maternal education (<high school, high school, >high school), maternal income (<$10,000, $10,000-$40,000, >$40,000), parity (no previous live birth, 1 previous live births, 2+ previous live births) and, in some instances, substance use (alcohol, tobacco, illicit drugs).

Participants were asked a series of yes/no questions about alcohol, tobacco and illicit drug use prior to, and during pregnancy. Participants were asked, "From three months before you became pregnant to the end of your pregnancy, did you smoke cigarettes?" In addition, participants were asked, "From three months before you became pregnant to the end of your pregnancy, did you drink any wine, beer, mixed drinks or shots of liquor?" Lastly, participants were asked, "From three months before you became pregnant to the end of your pregnancy, did you use any of the following recreational or street drugs?" Answer options for drug use originally included: Marijuana (yes, no), Cocaine (yes, no), Ecstasy (yes, no), Methamphetamines or crank or ice (yes, no), and anything else (yes, no). For the purposes of this study, one dichotomous (yes, no) drug

variable was created. Positive indication for using any of the drug options listed, categorized a woman as 'yes' for drug use. For example, a woman who said that she used marijuana, but did not use any other drugs, was still considered to use drugs during pregnancy.

Pregnancy intention was also assessed. Participants were asked, "At the time you became pregnant (with [NOIB]/with this pregnancy), did you want to become pregnant, did you want to wait until later, or did you not want to become pregnant at all?" This variable was recoded as missing if participants responded with: 'don't know'.

Exposures of Interest:

Previous Pregnancy Outcomes

Women were asked, "Did your (1st/2nd/3rd, etc.) pregnancy end with a live birth, stillbirth, induced abortion, miscarriage, tubal pregnancy, or molar pregnancy?" For the purposes of this study, stillbirth, miscarriage (i.e. spontaneous abortion) and induced abortion were assessed. These continuous variables were recoded into dichotomous variables: 'yes' (1 or more previous stillbirth/miscarriage/ induced abortion), 'no' (no previous stillbirth/miscarriage/induced abortion). Participants who responded with 'don't know' or 'refuse to answer' were coded as missing.

Maternal Health

Participants were asked a series of questions relating to maternal health including diagnoses of medical conditions, reproductive health and medication use. For the purposes of this study, five maternal health topics were assessed: high blood pressure (yes, no), diabetes (yes, no), seizures (yes, no), morning sickness (yes, no), and fertility

procedures/medications (yes, no). Participants were asked the following questions: "Were you ever told by a doctor that you had diabetes (including gestational diabetes), sometimes called sugar diabetes or diabetes mellitus? Were you ever in your life told by a doctor that you had a high blood pressure, toxemia, preeclampsia or eclampsia? Have you ever had seizures? During this pregnancy, did you have morning sickness or nausea? Did you or ([NOIB]'s/the) father take any medications or have any procedures to help you become pregnant for this pregnancy?" Women reporting gestational diabetes and pregnancy related high blood pressure were excluded in order to assess pre-existing (i.e. prior to pregnancy) maternal conditions only. These variables were recoded as missing if participant responses were: 'don't know' or 'refuse to answer'.

Stress & Social Support Indicators

Participants were asked a series of nine (yes, no) questions about stressful events that might have occurred in their life from 3 months prior to pregnancy (P3) through the 3rd month of pregnancy (B3). Six of the nine questions were categorized under stress and three questions were categorized under social support. An example of a stress question includes, "From 3 months before you became pregnant through your 3rd month of pregnancy, did you experience any serious relationship difficulties with your husband or partner or become separated or divorced?" The remaining stress questions asked about financial problems, abuse/violence/crime, serious illness/injury and the death of someone close (Appendix A). An example of a social support question includes, "During this same time period, could you count on anyone to provide you with emotional support such as talking over a problem or helping with a difficult decision, if you had needed it?"

Remaining social support questions asked about counting on someone for financial assistance and daily tasks (Appendix A).

Data regarding stressful life events was only available with EDDs from 2006-2009, as these questions were added to later versions of the CATI. Prior to analyses, these variables were recoded as missing if participant responses were: 'don't know' or 'refuse to answer'. The newly recoded variables were analyzed individually, and then were summed to create two indices. Five of the six stress questions (Appendix) were used to create a stress index. A 'yes' response to 0-2 stress questions designated the woman as having 'low stress', while a 'yes' response to 3-5 stress questions designated the woman as having 'high stress'. Additionally, for the social support index, a 'yes' response to 0-2 social support questions signified 'low social support', while a 'yes' response to all 3 of the social support questions signified 'high social support'. (Carmichael, Ma, Tinker, Rasmussen, & Shaw, 2014)

Outcome of Interest:

Prenatal Care

The outcome of interest for this study was prenatal care utilization (yes, no). During the telephone interview, participant mothers were asked, "Did you have prenatal care with ([NOIB]'s/this) pregnancy?" This variable was recoded as missing if participant responses were: 'don't know' or 'refuse to answer'.

