ABSTRACT

Title of Document: THE IMPORTANCE OF UNMARRIED RESIDENTIAL FATHERS TO MATERNAL AND CHILD HEALTH: THE ASSOCIATION BETWEEN PRENATAL INVOLVEMENT AND BIRTH OUTCOMES

Barbara Jones Singer
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Directed By: Sandra L. Hofferth, Ph.D.
Professor, Department of Family Science

Rates of low birth weight and preterm birth in the United States remain higher than those of other industrialized countries. The influence of fathers during the pregnancy period and the impact they have on birth outcomes represent under-researched areas in the field of maternal and child health.

This study used nationally representative data from the Early Childhood Longitudinal Study – Birth cohort (2001) to explore three lines of research. Approximately 850 children of unmarried residential fathers comprised the analytic sample. First, as several studies have used paternity acknowledgement as a proxy for paternal involvement during the pregnancy, this study tested three fatherhood constructs to determine if they were associated with whether the father's name was listed on the birth certificate. This study then examined if these fatherhood constructs were associated

with low birth weight and preterm birth. Two mediating pathways were considered: change in maternal smoking during pregnancy and adequacy of prenatal care. Finally, the influence of state-level paternity establishment rates on the association between fatherhood constructs and father's name on the birth certificate was studied.

The results indicated that paternal history of negative behaviors was associated with the unmarried residential father being named on the birth certificate. Furthermore, children who lived in states with high rates of paternity establishment were more likely to have their father's name on the birth certificate. Paternal prenatal involvement was associated with both an increased chance of receiving adequate prenatal care and a reduced risk of low birth weight. Maternal smoking during pregnancy was reduced when both parents wanted the pregnancy, and not reduced when the father had a history of negative behaviors.

This study supports the conclusion that paternal prenatal involvement is an important area to be considered in the reduction of adverse birth outcomes. Moreover, this study adds to our understanding of some limitations of using the father's name on the birth certificate as a proxy for paternal involvement during pregnancy for unmarried residential fathers. Finally, although mediation was not evident, this study confirms the influential role that unmarried residential fathers play in maternal health behaviors.

THE IMPORTANCE OF UNMARRIED RESIDENTIAL FATHERS TO MATERNAL AND CHILD HEALTH: THE ASSOCIATION BETWEEN PRENATAL INVOLVEMENT AND BIRTH OUTCOMES

By

Barbara Jones Singer

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Advisory Committee:
Professor Sandra L. Hofferth, Chair
Professor Elaine A. Anderson
Associate Professor Natasha Cabrera
Assistant Professor Xin He
Professor of the Practice Samuel S. Kessel

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Chapter 1: Introduction

Though a country of enormous wealth and access to top-quality health care services, the U.S. ranks poorly compared to other industrialized nations with regard to birth outcomes (MacDorman & Mathews, 2009). In particular, unmarried women are at higher risk for adverse birth outcomes such as low birth weight and preterm birth than married women (Mathews & McDorman, 2010; Ventura & Bachrach, 2000). These birth outcomes have been linked to a multitude of other maternal risk factors including maternal age, stress, income, education, employment, housing, prenatal care utilization, smoking, and alcohol consumption (Lu & Halfon, 2003). Despite a vast amount of literature on low birth weight and preterm birth, there is still a great deal we don't know about predicting and ultimately preventing these birth outcomes.

An area of evolving research in maternal and child health shines light on the importance of fathers during pregnancy. Little is known about the role of the expectant father in pregnancy outcomes (The Commission on Paternal Involvement in Pregnancy Outcomes, 2010), how the father supports or does not support the mother during a pregnancy (Martin, McNamara, Milot, Halle, & Hair, 2007), or which specific aspects of paternal involvement in pregnancy lead to optimal outcomes (Bond, 2010). The research that does exist related to the impact of fathers on birth outcomes establishes that paternal prenatal involvement is beneficial to maternal and child health outcomes. It is also understood that paternal prenatal involvement is quite important as it relates to later paternal involvement throughout childhood (Bronte-Tinkew, Ryan, Carrano, & Moore, 2007; Cabrera, Fagan & Farrie, 2008; Cook, Jones, Dick & Singh, 2005; Cowan, 1998).

The current study focuses on children born to couples who live together but do not marry, building upon our understanding of the influence of *unmarried residential fathers* during pregnancy on the health status of the mother and child. Marital status alone as an indicator of paternal prenatal involvement has become increasingly less relevant as an accurate measure of paternal involvement as the number of births to unmarried women increases and stigma surrounding childbearing by unmarried cohabiting couples decreases (Martinez, Chandra, Abma, Jones, & Mosher, 2006). A study by Bumpass and Lu (2000) suggests that births to cohabitors represent close to 40% of nonmarital births. Perhaps more meaningful measures than marital status are fathers' attitudes towards the pregnancy, fathers' behaviors during the prenatal period, and the relationship between the mother and father (Bird, Chandra, Bennett, & Harvey, 2000; Misra, Caldwell, Young, & Abelson, 2010). Studies that only take into account marital status may underestimate the contribution of many unmarried fathers who are very involved with the pregnancies but are simply not married to the mother of their child. Many other studies on father involvement have, as a result of growing divorce and separation rates, been interested in the absent, or nonresidential father (Hofferth et al., 2007).

Because very few nationally representative studies include information on unmarried fathers (Kotelchuck, 2009), the literature on their influence on birth outcomes is scarce. As a result, researchers in this field have had to rely on proxies for paternal prenatal involvement. For unmarried fathers, one proxy is the listing of father's name on the birth certificate as an indication of his presence or absence during the pregnancy. The studies using this proxy have primarily been conducted using linked infant birth-death vital statistics data that have connected the father's name on the birth certificate to infant

mortality and other adverse health outcomes in infancy (Guadino, Jenkins, & Rochat, 1999; Luo, Wilkins, & Kramer, 2004; Phipps, Sowers, & Demonner, 2002; Tan, Wen, Walker, & Demissie, 2004). Because vital statistics data collects a relatively low level of information on the father, the father's name on the birth certificate proxy for paternal prenatal involvement has not been validated in these studies, and has received only very limited validation in other research (Knight et al., 2006; Phipps et al., 2005). **Therefore, the first objective of this study is focused on learning more about what is meant by the appearance of the father's name on a birth certificate.**

The study of birth outcomes is complex, with many factors posited to play a role. Adverse birth outcomes have been linked to a multitude of maternal risk factors including maternal age, stress, income, education, employment, housing, prenatal care utilization, smoking, alcohol consumption, and marital status (Lu & Halfon, 2003). Although maternal risk factors have been studied in depth, as previously noted, research on paternal influence on birth outcomes has been relatively limited. Because fathers are more than just a name on the birth certificate, the current study will also delve "behind the scenes" to assess ways that fathers may be influencing birth outcomes. **In this, the second line of research, the study examines the association between various constructs of fatherhood - including paternal prenatal involvement - and birth outcomes, and explores possible maternal pathways of these associations.**

Finally, for unmarried fathers, inclusion on the birth certificate is more complex than it is for married fathers. Married men are presumed to be the fathers of their wives' children (Phipps, Rosengard, Weitzen, & Boardman, 2005) and almost all (99% in one sample) birth certificates of infants born to married women name the father (Singer &

Hofferth, unpublished data). For unmarried fathers, there are various obstacles to establishing paternity, including procedural and policy-related barriers (Phipps et al., 2005). Moreover, there are broad financial obligations to establishing paternity, and as a result many federal and state policies that impact paternity acknowledgment are driven by a desire to establish child support orders. One mechanism used to evaluate states is the Paternity Establishment Percentage (PEP), or generally the number of children born to unmarried parents for whom paternity has been established (Social Security Act, 2012). More aggressive policies or programs to establish paternity may be reflected in a higher state PEP, and consequently impact the father's name being listed on the birth certificate. **The last line of research tests how state-by-state variation of paternity establishment policies may influence the associations between fatherhood constructs and unmarried fathers being listed on birth certificates.**

Research Questions

To summarize, the aims of this study were to:

1) Examine the association between various fatherhood constructs for unmarried residential fathers - a) paternal prenatal involvement, b) concordance of pregnancy wantedness, and c) paternal history of negative behaviors - and the inclusion of their names on the birth certificate**.**

    1a. Identify whether and how unmarried residential paternal prenatal involvement (such as discussing the pregnancy with his partner, attending childbirth classes, or seeing a sonogram) are associated with the father's name being listed on the birth certificate.

1b. Identify whether and how concordance of pregnancy wantedness is associated with the father's name being listed on the birth certificate.

1c. Identify whether and how a history of paternal negative behaviors is associated with the father's name being listed on the birth certificate.

2) Examine whether and how an association exists between birth outcomes and various fatherhood constructs (including paternity acknowledgment) of unmarried residential fathers. These outcomes include low birth weight and preterm birth.

2a. Determine whether and how being named on the birth certificate is associated with birth outcomes.

2b. Determine whether and how paternal prenatal involvement (such as discussing the pregnancy with his partner, attending childbirth classes, or seeing a sonogram) is associated with birth outcomes.

2c. Determine whether and how concordance of pregnancy wantedness is associated with birth outcomes.

2d. Determine whether and how a paternal history of negative behaviors is associated with birth outcomes.

3) Examine if the association between birth outcomes and various fatherhood constructs of unmarried residential fathers is mediated by maternal prenatal health behaviors such as change in smoking during pregnancy and prenatal care utilization.

    3a. Determine whether and how maternal prenatal health behaviors are associated with birth outcomes.

    3b. Determine whether and how various fatherhood constructs are associated with maternal prenatal health behaviors.

    3c. Determine whether and how the effect of fatherhood constructs on birth outcomes is mediated by maternal prenatal health behaviors.

4) Determine whether state-level Paternity Establishment Percentages (PEP) modifies the effect of various fatherhood constructs on the unmarried residential father being named on the birth certificate.

Conceptual model

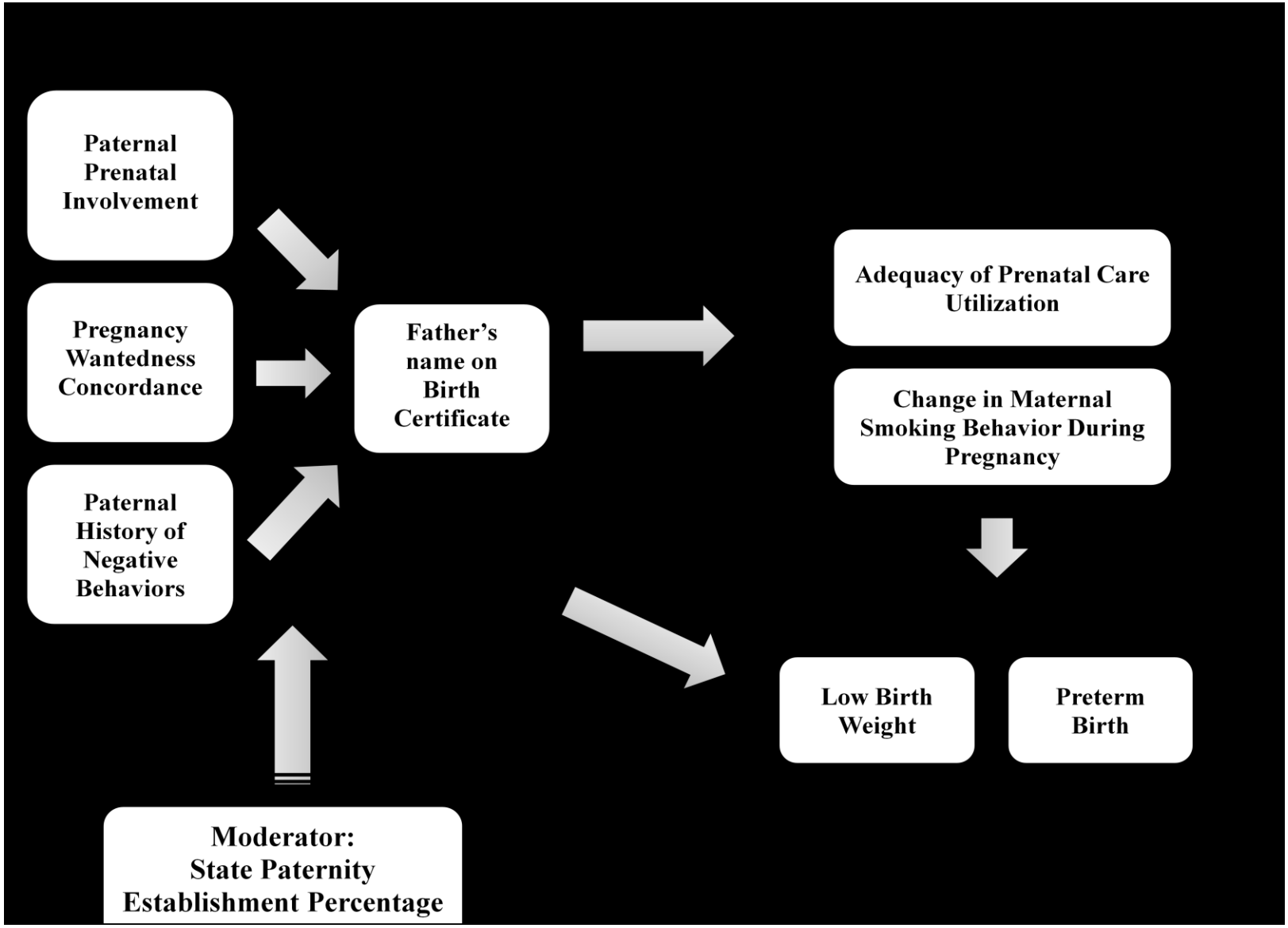
This study utilized data collected in the Early Childhood Longitudinal Study – Birth Cohort (ECLS-B). The ECLS-B is a nationally representative sample of 14,000 children born in the year 2001 (U.S. Department of Education, n.d.). At approximately nine months post-partum, separate survey instruments were conducted with the infant's mother and father. These survey data, in combination with birth certificate data, were used to test the research questions of this study.

There were three components to the conceptual model (Figure 1). First was an exploration of the various fatherhood constructs during pregnancy and their association

with whether the father is subsequently named on the child's birth certificate. The study assessed three involvement constructs: the father's prenatal involvement (such as attending childbirth classes, viewing an ultrasound, and buying things for the baby); concordance between the mother and father's wantedness of pregnancy; and whether the father might be considered an asset to the mother/father dyad, based on his history of negative behaviors.

Second, the model explored how the various fatherhood constructs during pregnancy, with the inclusion of father's name on the birth certificate, are associated with birth outcomes – low birth weight and pre-term birth. The study examined whether maternal health behaviors (change in smoking behavior and prenatal care utilization) help explain the impact of fathers on birth outcomes.

Finally, the study analyzed the effect that the state-level Paternity Establishment Percentages (PEP) had on associations between fatherhood constructs and father's name on the birth certificate. Control variables included maternal age, household income, maternal education, child race/ethnicity, maternal pregnancy complications, support from other adults in household over the age of 18, gender, twin status, and maternal/paternal parity.


Paternal Prenatal Involvement
Pregnancy Wantedness Concordance
Paternal History of Negative Behaviors
Father's name on Birth Certificate
Adequacy of Prenatal Care Utilization
Change in Maternal Smoking Behavior During Pregnancy
Low Birth Weight
Preterm Birth
Moderator: State Paternity Establishment Percentage

Theories

Two theories were applied to this research. First, the study used **social exchange theory** to understand the association between paternal behaviors during pregnancy and fathers being named on birth certificates (Research Questions 1 and 4). Social exchange theory posits that "every individual voluntarily enters and stays in a relationship only as long as it is adequately satisfactory in terms of his rewards and costs" (Thibaut & Kelley, 1959, p. 37). Individuals in social situations make decisions about how to act, and in doing so consider the value of rewards and the probability of obtaining them, as opposed to the costs (Sabatelli & Shehan, 1993). One of the decisions unmarried parents must make is whether or not to include the father's name on the birth certificate of the child. Applying social exchange theory, both mothers and fathers will weigh the benefits of the father's name appearing on the birth certificate (and theoretically, the benefits of being involved as a father) against the costs. This research assessed cost/benefit considerations such as wantedness of the pregnancy, paternal prenatal involvement, and history of negative behaviors of the father.

Second, **the theory of reasoned action** provides a framework for understanding the association between paternal involvement and birth outcomes (Research Questions 2 and 3). The theory of reasoned action states that individual performance of a given behavior is primarily determined by 1) the person's attitude toward the behavior (i.e., beliefs about the outcomes of the behavior and the value of these outcomes) and 2) the influence of the person's social environment or subjective norm (i.e., beliefs about what other people think the person should do, as well as the

person's motivation to comply with the opinions of others) (Fishbein & Ajzen, 1975). This theory is particularly concerned with the influence of 'significant others' on an individual's intention to act (Earle, Lloyd, Sidell, & Spurr, 2007, p.135), making it particularly relevant to this study. From this theoretical perspective, unmarried residential fathers should play an influential role in the initiation of positive maternal health behaviors, such as adequate prenatal care utilization; as well as the cessation of unhealthy maternal behaviors, such as smoking. Each of these behaviors has been associated with negative birth outcomes.

The strengths of this study are multiple. First, this is the first study to use a nationally representative sample to identify correlates of fathers being named on the birth certificate of their children. A unique aspect of this study is that it used fathers' self-report of their actual behaviors during pregnancy -- data that are typically unavailable in most large samples (The Commission on Paternal Involvement in Pregnancy Outcomes, 2010). The study's approach is novel in that it combined birth certificate data with survey data from both the mother and father. In addition, it examined how state-level policies influence paternity acknowledgement for these fathers. Finally, this study is among only a few to test for the mediation of maternal health behaviors, enabling us to learn more about the pathways between fatherhood constructs and birth outcomes.

In order to improve pregnancy outcomes, it is clear that we need to learn more about the contributions of fathers during the influential prenatal period of life. Extensive research has been conducted on fathers' involvement with their children after birth. Yet the influence of fathers during pregnancy – whether helpful or harmful

– is an area in which research is quite limited. This study helps us understand the role that fathers play and better gauge how their involvement is affecting the fetal and early post-natal development of their children. From programmatic and policy perspectives, it also contributes to the growing discourse around the role of men in prenatal care and reproductive health.

Chapter 2: Review of the Literature

Theoretical framework

Two theories were used to understand the associations in this study. First, social exchange theory assisted in understanding the association between the various fatherhood constructs and father's name on the birth certificate (Research Questions 1 and 4). Second, theory of reasoned action helped with understanding the association between the various fatherhood constructs and birth outcomes, as mediated by maternal health behaviors (Research Questions 2 and 3).

Social Exchange Theory

Social exchange theory dictates that "social relationships involve a process of giving and getting rewards to and from others in a way that is mutually gratifying" (Sabatelli & Shehan, 1993, p. 390). One of the forefathers of this theory, George Homans, highlighted the rule of distributive justice as one of these factors, stating that "a man in an exchange relation with another will expect that the rewards of each man be proportional to his costs – the greater the rewards, the greater the costs" (Homans, 1961, p.75). In other words, an individual should feel they are benefiting in a way that is proportionate to their input. Another social exchange theorist, Peter Blau, inserted more economic principles into social exchange theory (Sabatelli & Shehan, 1993, p.391). He conceived of social life as a "marketplace" in which participants negotiate with each other in an effort to make a profit (Sabatelli & Shehan, 1993, p. 391). He also suggested that the more people have exchanged rewards with one another, the more likely it is for reciprocal obligations to emerge and guide subsequent exchanges

(Sabatelli & Shehan, 1993, p.391). Those who have been in a longer or more committed relationship may more readily participate in exchanges.