Statistical Analysis:

Chi square tests were used to determine whether differences were observed between women who reported prenatal care during pregnancy and women who did not

report prenatal care during pregnancy. Multivariable logistic regression was used to estimate crude and adjusted odds ratios (ORs), as well as corresponding 95% confidence intervals (CIs), for newly proposed predictor variables (i.e. previous pregnancy outcomes, maternal health and stress/social support). A significance level of 0.05 was used for reporting statistical significance. A priori confounders identified in the literature (e.g. maternal age, race-ethnicity, education, income, parity, alcohol, tobacco, illicit drugs) were included in the various logistic regression models. Using DAT Version 9, analyses were conducted with case (n=27,673) and control women (n=10,143) combined (n= 37,816). The percentages of women reporting prenatal care did not differ among cases and controls, and therefore the decision was made to include cases and controls to ensure a larger sample size. SAS version 9.3 (SAS Institute Inc.) was used to conduct the analyses.

A priori confounders were chosen for logistic regression models of each of the three exposure areas (i.e. previous pregnancy outcomes, maternal health and stress/social support). After theoretical, as well as statistical consideration, it was determined that all models would at least control for maternal age, race-ethnicity, education, income and parity. Logistic regression models of stress and social support also controlled for substance use (i.e. alcohol, tobacco, illicit drugs).

CHAPTER IV: RESULTS

Among women who completed the interview, 98.8% (n=37,346) reported obtaining prenatal care during their pregnancy, and 1.2% (n=470) reported no prenatal care during pregnancy. Demographic characteristic frequencies and chi square test results are presented in Table 1. Compared with women reporting no prenatal care during pregnancy, women reporting prenatal care were more likely to be non-Hispanic white (58.9% vs. 32.6%), more likely to have an educational attainment beyond high school (56.2% vs. 30.4%), more likely to have a household income of >$40,000 (38.6% vs. 9.8%), less likely to be multiparous (26.3% vs. 38.7%), more likely to want to be pregnant at the time of conception (59.0% vs. 37.4%), more likely to report drinking during pregnancy (35.7% vs. 28.9%), less likely to report smoking during pregnancy (19.9% vs. 24.8%) and less likely to report drug use during pregnancy (5.6% vs. 9.4%).

In terms of previous pregnancy outcomes, a significant association was observed between history of miscarriage(s) and prenatal care when adjusting for maternal age, race-ethnicity, education, income and parity. The odds of reporting prenatal care were nearly 1.5 times higher for women reporting a previous miscarriage compared to women without a previous miscarriage (aOR = 1.4, 95% CI = 1.1, 1.8). No significant associations were found between prenatal care and history of stillbirth or induced abortion when adjusting for maternal age, race-ethnicity, education, income and parity (Table 2).

When examining maternal health, a significant association was observed between morning sickness and prenatal care when adjusting for maternal age, race-ethnicity, education, income and parity. The odds of reporting prenatal care were 1.5 times higher

for women reporting morning sickness during pregnancy compared to women who did not report morning sickness (aOR = 1.5, 95% CI = 1.2, 1.9). A significant association between fertility treatment/medications and prenatal care utilization was observed in the crude analysis (OR = 3.8; 95% CI = 1.9, 7.6), however, after adjusting for maternal age, race-ethnicity, education, income and parity, the association was no longer significant (aOR = 1.6; 95% CI = 0.8, 3.2). No significant associations were seen between the assessed pre-existing maternal health conditions (i.e. diabetes, high blood pressure, seizures) and prenatal care utilization when adjusting for maternal age, race-ethnicity, education, income and parity (Table 2).

In terms of stress indicators, a significant association between experiencing abuse, violence or crime and prenatal care utilization was observed in the crude analysis (OR = 0.5; 95% CI = 0.3, 0.8), however, after adjusting for maternal age, race-ethnicity, education, income, parity and substance use (i.e. alcohol, tobacco, illicit drugs) the association was no longer significant (aOR = 0.7; 95% CI = 0.4, 1.1). Similarly, significant associations were observed in the crude analysis between women reporting almost never feeling nervous or stressed (OR=2.3; 95% CI = 1.2, 4.4), sometimes feeling nervous or stressed (OR=1.9; 95% CI = 1.1, 3.2), feeling nervous or stressed somewhat often (OR=2.1; 95% CI = 1.1, 3.9) and prenatal care utilization. However, after adjusting for maternal age, race-ethnicity, education, income, parity and substance use (i.e. alcohol, tobacco, illicit drugs), the associations were no longer significant. Reports of stressful events, including experiencing relationship difficulties; serious legal or financial problems; serious illness or injury; the death of someone close; and feeling nervous or stressed very often did not significantly predict prenatal care utilization, when adjusting

for maternal age, race-ethnicity, education, income, parity and substance use (Table 2). The question concerning serious legal or financial problems did not adjust for income.