This theory provides a framework for understanding the contexts surrounding establishment of paternity at birth for unmarried fathers. Phipps et al (2005) discusses three possible explanations for when paternity is not established: 1) maternal factors, such as the mother's unwillingness to identify the father; 2) paternal factors, such as the father's unwillingness to be identified; and 3) procedural obstacles, such as difficulties with the process of establishing paternity. Exchanges, in the form of the costs and benefits of including the father on the birth certificate, must be assessed from two perspectives – that of the mother and that of the father.

Benefits of paternity acknowledgment from mother's perspective

From the mother's perspective, there are social and economic benefits of naming the father on the birth certificate. Eligibility for public assistance depends on a father's name appearing on the birth certificate; thus, the financial implications of paternity establishment for mothers and children can be significant (U.S. Department of Health and Human Services, 1999). Furthermore, it legalizes and formalizes the relationship with the father, which may lead to additional economic incentives (beyond child support) as well as social support. It provides the child the legitimacy of a named father and presumably, more access to that father than if he were not named. Finally, establishing a paternal identity for the father may reduce his ability to be elusive in defining his parental roles and responsibilities (Cabrera, Tamis-LeMonda, Bradley, Hofferth, & Lamb, 2000), which may be beneficial for the unmarried mother.

Costs of paternity acknowledgment from mother's perspective

There may be costs, or consequences, for an unmarried mother to include the father's name on the birth certificate. First and foremost, the relationship between mother and father may be a negative one; by refraining from naming the father, she may be distancing herself and her child from someone she feels is problematic. There may be legal reasons for why naming the father would come at a cost. In instances where a father may be accused of statutory rape (Phipps et al., 2005) or is not a legal U.S. citizen, the mother may fear that naming the father could lead to his arrest. The aforementioned connection between paternity establishment and eligibility for social services may not work in the best interest for the mother. In some cases, parents may be able to work out a financial situation that makes it economically more feasible to forgo paternity acknowledgment (Turner, 2001). Finally, if the mother does not need financial support from the father, she may not feel she would benefit from paternity establishment (Mincy, Garfinkel, & Nepomnyaschy, 2005). Recent research also suggests that some mothers are unwilling to sign paternity affidavits because they do not want the father to gain custody or visitation rights (Pearson & Thoennes, 1995).

Benefits of paternity acknowledgment from father's perspective

Similar to the previously discussed benefits for the mother, from the father's perspective, the benefits of being named on the birth certificate include formalizing the relationship with the mother and legalizing the relationship with the child. This validation of the relationship with the child should enable increased access to the child, regardless of the father's future relationship with the mother. The naming of the

father on the birth certificate may also be considered a reward for the father in return for his engagement and support during the pregnancy.

Costs of paternity acknowledgment from the father's perspective

The perceived costs to the father may include the aforementioned fear of arrest related to statutory rape or citizenship. Furthermore, men can never really be sure of paternity and thus face the risk of investing resources in someone else's child (Lamb, 2000). Some fathers may be interested in being involved, but hesitant to be named on the birth certificate because of child support obligations (Turner, 2001). Moreover, the father may not be interested in providing any sort of support – financial or otherwise – to the mother and baby. This may be particularly true if one or both of them is not in good health (Hofferth & Pinzon, 2011). The age of the father may factor into reluctance to be involved. Compared to older fathers, teen fathers may be more likely to see parenthood as a "crisis" (Cabrera et al., 2000) rather than a situation that could provide some benefits. And finally, the procedural barriers that exist for fathers to be named as the parent may pose too much of a cost to the father.

Theory of Reasoned Action

The theory of reasoned action, and its newer version, the theory of planned behavior, provide a framework for understanding behavior change at an individual level. The theory suggests that an individual's intention to behave in a certain way is the key to whether they actually do so (Earle, 2007, p. 134). Behavior is influenced by three things: attitudes towards that behavior, subjective norms, and perceived behavioral control. These theories are particularly concerned with the influence of 'significant others' on an individual's intention to act.

The theory of reasoned action can be utilized to understand the influence of fathers on birth outcomes, as mediated by maternal health behaviors. Men are considered "important actors who influence, both positively and negatively, both directly and indirectly, the reproductive health outcomes of women and children" (Dudgeon, 2004). Men's intention and desires have been shown to influence timing of first pregnancy (Chalmers & Meyer, 1996), women's prospective desire to become pregnant (Chalmers & Meyer, 1996), feelings upon learning of pregnancy (Major, Cozzarelli, Testa & Mueller, 1992), and subsequent changes in women's evaluation of pregnancy wantedness, both during the pregnancy and post-partum (Kroelinger & Oths, 2000; Montgomery, 1996). Given the importance that women seemingly place on the feelings of their male partners with regard to their pregnancies, applying the theory of reasoned action provides an understanding of how a mother may take into consideration his actions, behaviors, and opinions as she is making decisions about her own prenatal health behaviors.

This theory is useful in considering how each of the fatherhood constructs may influence maternal health behaviors, which in turn impacts birth outcomes. According to the theory, the intention to act on a health behavior can be influenced by subjective norms. Subjective norms relate to a person's belief about what they should do and to their motivation to comply with the wishes of others (Earle et al., 2007, p. 134). During the pregnancy period, fathers have a great deal of potential to influence subjective norms. Mothers are making choices about health behaviors to adopt during pregnancy, and likely look to the fathers when assessing which behavioral path to take. For instance, in determining if a mother should reduce or quit smoking, the

mother's belief about what the father wants may be an important decision point for the mother. If the father has indicated to her how much he wants the pregnancy (pregnancy wantedness concordance), she may in turn be more motivated to reduce smoking. If the relationship is such that both parents want the father's name listed on the birth certificate, his influence on her intention to modify her behaviors may be stronger than it would be if they were in relationship where his name was not going to be listed on the birth certificate (father's name on the birth certificate).

Another aspect of the theory of reasoned action states that an individual's attitude toward the behavior is influential in a person's intention to act on the behavior. Again, mothers may look to their 'significant other' (the fathers) to help shape their attitude towards a behavior. For instance, if the father himself is engaging in smoking or risk behaviors (paternal history of negative behaviors), the mother may deem that as acceptable behavior and continue to engage in smoking herself. Moreover, if the father expresses an interest in hearing the baby's heartbeat and has a positive attitude towards prenatal care (paternal prenatal involvement) the mother may adopt that attitude and receive adequate prenatal care.

Dependent Variables: Birth outcomes

Prior to a review of the literature on low birth weight and preterm birth, the influence of the biology of the mother and of the developing baby on these birth outcomes should be briefly discussed. Associated with low birth weight and/or preterm birth are many medical complications during the pregnancy, pre-existing health conditions of the mother, and biological characteristics of the mother or the child (see Literature Review, below). In some cases, avoidance of adverse birth

outcomes related to these biological conditions can be achieved with adequate prenatal care and reduction in smoking. In other cases, it cannot.

This study controlled for some known biologic predictors of low birth weight and preterm birth, including pregnancy complications, gender of the child, and maternal age. However, there were many more biological aspects of the woman and child that could not be controlled for. One such area worth discussing in more detail, as it can certainly be impacted by paternal prenatal involvement, is the effect of stress. Preterm birth and fetal growth restriction have been attributed to elevated rates of placental corticotropin-releasing stress hormone (CRH), a notion discussed as the "placental clock" (Wadhwa et al., 2004). Stress has also been discussed as it relates to the combined effect of the mother's development prior to the pregnancy. A life course perspective proposed by Lu and colleagues (2010) conceptualizes birth outcomes as the end product of not only the nine months of pregnancy, but the entire life course of the mother before pregnancy. They speculate, for example, that the increased risk of African American women to preterm birth and low birth weight may be traced to greater exposures to stress hormones during pregnancy, early life, and possibly even in utero.

Low birth weight

As a major determinant of morbidity and disability in infancy and childhood, low birth weight also has a long-term impact on health outcomes (World Health Organization, 2008), including links to chronic diseases such as diabetes, obesity and cardiovascular disease in adulthood (Shore & Shore, 2009). There are two primary ways in which low birth weight occurs during pregnancy. The first is as a result of

preterm delivery (birth prior to 37 completed weeks of gestation), thus providing insufficient time for growth and weight gain. About 67% of low weight births are delivered preterm (Martin et al., 2010). The other 30-35% of low weight births occur in full term pregnancies, resulting from restricted growth during the pregnancy (Martin et al., 2010).

Low birth weight (less than 2,500 grams) occurred at a rate of 8.1 % in 2011 (Hamilton, Martin, & Ventura, 2012). In the U.S. there was a decline in the rate of low birth weights between 1971 and 1981, from 7.6 to 6.8 respectively, (Child Trends, 2010), then an increase of more than 20% from the mid-1980s through 2006 (Martin et al., 2012). More recently there has been a slight decline, starting in 2006, to the current rate of 8.10 in 2011 (Hamilton et al., 2012). The low birth weight rate varies by race and ethnicity. In 2011, for the non-Hispanic white population the rate was lower than the average, at 7.09, whereas the rate for the non-Hispanic black population was nearly twice that of whites, at 13.33. The Hispanic population has a rate of low birth weight below that of whites, at 7.02 (Hamilton, Martin, & Ventura, 2012).

Factors that have been associated with an increased risk for low birth weight include: young maternal age (teens) or older maternal age (over 35); black race; low socioeconomic status; low education (under 12 years); unmarried status; medical and obstetric risks including preeclampsia/hypertension and diabetes; history of previously delivering low birth weight baby or previous fetal or neonatal death; short interpregnancy interval (with the highest risk at less than six months); multi-gestational pregnancy; infections (rubella, cytomegalovirus, urinary tract infections);

inadequate prenatal care; and poor nutrition, smoking, alcohol, or drug use during pregnancy (March of Dimes, 2008), or inadequate maternal weight gain (Ludwig & Currie, 2010).

Preterm birth

In the U.S. in 2011, 11.7 % of babies were born pre-term (Hamilton, Martin, & Ventura, 2012). According to the World Health Organization, the U.S. incidence of preterm birth is more similar to the rate in Africa (approximately 12%) than that in Europe (approximately 6%) (Beck et al., 2010). The rate of preterm births in the United States has declined during the last five years to a rate of 11.72 in 2011 (Hamilton et al., 2012). Although the lowest level reported in more than a decade, the 2011 rate of preterm birth is still higher than rates reported during the 1980s and most of the 1990s (Hamilton et al., 2012). As with low birth weight, the rate of preterm birth varies by racial and ethnic groups. The rate of preterm birth for non-Hispanic black children (16.65) was higher in 2011 than for non-Hispanic white children (10.49) or Hispanic children (11.66) (Hamilton et al., 2012). Although still substantially higher than that of other groups, the 2011 preterm rates for non-Hispanic black infants were the lowest reported in the last three decades (Hamilton et al., 2012).

Children who are born preterm are at risk for myriad health problems including acute respiratory, gastrointestinal, immunologic, central nervous system, hearing, and vision, as well as longer-term motor, cognitive, visual, hearing, behavioral, socio-emotional, health and growth problems (Berhman & Butler, 2007). It has been estimated that in the United States the annual costs associated with

preterm birth, in terms of medical and educational expenses and lost productivity, are more than $26.2 billion (Berhman & Butler, 2007).

Preterm birth is associated with women who are younger maternal age (less than 16) or older maternal age (35 years of age or older), unmarried, lower socioeconomic status and lower educational attainment women. Marriage has been shown to provide the greatest protective factors for preterm birth in those over the age of 35 and in African Americans (Berhman & Butler, 2007). Family history of preterm birth (self, mother or sister), short interpregnancy period (less than or equal to 6 months) and plurality have been also associated with increased risk of preterm birth (Berhman & Butler, 2007). Both chronic and acute stress have been consistently associated with preterm birth (Dole et al., 2003; Hobel, 2004; Kramer et al., 2001). Finally, numerous maternal medical conditions have been associated with increased risk of preterm birth including lupus, restrictive lung disease, hyperthyroidism, diabetes (including gestational diabetes), maternal cardiac disease, asthma, renal disorders and hypertension (including preeclampsia), shortened cervix mid-pregnancy (Berghella et al., 1999), underweight in women (Berhman & Butler, 2007), bacterial vaginosis (Ruiz, Fullerton, Brown & Dudley, 2002), periodontal disease (Pretorius, Jagatt, & Lamont, 2007) and maternal HIV infection (Schulte, Dominguez, Sukalac, Bohannon, & Fowler, 2007).

Mediating Variables: Maternal health behaviors

Reducing maternal smoking during pregnancy

Smokers have almost twice the rate of low birth weight babies compared to nonsmokers (Martin et al., 2010). A reduction in smoking has been shown to be

beneficial in reducing low birth weight. A large prospective cohort study based in Netherlands followed 7,098 pregnant women to determine associations between smoking during pregnancy and adverse birth outcomes. For those women who smoked before pregnancy, continued active smoking after pregnancy was associated with low birth weight (adjusted odds ratio 1.75 [95% CI 1.20, 2.56]) and preterm birth (adjusted odds ratio 1.36 [95% CI 1.04, 1.78]). There is evidence that the timing of the smoking during the pregnancy is important. The strongest associations were found for active maternal smoking in late pregnancy. For all active smoking categories in early pregnancy, quitting smoking was associated with a higher birth weight than continuing to smoke (Jadoe et al., 2008). A Colorado study of Medicaid-eligible women (N=3569) also supports these findings. Of pre-pregnancy smokers, women who quit smoking had a low birth weight rate of 8.5%, compared to a low birth weight rate of 13.7% among women who did not quit (Ricketts, Murray, & Schwalberg, 2005).

There is less concrete evidence linking smoking during pregnancy to preterm birth, although researchers have speculated that behavioral factors such as smoking can provide pathways for preterm birth, particularly in certain populations such as women with lower socioeconomic status and less education. Although smoking is among the most prevalent and preventable causes of adverse pregnancy outcomes, the relationship between smoking and preterm birth is rather modest and not entirely consistent (Behrman & Butler, 2007). As with the association between smoking and low birth weight, there is evidence to support that the greatest influence of smoking

on preterm birth occurs in the later part of pregnancy (Berhman & Butler, 2007; Jadoe et al., 2008).

Prenatal care utilization

Prenatal care is among the most frequently utilized health care service (Kogan et al., 1998) and has been considered the cornerstone of the U.S health strategy for improving pregnancy outcomes (Lu et al., 2006). Despite its widespread use, there is growing speculation about the limits of prenatal care. Specifically, there has been some doubt about whether prenatal care is a truly effective factor in reducing low birth weight (Lu, Tache, Alexander, Kotelchuck, & Halfon, 2003) and preterm birth (Alexander & Kotelchuck, 2001). To illustrate this point, a review of one 15-year time period (1981-1995) noted a decrease in the level of inadequate prenatal care coinciding with an increase in low birth weight and preterm birth (Kogan et al., 1998).

The benefits of prenatal care may be more accurately captured in the decrease in the infant mortality rate during that time period. Researchers have speculated that the true benefit of prenatal care is seen not in reduced birth weights and preterm births, but in the decrease of birth weight-specific mortality (Alexander & Kotelchuck, 2001.) By monitoring the growth of the baby and the health of the mother, prenatal care can pinpoint and treat medical issues that increase the risk for adverse birth outcomes (for example, bacterial vaginosis, which can lead to preterm birth).

Despite the debate about the effect of prenatal care on low birth weight and preterm birth, utilization of prenatal care has been recognized for its many benefits

during pregnancy. Prenatal care provides an opportunity for medical providers to work with pregnant mothers on optimizing healthy pregnancies by educating them about healthy eating, vitamin supplementation, and cessation of alcohol, smoking or drug use. Preventive health care such as vaccinations can be provided to women who need them as can prenatal testing and screening for depression or abuse.. Prenatal care can also include preparation for childbirth in the form of educational classes. In addition, for many women prenatal care serves as an entry point for Medicaid and social services (Misra & Guyer, 1998).

Independent Variables: Fatherhood constructs

The following section provides a review of the literature on the four fatherhood constructs under investigation in this study: 1) father's name on the birth certificate; 2) paternal prenatal involvement; 3) pregnancy wantedness concordance; and 4) paternal history of negative behaviors. This section will explore the effect of each construct on the dependent variables in question.

Fatherhood construct 1: Father's name on the birth certificate

Some studies have discussed the father's name on the birth certificate as a relevant indication of the father's involvement during the pregnancy (Teitler, 2001), and his support of and commitment to the mother during this time (Mincy et al., 2005). Birth certificates including the father's name have also been linked to parents who have more human capital (education, health, work, no incarceration history, and no welfare reliance) (Mincy et al., 2005). Father's name on the birth certificate was used in two ways in this study. First, this study explored which fatherhood constructs

predict father's name on the birth certificate, enabling us to hone in on the underlying meaning of this variable. The study then explored if there were associations between father's name on the birth certificate and birth outcomes, as mediated by maternal health behaviors.

Use of father's name on the birth certificate as a proxy for paternal involvement during the pregnancy

The current state of the research is such that it is unclear which behaviors of fathers during pregnancy may be associated with being named on the birth certificate. Using Fragile Families data, Teitler (2001) revealed that there were similar proportions of fathers who were involved during pregnancy and fathers who had their names on the birth certificate (87% and 90%, respectively). Here, father involvement was measured by whether the child has the father's surname, whether the father's name is on the birth certificate, whether the father went to the hospital, whether he provided financial and in-kind contributions during pregnancy, whether the father told the mother he would provide financial support for the baby during the coming year, and whether the father indicated a desire to be involved in raising the child. In another study, which focused on adolescents, paternal prenatal involvement was defined as the appearance of a father's name in the prenatal record. The study found that a father's name on the prenatal record corresponded with 2.2 times the likelihood that the name would also appear on the birth certificate, compared to when it did not appear on the prenatal record. However, after adjusting for maternal age, maternal race/ethnicity and paternal age, the association was no longer significant (Phipps et al., 2005). Finally, Knight and colleagues (2006) used randomly selected birth certificates to validate use of father's name on the birth certificate as a proxy for

involvement during the pregnancy. The study looked at three births where no father was listed on the birth certificate. For these pregnancies, the authors used medical records to determine that no partner was present at delivery; they also confirmed lack of father involvement during pregnancy through interviews with the mother's medical care providers. Conversely, they examined another 47 cases where the father's name did appear on the birth certificate, and for each case found evidence of some father involvement during the pregnancy.

Effect of father's name on birth certificate on maternal health behaviors

A few studies have considered the association between the father's name on the birth certificate and maternal health behaviors during pregnancy. Perhaps considered the landmark study using this variable, Guadino et al. (1999) used Georgia vital statistics data to examine relationships between father's name on the birth certificate, various maternal health behaviors, and infant health outcomes. Their findings provide evidence of an association between father's name on the birth certificate and maternal smoking and prenatal care utilization. Married women who did not report father's name on the birth certificate were more likely to be smokers (37%) than married women who reported the father's name (14.2%, $P<0.001$). Likewise, unmarried women not listing the father's name were more likely to be smokers (20.2%) than unmarried women listing the father's name (18.9%, $p<0.001$). There was also an association between the father's name on the birth certificate and adequacy of prenatal care (measured using a modified Kessner index). Married women reporting the father's name on the birth certificate were more likely to have adequate prenatal care (77.1%) than married women not reporting the father's name

(44.9%, p<0.001). Unmarried women listing the father's name were also more likely to have adequate prenatal care (50%) than unmarried women not listing father's name (37.6%, p<0.001). A similar finding was reported by Tan et al. in a study of twin births. Women with missing partner information on the birth certificate were more likely to be black, unmarried, to report prenatal smoking, and to have inadequate prenatal care (2004).

Teitler's (2001) examination of Fragile Families data assessed an association between the father's name on the birth certificate, prenatal care, and smoking and drinking during pregnancy. Women who reported the father's name were more likely to initiate prenatal care in the first trimester (.587, se .173, p<0.01), less likely to use alcohol during pregnancy (-.679, se .388, p<.10) and less likely to smoke during pregnancy (-.409, se.184, p<.05) than those women who didn't report the father's name on the birth certificate. Knight et al. (2006) also reported that mothers without the father's name on the birth certificate were more likely to smoke during pregnancy, compared to those who had the father's name on the certificate.