Significant associations were observed between the social support questions and prenatal care utilization when adjusting for maternal age, race-ethnicity, education, parity and substance use (i.e. alcohol, tobacco, illicit drugs). The odds of reporting prenatal care were 2.4 times higher for women reporting being able to count on someone to provide emotional support from 3 months prior to pregnancy through the 3rd month of pregnancy, compared to women who did not report experiencing this emotional support (aOR = 2.4, 95% CI = 1.7, 3.6). Additionally, the odds of reporting prenatal care were 1.8 times higher for women who were able to count on someone to provide them with help financially, from 3 months prior to pregnancy through the 3rd month of pregnancy, compared to women who did not report experiencing this financial help (aOR = 1.8, 95% CI = 1.2, 2.6). A significant association between help with daily tasks and prenatal care was observed in the crude analysis (OR = 1.8; 95% CI=1.3, 2.6), however after adjusting for maternal age, race-ethnicity, education and income the association was no longer significant (aOR = 1.3; 95% CI = 0.9, 1.9).

A significant association was observed between women reporting low stress/low support with prenatal care utilization when adjusting for maternal age, race-ethnicity, education, parity, income and substance use (i.e. alcohol, tobacco, illicit drugs). These women were significantly less likely to report having had prenatal care compared to women reporting low stress/high support (aOR = 0.5; 95% CI = 0.4, 0.8). A significant association between high stress/high support and prenatal care utilization was observed in the crude analysis (OR = 0.5; 95% CI = 0.2, 1.0), however, after adjusting for maternal

age, race-ethnicity, education, income, parity and substance use, the association was no longer significant (aOR = 0.6; 95% CI = 0.3, 1.3). A borderline significant association was observed between mothers reporting high stress/low support with utilization (aOR = 0.5; 95% CI = 0.3, 1.0) when adjusting for maternal age, race-ethnicity, education, parity, income and substance use (i.e. alcohol, tobacco, illicit drugs).

Table 1. Characteristics associated with reporting any prenatal care among mothers, National Birth Defects Prevention Study, 1997-2009*

	Mothers reporting prenatal care during pregnancy n (%)[a]	*Mothers reporting no prenatal care during pregnancy* n (%)[a]	*p-value*[b]
Total study participants	37,346 (98.8)	470 (1.2)	
Maternal age, years			**<0.0001**
<18	1,306 (3.5)	35 (7.5)	
18-24	11,260 (30.2)	203 (42.3)	
25-29	10,098 (27.0)	90 (19.2)	
30-34	9,159 (24.5)	93 (19.8)	
35+	5,523 (14.8)	49 (10.4)	
Missing	0	0	
Maternal race-ethnicity			**<0.0001**
Non-Hispanic white	22,003 (58.9)	153 (32.6)	
Non-Hispanic black	3,839 (10.3)	73 (15.5)	
Hispanic	8,827 (23.6)	203 (43.2)	
Asian, Pacific Islander	1,019 (2.7)	15 (3.2)	
Native American or Alaskan Native	188 (0.5)	8 (1.7)	
Other	1,441 (3.9)	18 (3.8)	
Missing	29 (0.1)	0	
Maternal education, years			**<0.0001**
< 12	6,396 (17.1)	183 (38.9)	
12	9,320 (25.0)	130 (27.7)	
>12	20,975 (56.2)	143 (30.4)	
Missing	655 (1.8)	14 (3.0)	
Maternal income, US dollars			
<$10,000	6,487 (19.1)	194 (48.4)	**<0.0001**
$10,000-$40,000	13,051 (34.9)	133 (28.3)	
>$40,000	14,433 (38.6)	46 (9.8)	
Missing	3,375 (9.0)	69 (14.7)	
Parity			**0.0051**
No previous live birth	15691 (42.0)	167 (35.5)	
1 previous live birth	11804 (31.6)	120 (25.5)	
2 or more live birth(s)	9838 (26.3)	182 (38.7)	
Missing	13 (<0.1)	1 (0.2)	
Pregnancy intention			**<0.0001**
Wanted to be pregnant	22,030 (59.0)	176 (37.4)	
Wanted to wait	5,842 (15.6)	92 (19.6)	
Did not want to be pregnant	6,382 (17.1)	157 (33.4)	
Did not care	3053 (8.2)	42 (8.9)	
Missing	39 (0.1)	3 (0.6)	
Maternal alcohol use during pregnancy			**0.0045**
Any	13,321 (35.7)	136 (28.9)	
None	23,348 (62.5)	319 (67.9)	
Missing	677 (1.8)	15 (3.2)	
Maternal smoking during pregnancy			**0.0098**
Any	7,334 (19.9)	114 (24.8)	
None	29,457 (80.1)	346 (75.2)	
Missing	555 (1.5)	10 (2.1)	