Effect of father's name on birth certificate on birth outcomes

Few studies have investigated the link between reporting the father on the birth certificate and the birth outcomes of low birth weight and preterm birth. Returning to the Georgia vital statistics-based study described earlier, Guadino et al. (1999) reported that, after stratifying by marital status, absence of father's name on the birth certificate was associated with a higher proportion of infants born with low birth weight (and very low birth weight), when compared to those who had a father's name listed. Married women who did not report the father's name on the birth

certificate were more likely to give birth to infants between 1,500-2,499 grams (9.4%) than married women who reported the father's name (4.3%, $p<0.001$). Unmarried women not listing the father's name were also more likely to give birth to infants between 1,500-2,499 grams (10%) than unmarried women listing the father's name (8.6%, $p<0.001$). They were also more likely to deliver preterm or very preterm. Married women who did not report the father's name on the birth certificate were more likely to deliver between 32-36 weeks (3.5%) than married women who reported the father's name (1.3%, $p<0.001$). Likewise, unmarried women not listing the father's name were more likely to deliver between 32-36 weeks (11.7%) than unmarried women listing the father's name (19.6%, $p<0.001$).

In another state-based study, Alio et al. (2010a) reviewed vital records data from singleton births in Florida between 1998 and 2005 to assess the impact of absence of the father on the birth certificate. Father-presence/absence groups were defined as such according to the presence or absence of the first and/or last name on the birth certificate. Infants of mothers who were in the father-absent group were born slightly earlier than those in the father-involved group (mean gestational age was 38.32 weeks, se 2.70 versus 38.64 weeks, se 1.97, $p<0.01$). Furthermore, infants of mothers in the father-absent group weighed on average 165g less than those of mothers in the father-involved group (mean birth weight was 3169g, se 639.3 versus 3333.7g, se 559.7, $p<0.01$). Likewise, in a Milwaukee-based vital statistics study, Ngui, Cortright, and Blair (2009) reported increased rates of preterm birth and low birth weight for those infants born to unmarried parents not reporting the father's name on the birth certificate. Compared to infants born to married parents, infants

born without a name on the birth certificate were 1.53 times as likely to be born preterm (95% CI 1.45-1.62, $p<0.001$) and 1.58 times as likely to be born low birth weight (95% CI 1.48,1.67, $p<0.001$).

Using Canadian vital records data from 1990 to 1997, Luo et al. (2004) also reported higher rates of preterm birth and low birth weight for unmarried women who did not have fathers listed on the birth certificate, compared to married and unmarried women with the father listed on the birth certificate. Compared to married women, unmarried women with no father listed on the birth certificate had 1.41 (95%CI 1.34, 1.48) times the risk for preterm birth and 1.63 (95%CI 1.54, 1.72) times the risk for low birth weight. In a sample of twin births, Tan et al. (2004) noted an increased risk of preterm birth and low birth weight for mothers whose partner's information was partly or especially totally missing from the birth certificate. When compared to infants born to mothers with total paternal information on the birth certificate, the relative risk of a preterm birth was 1.08 for infants born with partly missing information and 1.11 for infants born with totally missing information ($p<0.05$). The relative risk of low birth weight for infants born with partly missing information was 1.7; with totally missing information it was 1.26 ($p<0.05$).

Not all studies describe associations between the absence of father's name on the birth certificate and adverse birth outcomes. Using Fragile Families data, Teitler (2001) used multiple measures of father involvement to explore associations with maternal health behaviors and birth outcomes. Again here, father involvement was measured by whether the child has the father's surname, whether the father's name is on the birth certificate, whether the father went to the hospital, whether he provided

financial and in-kind contributions during pregnancy, whether the father told the mother he would provide financial support for the baby during the coming year, and whether the father indicated a desire to be involved in raising the child. None of these measures of father involvement was significantly associated with low birth weight. In a United Kingdom study, Knight et al. (2006) also did not find significantly higher birth weights or rates of preterm births for children with father's information on the birth certificate, compared to those without the father's name on the birth certificate, in adjusted analysis.

The findings from these studies provide a rationale to further explore the association between father's name on the birth certificate and birth outcomes. Yet, none of the aforementioned studies were nationally representative. The current study will add to the literature in that it uses a nationally representative sample, tests alternatives paternal involvement constructs in addition to father's name on the birth certificate, and explores the potential mediation of maternal health behaviors.

Fatherhood construct 2: Paternal prenatal involvement

Despite a great deal of research on "paternal involvement" in childhood, the term is not well-defined, even in that more robust body of literature (Lamb, 2000). Comparing different research is difficult because the conceptualization of paternal involvement varies from study to study, with different activities included (Lamb, 2000). It is also hard to measure paternal prenatal involvement directly due to limited data collection from the father in most studies (Kotelchuck, 2009). Despite these issues, there is a growing body of evidence that paternal prenatal involvement is tied to maternal health behaviors (Martin et al., 2007; Teitler, 2001), and birth outcomes

(Guadino, Jenkins, & Rochat, 1999; Luo, Wilkins, & Kramer, 2004; Padilla & Reichman, 2001; Phipps, Sowers, & Demonner, 2002; Tan, Wen, Walker, & Demissie, 2004; Teitler, 2001). The current study has the benefit of data on paternal prenatal behaviors that have been reported by the fathers themselves. As a result, this study will review the combined effect of seven behaviors the father reports having engaged in during the pregnancy. Contact with the mother is essential for all but one of the behaviors (buying things for the child), and the majority are related to the health or medical aspects of the pregnancy. The seven behaviors are: attending at childbirth/Lamaze classes, viewing a sonogram or ultrasound, feeling the baby move, discussing how the pregnancy was going with the mother, buying things for the child, listening to the baby's heartbeat, and being in the room when the baby was born.

Effect of paternal prenatal involvement on maternal health behaviors

The direct examination of the impact of behaviors of unmarried residential fathers during pregnancy on maternal health behaviors has been studied very little. Using ECLS-B data, Martin et al. (2007) examined paternal prenatal involvement and the association with maternal health behaviors. The study examined paternal prenatal involvement behaviors including whether the father discussed pregnancy with the mother; saw a sonogram/ultrasound; listened to baby's heartbeat; felt baby move; attended childbirth or Lamaze classes; and bought things for the baby. After summing these dichotomous items, fathers with a score of 5 or higher were considered to be involved in the pregnancy. According to study authors, that score indicated involvement in more than one setting (e.g. home and physician's office, or home and childbirth class), demonstrating a higher level of involvement than participation in the

home setting alone. Women whose partners were involved in their pregnancy were 1.42 times as likely to receive prenatal care in their first trimester (95%CI 1.01, 1.99); and, among those who smoked at conception, were 36% more likely to reduce their cigarette consumption than women whose partners were not involved in the pregnancy (p=.09).

The current study advances the work of Martin and colleagues by examining one additional paternal prenatal involvement behavior, and constructing a paternal prenatal involvement scale that was treated as a continuous variable. This enables us to see a gradient effect of paternal involvement on the outcomes. Moreover, Martin's sample included both married and unmarried resident fathers, while this study limits the focus to solely unmarried resident fathers.

Teitler examined other aspects of paternal involvement among unmarried couples using the aforementioned Fragile Families data (2001). The study found that the indicators used to determine involvement (paternity acknowledgment, contributions during pregnancy, intentions to contribute, and whether the child took the father's surname) were all positively associated with early utilization of prenatal care. Furthermore, the father's presence at the hospital for the delivery was associated with greater initiation of prenatal care in the first trimester (.383, se .121, $p<.01$) and reduced likelihood of smoking during pregnancy (-.265, se .129, $p<.05$).

Effect of paternal involvement behaviors on birth outcomes

A review of the literature revealed that no studies have been conducted associating birth outcomes with the same paternal prenatal involvement behaviors that this study assessed (e.g. attendance at childbirth classes). However, several

studies that used different definitions of paternal prenatal involvement have provided information on birth outcomes. As previously noted, none of Teitler's various measures of paternal involvement was significantly associated with low birth weight. In another study, Padilla & Reichman (2001) evaluated paternal prenatal involvement with three different indicators: mother's relationship with the father, paternal suggestion of an abortion, and financial support from the father. They reported that mothers who were romantically involved with the father but not living with him were more likely to have a low birth weight baby than those who lived with their partners. This study also reported that total absence of a mother-father romantic relationship was actually protective against low birth weight, compared to a romantic relationship where the father did not live with the mother. Teitler (2001) reported similar findings. The findings of these studies suggest that ambiguity in relationships may be detrimental to birth outcomes.

Fatherhood construct 3: Pregnancy wantedness concordance

Wantedness of the pregnancy, often asked solely of mothers, is a commonly used construct in studies of maternal and child health to assess whether women's behavior during pregnancy may be influenced by their attitude toward the pregnancy. Wantedness of the pregnancy is a particularly relevant area for exploration for unmarried couples, as their pregnancies are often characterized by women as unwanted, unintended, or mistimed (Bouchard, 2005; Finer & Henshaw, 2006; Heaton, Jacobson, & Holland, 1999; Sassler, Miller, & Favinger, 2009). For instance, mothers with wanted pregnancies have reported early or adequate prenatal care (Sable & Wilkinson, 1998; Marsiglio & Mott, 1988), and smoking cessation (Weller,

Eberstein, & Bailey, 1987) compared to those with unwanted pregnancies. Father's wantedness of the pregnancy has been cited as influencing the mother's wantedness of the pregnancy (Kroelinger & Oths, 2000; Montgomery, 1996).

This study will take into account the wantedness of the pregnancy of both the mother and the father relative to each other. Concordance or discordance between the mother and the father over the wantedness of the pregnancy provides some insight into the relative importance of the pregnancy for each parent, and enables some perspective about how wantedness by each parent impacts behavior change and birth outcomes. Studies considering the concordance of pregnancy wantedness are few, however there is some evidence suggesting it is an important consideration with regard to behavior change.

Effect of pregnancy wantedness concordance on maternal health behaviors

In Martin et al.'s review of ECLS-B data, they examined concordance of maternal/paternal pregnancy wantedness in parents residing with each other (both married and unmarried). When both parents wanted the pregnancy, fathers were about 1.4 times as likely to be involved as fathers in couples where neither parent wanted the pregnancy (95%CI 1.06, 1.95). When only the father reported wanting the pregnancy, he was 1.7 times as likely to be involved (95%CI 1.14, 2.51). The researchers also reported that when fathers wanted the pregnancy, even if mothers did not, the mothers were more likely to receive early prenatal care. The prenatal care finding was also reported in another study of Latino married couples, but not unmarried (Sangi-Hanghekpar, Mehta, Posner & Poindexter, 2005). In these studies, the father's wantedness of the pregnancy seems to impact the prenatal care behaviors

of the mother. Prenatal care behaviors were less optimal when the father did not want the pregnancy, and better when he did want the pregnancy, regardless of the maternal wantedness of the pregnancy. Moreover, when only fathers wanted the pregnancy, they became more involved, perhaps to modify the effect of the mother not wanting the pregnancy.

Hohmann-Marriott (2009) reported opposite findings when they included the factor of intendness of pregnancy to the model. Also using ECLS-B data, she found that the odds of the mother receiving no early prenatal care were 1.5 times higher when the mother did not intend the pregnancy – even if the father did – and almost two times higher if neither partner intended it, compared to cases where both partners intended the pregnancy. Findings from the Pregnancy Risk Assessment Monitoring System 2000-2003 data also showed that early prenatal care was less likely when fathers were reportedly ambivalent or did not want the pregnancy (Oklahoma State Department of Health, 2007).

Although several studies have looked at the effect of maternal/paternal pregnancy wantedness concordance and utilization of prenatal care; as far as we are aware, there are no studies on concordance of pregnancy wantedness and smoking behavior during pregnancy. Some studies have seen smoking cessation when the mother reported wanting the pregnancy (Weller, Eberstein, & Bailey, 1988) but other studies have not seen this association (Marsiglio & Mott, 1988).

Effect of pregnancy wantedness concordance on birth outcomes

With regard to concordance of maternal/paternal pregnancy wantedness and the association with birth outcomes, again using ECLS-B data with the combination

of intendness and wantedness, Hohmann-Marriott (2009) reported a higher likelihood of preterm birth when one or both partners did not intend the pregnancy. When the intendedness of pregnancy came from the mother only or the father only – or when neither partner intended the pregnancy – odds of prematurity were 1.3-1.4 times those when both the mother and father intended the pregnancy. However, there was not a significant association between risk of low birth weight and maternal/paternal wantedness. Another study of a national sample of youth showed that when both parents wanted the pregnancy, their infant had better health outcomes than when the father did not desire the pregnancy. However, compared to when both parents wanted the pregnancy, when it was the only mother who did not desire the pregnancy, the infant had no worse health outcomes (Koreman, Kaestner & Joyce, 2002).

There is compelling evidence that consideration of the father's wantedness of the pregnancy is warranted in analysis of birth outcomes. Paternal wantedness of a pregnancy can add to maternal wantedness, or may even outweigh a mother not wanting a pregnancy. In light of wantedness of the pregnancy by the father, the mother may engage in positive health behaviors even when she herself does not want the pregnancy.

Fatherhood construct 4: Paternal history of negative behaviors

The final fatherhood construct being used in this study is the history of negative behaviors. The concept of "good dad-bad dad" was discussed in a now highly influential article about fatherhood by Furstenberg (1988). He discussed two fathers that have emerged in past several decades: the good, or involved, father; and the bad, or less involved/absent father (Pleck, 2004). Inclusion of this variable is an

attempt at capturing characteristics of fathers who may not be as involved. Fathers who have experienced loss of a job, incarceration, or other adversity may influence mothers and the pregnancies in ways different from those of fathers who have not had these experiences. For instance, a father who has experienced several psychosocial problems in his lifetime may not be considered by the mother to be an asset to a family situation and as a result, the mother may prevent him from being named on the birth certificate. He may also bring more stress to the mother than support, which, in turn, may lead to less healthy behaviors by the mother or to increased risk of adverse birth outcomes.

Effect of paternal history of negative behaviors on maternal health behaviors

Problematic behaviors by the father, such as violence or abuse of drugs or alcohol, can lead to less involvement, largely because of the mother's efforts to protect her children (Lerman, 2010). Additionally, if the father smokes or drinks alcohol he could have a negative impact on the mother's efforts to refrain from similar behaviors. In his study, Teitler (2001) examined the father's earning potential, along with his smoking and alcohol use, as factors impacting maternal health behaviors. When the father's earning potential was high, 77% of mothers initiated prenatal care in the first trimester and 18% smoked, compared to 70% who received prenatal care and 25% who smoked when earning potential was low ($p<.01$). When the father had an alcohol or drug problem, 59% of mothers initiated prenatal care in first trimester, 11% drank alcohol and 37% smoked, compared with 74% initiating prenatal care in first trimester, 3% drinking alcohol, and 21% smoking when fathers had no alcohol or drug problem (all $p<.001$).

Effect of paternal history of negative behaviors on birth outcomes

A review of the literature reveals no relevant research related to the effect on birth outcomes of the paternal history of negative behaviors examined in this study. However, one important avenue to consider is the impact of stress on preterm birth. Fathers may prove to be a source of acute (during the pregnancy) or chronic (before the pregnancy) stress for women – or, alternately, they may alleviate other sources of chronic stress (Dudgeon, 2004; Mullings et al., 2001). For instance, a retrospective study of primarily Latina births in Los Angeles County examined whether support from the father during pregnancy influenced birth outcomes as well as effects of chronic stress, pregnancy anxiety, and life-event stress. To measure father support, researchers asked the mother if the baby's father showed he cared for her, criticized her, and supported her financially while she was pregnant. Data suggested that paternal support during pregnancy may modify the effect of chronic stress on the risk of preterm birth. Among mothers lacking support, those with moderate-to-high stress were at increased odds of delivering preterm (OR 2.15, 95%CI .92, 1.35) (Ghosh et al., 2010).

Moderating variable: State-level paternity establishment policies

When a child is born to a married couple, the husband is presumed to be the child's legal father and paternity does not need to be specially established (DHHS, 2006). For children born to unmarried parents, however, the establishment of paternity is not as simple, and several policies impact how that establishment can be made. Both state and federal governments have worked to streamline the procedure, recognizing paternity establishment as a way to give the child the right to financial

benefits such as child support, social security and insurance benefits and inheritances, as well as an avenue to develop emotional and social ties with the child (DHHS, 2006). The effort to streamline has come under the auspices of child support enforcement. Several pieces of legislation illustrate the relationship between paternity establishment and child support enforcement. The Family Support Act of 1988 set specific paternity establishment goals for states to meet, with sanctions for those that failed to meet them. More recently, the child support enforcement provisions of the welfare reform legislation (the Personal Responsibility and Work Opportunity Reconciliation Act of 1996) increased these establishment goals and introduced several other requirements to encourage paternity establishment (Miller & Garfinkel, 1999).

Aside from a few specific requirements, states have been left to determine the most effective way to meet these goals (Miller & Garfinkel, 1999) and there can be significant variation between states in child support award rates and success in paternity establishment. States' paternity establishment rates are monitored using a state Paternity Establishment Percentage (PEP). States are motivated to strive for a high PEP as their PEP is tied to financial penalties or incentives from the federal government (Social Security Act, 2012). However a state's success at establishing paternity may depend on whether local laws and practices are designed to facilitate the process. As a result, PEP variations across states can in some ways reflect the state-by-state variation of policies and programming for establishing paternity.

In light of the procedural requirements to establish paternity, it is reasonable to believe that unmarried fathers who are committed to the mothers and the

pregnancy may be more likely to complete the requirements for inclusion on the birth certificate than those who are not committed. Conversely, procedural factors (Phipps et al., 2005) related to state policies and programs may act as a barrier to paternity establishment for even the most involved fathers. Understanding the historical and current context of paternity acknowledgment enables us to consider multiple factors related to the presence of a father's name on a birth certificate. This study takes into account that context at the state level by examining variations in the associations between fatherhood constructs and paternity establishment.

Control variables

Household income

Low socioeconomic status is one predictor of low birth weight and preterm birth (Berhman & Butler, 2007; March of Dimes, 2008). It is suspected that women who report lower incomes may also have less paternal involvement. There is also evidence that income is associated with maternal health behaviors. For instance, smoking during pregnancy has become increasingly linked to women of lower socioeconomic status (Cnattingius, 2004).

Maternal education

Lower maternal education is one predictor of low birth weight and preterm birth (Berhman & Butler, 2007; March of Dimes, 2008). It is suspected that women with lower levels of education may also have less paternal involvement (Martin et al., 2007; Tan et al., 2007).

Maternal age

Both younger (under 17) and older (over 35) maternal age have been associated with an increased risk of low birth weight and preterm birth (March of Dimes, 2008; Berhman & Butler, 2007). Young maternal age has also been associated with less paternal prenatal involvement (Phipps et al., 2002).

Maternal pregnancy complications

Maternal complications that occur during the pregnancy can result in adverse birth outcomes such as preterm birth and/or low birth weight (Berhman & Butler, 2007; March of Dimes, 2008). Paternal involvement may increase or decrease if a mother starts to experience complications during her pregnancy. Finally, pregnancy complications may have associations with maternal health behaviors. For instance, maternal smoking has been associated with pregnancy complications, and a mother experiencing complications may consequently attend more prenatal care appointments.

Maternal/Paternal parity

A parent's number of previous children may influence their involvement and behaviors in subsequent pregnancies. For example, more engagement in healthy behaviors may occur during a mother's first pregnancy, compared to her later pregnancies. Fathers may be more involved in a first pregnancy than later pregnancies (Martin et al., 2007). The effect of one partner on the other with regard to healthy behaviors or involvement during the pregnancy may be evident if parity between

them is discordant. Finally, there is some evidence to suggest that maternal parity has an effect on birth weight (Shah, 2010).

Individuals over the age of 18 in household

Individuals over the age of 18 who are living in the mother's household may be acting as a maternal support, and may be impacting her health behaviors and potentially the birth outcomes. Additionally, depending on the nature of the relationship, these individuals may influence paternal involvement by inhibiting or encouraging it.

Child race/ethnicity

There are disparities in the rates of low birth weight and preterm birth by racial and ethnic background (see Literature Review of Birth Outcomes, above). Moreover, there is evidence of the influence of race/ethnicity in the association between paternity acknowledgement and birth outcomes (Alio et al., 2010a; Alio, Kornosky, Mbah, Marty. & Salihu., 2010b). Finally, birth rates for unmarried women vary considerably by race and Hispanic origin (Martin et al., 2002).

Gender

Birth weight has consistently been shown to be higher in boys than in girls (Kramer, 1987). Additionally, the gender of the child may influence involvement of the father. Once the gender is known during the pregnancy (for those who opt to learn of the gender, this information is usually available about halfway through the

pregnancy), the father may adjust his involvement based on that gender and his preferences for having a child of that gender.

Twin status

Pregnancies of multiples (twins, triplets, or higher) have higher rates of preterm birth and low birth weight. Infants born in multiple deliveries are about 10 times as likely to be born low birth weight than singletons (Martin et al., 2002). In 2001, the average twin was delivered more than three weeks earlier than the average singleton (Martin et al., 2002).

Chapter 3: Methods

Description of the data

This study drew data from the birth cohort of the Early Childhood Longitudinal Study (ECLS-B), U.S. Department of Education. The ECLS-B is a longitudinal study following children from birth through kindergarten entry that collects data on children's health, development, care, and education at four ages: approximately 9 months old, 2 years old, 4 years old, and kindergarten (U.S Department of Education, n.d.). For this study, the ECLS-B's 9-month data were used.

Sample

The birth cohort of the ECLS-B is a nationally representative sample of 14,000 children born in the year 2001, drawn from U.S. birth certificates (National Center for Education Statistics, 2011). The children participating in the study came from diverse socioeconomic and racial/ethnic backgrounds with oversamples of Asian and Pacific Islander children, American Indian and Alaska Native children, Chinese children, twins, and low and very low birth weight children (U.S Department of Education, n.d.).

The ECLS-B's 9-month sample includes approximately 10,700 children, representing a weighted response rate of 74.1% (NCES, 2011a). The sample excluded children who had died prior to the first wave of data collection (9 months) or were born to mothers younger than 15 years of age. The children's ages at the time of the assessment for the 9-month sample ranged from six months to 22 months, although

almost 85% of interviews were conducted when the child was eight months to 11 months of age (NCES, 2011a).

Survey descriptions

This study draws on data from three aspects of the ECLS-B: the parent survey, father survey, and child's birth certificate. Using trained assessors, the ECLS-B administered two parent survey instruments: a parent interview and a self-administered questionnaire (NCES, 2011a). The *parent interview* captured information about children's early health and development, and about children's experiences with family members and others (NCES, 2011a). Parents also provided key information about themselves as caregivers, the home environment, and the neighborhood in which they lived. The *self-administered questionnaire* included questions on topics that could be considered sensitive, such as the parent's relationship with his or her partner and exposure to violence in the home. Each were computer-assisted (NCES, 2011a).

Fathers completed a separate self-administered questionnaire regarding the particular role they played in their children's development. The questionnaires collected information about the activities the fathers engaged in with their children, and about themselves as caregivers (NCES, 2011a). Information was collected both from residential fathers and, with permission from the child's mother, from biological nonresidential fathers (NCES, 2011a). The weighted response rate for the resident father questionnaire was 76.1%. The weighted response rate for the nonresident father questionnaire was 50% (NCES, 2011a).

Finally, the ECLS-B incorporated information taken from the child's birth certificate. In the United States, state laws require birth certificates to be completed for all births, and federal law mandates national collection and publication of births and other vital statistics data. The National Center for Health Statistics collects these data from the states and provides access to them through the National Vital Statistics System (CDC, 2011). A standard certificate of live birth collects the same information across states, though states may add additional questions to the birth certificate based on their needs (CDC, 2005). The sources of the data collected on birth certificates include the mother, the medical provider, and the patient's records, depending on the question (CDC, 2005). Over 95 percent of all birth certificates registered with NCHS are done so electronically (CDC, 2005).

The current study used ECLS-B surveys from the parent, from resident fathers, and from nonresident fathers. It also included information taken from the child's birth certificate. This sample included only children of parents who were unmarried at the time of child's birth.

Survey of parent

ECLS-B conducted parent surveys with one primary caretaker in the family to gather information about the family and the child. The parent respondent was the primary caregiver or the person most knowledgeable about the child, most often the mother (NCES, 2011a). The survey of the mother provided data on her wantedness of pregnancy, her tobacco use prior to and during the pregnancy, her education, and her household's income and structure. The survey also gathered maternal parity

information, but the current study ultimately relied on birth certificate parity since it was deemed more complete.

Most of the paternal information in the current study came from the separate ECLS-B father survey, though in approximately 50 cases the father was the individual who filled out the parent survey for primary caretakers. For those cases, the current study added the parent survey responses to the information gathered from the separate father survey (see next section for a description of the father survey instrument). This analysis did not include surveys completed by someone other than the biological mother or the biological father.

Survey of father

The ECLS-B administered separate surveys to residential fathers and nonresidential fathers. For this study only residential fathers were included in the regression analysis, due to the low response rate from nonresidential fathers (approximately 50%). However, this study reports descriptive data on all unmarried fathers, both residential and nonresidential. Data from residential father surveys were analyzed to determine paternal pregnancy wantedness; history of paternal negative risk behaviors; and paternal involvement behaviors during the pregnancy, including attendance at childbirth classes, viewing a sonogram, feeling the baby move, discussing the pregnancy with the mother, hearing the baby's heartbeat, buying things for the baby, and attendance at the delivery. The construction of the independent and dependent variables from ECLS-B survey data is described in more detail below.

Birth certificate data

Birth certificate data were collected at the time of the child's birth. The current study used data from these birth certificates to measure birth weight and gestational age of the infant. The certificates also provided information on prenatal care, marital status, maternal pregnancy complications, maternal age and parity, state of birth, and the child's gender, race and ethnicity. Finally, the birth certificates provided information about whether or not the father was listed on the certificate.

Weighting and complex survey design

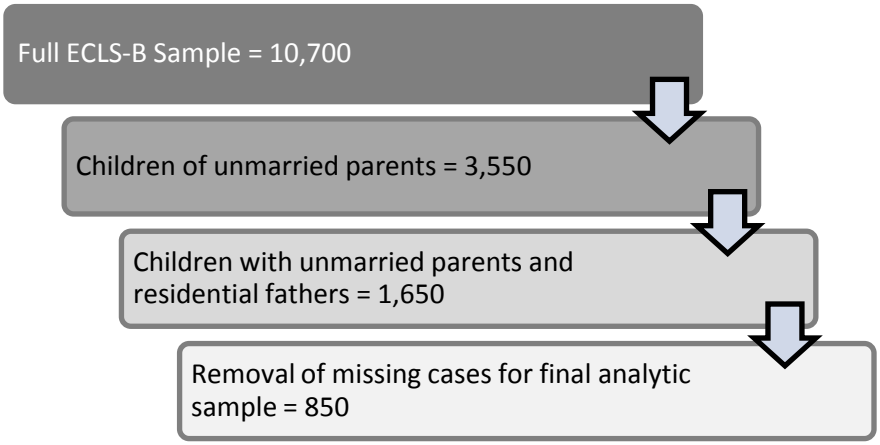
The ECLS-B sample was derived using a multi-stage, stratified, clustered design (NCES, 2011a). In stage one, the country was separated into primary sampling units. Of these, 96 primary sampling units (PSUs) were selected, in a manner that allowed for clustering (for data collection efficiency) and with probability proportional to size. PSUs were also stratified based on selected characteristics (region, median household income, percent minority, and metropolitan status) (NCES, 2011a).

NCES created probability weights that were used to adjust for differential selection probabilities and non-response rates for the mother interview and father questionnaire (NCES, 2011a). The ECLS-B weight W1F0 and accompanying replicate weights (W1F1-W1F90) were used in this study. To account for the complex survey design, the study conducted all analyses using SAS PROC SURVEY procedures.

Analytic sample

The analytic sample for this study was comprised of children from the ECLS-B surveys whose parents were unmarried at the time of birth and for whom a biological mother or father completed the parent survey. The variables of interest (fatherhood constructs) restricted the sample to only residential fathers, as nonresidential father were not asked these items. Of the approximately 10,700 children included in the ECLS-B study, approximately 3,550 were children of unmarried parents where a biological mother or father completed a parent survey. Of these, approximately 1,650 children had residential fathers and 1,850 children had nonresidential fathers. Approximately 50 children were identified as having neither residential nor nonresidential fathers. The current study included only those children with full responses for each variable in the analytic sample. One exception was the inclusion of approximately 50 children who otherwise would have been excluded due to the absence of a response on maternal pregnancy wantedness. These 50 were categorized as "unknown" maternal wantedness, which the study included as a dummy variable. Finally, the study dropped those children with a missing value for any weight (W1F0) or replicate weight (W1F1-W1F90). The final sample consisted of approximately 850 children of unmarried residential fathers with full responses. Figure 2 illustrates how the analytic sample was derived.

Figure 2. Development of analytic sample



Handling missing data

The ECLS-B study made provisions for dealing with some missing demographic data by developing composite variables. NCES has encouraged researchers to use these composites, since they have already been handled in a standardized and documented manner. The current study used relevant ECLS-B composites for many of its main variables of interest.

In the final analysis, only those children for whom a complete case was available (i.e. data available on all variables) were included. Almost half of the cases from the ECLS-B surveys were not included in the analytic sample because they contained missing data on key constructs. To examine whether cases were missing completely at random, a missing value analysis procedure in SPSS was used that tests the significance of differences (among other variables) across cases that are missing (5% or more responses) and not missing on each variable. Using the EM (expectation-maximization) method the Little's MCAR chi-square statistic was calculated. For this test, the null hypothesis is that the data are missing completely at random. If the p value is less than 0.05, the data are not missing completely at random (IBM, 2011). The reported p value here (1.0) was not significant, indicating that cases were indeed missing completely at random. As a result of these findings, the decision was made not to impute any data.

Measures

This section defines the variables of this study and shows how each was used. As mentioned above, whenever possible the documented, standardized composite variables from ECLS-B were used.

Dependent variables

This study studied two dependent variables assessing birth outcomes: low birth weight and preterm birth.

Low birth weight

Birth weight data, measured in grams, were collected from the infant's birth certificate and coded by ECLS-B as a dichotomous variable. Those infants weighing between 2,499 grams or less categorized as low birth weight (1). Those weighing 2500 grams or more were categorized as not low birth weight (0).

Preterm birth

Gestational age data, measured in weeks using the clinical estimation of gestation, were collected from the infant's birth certificate and coded by ECLS-B as a dichotomous variable. Those infants born at less than 37 completed weeks (i.e. including or less than 36 weeks, 6 days) of gestation were categorized as preterm (1). Those born at or after 37 completed weeks of gestation were categorized as not preterm (0).

Independent variables

Fatherhood Constructs

Four fatherhood constructs were created: 1) father's name on the birth certificate, 2) paternal prenatal involvement, 3) concordance of pregnancy wantedness, and 4) paternal history of negative behaviors.

Father's name on the birth certificate

When working with birth certificate data, the father's listed name on the certificate is not information that is readily available. Therefore, the father's listed age

on the birth certificate was used as a proxy for father's name. Data were reverse coded: if the father's age was present, then the name was on birth certificate (0); or if father's age was absent, then the name was not on the birth certificate (1).

Paternal prenatal involvement

Paternal prenatal involvement was determined with seven items from the following two questions:

"Did you do any of the following before your child was born?"

- *"Attend childbirth or Lamaze classes with your child's mother?"*
- *"See a sonogram or ultrasound of the baby?"*
- *"Feel the baby move?"*
- *"Discuss how your spouse/partner's pregnancy was going with her?"*
- *"Buy things for the child?"*
- *"Listen to the baby's heartbeat?"*

"Thinking of your child's birth, were you in the delivery room or the room where the child was born" Yes (1) or No (0)

Fathers answered "Yes" or "No" to each of the items. Each item was coded (1) for "Yes" and "0" for "No," and first analyzed separately as dichotomous variables. Then items were summed and analyzed as one continuous variable. The final range for the continuous variable had a maximum value of 7 and a minimum value of 0.

Concordance of pregnancy wantedness

Maternal wantedness of pregnancy was assessed using a series of questions and skip patterns in the ECLS-B parent survey. The first question (q.12) was "*Think back to just before you became pregnant. Before you became pregnant with your baby, had you or your baby's father stopped using all methods of birth control?"* Those who answered "Yes" or "Never used birth control" were then provided a list of choices to explain why (q.13). This study used the response of "Wanted to get pregnant" to categorize as wanted (1). Those who answered "No" to the question about stopping birth control were then directed to the next question (q.14): "*At the time you became pregnant with your baby, did you yourself actually want to have a baby at some time?*" Responses were either "Yes," "No," or "Unsure." For those who responded "Unsure," the survey followed up with (q.15): "*It is sometimes difficult to recall these things but, just before the pregnancy began, would you say you probably wanted a(nother) baby at some time or probably did not?*" The responses were "Probably Yes," "Probably No," or "Didn't Care." This study categorized the "No," "Probably No," and "Didn't Care" responses from questions 14 and 15 as maternal unwanted pregnancies (0). Responses of "Yes" and "Probably Yes" to the same questions were categorized as maternal pregnancy wantedness (1).

Paternal pregnancy wantedness was determined using the following item from the father survey: "*At the time the child's mother became pregnant with the child, did you want her to have a(nother) baby at some time?*" The available responses were categorized as "Yes" (1) or "No" (0) for paternal pregnancy wantedness. Additionally, there were seven fathers who answered the wantedness

question within the parent survey. Those were incorporated into the paternal wantedness variable.

The variable of concordance of maternal and paternal pregnancy wantedness was created by combining the wantedness of the mother with the wantedness of the father. Four categories were created: 1) both mother and father wanting pregnancy, 2) only mother wanting pregnancy, 3) only father wanting pregnancy, and 4) neither mother nor father wanting pregnancy. A set of three dummy variables were then created, omitting category 4 with both mother and father wanting the pregnancy.

One survey question that preceded the maternal wantedness series had a high number of item-level missing responses. Question 12 asked: "*Think back to just before you became pregnant. Before you became pregnant with your baby, had you or your baby's father stopped using all methods of birth control?"* Approximately 50 mothers did not answer these questions yet have complete data for the remainder of the survey. These mothers were categorized as not wanting the pregnancy; the final analyses then used a dummy variable of "unknown maternal wantedness" to identify these individuals.

Paternal history of negative risk behaviors

Paternal history of negative risk behaviors was derived from the following set of questions from the residential father survey:

"Which of these, if any, have happened to you in your whole life?"

- *Have you ever been suspended or expelled from school?*
- *Have you ever been fired or laid off from a job because of behavior, attitude, or work performance?*

- *Have you ever been in a facility overnight for a psychological or mental health problem?*
- *Have you ever had a drinking or drug problem or have other people thought you had one?*
- *Have you ever been convicted of driving while intoxicated or drunk driving?*
- *Have you ever been put in jail, arrested or convicted of a crime, other than drunk driving?*

Each question was coded no (0) or yes (1). The items were summed and divided into three categories: no history of negative risk behaviors (0 risk behaviors indicated); some history of negative risk behaviors (one or two risk behaviors indicated); and most history of negative risk behaviors (three or more risk behaviors indicated). Dummy variables were then created for the categories, and "no history of negative risk behaviors" was as the reference group in analysis.

Mediators of birth outcomes

Maternal smoking during pregnancy

The study used the ECLS-B parent survey to determine tobacco use by the mother during her pregnancy. A change score in the number of cigarettes smoked over the duration of her pregnancy was derived using two items: "*In the 3 months before you got pregnant, how many cigarettes or packs did you smoke on an average day?*" and "*In the last 3 months of your pregnancy, how many cigarettes or packs did you smoke on an average day?*" A categorical variable was created to indicate:

"nonsmokers" (those who did not smoke before or during pregnancy – coded as 0); "reduced smoking" (those who were smokers before the pregnancy and indicated that they smoked less cigarettes during the pregnancy – coded as 1); and "increased smoking" (those nonsmokers who started smoking during the pregnancy or smokers before the pregnancy who smoked at the same level or more cigarettes during the pregnancy – coded as 2). The ECLS-B labeled women who indicated they did not smoke, or who indicated they had smoked less than 100 cigarettes in their lifetime, as nonsmokers. The mediation analysis used this categorical variable as the dependent variable using ordinal logistic regression. Two dummy variables were created for use as independent variables in the multiple logistic regression analysis, with the nonsmoker category as the reference group.

Prenatal care

The ECLS-B obtained information on prenatal care utilization from birth certificates. ECLS-B used two measures to assess adequacy of prenatal care utilization: receipt of prenatal care in first trimester, and the modified Kessner Index. The Kessner Index variable in the current study because it offers more complete information and a more comprehensive approach than solely examining the month prenatal care begins. The Kessner Index takes into account the trimester that prenatal care began, the total number of prenatal visits conducted, and gestational age at delivery. In this study, "Adequate" prenatal care indicates initiation in the first trimester with nine or more visits; "Intermediate" prenatal care indicates initiation in the first trimester with five to eight visits, or initiation in the second trimester with

five or more visits; "Inadequate" prenatal care indicates initiation in the second trimester with one to four visits, or initiation in the third trimester with one or more visits. Omitted from analysis were those mothers whose prenatal care was "unknown."

A categorical variable was used as the dependent variable using ordinal logistic regression in the mediation analysis. "Adequate" was coded as (1); "Intermediate" was coded as (2); and "Inadequate" was coded as (3). A dummy variable was created for use as an independent variable in the multiple logistic regression analysis, with the "Adequate" coded as (1) and "Not Adequate" (the combined "Intermediate" and "Inadequate" categories) coded as (0).

Moderators

State paternity establishment percentages

The state of birth of the infant was taken from the birth certificate (birth state of occurrence item). States were reviewed for their 2001 State Paternity Establishment Percentage (PEP), as reported by the Administration for Children and Families Office of Child Support Enforcement Annual Report to Congress (Administration for Children and Families, 2002). States have the option to determine paternity establishment performance level for a fiscal year by either the IV-D PEP or the statewide PEP (see Glossary for PEP definitions) (Social Security Act, 2012). The PEP rates were divided into quartiles, with those states in the highest quartile categorized as high PEP (1), and all others categorized as low PEP (0). One state, Georgia, did not have a reported 2001 PEP. This percentage was imputed from Georgia's 2002 report, because some of the fiscal year 2002 falls within the calendar

year 2001 (the year from which the ECLS-B birth certificates were selected). The 2001 Paternity Establishment Percentage data used in the development of this variable are presented in Appendix A.

Control Variables

Household income

This study derived a categorical variable of income by using a composite variable of household income created by ECLS-B. For the current study households were divided into four categories: low income ($20,000 or less); low-moderate income ($20,001 to $35,000); moderate income ($35,001 to $50,000); and high income ($50,001 or greater). These categories were developed after reviewing the 2001 census-reported income level categories. Further categorization was not possible due to low numbers of respondents in each category. Dummy variables were created and low income was as the reference group in analysis.