	Mothers reporting prenatal care during pregnancy n (%)[a]	*Mothers not reporting prenatal care during pregnancy* n (%)[a]	*P-value*[b]
Maternal drug use during pregnancy			**0.0004**
Any	2,082 (5.6)	44 (9.4)	
None	35,236 (94.4)	425 (90.6)	
Missing	28 (0.1)	1 (0.2)	
Previous Pregnancy Outcomes			
Stillbirth			0.1177
No previous stillbirth	36,723 (98.3)	457 (97.2)	
≥ 1 previous stillbirth	610 (1.6)	12 (2.6)	
Missing	13 (<0.1)	1 (0.2)	
Miscarriage			**0.0022**
No previous miscarriage	28,292 (75.8)	384 (81.7)	
≥ 1 previous miscarriage	9,041 (24.2)	85 (18.1)	
Missing	13 (<0.1)	1 (0.2)	
Induced abortion			0.6736
No previous abortion	32,633 (87.4)	413 (88.1)	
≥ 1 previous abortion	4,700 (12.6)	56 (11.9)	
Missing	13 (<0.1)	1 (0.2)	
Maternal Health			
Diabetes[c]			0.3776
Yes	793 (2.3)	9 (2.1)	
No	33,600 (97.4)	423 (97.2)	
Missing	107 (0.3)	3 (0.7)	
High blood pressure[c]			0.9846
Yes	1691 (5.1)	24 (5.6)	
No	31,594 (94.6)	404 (94.0)	
Missing	107 (0.3)	2 (0.5)	
Seizures			0.3404
Yes	1,213 (3.3)	19 (4.0)	
No	36,041 (96.7)	451 (96.0)	
Missing	92 (0.2)	0	
Morning sickness			**<0.0001**
Yes	26,617 (71.4)	296 (63.0)	
No	10,685 (28.6)	174 (37.0)	
Missing	44 (0.1)	0	
Fertility treatment or medications			**<0.0001**
Yes	2,258 (6.2)	8 (1.7)	
No	34,408 (93.8)	458 (92.3)	
Missing	680 (1.8)	4 (0.9)	
Stress Indicators			
Relationship difficulties			**0.0001**
Yes	2,351 (20.4)	48 (33.3)	
No	9,185 (79.6)	96 (66.7)	
Missing	6 (0.1)	0	

	Mothers reporting prenatal care during pregnancy n (%)[a]	*Mothers not reporting prenatal care during pregnancy* n (%)[a]	*P-value*[b]
Serious legal/financial problems			0.5996
Yes	1,894 (16.4)	26 (18.1)	
No	9,638 (83.6)	118 (81.9)	
Missing	10 (0.1)	0	
Victim of abuse, violence or crime			**0.0025**
Yes	897 (7.8)	21 (14.6)	
No	10,642 (92.2)	123 (85.4)	
Missing	3 (<0.1)	0	
Serious illness or injury			0.8056
Yes	1,686 (14.6)	20 (13.9)	
No	9,848 (85.4)	124 (86.1)	
Missing	8 (0.1)	0	
Death of someone close			0.8457
Yes	1,774 (15.4)	23 (16.0)	
No	9,758 (84.6)	121 (84.0)	
Missing	10 (0.1)	0	
Stressed			**0.0187**
Never	821 (7.1)	17 (11.9)	
Almost never	1,974 (17.1)	18 (12.6)	
Sometimes	4,558 (39.5)	51 (35.7)	
Somewhat often	2,190 (19.0)	22 (15.4)	
Very often	1,999 (17.2)	35 (24.5)	
Missing	0	1 (0.7)	
Social Support Indicators[c]			
Emotional support			**<0.0001**
Yes	9,798 (85.0)	89 (62.2)	
No	1,733 (15.0)	54 (37.8)	
Missing	11 (0.1)	1 (0.7)	
Financial help			**<0.0001**
Yes	9,490 (82.4)	92 (63.9)	
No	2,026 (17.6)	52 (36.1)	
Missing	26 (0.2)	0	
Daily tasks			**0.0012**
Yes	9,523 (82.6)	104 (72.2)	
No	2,008 (17.4)	40 (27.8)	
Missing	11 (0.1)	0	
Stress/Social Support Index[d]			
Low stress, high support	7,845 (68.4)	64 (44.8)	**<0.0001**
High stress, high support	454 (4.0)	8 (5.6)	
Low stress, low support	2,754 (24.0)	60 (42.0)	
High stress, low support	432 (3.7)	11 (7.7)	
Missing	57 (0.5)	1 (0.7)	

[a] Numbers may not add up to 100 due to rounding.
[b] p-values are from Chi Square Test for Differences of Proportions.
[c] Excluded women with gestational diabetes and/or pregnancy related high blood pressure.
[d] The first 5 questions listed under 'Stress Indicators' were used to create a stress index. A yes response to 0-2 stress indicator questions designates *low stress*; 3-5 designates *high stress*. All of the questions listed under 'Social Support Indicators' were used to create a social support index. A yes response to 0-2 social support indicator questions designates *low social support*; all 3 designate *high social support*.
*Stress & Social Support data only available for 2006-2009; total participants =11,686.