Maternal education

A categorical variable of maternal education was derived for the current study by using a composite variable from ECLS-B, which combined survey self-responses with birth certificate data. The study then divided mothers into three categories: "less than high school education," "high school diploma," and "some college or more." Further categorization was not possible due to low numbers of respondents in each category. Dummy variables were then created, with "less than high school education" as the reference group from analysis.

Maternal pregnancy complications

Birth certificate data provided information on complications associated with the pregnancy. Using these data, a maternal pregnancy complications variable was created based on the occurrence of the following: anemia, cardiac disease, diabetes, chronic hypertension, hypertension during pregnancy, eclampsia, incompetent cervix, previous preterm or small baby, renal disease (Alio et al., 2010b). The existence of the complication was coded as (1), whereas non-existence of the complication was coded as (0). The study summed complications with the intent to analyze this as a continuous variable. However, because most mothers did not report having more than one complication, the final analysis used a dichotomous variable with women experiencing one or more complications during pregnancy coded as (1) and women experiencing no complications during pregnancy coded as (0).

Maternal and paternal parity

Both the birth certificate and self-administered parent questionnaire asked for the parity of the mother. Both sets of data were assessed and compared for the current study. Ultimately only information from the birth certificate was included in these analyses, because it was more complete. The birth certificate asks mothers to indicate separately the total number of children born who are still living, and the total number of children born who are now deceased (not including the child for whom the birth certificate is being issued). To get the maternal parity, each total (children born who are still living, and children who are deceased) was summed with the number 1

(representing the current child). Maternal parity was then coded dichotomously as first child (1) or not first child (0).

The father questionnaire asked for the parity of the father with the following question: "*Altogether, how many biological or natural children do you have? Please include the subject child – that is the child selected for this survey."* For the current study paternal parity was coded dichotomously as first child (1) or not first child (0). The maternal and paternal parity were then combined into one variable, categorized as "both first child," "father first child," "mother first child," and "neither first child". Three dummy variables were created, with "neither first child" used as the reference group during analysis.

Gender of child

The ECLS-B developed a composite variable for the child's gender using information from the birth certificate and verified in the parent survey. The current study codes the child's gender dichotomously as boy (1) or girl (0).

Maternal age

This study derived a categorical variable of maternal age by using a composite variable developed by ECLS-B. The current study then divides mothers by maternal age using National Center for Health Statistics age categories: 15-19 years old; 20-24 years old; 25-29 years old; and 30 years and older. Dummy variables were created for each, with the 25-29 year olds used as the reference group in analysis.

Individuals over the age of 18 in household

This study assessed individuals in the household who may be acting as a source of maternal support by using a composite variable from ECLS-B: *number of household members 18 and over.* A dichotomous variable was created to indicate additional members over the age of 18 (1), or no additional members over the age of 18 (0).

Child race/ethnicity

This study derived a categorical variable of child race/ethnicity using a composite variable from ECLS-B. Categories were non-Hispanic white, non-Hispanic black, Hispanic, and other. Further categorization was not possible due to low numbers of respondents in each category. Dummy variables were created, with the non-Hispanic white category as the reference group in analysis.

Multiple birth status

Twins were oversampled in the ECLS-B, which derived a composite variable for them in the data file. In the current study this composite was used to create a dummy variable to control for the occurrence of a multiple birth. Children that were born as a twin or higher order birth were coded as (1), and those born as a singleton were coded as (0).

Data Analysis

In order to optimize the quality of the data, data cleaning was conducted on each of the variable. The SAS PROC UNIVARIATE statement was used to review data range and distribution for each variable. Extreme values, defined as the 99th percentile or greater, were examined and set equal to missing. Bivariate correlations of all variables were examined using the SAS PROC CORR statement. There were no high intercorrelations that warranted removal of any variables from the analysis. As previously described, Little's MCAR test was conducted in SPSS to discern if missing items were random.

Descriptive statistics (including means and frequencies) were conducted on all study variables for a subsample of the unmarried sample (which included both residential and nonresidential fathers) and the final analytic sample (which included only residential fathers). Chi-square analysis was conducted between samples of unmarried residential and unmarried nonresidential fathers.

The empirical strategy used both multiple and ordinal logistic regression to assess associations between independent and dependent variables (Table 1). Each research question was analyzed separately. In all cases, data were weighted to account for the complex survey design of the ECLS-B. The NCES has derived appropriate weights to be used with the ECLS-B dataset, depending on the population analyzed. The ECLS-B weight of W1F0 and 90 associated replicate weights (W1F1-W1F90) were used for all analyses. Unless noted otherwise, all data analyses were conducted with SAS 9.2 software using SAS survey procedures and Jacknife methodology to account for the clustered design of the ECLS-B. After removing all children of

unmarried parents who were missing any item-level data, the final analytic sample was approximately 850 children.

The first part of the analysis used multiple logistic regression to examine the association between fatherhood constructs and the father being named on the birth certificate (Research Question 1). The variable of the father's name on the birth certificate was regressed separately on each of the three independent variables – paternal involvement behaviors during pregnancy, maternal/paternal pregnancy wantedness concordance, and paternal history of negative risk behaviors (see Research Questions 1a, 1b, and 1c). Each fatherhood construct were then entered into one model with all control variables. Odds ratios (OR) and 95% confidence intervals were reported for each association.

The second part of the analysis, Research Question 2, examined the association between the various fatherhood constructs and birth outcomes (low birth weight and preterm birth). Multiple logistic regression was conducted. Each of the birth outcomes were regressed in a separate regression on the four fatherhood construct variables, a total of two models (see Research Questions 2a, 2b, 2c, and 2d). All control variables were then added to the models. Odds ratios (OR) and 95% confidence intervals were reported for each association.

The third part of the analysis tested to assess if maternal health behaviors (adequacy of prenatal care utilization and change in smoking behavior during pregnancy) were mediating associations between the various fatherhood constructs and birth outcomes (Research Question 3). To assess mediation, significant

associations must first be demonstrated between the mediators and independent and dependent variables (Baron & Kenney, 1986).

For the first part of the mediation analysis, multiple logistic regression was applied to regress the dependent variables – the two birth outcomes -- on the two variables of maternal health behaviors (see Research Question 3a). Each dependent variable was regressed separately. All control variables were then added to the model.

For the second part of the mediation analysis, each of the maternal health behaviors were regressed on the various fatherhood constructs as a group using ordinal logistic regression (see Research Question 3b). Ordinal logistic regression was warranted because the mediating variables used in this model were categorical. All control variables were then added to the model. Odds ratios (OR) and 95% confidence intervals were reported for each association.

Finally, using multiple logistic regression, each of the two birth outcomes were regressed on all fatherhood constructs, all mediating maternal health behaviors, and all control variables using one model. The coefficients for each of the fatherhood constructs were examined for mediation (Research Question 3c).

The final part of the analysis tested for evidence of interaction to determine whether the effects of various fatherhood constructs on the father being named on the birth certificate was modified by state-level Paternity Establishment Percentages (Research Question 4). Using multiple logistic regression, the father being named on the birth certificate was first regressed on fatherhood constructs, control variables, and the state-level PEP in one model to determine if an association was evident. Interaction terms were then created by taking each of the fatherhood constructs that

showed an association with the father's name on the birth certificate, and multiplying those by the effect modifier (state-level PEP categories). Using multiple logistic regression, the father being named on the birth certificate was regressed on the fatherhood constructs, the state-level PEP variable, and each of the newly created interaction terms as the independent variables. Control variables were included in the model. Odds ratios (OR) and 95% confidence intervals were examined for each association.

Table 1. Summary of research questions, hypotheses, and analytical strategy

Research Question	**Hypothesis**	**Analytic Strategy**
1) Examine the association between various fatherhood constructs for unmarried residential fathers (paternal prenatal involvement, pregnancy wantedness concordance , and paternal history of negative behaviors) and the inclusion of their names on the birth certificate.		
1a. Identify whether and how unmarried residential paternal prenatal involvement is associated with the father's name being listed on the birth certificate.	Unmarried residential fathers who engage in more paternal prenatal involvement will have a greater likelihood of being named on the birth certificate than fathers who engage in less paternal prenatal involvement.	Multiple logistic regression
1b. Identify whether and how concordance of pregnancy wantedness is associated with the father's name being listed on the birth certificate.	Unmarried residential fathers who report higher levels of pregnancy wantedness will be more likely to be named on the birth certificate, regardless of maternal wantedness, than those fathers reporting lower levels of pregnancy wantedness. Couples with concordant wantedness of pregnancy will be more likely to have the father listed on the birth certificate than couples with discordant wantedness of pregnancy.	Multiple logistic regression
1c. Identify whether and how a paternal history of negative behaviors is associated with the father's name being listed on the birth certificate.	Unmarried residential fathers who have a more significant history of negative behaviors will be less likely to be named on the birth certificate than those fathers who have a less significant history of negative behaviors.	Multiple logistic regression
2) Examine whether and how an association exists between birth outcomes and various fatherhood constructs (including paternity acknowledgment) of unmarried residential fathers. These outcomes include low birth weight and preterm birth.		
2a. Determine whether and how being named on the birth certificate is associated with birth outcomes.	Infants of unmarried residential fathers without a father named on the birth certificate will have a greater likelihood of low birth weight and preterm birth than infants with a father named on the birth certificate.	Multiple logistic regression
2b. Determine whether and how paternal prenatal involvement is associated with birth outcomes.	Infants of unmarried residential fathers who engage in less prenatal paternal involvement will have a greater likelihood of low birth weight and preterm birth than infants of fathers who engage in more prenatal paternal involvement.	Multiple logistic regression
2c. Determine whether and how concordance pregnancy wantedness is associated with birth outcomes.	Infants of unmarried residential fathers who report higher levels of pregnancy wantedness will have a lower likelihood of low birth weight and preterm birth, regardless of maternal wantedness, as compared with those fathers reporting lower levels of wantedness. Infants of couples with concordant wantedness of pregnancy will have a lower likelihood of low birth weight and preterm birth than infants of couples with discordant wantedness of pregnancy.	Multiple logistic regression
2d. Determine whether and how a paternal history of negative risk behaviors is associated with birth outcomes.	Infants of unmarried residential fathers who have a more significant history of negative behaviors will have a greater likelihood of low birth weight and preterm birth than infants of fathers who have a less significant history of negative behaviors.	Multiple logistic regression

3. Examine if the association between birth outcomes and various fatherhood constructs of unmarried residential fathers is mediated by maternal prenatal health behaviors such as change in smoking during pregnancy and prenatal care utilization.		
3a.Determine whether and how maternal prenatal health behaviors are associated with birth outcomes.	Mothers who do not lessen their smoking during pregnancy and have less than adequate prenatal care will have an increased risk of low birth weight and preterm birth than mothers who lessen their smoking during pregnancy and have adequate prenatal care.	Multiple logistic Regression
3b. Determine whether and how various fatherhood constructs are associated with maternal prenatal health behaviors.	Infants of fathers who engage in more prenatal paternal involvement, had a less significant history of negative behaviors, were named on the birth certificate, or whose fathers wanted the pregnancy, will be more likely to have mothers who lessen their smoking during pregnancy and have adequate prenatal care. This is compared to infants with fathers who engage in less prenatal involvement behaviors, have a more significant history of negative behaviors, are not named on the birth certificate, or whose fathers did not want the pregnancy or the couples did not want the pregnancy.	Ordinal logistic regression
3c. Determine whether and how the effect of fatherhood constructs on birth outcomes is mediated by maternal health behaviors.	Change in smoking behavior during pregnancy and adequacy of prenatal care will mediate the association between fatherhood constructs and birth outcomes. The inclusion of maternal health behaviors will reduce the association between fatherhood constructs and birth outcomes.	Multiple logistic regression
4. Determine whether state-level Paternity Establishment Percentages (PEP) modifies the effect of various fatherhood constructs on the unmarried residential father being named on the birth certificate.	In states with higher rates of paternity establishment there will be an increased association between fatherhood constructs and the father being named on the birth certificate for unmarried residential fathers than in states with lower rates of paternity establishment.	Multiple logistic regression

Human Subjects protection

This research was conducted using existing data. The analyses produced only aggregate tabulations for infants and their parents. Informed consent of participants was obtained by the original investigators. Confidentiality was maintained in the current study, as there was no contact with subjects and no identifiable information (i.e. names) regarding subjects in the data provided. Per NCES requirements, all unweighted N's were rounded to the next 50 (NCES, 2011a).

ECLS-B data are available only through a restricted-use data license agreement. An application for access to the data was submitted to the U.S. Department of Education and subsequently approved. All data and analyses were handled per NCES security requirements outlined in the Restricted-Use Data Procedures Manual (NCES, 2011b). As a result, ECLS-B data were reviewed and analyzed on a password-protected computer that did not have connectivity to the internet. This computer was located in an office within the Department of Family Science at the University of Maryland, accessible only by a limited number of individuals with a key. In addition, the CD-ROM containing the micro-data was stored in a locked file cabinet in that office.

The research proposal was submitted to the University of Maryland Human Institutional Review Board and approved on July 22, 2011 (Appendix B).

Chapter 4: Results

This chapter presents the results of the descriptive and multivariate analyses conducted to answer the four research questions under investigation. The descriptive analyses are presented, followed by the analysis conducted for each of the research questions. All analyses are weighted but sample sizes are unweighted. Note that unweighted sample sizes presented are rounded to the nearest 50 (NCES, 2011b).

Descriptive Analysis

Children of unmarried residential fathers

Table 2 summarizes the characteristics of the analytic sample of children of unmarried parents where a biological mother and father lived in the home (n=850). Of children born to unmarried resident fathers, almost 9% were born low birth weight (less than 2500 grams) and approximately 11% were born preterm (prior to 37 completed weeks of gestation). Most mothers (70%) indicated they received adequate prenatal care during their pregnancy. Comparing smoking levels before and during their pregnancies, nearly 60% of children had mothers who were nonsmokers at both intervals, 31% of children had mothers who smoked less during the pregnancy than they did prior to the pregnancy, and just under 10% of children had mothers who smoked the same or more during the pregnancy than they did prior to the pregnancy. In the examination of the fatherhood constructs, 14.3% of children of unmarried residential fathers did not have their father's name listed on the birth certificate whereas 85.7% did. Unmarried resident fathers were highly involved in the pregnancy, engaging, on average, in nearly 6 behaviors during the pregnancy. At the same time, more than half of fathers indicated a history of at least one negative

behavior. Approximately 17% of fathers indicated a history of 3 or more negative behaviors, 44% indicated a history of 1-2 negative behaviors, and 39% indicated a history of no negative behaviors. With regard to wantedness concordance of the pregnancies, almost 13% of children were born to families in which the mother indicated she wanted the pregnancy and the father indicated he did not. Approximately 35% of children were born to families in which the father indicated he wanted the pregnancy but the mother indicated she did not. For about 32% of children both parents wanted the pregnancy, and for almost 20% of children neither parent wanted the pregnancy. For a small percentage (10%) of mothers, the wantedness of the pregnancy was unknown; however, they were retained in the sample if other data were complete. An indicator for this small group of mothers was included in the analyses.

Children were almost evenly split between being the first born or later born. Thirty-four percent of children were the first-born to both parents, while approximately 38% were the first born to neither parent. First born children to mothers (but not fathers) comprised 12% of the sample, and first born children to fathers (but not mothers) comprised 15.5% of the sample. Approximately 2% of children were born as part of a multiple birth (twin, triplet, etc.). Although most mothers did not have any complications during the pregnancy, almost 9% did indicate having one or more complication. About 35% of children of nonresidential fathers were born in states with high paternity establishment percentages.

Table 2. Frequencies - Children of unmarried parents with resident father	Resident Fathers (N=850^)	
	N^	%
Low birth weight (1=Yes)	250	8.8
Preterm birth (1=Yes)	250	11.5
Father's Name on the Birth Certificate (1=No)	150	14.3
Paternal Prenatal Involvement		
Sum of all Pregnancy Behaviors (range/mean)	0-7	5.9
Pregnancy Wantedness Concordance		
Mother wanted pregnancy only	100	12.9
Father wanted pregnancy only	300	35.3
Both wanted pregnancy	300	31.9
Neither wanted pregnancy (reference)	300	19.9
Maternal wantedness unknown	50	10.1
Paternal History of Negative Behaviors		
No negative behaviors reported (reference)	300	38.6
Some (1-2) negative behaviors reported	300	43.8
Most (3 or more) negative behaviors reported	200	17.6
Parity concordance		
Mom first pregnancy (dad not)	100	12.0
Dad first pregnancy (mom not)	100	15.5
Both first pregnancy	300	34.2
Neither first pregnancy (reference)	350	38.3
Gender of child (1=Male)	450	54.1
Maternal Age		
15-19 years old	200	20.1
20-24 years old	350	43.0
25-29 years old (reference)	150	18.6
30 years and older	150	18.4
Household Income		
$20,000 or less (reference)	300	34.4
$20,001 to $35,000	250	33.5
$35,001 to $50,000	150	16.4
Over $50,001	150	15.7
Maternal Education		
Less than high school degree (reference)	300	34.0
High School degree	300	38.4
Some college or higher	250	27.6
Child Race/ethnicity		
Non-Hispanic white (reference)	300	40.8
Non-Hispanic black	150	12.9
Hispanic	250	39.4
Other	150	6.91
Maternal pregnancy complications (1=yes)	150	8.73
Additional adults in household (1=yes)	200	25.65
Twin or higher order birth (1=yes)	100	1.97
State with high paternity establishment percentage (1=yes)	550	38.10
Adequacy of prenatal care		
Adequate	600	70.25
Intermediate	200	22.40
Inadequate	50	7.40
Change in smoking during pregnancy		
Nonsmoker before and during pregnancy	500	59.06
Smoker, smoked less during pregnancy	300	31.40
Smoker, smoked same or more during pregnancy	100	9.54
^Unweighted sample sizes rounded to nearest 50		
Note: Percentages weighted using W1F0		

In describing race/ethnicity, nearly 41% of children of unmarried resident fathers were non-Hispanic white, 13% were non-Hispanic black, 40% were Hispanic, and 7% were characterized as Other. Children born to unmarried teen mothers (14-19 years old) with residential fathers comprised 20 % of the sample, those born to 20-24 year olds comprised 43% %, those born to 25-29 year olds comprised almost 19 %, and finally those born to mothers age 30 and over comprised just over 18%. In assessing other individuals in the household, approximately 26% of children of unmarried residential fathers lived in households with another adult (in addition to their parents).

Most of the children in the sample had mothers with a high school degree or less. Those with less than a high school degree comprised 34% of the sample, while those with a high school degree (but no college experience) comprised 38% of the sample. Finally, those with mothers who had some college experience or higher comprised nearly 28% of the sample. Most children were living in households with incomes of under $35,000 annually. Approximately 35% of children of unmarried residential fathers were living in households with incomes of $20,000 or less and approximately 34% were living in households with incomes of $20,001 to $35,000. About 16% of children lived in households with incomes of $35,001 to $50,000 while another 16% lived in households with incomes of $50,001 or higher.

Children of unmarried nonresidential fathers

Children of unmarried residential fathers were compared with children of unmarried nonresidential fathers on a number of variables. Many of the items used in the analytic sample are not asked of nonresidential fathers in the ECLS-B and thus,

were not able to be reported. As a result, although the sample sizes increased, only a limited description consisting of demographic and birth certificate data could be provided. Table 3 provides a summary of the larger samples of children of unmarried residential (N=1550) and nonresidential fathers (N=1800).

Significant differences existed between the children of unmarried residential fathers and children of unmarried nonresidential fathers. Compared to children of unmarried residential fathers, children of unmarried nonresidential fathers had significantly higher rates of low birth weight ($p<.05$) but not preterm births. Over half of birth certificates of children of nonresident fathers were missing the father's name on the birth certificate, compared to only 17% of children of resident fathers ($p<.001$). More mothers of children of nonresident fathers were teen aged ($p<.001$) or 25-29 years of age ($p<.05$) while children of resident fathers had significantly more mothers who were 30 years or older ($p<.001$).