Table 2. Associations of previous pregnancy outcomes, maternal health and stress/social support with reporting of prenatal care during pregnancy, National Birth Defects Prevention Study, 1997-2009*

	Mothers reporting prenatal care during pregnancy n (%)[a]	*Mothers reporting no prenatal care during pregnancy n (%)*[a]	*Crude OR (95% CI)*	*Adjusted OR (95% CI)*
Previous Pregnancy Outcomes[b]				
Stillbirth				
No previous stillbirth	36,723 (98.3)	457 (97.2)	Reference	Reference
≥ 1 previous stillbirth	610 (1.6)	12 (2.6)	0.6 (0.4, 1.1)	0.7 (0.4, 1.4)
Missing	13 (<0.1)	1 (0.2)		
Miscarriage				
No previous miscarriage	28,292 (75.8)	384 (81.7)	Reference	Reference
≥ 1 previous miscarriage	9,041 (24.2)	85 (18.1)	**1.4 (1.1, 1.8)**	**1.4 (1.1, 1.8)**
Missing	13 (<0.1)	1 (0.2)		
Induced abortion				
No previous abortion	32,633 (87.4)	413 (88.1)	Reference	Reference
≥ 1 previous abortion	4,700 (12.6)	56 (11.9)	1.0 (0.8,1.4)	0.9 (0.7,1.3)
Missing	13 (<0.1)	1 (0.2)		
Maternal Health[b]				
Diabetes[c]				
Yes	793 (2.3)	9 (2.1)	1.4 (0.6, 3.6)	1.7 (0.7, 4.1)
No	33,600 (97.4)	423 (97.2)	Reference	Reference
Missing	107 (0.3)	3 (0.7)		
High blood pressure[c]				
Yes	1691 (5.1)	24 (5.6)	1.1 (0.6, 1.6)	1.0 (0.6,1.7)
No	31,594 (94.6)	404 (94.0)	Reference	Reference
Missing	107 (0.3)	2 (0.5)		
Seizures				
Yes	1,213 (3.3)	19 (4.0)	0.8 (0.5, 1.3)	1.1 (0.6,1.9)
No	36,041 (96.7)	451 (96.0)	Reference	Reference
Missing	92 (0.2)	0		
Morning sickness				
Yes	26,617 (71.4)	296 (63.0)	**1.5 (1.2, 1.8)**	**1.5 (1.2,1.9)**
No	10,685 (28.6)	174 (37.0)	Reference	Reference
Missing	44 (0.1)	0		
Fertility treatment or medications				
Yes	2,258 (6.2)	8 (1.7)	**3.8 (1.9, 7.6)**	1.6 (0.8, 3.2)
No	34,408 (93.8)	458 (92.3)	Reference	Reference
Missing	680 (1.8)	4 (0.9)		
Stress Indicators[d]				
Relationship difficulties				
Yes	2,351 (20.4)	48 (33.3)	0.5 (0.4, 0.7)	0.8 (0.5,1.1)
No	9,185 (79.6)	96 (66.7)	Reference	Reference
Missing	6 (0.1)	0		

	Mothers reporting prenatal care during pregnancy n (%)[a]	*Mothers reporting no prenatal care during pregnancy n (%)*[a]	*Crude OR (95% CI)*	*Adjusted OR (95% CI)*
Serious legal/ financial problems				
Yes	1,894 (16.4)	26 (18.1)	0.9 (0.6, 1.4)	1.0 (0.7,1.6)
No	9,638 (83.6)	118 (81.9)	Reference	Reference
Missing	10 (0.1)	0		
Victim of abuse, violence or crime				
Yes	897 (7.8)	21 (14.6)	**0.5 (0.3, 0.8)**	0.7 (0.4,1.1)
No	10,642 (92.2)	123 (85.4)	Reference	Reference
Missing	3 (<0.1)	0		
Serious illness or injury				
Yes	1,686 (14.6)	20 (13.9)	1.1 (0.7,1.7)	1.0 (0.6, 1.7)
No	9,848 (85.4)	124 (86.1)	Reference	Reference
Missing	8 (0.1)	0		
Death of someone close				
Yes	1,774 (15.4)	23 (16.0)	1.0 (0.6, 1.5)	1.1 (0.7, 1.8)
No	9,758 (84.6)	121 (84.0)	Reference	Reference
Missing	10 (0.1)	0		
Stressed				
Never	821 (7.1)	17 (11.9)	Reference	Reference
Almost never	1,974 (17.1)	18 (12.6)	**2.3 (1.2, 4.4)**	1.5 (0.7, 3.1)
Sometimes	4,558 (39.5)	51 (35.7)	**1.9 (1.1, 3.2)**	1.6 (0.9, 2.8)
Somewhat often	2,190 (19.0)	22 (15.4)	**2.1 (1.1, 3.9)**	1.7 (0.8, 3.3)
Very often	1,999 (17.2)	35 (24.5)	1.2 (0.7, 2.1)	1.1 (0.6, 2.1)
Missing	0	1 (0.7)		
Social Support Indicators[d]				
Emotional support				
Yes	9,798 (85.0)	89 (62.2)	**3.4 (2.4, 4.8)**	**2.4 (1.7, 3.6)**
No	1,733 (15.0)	54 (37.8)	Reference	Reference
Missing	11 (0.1)	0		
Financial help				
Yes	9,490 (82.4)	92 (63.9)	**2.6 (1.9, 3.7)**	**1.8 (1.2, 2.6)**
No	2,026 (17.6)	52 (36.1)	Reference	Reference
Missing	26 (0.2)	0		
Daily tasks				
Yes	9,523 (82.6)	104 (72.2)	**1.8 (1.3, 2.6)**	1.3 (0.9, 1.9)
No	2,008 (17.4)	40 (27.8)	Reference	Reference
Missing	11 (0.1)	0		
Stress/Social Support Index[e]				
Low stress, high support	7,845 (68.4)	64 (44.8)	Reference	Reference
High stress, high support	454 (4.0)	8 (5.6)	**0.5 (0.2, 1.0)**	0.6 (0.3, 1.3)
Low stress, low support	2,754 (24.0)	60 (42.0)	**0.4 (0.3, 0.5)**	**0.5 (0.4, 0.8)**
High stress, low support	432 (3.7)	11 (7.7)	**0.3 (0.2, 0.6)**	0.5 (0.3, 1.0)
Missing	47 (0.4)	1 (0.7)		