There were significant differences between families of resident and nonresident fathers in each income category. Children of nonresident fathers tended to live in households with incomes lower than $20,000, while children of resident fathers tended to live in households with incomes of 20,001 or higher (all $p<.001$). Mothers of children with resident fathers were more educated, with significantly more having some college education or higher ($p<.05$). In all racial/ethnic categories significant differences between resident and nonresident fathers were also observed. Children with resident fathers were more likely non-Hispanic white, Hispanic or Other, whereas nearly 50% of children with nonresident fathers identified as non-Hispanic Black (all $p<.001$).

With regard to household structure, significant differences were again seen between children of residential and nonresidential fathers. Additional adults ($p<.05$) were more likely to be present in households of children with nonresidential fathers. Finally, children of unmarried residential fathers were more likely to live in states with high paternity establishment percentages than children of unmarried nonresidential fathers ($p<.05$). No significant differences were seen between children of residential and nonresidential fathers with regards to maternal pregnancy complications, multiple birth status, gender of child, maternal age of 20-24 years, and maternal education of a high school degree or less.

Table 3. Limited frequencies - Children of unmarried parents by father-type

	Children of unmarried parents (N=3550^)[1]				
	Subsample of Resident Fathers (N=1550^)		Subsample of Nonresident fathers (N= 1800^)		
	N^	%	N^	%	Chi-Square
Low birth weight (1=Yes)	450	29.2	600	33.2	*
Preterm birth (1=Yes)	450	29.1	550	32.1	
Father's Name on the Birth Certificate (1=No)	250	17.0	950	53.8	***
Gender of child (1=Male)	800	50.9	900	49.9	
Maternal Age					
15-19 years old	350	21.8	550	31.3	***
20-24 years old	650	40.1	700	38.8	
25-29 years old (reference)	300	18.2	250	15.4	*
30 years and older	300	20.0	250	14.5	***
Household Income					
$20,000 or less (reference)	600	37.4	1100	62.0	***
$20,001 to $35,000	550	33.4	400	22.7	***
$35,001 to $50,000	250	15.4	150	8.3	***
Over $50,001	200	13.9	100	7.0	***
Maternal Education					
Less than high school degree (reference)	500	33.3	650	35.7	
High School degree	600	37.1	700	39.5	
Some college or higher	450	29.6	450	24.8	*
Child Race/ethnicity					
Non-Hispanic white (reference)	450	29.9	300	17.8	***
Non-Hispanic black	250	16.7	900	48.7	***
Hispanic	550	34.7	400	21.4	***
Other	300	18.8	200	12.1	***
Maternal pregnancy complications (1=yes)	200	14.2	300	16.0	
Additional adults in household (1=yes)	400	24.8	500	29.3	*
Twin or higher order birth (1=yes)	200	12.2	250	13.4	
High state paternity establishment percentage (1 = yes)	550	34.5	550	30.8	*

[1] Approximately 100 fathers removed that were neither residential nor nonresidential biological fathers

^Unweighted sample sizes are rounded to nearest 50

***p<.001, ** p<.01, *p<.05; 2-tailed test

Multivariate Results

The following section describes the results from the regression analyses. Results are presented as for each of the four research questions under investigation.

Research Question 1: Association between various fatherhood constructs and father's name on the birth certificate

The first component of this analysis examines which fatherhood constructs were associated with the father's name being listed on the birth certificate. Three constructs were examined: paternal involvement behaviors during the pregnancy; concordance of pregnancy wantedness; and history of paternal negative behaviors. Table 4 shows the results of the regression analysis.

Paternal Prenatal Involvement

In unadjusted analysis, paternal prenatal involvement (e.g. listening to the baby's heartbeat) was significantly associated with the father being named on the birth certificate. Each additional behavior the father engaged in was associated with a 22% increased odds of being named (Table 4, Model I). However, although the size of the association was the same, it was no longer statistically significant after controlling for all independent and control variables (Table 4, Model IV).

Concordance of pregnancy wantedness

Concordance of pregnancy wantedness was associated with father's name being on the birth certificate in Model II (Table 4). In unadjusted analysis, when both parents wanted the pregnancy as compared to when neither wanted the pregnancy it was nearly 2.8 times as likely that the father's name would be on the birth certificate as when neither reported wanting the pregnancy (OR 2.75, 95%CI 1.11, 6.82, $p<.05$).

Table 4. Fatherhood constructs predicting Father's Name on the Birth Certificate (Odds ratios)

	Children of Unmarried Parents with Resident Father in Household (N=850^)							
	Model I		Model II		Model III		Model IV	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Paternal Prenatal Involvement								
Sum of all Pregnancy Behaviors	1.22	(1.00, 1.49) *					1.21	(0.93, 1.58)
Pregnancy Wantedness Concordance								
Mother want pregnancy only			2.03	(0.92, 4.60)			1.80	(0.82, 3.94)
Father want pregnancy only			1.23	(0.61, 2.40)			0.97	(0.46, 2.04)
Both want pregnancy			2.75	(1.11, 6.82) *			2.38	(0.90, 6.23)
Neither want pregnancy (reference)				omitted				omitted
Mother wantedness unknown			1.17	(0.43, 3.24)			1.04	(0.37, 2.99)
Paternal History of Negative Behaviors								
No negative behaviors reported (reference)						omitted		omitted
Some (1-2) negative behaviors reported					0.51	(0.28, 0.93) *	0.60	(0.31, 1.19)
Most (3 or more) negative behaviors reported					0.23	(0.12, 0.46) ***	0.22	(0.10, 0.49) **
Parity concordance								
Mom first pregnancy (dad not)							1.53	(0.55, 4.22)
Dad first pregnancy (mom not)							1.15	(0.26, 5.02)
Both first pregnancy (reference)								omitted
Neither first pregnancy							1.23	(0.33, 4.61)
Gender of child (1=Male)							0.65	(0.41, 1.03)
Maternal Age								
15-19 years old							1.50	(0.56, 4.02)
20-24 years old							1.43	(0.73, 2.80)
25-29 years old (reference)								omitted
30 years and older							2.00	(0.85, 4.66)
Household Income								
$20,000 or less (reference)								omitted
$20,001 to $35,000							1.48	(0.79, 2.79)
$35,001 to $50,000							2.13	(0.91, 4.98)
Over $50,001							1.69	(0.59, 4.89)
Maternal Education								
Less than high school degree (reference)								omitted
High School degree							1.19	(0.85, 4.66)
Some college or higher							1.76	(0.87, 3.56)
Child Race/ethnicity								
Non-Hispanic white (reference)								omitted
Non-Hispanic black							0.58	(0.26, 1.31)
Hispanic							1.69	(0.81, 3.50)
Other							1.57	(0.59, 4.19)
Maternal pregnancy complications							0.80	(0.38, 1.67)
Additional adults in household (1=yes)							1.14	(0.55, 2.39)
Twin or higher order birth (1=yes)							1.14	(0.45, 2.92)

***p<.001, ** p<.01, *p<.05; 2-tailed test
^Unweighted sample sizes rounded to nearest 50.
Note: Weight W1F0 applied
Model I: Paternal involvement behaviors during pregnancy, no controls.
Model II: Maternal/paternal pregnancy wantedness concordance, no controls
Model III: History of paternal negative behaviors, no controls
Model IV: Paternal involvement, wantedness concordance, paternal negative behaviors and all controls.

However, after adjusting for all independent and control variables the only association was no longer statistically significant (Table 4, Model IV).

Paternal History of Negative Behaviors

Of these three fatherhood constructs, only history of paternal negative behaviors (e.g. if father had ever been arrested) was significantly associated with father's name being listed on the birth certificate in both unadjusted and adjusted analysis. In unadjusted analysis fathers who indicated some (1 or 2) or most (3 or more) negative behaviors as compared to those who indicated no negative behaviors were less likely to be named on the birth certificate (Table 4, Model III). Fathers who had a history of some negative behaviors were nearly half as likely to be named on the birth certificate (OR 0.51, 95%CI 0.28, 0.93, $p<.05$) and fathers who had a history of most negative behaviors were 77% less likely to be named on the birth certificate (OR 0.23, 95%CI 0.12, 0.46, $p<0.01$) than those with no negative behaviors. After controlling for all independent and control variables, the risk remained virtually unchanged with those fathers who indicated having the most negative behaviors 78% less likely to be named on the birth certificate (OR 0.22, 95%CI 0.10, 0.49, $p <0.01$) than those with no negative behaviors. A significant association was no longer seen between father's name on the birth certificate and fathers with a history of *some* negative behaviors (Table 4, Model IV).

Research Question 2: Association between various fatherhood constructs and birth outcomes

The second part of the regression analysis examined the association between fatherhood constructs and birth outcomes – low birth weight and preterm birth (Research Question 2).

Low birth weight

Table 5 (first and second columns) provides results from these analyses. In first exploring associations with low birth weight, mothers living with fathers who engaged in more paternal involvement behaviors (e.g. listening to the baby's heartbeat) during pregnancy were less likely to have low birth weight babies. Each additional behavior the father engaged in was associated with a 30% decreased odds of low birth weight (OR 0.70, 95%CI 0.57, 0.87, p<0.01). This association remained after adjusting for all other independent and control variables. Neither father's name on the birth certificate nor the remaining fatherhood constructs (pregnancy wantedness concordance or history of negative behaviors) were significantly associated with low birth weight. Several control variables were significantly associated with low birth weight. Boys were half as likely to be low birth weight (OR 0.50, 95%CI 0.32, 0.78, p<.01) as girls. Children born as part of multiples were over 40 times as likely to be low birth weight (OR 42.65, 95%CI 20.55, 88.52, p <.001) as singletons. Finally, children of mothers who indicated that there were pregnancy complications were almost 2.5 times as likely to be low birth weight (OR 2.46, 95%CI 1.30, 4.65, p<.01) compared to those born to mothers with no pregnancy complications.

Table 5. Factors Predicting Birth Outcomes - Low birth weight and preterm birth (Odds ratios)

	Children of Unmarried Parents with Resident Father in Household (N=850^)							
	Low birthweight		Preterm Birth		Low birthweight		Preterm Birth	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Father's Name on the Birth Certificate (1=No)	1.05	(0.56, 1.97)	0.71	(0.36, 1.42)	1.04	(0.55, 1.98)	0.71	(0.35, 1.42)
Paternal Prenatal Involvement								
Sum of all Pregnancy Behaviors	0.70	(0.57, 0.87) **	0.83	(0.63, 1.10)	0.70	(0.57, 0.87) **	0.83	(0.62, 1.09)
Pregnancy Wantedness Concordance								
Mother want pregnancy only	0.86	(0.39, 1.89)	1.39	(0.53, 3.70)	0.87	(0.39, 1.95)	1.39	(0.52, 3.70)
Father want pregnancy only	1.60	(0.85, 3.01)	0.53	(0.26, 1.08)	1.60	(0.85, 3.02)	0.50	(0.23, 1.07)
Both want pregnancy	1.14	(0.63, 2.06)	1.08	(0.54, 2.17)	1.20	(0.66, 2.18)	1.06	(0.53, 2.13)
Neither want pregnancy (reference)		omitted		omitted		omitted		omitted
Mother wantedness unknown	1.91	(0.90, 4.05)	2.96	(1.23, 7.06) *	1.93	(0.89, 4.20)	2.98	(1.23, 7.25) *
Paternal History of Negative Behaviors								
No negative behaviors reported (reference)		omitted		omitted		omitted		omitted
Some (1-2) negative behaviors reported	1.03	(0.59, 1.77)	1.12	(0.61, 2.04)	1.01	(0.59, 1.73)	1.14	(0.61, 2.11)
Most (3 or more) negative behaviors reported	1.10	(0.49, 2.45)	1.48	(0.67, 3.29)	1.09	(0.48, 2.43)	1.48	(0.66, 3.33)
Maternal Health Behaviors								
Adequate prenatal care (1=Yes)					0.91	(0.55, 1.53)	1.04	(0.56, 1.92)
Change in smoking during pregnancy								
Nonsmoker before and during pregnancy (reference)						omitted		omitted
Smoker, smoked less during pregnancy					1.30	(0.78, 2.14)	1.31	(0.72, 2.38)
Smoker, smoked same or more during pregnancy					1.53	(0.69, 3.42)	0.82	(0.27, 2.54)
Control Variables								
Parity concordance								
Mom first pregnancy (dad not)	1.32	(0.79, 2.24)	1.80	(0.93, 3.47)	1.31	(0.78, 2.21)	1.79	(0.91, 3.51)
Dad first pregnancy (mom not)	0.46	(0.15, 1.14)	0.70	(0.29, 1.71)	0.45	(0.14, 1.41)	0.61	(0.19, 2.02)
Both first pregnancy (reference)		omitted		omitted		omitted		omitted
Neither first pregnancy	0.52	(0.18, 1.45)	0.82	(0.41, 1.67)	0.51	(0.18, 1.44)	0.75	(0.28, 2.03)
Gender (1=Male)	0.50	(0.32, 0.78) **	1.35	(0.80, 2.28)	0.50	(0.32, 0.78) **	1.33	(0.79, 2.24)
Maternal Age								
15-19 years old	1.59	(0.69, 3.67)	1.78	(0.86, 3.83)	1.60	(0.69, 3.67)	1.71	(0.81, 3.60)
20-24 years old	1.32	(0.68, 2.58)	1.08	(0.52, 2.23)	1.29	(0.66, 2.53)	1.06	(0.51, 2.24)
25-29 years old (reference)		omitted		omitted		omitted		omitted
30 years and older	1.80	(0.71, 4.56)	1.91	(0.84, 4.31)	1.82	(0.71, 4.66)	1.93	(0.84, 4.44)
Household Income								
$20,000 or less (reference)		omitted		omitted		omitted		omitted
$20,001 to $35,000	0.61	(0.34, 1.10)	0.74	(0.36, 1.56)	0.62	(0.34, 1.12)	0.75	(0.36, 1.57)
$35,001 to $50,000	0.93	(0.45, 1.91)	0.48	(0.20, 1.15)	0.92	(0.45, 1.89)	0.46	(0.18, 1.18)
Over $50,001	0.59	(0.24, 1.47)	0.76	(0.28, 2.13)	0.61	(0.25, 1.52)	0.76	(0.27, 2.09)
Maternal Education								
Less than high school degree (reference)		omitted		omitted		omitted		omitted
High School degree	1.05	(0.54, 2.07)	2.74	(1.23, 6.10) *	1.07	(0.54, 2.13)	2.69	(1.20, 6.03) *
Some college or higher	1.34	(0.73, 2.47)	2.94	(1.29, 6.73) *	1.41	(0.78, 2.58)	2.98	(1.29, 6.88) *
Child Race/ethnicity								
Non-hispanic white (reference)		omitted		omitted		omitted		omitted
Non-hispanic black	1.56	(0.78, 3.11)	1.24	(0.57, 2.71)	1.75	(0.81, 3.78)	1.30	(0.59, 2.84)
Hispanic	0.51	(0.27, 0.98) *	1.14	(0.58, 2.28)	0.60	(0.30, 1.22)	1.24	(0.63, 2.43)
Other	0.38	(0.11, 1.31)	0.91	(0.30, 2.74)	0.40	(0.12, 1.35)	0.93	(0.31, 2.81)
Maternal pregnancy complications	2.46	(1.30, 4.65) **	1.41	(0.62, 3.20)	2.48	(1.31, 4.70) **	1.35	(0.59, 3.05)
Additional adults in household (1=yes)	1.20	(0.71, 2.05)	1.13	(0.58, 2.20)	1.23	(0.73, 2.08)	1.16	(0.58, 2.35)
Twin or higher order birth (1=yes)	42.65	(20.55, 88.52) ***	41.36	(16.01, 106.85) ***	42.51	(20.41, 88.52) ***	41.65	(16.09, 107.82) ***

***p<.001, ** p<.01, *p<.05; 2-tailed test
^Unweighted sample sizes rounded to nearest 50.
Note: Weight W1F0 applied

Preterm Birth

Turning to the other birth outcome, only one fatherhood construct was found to have a marginally significant association with preterm birth (Table 5). Children born to parents who reported that the father wanted the child (and the mother did not) were half as likely to be preterm as those children born to parents who reported that neither wanted the child (OR 0.52, 95% CI 0.25, 1.09, p< 0.1), after adjusting for all independent and control variables. Preterm birth was more likely for children of mothers whose pregnancy wantedness was unknown (due to nonresponse on the survey instrument) than for those cases in which neither wanted the birth (OR 2.96, 95%CI 1.23, 7.06, p<.05). Preterm birth was not significantly associated with the father's name on the birth certificate or any of the other fatherhood constructs (father's behaviors during pregnancy and paternal history of negative behaviors).

Several control variables were significantly associated with preterm birth. Children who were born as part of multiples were more likely to be born preterm than singleton children (OR 41.36, 95%CI 16.01, 106.85, p <.001). Maternal education was also significantly associated with preterm birth. Children born to women with a high school degree (OR 2.74, 95%CI 1.23, 6.10, p<.05) or any college experience (OR 2.94, 95%CI 1.29, 6.73, p<.05) were more likely to be born preterm than children born to women with less than a high school degree.

Research Question 3: Mediation of maternal health behaviors in the association between fatherhood constructs and birth outcomes

The mediators being tested in this study were change in maternal smoking behavior during pregnancy and adequacy of prenatal care. We first examine the

association between fatherhood constructs and maternal health behaviors. We then examine the association between maternal health behaviors and birth outcomes. Finally we examine the association between fatherhood constructs and birth outcomes, including mediating variables.

Association between fatherhood constructs and maternal smoking behaviors

Table 6 shows the results from the regression analysis. Several significant associations were seen related to the change in maternal smoking during pregnancy. Children born to fathers with a history of some negative behaviors were 40% less likely to have mothers who smoked less or were nonsmokers during the pregnancy compared to children born to fathers with no history of negative behaviors (OR .61, 95%CI .39, .95, $p<.05$). The size and direction of the effect was similar for children born to fathers with a history of more negative behaviors, but it was not statistically significant at $p<.05$. Compared to when neither parent wanted the pregnancy, when both parents wanted the pregnancy (OR 1.91, 95%CI 1.13, 3.23, $p<.05$), the child was almost two times as likely to be born to a mother who smoked less or was a nonsmoker during pregnancy. The unknown maternal wantedness variable was also significantly associated with smoking less during pregnancy. Compared to when neither parent wanted the pregnancy, those mothers whose pregnancy wantedness was unknown were more likely to smoke less or be nonsmokers during the pregnancy (OR 1.84, 95%CI 1.14, 2.96, $p<.05$).

Table 6. Association between Fatherhood constructs and maternal health behaviors (Odds ratios)

	Children of Unmarried Parents with Resident Father in Household (N=850^)				
	Change in Smoking Level[1]			Adequacy of Prenatal Care[2]	
Fatherhood Constructs	OR	95%CI		OR	95%CI
Father's Name on the Birth Certificate (1=No)	0.79	(0.53, 1.17)		0.58	(0.32, 1.05)
Paternal Prenatal Involvement					
Sum of all Pregnancy Behaviors	0.84	(0.69, 1.02)		1.74	(1.39, 2.17) ***
Pregnancy Wantedness Concordance					
Mother want pregnancy only	2.06	(0.89, 4.79)		1.00	(0.43, 2.31)
Father want pregnancy only	1.07	(0.63, 1.82)		1.02	(0.57, 1.83)
Both want pregnancy	1.91	(1.13, 3.23)	*	0.96	(0.52, 1.77)
Neither want pregnancy (reference)		omitted			omitted
Mother wantedness unknown	1.84	(1.14, 2.96)	*	0.63	(0.32, 1.24)
Paternal History of Negative Behaviors					
No negative behaviors reported (reference)		omitted			omitted
Some (1-2) negative behaviors reported	0.61	(0.39, 0.95)	*	1.14	(0.68, 1.90)
Most (3 or more) negative behaviors reported	0.66	(0.44, 1.09)		1.44	(0.70, 2.96)
Control variables					
Parity concordance					
Mom first pregnancy (dad not)	1.06	(0.56, 1.98)		0.90	(0.47, 1.72)
Dad first pregnancy (mom not)	0.74	(0.31, 1.77)		1.20	(0.55, 2.61)
Both first pregnancy (reference)		omitted			omitted
Neither first pregnancy	0.87	(0.43, 1.76)		1.05	(0.52, 2.11)
Gender of child (1=Male)	1.08	(0.70, 1.65)		1.05	(0.52, 2.11)
Maternal Age					
15-19 years old	0.79	(0.43, 1.46)		0.99	(0.46, 2.15)
20-24 years old	0.80	(0.48, 1.33)		0.96	(0.50, 1.85)
25-29 years old (reference)		omitted			omitted
30 years and older	1.05	(0.43, 2.61)		1.98	(0.64, 2.25)
Household Income					
$20,000 or less (reference)		omitted			omitted
$20,001 to $35,000	0.67	(0.41, 1.07)		1.27	(0.78, 2.08)
$35,001 to $50,000	0.66	(0.40, 1.10)		1.53	(0.71, 3.33)
Over $50,001	1.10	(0.55, 2.20)		1.92	(0.88, 4.18)
Maternal Education					
Less than high school degree (reference)		omitted			omitted
High School degree	1.22	(0.76, 1.96)		1.41	(0.86, 2.30)
Some college or higher	2.25	(1.27, 4.00)	**	1.14	(0.61, 2.13)
Child Race/ethnicity					
Non-hispanic white (reference)		omitted			omitted
Non-hispanic black	5.89	(3.35, 10.37)	***	0.72	(0.40, 1.30)
Hispanic	10.68	(6.12, 18.62)	***	0.99	(0.54, 1.84)
Other	0.96	(0.50, 1.85)		1.24	(0.61, 2.52)
Maternal pregnancy complications	1.27	(0.71, 2.26)		2.50	(1.18, 5.32) *
Additional adults in household (1=yes)	1.60	(0.90, 2.82)		0.78	(0.50, 1.22)
Twin or higher order birth (1=yes)	0.88	(0.46, 1.70)		1.37	(0.66, 2.81)

***p<.001, ** p<.01, *p<.05; 2-tailed test

^Unweighted sample sizes rounded to nearest 50.

Note: Weight W1F0 applied

[1]Ordinal logistic regression used for analysis: (1) Nonsmokers (2) Reduced smokers (3) Same or increased smokers

[2]Ordinal logistic regression used for analysis: (1) Adequate prenatal care (2) Intermediate (3) Inadequate

Several control variables were also significantly associated with change in smoking behavior during pregnancy. Compared to mothers of non-Hispanic white children, mothers of non-Hispanic black (OR 5.89, 95%CI 3.35, 10.37, p<.001) or Hispanic (OR 10.68, 95% CI 6.12, 18.62, p<.001) children were almost 6 times and 11 times (respectively) as likely to smoke less or be nonsmokers during the pregnancy. Women with some college education were also more likely to smoke less or be nonsmokers during pregnancy (OR 2.25, 95% CI 1.27, 4.00, p<.0.01) than women with less than a high school degree.

Association between fatherhood constructs and adequacy of prenatal care

Only one fatherhood construct was significantly associated with adequacy of prenatal care (Table 6). Fathers who reported more prenatal involvement behaviors (e.g. listen to the baby's heartbeat) during the pregnancy were more likely to have children whose mothers had more adequate prenatal care. For each additional behavior the father reported there was associated with a 74% increased odds of the mother having adequate prenatal care (OR 1.74, 95%CI 1.39, 2.17, p<.001).

Several control variables were significantly associated with adequacy of prenatal care. Mothers who experienced one or more complications during the pregnancy were two and a half times as likely to have had adequate prenatal care than those who had no complications during pregnancy (OR 2.50, 95% CI 1.18, 5.32 p<.05). There were no other significant associations between potential mediating variables and independent or control variables.

In summary, several associations were seen between the potential mediating variables and fatherhood constructs. We turn next to an examination of the

associations between the potential mediating variables and birth outcomes (low birth weight and preterm birth).

Association between maternal health behaviors and birth outcomes.

There were no significant associations between the mediating variables (smoking change during pregnancy and adequacy of prenatal care) and either of the dependent variables (preterm birth and low birth weight) (Table 7).

Although not significant, the associations were generally in the direction expected. For example, having received adequate prenatal care was (nonsignificantly) associated with lower odds of having a low birth weight baby. The exception was for mothers who smoked the same or more during pregnancy and association with preterm birth, a negative association. This was not in the direction expected; however, the estimate was imprecise and not statistically significant.

There were several associations of significance between control variables and birth outcomes (Table 7). With regard to low birth weight, male children (OR 0.51, 95%CI 0.34, 0.78, p<.01) and children born as part of a multiple order birth (OR 36.71, 95%CI 19.26, 69.95, p <.001) were more likely to be born low birth weight compared to female or singleton children. Children of mothers who experienced one or more pregnancy complication were over 2.5 times as likely to be born low birth weight than those born to mothers with no pregnancy complications (OR 2.55, 95%CI 1.28, 5.07, p<.01).

Table 7. Association between maternal health behaviors and Birth Outcomes - Low birthweight and preterm birth (Odds ratios)

	Children of Unmarried Parents with Resident Father in Household (N=850^)					
	Low birth weight			Preterm Birth		
	OR	95% CI		OR	95% CI	
Adequate prenatal care (1=Yes)	0.74	(0.45, 1.22)		0.93	(0.52, 1.66)	
Change in smoking during pregnancy						
Nonsmoker before and during pregnancy (reference)		omitted			omitted	
Smoker, smoked less during pregnancy	1.37	(0.83, 2.24)		1.15	(0.68, 1.94)	
Smoker, smoked same or more during pregnancy	1.40	(0.64, 3.04)		0.71	(0.23, 2.17)	
Control variables						
Parity concordance						
Mom first pregnancy (dad not)	1.31	(0.82, 2.09)		2.11	(1.10, 4.06)	*
Dad first pregnancy (mom not)	0.58	(0.25, 1.36)		0.79	(0.32, 1.94)	
Both first pregnancy (reference)		omitted			omitted	
Neither first pregnancy	0.56	(0.27, 1.19)		0.79	(0.37, 1.69)	
Gender of child (1=Male)	0.51	(0.34, 0.78)	**	1.26	(0.76, 2.08)	
Maternal Age						
15-19 years old	1.40	(0.63, 3.11)		1.48	(0.73, 3.02)	
20-24 years old	1.17	(0.63, 2.18)		0.96	(0.50, 1.86)	
25-29 years old (reference)		omitted			omitted	
30 years and older	1.87	(0.75, 4.66)		2.14	(1.00, 4.61)	
Household Income						
$20,000 or less (reference)		omitted			omitted	
$20,001 to $35,000	0.66	(0.38, 1.15)		0.73	(0.37, 1.43)	
$35,001 to $50,000	0.82	(0.40, 1.67)		0.43	(0.18, 1.07)	
Over $50,001	0.53	(0.23, 1.24)		0.66	(0.25, 1.71)	
Maternal Education						
Less than high school degree (reference)		omitted			omitted	
High School degree	1.06	(0.57, 1.97)		2.26	(1.04, 4.06)	*
Some college or higher	1.23	(0.70, 2.17)		2.48	(1.11, 4.00)	*
Child Race/ethnicity						
Non-Hispanic white (reference)		omitted			omitted	
Non-Hispanic black	1.86	(0.95, 3.64)		1.19	(0.57, 2.49)	
Hispanic	0.74	(0.40, 1.36)		1.13	(0.64, 2.03)	
Other	0.47	(0.16, 1.41)		0.98	(0.63, 2.01)	
Maternal pregnancy complications	2.61	(1.32, 5.14)	**	1.04	(0.33, 3.23)	
Additional adults in household (1=yes)	1.27	(0.75, 2.17)		1.13	(0.57, 2.23)	
Twin or higher order birth (1=yes)	36.51	(19.00, 70.16)	***	39.56	(15.17, 103.01)	***

***p<.001, ** p<.01, *p<.05; 2-tailed test
^Unweighted sample sizes rounded to nearest 50.
Note: Weight W1F0 applied

Several control variables were associated with preterm birth. Children born to mothers with a high school degree (OR 2.26, 95%CI 1.04, 4.93, p<.05) or some college (OR 2.48, 95% CI 1.10, 5.59, p<.05) were at higher risk for preterm birth than those born to mothers with less than a high school degree. Children who were the first child to mothers but not fathers (OR 2.11, 95% 1.10, 4.06, p<.05) or were part of a multiple birth (OR 39.56, 95%CI 15.19, 103.01, p<.001) were also at higher risk for preterm birth compared children born to parents where this is not the first born for either parent, or as a singleton.

To summarize, no significant associations were found between the mediating variables and either of the dependent variables.

Maternal health behaviors as mediators on the association between fatherhood constructs and birth outcomes

In the final test for mediation, maternal health behaviors were added to the full model to determine the extent to which maternal health behaviors explain the association between fatherhood constructs and birth outcomes. Table 5 (third and fourth columns) shows the results from these analyses.

Low birth weight. When smoking change during pregnancy and adequacy of prenatal care were added to the full model, paternal prenatal involvement remained significantly associated with low birth weight at the p<.01 level. For each additional behavior a father reported during pregnancy there was a 30% reduction in the risk of his baby being low birth weight. The odds ratio and 95% confidence intervals for this association (OR 0.70, 95%CI 0.57, 0.87) were unchanged with the addition of

smoking change during pregnancy and adequacy of prenatal care to the model. No percentage of the association between paternal prenatal involvement and low birth weight can be attributed to either mediator.

With the addition of the mediating variables to the model, several control variables with significant associations were affected. When mediators were added to the model, the association between Hispanic origin and low birth weight was no longer significant at the $p<.05$ level. The significance levels of gender of the child and multiple birth status were unchanged.

Preterm birth. One fatherhood construct was significantly associated with preterm birth prior to the addition of mediators. The association between unknown maternal pregnancy wantedness and preterm birth remained significant after adequacy of prenatal care and smoking change during pregnancy were added to the model (Table 5 third column). The odds ratio increased slightly from 2.96 (95%CI 1.23, 7.06, $p<.05$) prior to the addition of mediators to 2.98 (95%CI 1.23, 7.25, $p<.05$) after.

Several control variables were affected by the addition of mediators to the model. The association between mothers having a high school degree and preterm birth decreased from OR 2.74 (95%CI 1.23, 6.10, $p<.05$) to OR 2.69 (95%CI 1.20, 6.03, $p<.05$) with the addition of mediators to the model. Multiple birth order status and having a mother with a college degree or higher remained virtually unchanged.

For both low birth weight and preterm birth, the addition of mediators did not significantly affect the significant associations seen prior to the mediators being included (Table 5). Furthermore, there were no associations seen between the

mediating variables and the dependent variables (Table 7). Neither adequacy of prenatal care or change in smoking behavior during pregnancy explains the significant associations seen between paternal involvement during pregnancy and birth outcomes.

Research Question 4: Effect of state paternity establishment rates on association between fatherhood constructs and father's name on the birth certificate

In regression analysis, children born in states with a high 2001 paternity establishment percentage (highest quartile of states) were over two and a half times as likely to have a father named on the birth certificate compared to those born in a state with low 2001 paternity establishment percentage (OR 2.66, 95% CI 1.43, 4.94, $p<.05$) after controlling for all independent variables (Table 8). When high state paternity establishment percentage was added to the full model, the only other statistically significant association with father's name on the birth certificate remained virtually unchanged. Fathers with a history of the most negative behaviors were 78% (95% CI 0.10, 0.49, $p<.01$) less likely to be named on the birth certificate prior to the addition of high state paternity establishment percentage (see Research Question 1) and were 77% after (95% CI 0.10, 0.51, $p<.01$). This is an indication that state paternity establishment policies have an independent effect on paternity acknowledgement.

An interaction of state paternity establishment policies with the association between any of the three fatherhood constructs and father's name on the birth certificate could not be demonstrated (results not shown).

Table 8. Fatherhood Constructs Predicting Fathers Name on the Birth Certificate, with inclusion of State Paternity Establishment rates (Odds ratios)

	Children of Unmarried Parents with Resident Father in Household (N=850^)			
	Model I		Model II	
	OR	95% CI	OR	95%CI
Paternal Prenatal Involvement				
Sum of all Pregnancy Behaviors	1.21	(0.93, 1.58)	1.20	(0.91, 1.59)
Pregnancy Wantedness Concordance				
Mother want pregnancy only	1.80	(0.82, 3.94)	1.84	(0.79, 4.28)
Father want pregnancy only	0.97	(0.46, 2.04)	0.99	(0.46, 2.14)
Both want pregnancy	2.38	(0.90, 6.23)	2.42	(0.91, 6.40)
Neither want pregnancy (reference)		omitted		omitted
Mother wantedness unknown	1.04	(0.37, 2.99)	0.91	(0.32, 2.62)
Paternal History of Negative Behaviors				
No negative behaviors reported (reference)		omitted		omitted
Some (1-2) negative behaviors reported	0.60	(0.31, 1.19)	0.60	(0.30, 1.19)
Most (3 or more) negative behaviors reported	0.22	(0.10, 0.49) **	0.23	(0.10, 0.51) **
Parity concordance				
Mom first pregnancy (dad not)	1.53	(0.55, 4.22)	1.47	(0.53, 4.13)
Dad first pregnancy (mom not)	1.15	(0.26, 5.02)	1.20	(0.30, 4.71)
Both first pregnancy (reference)		omitted		omitted
Neither first pregnancy	1.23	(0.33, 4.61)	1.30	(0.36, 4.61)
Gender of child (1=Male)	0.65	(0.41, 1.03)	0.63	(0.39, 1.02)
Maternal Age				
15-19 years old	1.50	(0.56, 4.02)	1.74	(0.65, 4.68)
20-24 years old	1.43	(0.73, 2.80)	1.54	(0.78, 3.07)
25-29 years old (reference)		omitted		omitted
30 years and older	2.00	(0.85, 4.66)	1.91	(0.79, 4.63)
Household Income				
$20,000 or less (reference)		omitted		omitted
$20,001 to $35,000	1.48	(0.79, 2.79)	1.62	(0.87, 3.05)
$35,001 to $50,000	2.13	(0.91, 4.98)	2.07	(0.90, 4.81)
Over $50,001	1.69	(0.59, 4.89)	1.70	(0.56, 5.21)
Maternal Education				
Less than high school degree (reference)		omitted		omitted
High School degree	1.19	(0.85, 4.66)	1.28	(0.71, 2.30)
Some college or higher	1.76	(0.87, 3.56)	1.98	(0.95, 4.11)
Child Race/ethnicity				
Non-Hispanic white (reference)		omitted		omitted
Non-Hispanic black	0.58	(0.26, 1.31)	0.55	(0.24, 1.26)
Hispanic	1.69	(0.81, 3.50)	1.24	(0.61, 2.54)
Other	1.57	(0.59, 4.19)	1.47	(0.56, 3.88)
Maternal pregnancy complications	0.80	(0.38, 1.67)	0.87	(0.41, 1.83)
Additional adults in household (1=yes)	1.14	(0.55, 2.39)	1.07	(0.49, 2.31)
Twin or higher order birth (1=yes)	1.14	(0.45, 2.92)	0.98	(0.36, 2.64)
High State Paternity Establishment Percentage (1=yes)			2.66	(1.43, 4.94) **

***p<.001, ** p<.01, *p<.05; 2-tailed test

^Unweighted sample sizes rounded to nearest 50.

Note: Weight W1F0 applied

Model I: Paternal involvement, wantedness concordance, paternal negative behaviors and all controls

Model II: State Paternity Establishment rate, Paternal involvement, wantedness concordance, paternal negative behaviors and all controls.

Chapter 5 – Discussion

This chapter provides an interpretation of the findings outlined in Chapter 4, presenting a summary of the findings, along with a more detailed discussion related to the study hypotheses. Next, study limitations are discussed. Finally, the chapter explores implications for policies and programming, suggesting future directions for research.

Summary of findings

Several studies have used whether or not the father's name was on the birth certificate as a proxy to indicate whether the father was involved during the pregnancy. This proxy has received limited validation in prior research. The first component of this study tested several fatherhood constructs to determine their association with father's name on the birth certificate. Thus, the results of this study add to our understanding of this variable. Of the three fatherhood constructs tested, only one – history of paternal negative behaviors – predicted paternity acknowledgment at birth. Those fathers with a history of negative behaviors during pregnancy were significantly less likely to be named on the birth certificate. Neither of the two other constructs – the father's display of involvement during pregnancy, or the shared desire of the couple to have a child – led to increased likelihood of being named on the birth certificate. Consequently, studies working under the assumption that exclusion of father's name from the birth certificate at birth universally means that father is absent during pregnancy – or, conversely, that fathers who demonstrate engagement in the pregnancy will be named on the birth certificate – are not capturing the entire picture of paternal involvement during the pregnancy.

The second component of this study examined which, if any, of the fatherhood constructs were associated with low birth weight and preterm birth. Because they relate to numerous health conditions, these birth outcomes are widely studied in the field of maternal and child health. The findings from this study strengthen the literature on paternal prenatal involvement by revealing an association between paternal prenatal involvement and healthy birth weight. This is one of the few studies to connect the positive influence of father involvement behaviors during pregnancy with the health of his developing child. It is important to note that neither the father's name on the birth certificate nor its correlate – history of paternal negative behaviors – was associated with either birth outcome, in contrast to other studies using father's name on the birth certificate as a proxy for paternal involvement. Taken together, these results suggest that the behaviors of the fathers should be examined whenever possible, rather than father's name on the birth certificate, as the true connection to low birth weight.

The third component of this study examined if maternal health behaviors operated as mediators between the association of fatherhood constructs and birth outcomes. Several important associations were seen between the fatherhood constructs and maternal health behaviors. Children of fathers who reported more involvement during pregnancy were born to mothers who were more likely to have received adequate prenatal care.

Moreover, the negative behaviors of a father and his wantedness of pregnancy were associated with change in smoking behavior during pregnancy. Mothers were more likely to reduce their smoking during pregnancy (or be nonsmokers) when both

parents wanted the pregnancy compared to when neither wanted the pregnancy. The same was not true when only the mother wanted the pregnancy, thus underscoring the importance placed by the mother on father's wantedness of the pregnancy. When mothers were living with fathers with a moderate history of negative behaviors, they were less likely to reduce their smoking during pregnancy (or be nonsmokers). Notably, while each of the other paternal involvement constructs was associated with maternal health behaviors, we again saw no association between father's name on the birth certificate and adequacy of prenatal care or change in maternal smoking behavior during pregnancy.

In the current study, associations were not seen between either of the maternal health behaviors under investigation – change in smoking behavior during pregnancy and adequacy of prenatal care – and the two birth outcomes. However, limitations in the maternal health behaviors may be responsible for these unexpected results (see Discussion and Limitations, below). As a result, this study did not provide evidence of mediation. Finally, the current study analyzed whether the associations between the various fatherhood constructs and father's name on the birth certificate vary by Paternity Establishment Percentages (PEP) in the state in which the child was born. Although no interaction was seen, a significant association was found between the state PEP and the father's name on the birth certificate. As would be expected, in states with high PEPs, birth certificates of children born to unmarried mothers were more likely to include the father's name. Consequently, the location of a child's birth is an important consideration for future research using the variable, father's name on the birth certificate.