[a] Numbers may not add up to 100 due to rounding.
[b] Odds ratios were adjusted for maternal age, race-ethnicity, education, income and parity. Odds ratios are in **bold** if the CI excluded 1.0 before rounding.
[c] Excluded women with gestational diabetes and/or pregnancy related high blood pressure.
[d] Odds ratios were adjusted for maternal age, race-ethnicity, education, income, parity, alcohol use, tobacco use and illicit drug use. Odds ratios are in **bold** if the CI excluded 1.0 before rounding. Note: The question regarding 'serious legal/financial problems' did not adjust for income.
[e] The first 5 questions listed under 'Stress Indicators' were used to create a stress index. A yes response to 0-2 stress indicator questions designates *low stress*; 3-5 designates *high stress*. All of the questions listed under 'Social Support Indicators' were used to create a social support index. A yes response to 0-2 social support indicator questions designates *low social support*; all 3 designate *high social support*.
*Stress and social support data only available from 2006-2009; total participants =11,686.

CHAPTER V: DISCUSSION

This study examined the relationship between prenatal care and a variety of predictor variables, chosen from both the literature and through use of the Health Belief Model, to further examine factors influencing a woman's decision to seek prenatal care during pregnancy. Similarly to the annual estimate of prenatal care obtainment in the United States, 1.2% of women in this study (n=470) did not receive prenatal care during pregnancy. Compared with women reporting no prenatal care, women reporting prenatal care were more likely to: be non-Hispanic white; have an educational attainment beyond high school; have a household income of >$40,000; want to be pregnant at the time of conception; and report alcohol use from three months before pregnancy (B3) through the end of pregnancy (P9). These women were significantly less likely to: report smoking from B3-P9; and report illicit drug use from B3-P9. These findings, with the exception of alcohol use, concurred with known associations in the literature.

Women who had a previous pregnancy that ended in a miscarriage were significantly more likely to receive prenatal care during pregnancy compared to women who had never experienced a miscarriage. This finding corresponds to a previous study that examined data from the First Baby Study and suggested that women with a history of miscarriages might utilize health care more during subsequent pregnancies (Kinsey, Baptiste-Roberts, Zhu, & Kjerulff, 2015). While this previous study recommended that additional pregnancy outcomes, such as stillbirth and abortion, be assessed in future research, no significant associations were found in the current study between women who had experienced a previous stillbirth or induced abortion. A systematic review that examined late and or inadequate prenatal care in high-income countries found only one

study assessing previous birth outcomes and prenatal care initiation, of which specifically examined premature birth in relation to timing of care; women who had a previous premature birth were likely to initiate care early on in pregnancy (Ayoola, Nettleman, Stommel, & Canady, 2010; Feijen-de Jong et al., 2011). This finding does address one previous birth outcome in relation to prenatal care, however it does not directly assess history of miscarriage, stillbirth or induced abortion, and therefore comparisons with the literature cannot necessarily be made to the current study and prenatal care.

Women who had experienced morning sickness or nausea during pregnancy were significantly more likely to receive prenatal care compared to women who did not experience morning sickness or nausea. As a result, morning sickness might have acted as a cue to action for these women, and prompted them to seek care. No significant associations were observed between pre-existing health conditions during pregnancy (i.e. diabetes, high blood pressure, seizures) and prenatal care, or between fertility treatment/medications and prenatal care.

There is minimal literature in regards to maternal health and any prenatal care. However, research suggests that health status can impact timing of prenatal care. Specifically, history of medical conditions and or experiencing physical symptoms during pregnancy can influence timing of care (Enderlein, Stephenson, Holt, & Hickok, 1994). Additionally, a study examining obesity during pregnancy found that there were associations between obesity and increased use of health care (Chu et al., 2008). Nonetheless, these research findings do not directly relate to what was found in this study, and thus further research on maternal health and its impact on prenatal care is warranted.

No significant associations were observed when separately assessing each of the six stress questions and prenatal care, which was contrary to the literature's findings that stress is a predictor of prenatal care utilization (Institute of Medicine, 1988; Schetter & Glynn, 2011). Nonetheless, women who experienced emotional support, as well as financial support, before and during pregnancy, were significantly more likely to seek prenatal care compared to women who did not experience these types of support. When examining stress and social support together, women experiencing low stress/low support during pregnancy were significantly less likely to seek prenatal care compared to women experiencing low stress/high support. A borderline significant association was observed between women with high stress/low support during pregnancy, and prenatal care.

The literature has shown associations between stress and prenatal care, as well as social support and prenatal care (Johnson et al., 2007; Phillippi, Myers, & Schorn, 2014; Schaeffer & Lia-Hoagberg, 1997; Schetter & Glynn, 2011). Women experiencing high stress are less likely to seek prenatal care (Schetter & Glynn, 2011) as are women experiencing minimal social support (Schaeffer & Lia-Hoagberg, 1997). While this study did not observe significant associations between stress and prenatal care, social support findings were in agreement with previous literature. Literature has not specifically examined relationships between stress and social support in relation to prenatal care. Therefore, findings from this study cannot be compared to past literature, but lends itself to future research.

Strengths & Limitations

This study had several strengths worth noting. First, it examined participants from a population-based study with a large sample size, meaning that the sample size is more

representative of women of reproductive age in the United States (Yoon et al., 2001). This study also spanned numerous years (1997-2011) and covered various diverse regions throughout the United States. Additionally, this study was theory driven, as the Health Belief Model was used to guide the research process. In doing so, the HBM was effectively utilized to choose new exposure variables and to better determine factors that influence women's decisions to seek prenatal care.

Despite study strengths, there were limitations faced. First, the NBDPS CATI question regarding prenatal care obtainment during pregnancy, did not define 'prenatal care', and therefore it is unclear how women perceived this health care service and what exactly it entails. Prenatal care definitions are likely to vary among cultures. For example, as a result of cultural beliefs and traditions, some Hispanic women experience 'informal systems of health care' within their communities (McGlade, Saha, Dahlstrom, 2004). This informal care offers pregnant women a strong social support network (i.e. other women, community members, lay health workers) and allows women to learn healthy behaviors from older generations of women (McGlade, Saha, Dahlstrom, 2004). It is possible that Hispanic women view this type of informal care as prenatal care, which does not fit the definition of prenatal care in the United States. Additionally, responses to the prenatal care CATI question were strictly self-report, and no clinical verification was done (e.g. review of medical records) to determine whether or not the reporting was valid.

Second, there were temporality issues with the stress and social support indicator questions. These questions assessed whether a woman experienced stressful life events or social support from three months prior to pregnancy (B3) through the third month of

pregnancy (P3). A woman might have experienced a stressful life event (e.g. death of someone close, victim of abuse) three months prior to pregnancy, which would not fall within the timeline of seeking prenatal care. Or, a woman could have experienced a stressful life event after she had already sought prenatal care. Therefore, it is hard to assess exactly when these women experienced stress or social support, and whether or not those experiences affected prenatal care utilization.

Third, some variables, that the literature has shown to be related to prenatal care utilization among women, including insurance and marital status (Brady, Visscher, Feder & Burns, 2003; D'Ascoli, Alexander, Petersen, & Cogan, 1997; U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau, 2013), were not available for analysis in the NBDPS. Insurance status is a topic area that the National Birth Defects Prevention Study did not assess. Additionally, marital status was unavailable in the NBDPS DAT v9; it was included in a later DAT version. Despite this, this study assessed income level, which has been used as a proxy for health insurance status in other studies (Kearney, Haggerty, Munro, & Hawkins, 2004; Stronks, van de Mheen, van den Bos, & Mackenback, 1997). This study also assessed social support which some health related studies have used to get at the importance of assessing marital status, although others have argued that this can be problematic if marital status does not clearly align with chosen social support concepts (Barrera, 1986).

Fourth, there were sensitivity concerns with the substance use (i.e. alcohol, tobacco, illicit drug) questions. These questions asked women about behaviors that are often stigmatized by individuals in society, whether done during pregnancy or not. The

modality of the NBDPS (i.e. CATI) might have influenced potential underreporting of these behaviors, specifically illicit drug use. Women who participated in the NBDPS telephone interview might have felt uncomfortable discussing personal information with a stranger, and as a result answered questions less honestly than they would have if they were having a confidential conversation with their trusted physician. Illicit drug use often constitutes illegal behavior, and therefore women who used illicit drugs might have been less likely to report this honest behavior, and instead report the behavior most favorably viewed by others—i.e. no illicit drug use (Harrison, 1997); this might have introduced social desirability bias. Consequently, women of the legal drinking age might have felt more inclined to report alcohol use to the NBDPS interviewer, since their actions are not considered illegal. Inaccurate reporting of exposures and behaviors by the women, likely increases study concerns with validity and reliability (Harrison, 1997).

Lastly, existent literature has examined adequacy and timing of prenatal care in relation to various predictors, but neither timing or adequacy of care were assessed in this study, as reporting "no prenatal care" was this study's biggest concern. Nonetheless, adequacy and timing of prenatal care are important to examine for various reasons. For example, if a woman reported receiving prenatal care during pregnancy, this does not necessarily mean that she obtained the recommended number of visits. It also does not mean that she entered care early enough to ensure the health of herself and the baby. Associations between predictors of prenatal care might vary by prenatal care outcome (i.e. adequacy, timing, any/none). As a result, future research should examine exposures assessed in this study, as well as new exposures, in regards to adequacy and timing of prenatal care.

Implications & Future Research

Findings from this study have several implications for both behavioral sciences and health education research, as well as practice for public health overall. The study findings demonstrate that there are numerous factors influencing a woman's decision to seek prenatal care during pregnancy. While there are many known factors (e.g. maternal age, race-ethnicity, education, etc.) newly assessed exposure areas (i.e. previous pregnancy outcomes, maternal health, social support/stress) should be examined further. For example, no significant associations were found between pre-existing maternal health conditions (i.e. diabetes, high blood pressure, seizures) and prenatal care utilization. Women experiencing these health conditions are considered at high risk for complications during pregnancy, and therefore should definitely be seeking care (2014a). Future research should examine this phenomenon further, and should also assess additional health conditions and concerns that women might experience during pregnancy. This research will help to inform future interventions focused on targeting at-risk women (i.e. women with a health concern that can complicate their pregnancy) prior to, and during, pregnancy to ensure that these women are educated about the impact that their health has on their pregnancy, and the numerous benefits of prenatal care.

In addition, no significant associations were found between stress and prenatal care, which conflicts with the literature. While temporality issues did arise, future research should continue to examine stress and its influence on prenatal care. Further examination of the relationship between stress and social support would continue to contribute to the understanding of prenatal care predictors and overall use. This study's findings suggest that low social support might have driven both low and high stress

among the women. Individuals often experience some form of stress, but it is how these individuals cope with that stress, and whether or not they have adequate support that can impact the overall affect that stress has. Future research should also take a closer look at social support specifically, in order to better understand the phenomenon observed in this study. This research will, again, help to inform future intervention (e.g. interventions targeting women experiencing low support specifically).

Lastly, future research might also consider examining exposures from this study, and prenatal care, among women by the state in which a woman resides. As mentioned previously, the NBDPS had ten participating Centers for Birth Defects Research and Prevention: Arkansas, California, Georgia, Iowa, Massachusetts, New Jersey, New York, North Carolina, Texas and Utah. This study covered diverse regions of the United States and, as a result, it is likely that exposures among these women varied by geographic location, thus varying influences on their prenatal care utilization. Although transportation was not assessed in this study, access to, and ease of, transportation use differs among these states, and may act as a barrier or facilitator to seeking prenatal care. Issues surrounding transportation (i.e. to appointments) can be a source of stress among pregnant women, thus impacting prenatal care obtainment.

This study's research contributed to the current knowledge surrounding predictors of prenatal care utilization among women in the United States. Findings reinforced known associations from the literature (e.g. maternal age, race-ethnicity, education), and suggested newfound associations among previously understudied exposure areas (i.e. previous pregnancy outcomes, maternal health, stress/social support) and prenatal care among women. Further research, and a better understanding of prenatal care predictors

among women, will help to pinpoint characteristics and groups of women who are less likely to receive prenatal care during pregnancy. Although the majority of women in the U.S. receive prenatal care at some point during pregnancy, there is still a need to focus on women who are not receiving any prenatal care, as these women put not only their own health at risk, but also put their baby's health at risk (Healthy People, 2014; U.S. Department of Health and Human Services, n.d.a). Future research should continue to examine predictors of prenatal care utilization, to help inform interventions focused on improving education and utilization of prenatal care among pregnant women in the United States.

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APPENDIX

Appendix A. Stress & Social Support NBDPS CATI Questions

	CATI Question	Response Options
Stress	From 3 months before you became pregnant through your 3rd month of pregnancy, did you experience any serious relationship difficulties with your husband or partner or become separated or divorced?	Yes, No
	During the same time period, did you or your husband or partner have any serious legal or financial problems?	Yes, No
	During this same time period, were you or someone close to you a victim of abuse, violence or crime?	Yes, No
	During this same time period, did you or someone close to you have a serious illness or injury?	Yes, No
	During this same time period, did you someone close to you die?	Yes, No
	During this same time period, how often did you feel nervous or stressed? Would you say… ***This question was not used in the stress index, as it assessed frequency of stress, and not a stressful life event.***	Never, Almost Never, Sometimes, Somewhat Often, Very Often
Social Support	During this same time period, could you count on anyone to provide you with emotional support such as talking over a problem or helping with a difficult decision, if you had needed it?	Yes, No
	During this same time period, could you count on anyone to provide you with help financially such as paying bills or providing food or clothes, if you had needed it?	Yes, No
	During this same time period, could you count on anyone to provide you with daily tasks such as grocery shopping, child care, or cooking if you had needed it?	Yes, No