Interpretation of findings

This section provides an interpretation of the findings from the multivariate analyses conducted in this study. Table 9 provides an overview of each Research Question, associated study hypothesis and findings related to those hypotheses. Following the table is a discussion of the findings, organized by hypotheses tested.

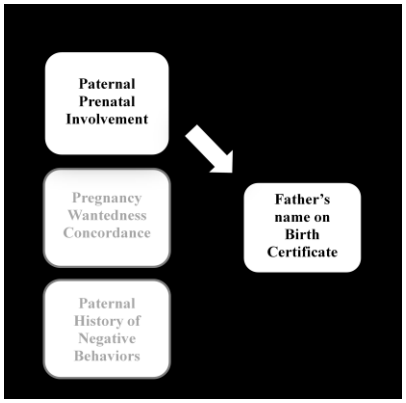
Table 9. Summary of research questions, hypotheses, and findings		
Research Question	Hypothesis	Findings
1. Examine the association between various fatherhood constructs for unmarried residential fathers (paternal prenatal involvement, concordance of pregnancy wantedness, and paternal history of negative behaviors) and the inclusion of their names on the birth certificate.		
1a. Identify whether and how unmarried residential paternal prenatal involvement is associated with the father's name being listed on the birth certificate.	Unmarried residential fathers who report more paternal prenatal involvement will have a greater likelihood of being named on the birth certificate than fathers who engage in less prenatal paternal involvement.	This hypothesis is not supported.
1b. Identify whether and how concordance of pregnancy wantedness is associated with the father's name being listed on the birth certificate.	Unmarried residential fathers who report higher levels of pregnancy wantedness will be more likely to be named on the birth certificate, regardless of maternal wantedness, than those fathers reporting lower levels of pregnancy wantedness. Couples with concordant wantedness of pregnancy will be more likely to have the father listed on the birth certificate than couples with discordant wantedness of pregnancy.	This hypothesis is not supported.
1c. Identify whether and how a paternal history of negative behaviors is associated with the father's name being listed on the birth certificate.	Unmarried residential fathers who have a more significant history of negative behaviors will be less likely to be named on the birth certificate than those fathers who have a less significant history of negative behaviors.	This hypothesis is supported. Unmarried residential fathers with significant history of negative behaviors were 80% less likely to be named on the birth certificate.

2. Examine whether and how an association exists between birth outcomes and various fatherhood constructs (including paternity acknowledgment) of unmarried residential fathers. These outcomes include low birth weight and preterm birth.		
2a. Determine whether and how being named on the birth certificate is associated with birth outcomes.	Infants of unmarried residential fathers without a father named on the birth certificate will have a greater likelihood of low birth weight and preterm birth than infants with a father named on the birth certificate.	This hypothesis is not supported.
2b. Determine whether and how paternal prenatal involvement is associated with birth outcomes.	Infants of unmarried residential fathers who engage in less paternal prenatal involvement will have a greater likelihood of low birth weight and preterm birth than infants of fathers who engage in more paternal prenatal involvement.	This hypothesis is partially supported. For each prenatal behavior unmarried residential fathers were engaged in, there was a 30% reduction in the risk of low birth weight.
2c. Determine whether and how concordance of maternal/paternal wantedness of pregnancy is associated with birth outcomes.	Infants of unmarried residential fathers who report higher levels of pregnancy wantedness will have a lower likelihood of low birth weight and preterm birth, regardless of maternal wantedness, as compared with those fathers reporting lower levels of wantedness. Infants of couples with concordant wantedness of pregnancy will have a lower likelihood of low birth weight and preterm birth than infants of couples with discordant wantedness of pregnancy.	This hypothesis is partially supported. Children born to mothers for whom the wantedness of the pregnancy was unknown were almost three times as likely to be born preterm.
2d. Determine whether and how a paternal history of negative risk behaviors is associated with birth outcomes.	Infants of unmarried residential fathers who have a more significant history of negative behaviors will have a greater likelihood of low birth weight and preterm birth than infants of fathers who have a less significant history of negative behaviors.	This hypothesis is not supported.

3. Examine if the association between birth outcomes and various fatherhood constructs of unmarried residential fathers is mediated by maternal prenatal health behaviors such as change in smoking during pregnancy and prenatal care utilization.		
3a.Determine whether and how maternal prenatal health behaviors are associated with birth outcomes.	Mothers who do not lessen their smoking during pregnancy and have less than adequate prenatal care will have an increased risk of low birth weight and preterm birth than mothers who lessen their smoking during pregnancy and have adequate prenatal care.	The hypothesis is not supported.
3b. Determine whether and how various fatherhood constructs are associated with maternal prenatal health behaviors.	Infants of fathers who engage in more prenatal involvement, had a less significant history of negative behaviors, were named on the birth certificate, or whose fathers wanted the pregnancy, will be more likely to have mothers who lessen their smoking during pregnancy and have adequate prenatal care. This is compared to infants with fathers who engage in less prenatal involvement behaviors, have a more significant history of negative behaviors, are not named on the birth certificate, or whose fathers did not want the pregnancy or the couples did not want the pregnancy.	This hypothesis is partially supported. For each additional paternal prenatal behavior, mothers were 74% more likely to have adequate prenatal care. Children born to fathers with a history of some negative behaviors were 40% less likely to have mothers who smoked less or were nonsmokers during pregnancy than those with fathers with a history of no negative behaviors. Children born to parents who both wanted the pregnancy or to mothers whose wantedness was unknown were almost two times as likely to have mothers who smoked less or were nonsmokers during the pregnancy as compared to those children where neither parent wanted the pregnancy.
3c. Determine whether and how the effect of fatherhood constructs on birth outcomes is mediated by maternal health behaviors.	Change in smoking behavior during pregnancy and adequacy of prenatal care will mediate the association between fatherhood constructs and birth outcomes. The inclusion of maternal health behaviors will reduce the association between fatherhood constructs and birth outcomes.	This hypothesis is not supported.

Research Question 4. Determine whether state-level Paternity Establishment Percentages (PEP) modifies the effect of various fatherhood constructs on the unmarried residential father being named on the birth certificate.	In states with higher rates of paternity establishment there will be an increased association between fatherhood constructs and the father being named on the birth certificate for unmarried residential fathers than in states with lower rates of paternity establishment.	This hypothesis is not supported.

Hypothesis 1a: ***Unmarried residential fathers who engage in more paternal prenatal involvement will have a greater likelihood of being named on the birth certificate than fathers who engage in less paternal prenatal involvement.***



This hypothesis was not supported. The overall number of behaviors that unmarried residential fathers reported during pregnancy was high (almost six items, on average). This type of support – such as attending childbirth classes, talking to the mother about her pregnancy, and listening to the baby's heartbeat – did not result in paternity acknowledgment at birth at a rate significantly higher than that of fathers who did not report these behaviors, after adjusting for all independent and control variables. This finding is not in line with the studies by Phipps et al. (2005) and Knight et al. (2006), each of which used prenatal records to help determine if the father had been present at prenatal appointments. However, these studies were small (Knight et al., 2006) or focused only on adolescents (Phipps et al., 2005).

The rejection of this hypothesis in the current study calls into question studies that have used the presence or absence of the father's name on the birth certificate as an indication of his presence or absence during the pregnancy (Alio et al., 2010a; Guadino et al., 1999; Luo et al., 2004; Ngui et al., 2009; Tan et al., 2004). Use of paternity acknowledgement as a blanket proxy for prenatal paternal involvement may be inappropriate, at least for unmarried residential fathers. This approach will likely

miss fathers who are participating during the pregnancy period and may include fathers who are not. Yet, the unadjusted findings of the current study and others (Knight et al., 2006; Phipps et al., 2005) suggest that the topic warrants additional study, perhaps with a larger sample size.

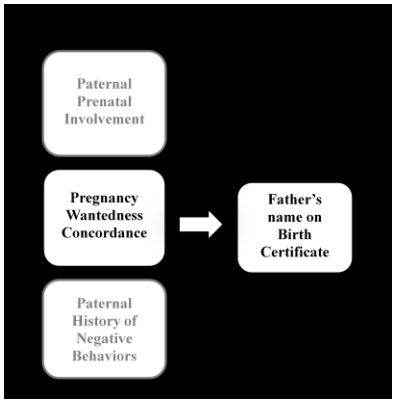
With regard to paternity acknowledgement, there are various considerations for unmarried parents, regardless of the pro-pregnancy behaviors the father exhibits during pregnancy. For instance, paternity acknowledgement can be viewed as a sign of legitimacy, validating the relationship between the parents and/or the relationship between the father and child. However, those mothers who see more involvement from the father during pregnancy may feel less compelled to push for legitimization of the paternity on paper, at least right away.

This study only assesses if the father signed the birth certificate at the time of birth. Of those fathers in this study sample who did not sign the birth certificate, more than half signed before the first survey was conducted at the 9-month period, according to the mother's report (results not shown). Labor and delivery may be a chaotic time for the mother and the father, during which they may choose to delay the paperwork until another time.

Moreover, while a mother is aware that the child is her own, a father may be unsure and thus hesitant about acknowledgement of paternity at the time of birth. Attributed to Aristotle is the statement: "The reason why mothers are more devoted to their children than fathers: it is that they suffer more in giving them birth and are more certain that they are their own" (Erlich & DeBruhl (eds.), 1996, p.487). Even the most prenatally involved men may have concerns about whether or not they are

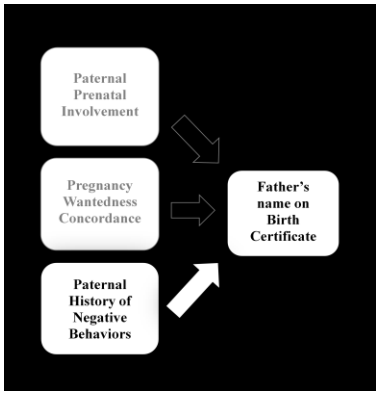
the father of the child. The social exchange theory (Chapter 2) provides a thorough exploration into many other considerations for mother and fathers as they explore the decision to establish paternity.

Hypothesis 1b: ***Unmarried residential fathers who report higher levels of pregnancy wantedness will be more likely to be named on the birth certificate, regardless of maternal wantedness, than those fathers reporting lower levels of pregnancy wantedness. Couples with concordant wantedness of pregnancy will be more likely to have the father listed on the birth certificate than couples with discordant wantedness of pregnancy.***



This hypothesis is not supported. The shared or discordant desires for the pregnancy did not play a factor in paternity acknowledgment. Though unexpected, these findings are not surprising when one considers the various maternal and paternal barriers to paternity establishment. For instance, if the father did not want the pregnancy, it is very possible that he would not be interested in signing the birth certificate, even if the mother did want the pregnancy. If the father wanted the pregnancy but the mother did not, he would still have to work through the mother to gain access to signing the birth certificate. An unwanted pregnancy by the mother may act as a barrier to that process in some way. Finally, even when both parents want the pregnancy, the costs of paternity acknowledgment, as discussed using the social exchange theory in Chapter 2, may outweigh the benefits.

Hypothesis 1c: ***Unmarried residential fathers who have a more significant history of negative behaviors will be less likely to be named on the birth certificate than those fathers who have a less significant history of negative behaviors.***



This hypothesis was supported. Despite being in the picture by virtue of their residential status, fathers who had engaged in three or more less desirable behaviors in the past were approximately 80% less likely to be named on the birth certificate than those fathers with a history of no negative behaviors. Moreover, the association remained virtually unchanged between the unadjusted and adjusted models. This is an indication that the effect of negative behaviors of the father on paternity acknowledgment is independent of any of the other variables in the model, including the other fatherhood constructs that were tested.

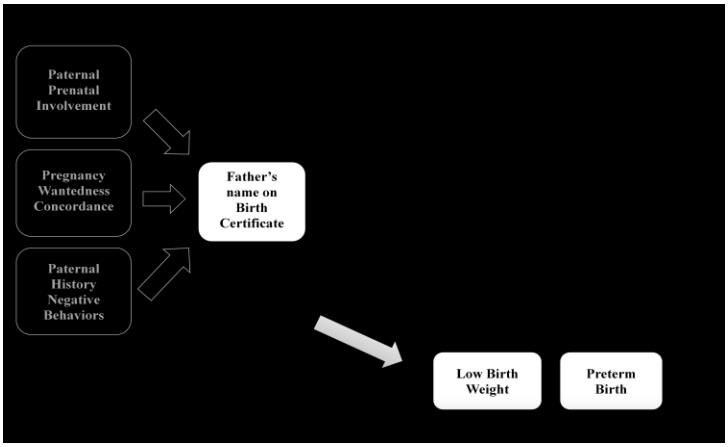
This finding could be indicative of several things. First, it may illustrate the power of the mother as gatekeeper for paternity acknowledgement. Using the social exchange theory as a guide, mothers may feel that a father with a history of negative behaviors is detrimental to the family unit, and thus she may prevent paternity establishment as a way to maintain some distance (Lerman, 2010).

Another interpretation using this theory is that the father may not be in a position to contribute financially. A father's history of arrests, expulsions from school, or firings from jobs could result in his difficulty finding or keeping a job with

enough earnings to support a child. As discussed using social exchange theory, this financial cost to the father may outweigh the benefits of being named on the birth certificate. The father may choose to not acknowledge paternity for fear of being ordered to provide child support now or in the future. It is certainly possible that the father is providing in some way financially, but doing so through informal arrangements rather than through a child support order.

In summary, many existing studies have used the father's name on the birth certificate as a proxy for paternal involvement, without being able to describe exactly what that means. One of the primary goals of the current study was to test several constructs of fatherhood to determine if they are associated with whether the father's name is on the birth certificate, for unmarried residential fathers. This study supports the association between paternity acknowledgement and one fatherhood construct – a history of negative behaviors.

Hypothesis 2a*: Infants of unmarried residential fathers without a father named on the birth certificate will have a greater likelihood of low birth weight and preterm birth than infants with a father named on the birth certificate.*



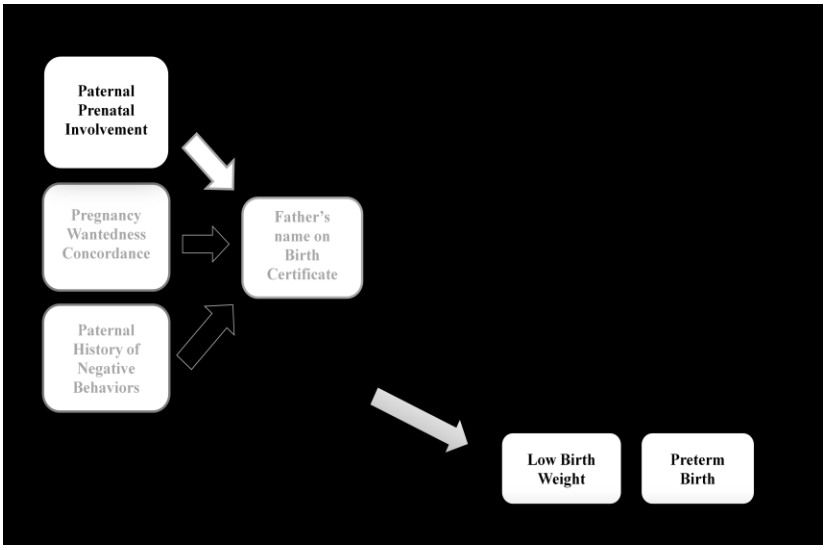
This hypothesis is not supported. Children were not more likely to be born too early or too small when the father's name was absent from their birth certificate. These results are in line with findings from Teitler (2001) using the Fragile Families study. He, too, found no association between father's name and low birth weight for unmarried fathers.

Despite these findings, it was somewhat unexpected that this study did not find an association between birth outcomes and paternity acknowledgement at birth, given several studies that have linked the two factors. However, those studies differ from the current study in several ways. The current study is the first to look at a nationally representative sample population of strictly unmarried residential fathers. Prior studies that have linked paternity acknowledgement and birth outcomes have used samples of unmarried parents compared to married couples (Ngui et al., 2009); unmarried fathers but not specifically residential or nonresidential (Guadino et al., 1999); or all fathers missing information compared to all fathers with information (regardless of marital or residential status) (Alio et al., 2010a; Luo et al., 2004; Tan et al., 2004).

Furthermore, prior studies with findings associating paternity acknowledgment with low birth weight or preterm birth were using infant mortality as the main outcome of interest. The design of the ECLS-B does not allow for an investigation into infant mortality. As a result, our findings may be fundamentally different from a study investigating whether infant mortality occurred (see Limitations, below).

Lack of paternity acknowledgement may indeed indicate that the father was not fully in the picture during the pregnancy. Although the current study examined a sample of residential fathers, their residency status was assessed at 9 months post-pregnancy – which makes it hard to know their residency status during the pregnancy. Paradoxical to the belief that having a father involved is always better than not having him involved, absence of fathers during pregnancy in some cases may result in better birth outcomes. As Teitler found in his analysis of the Fragile Families study, children of couples whose relationship was ambiguous (lived apart but remained romantic) had higher rates of low birth weight and were less likely to access prenatal care than those born to couples where the relationship was clear (the couple was either married, cohabitating and romantically involved, or they had no relationship) (2001). Similar findings were also discussed in another study of couple context and low birth weight (Padilla & Reichman, 2001).

Hypothesis 2b*: Infants of unmarried residential fathers who engage in less prenatal paternal involvement behaviors will have a greater likelihood of low birth weight and preterm birth than infants of fathers who engage in more prenatal paternal behaviors.*



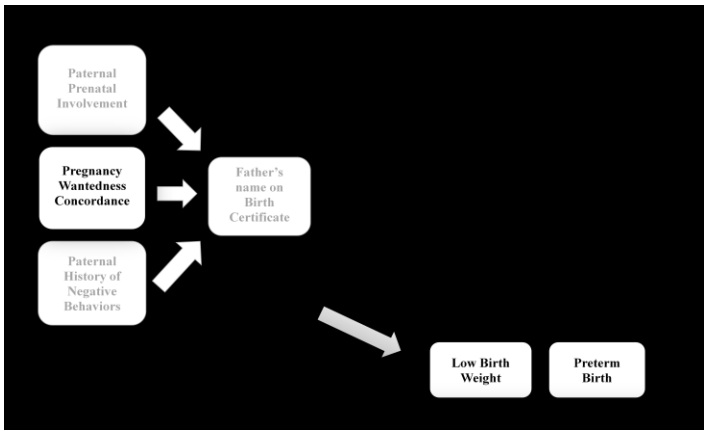
This hypothesis is partially supported. With the addition of each paternal involvement behavior during pregnancy, the likelihood of a low birth weight baby was reduced by 30 percent. Behaviors such as seeing the sonogram, buying things for the baby, and talking with the mom during the pregnancy are connected to better outcomes for the couple's unborn child. Given that no association was seen between paternal involvement behaviors and paternity acknowledgement, these findings suggest that the supportive behaviors of fathers during pregnancy – or lack thereof – are more relevant to birth outcomes than the name on the birth certificate.

Because several of the behaviors this study investigated – such as talking with the mother about how the pregnancy was going or hearing the baby's heartbeat – were related to interaction with the mother during pregnancy, paternal involvement of this nature is an indication of mothers "inviting in" the men. (Shapiro, 1995, p. 122). This type of interaction offers evidence of a healthier, less ambiguous and perhaps more intact relationship between the couple. Furthermore, the theory of reasoned

action suggests that the father's interest in the pregnancy and positive attitude towards health aspects of the pregnancy (as evidenced by seeing the sonogram, for example) may result in the mother adopting a more positive attitude about health during the pregnancy. Subsequently detection of a sign or symptom associated with low birth weight and connection with medical care may occur earlier than if she were experiencing the pregnancy alone.

There was no significant association between paternal behaviors during pregnancy and preterm birth. Preterm birth is often associated with physiological conditions of the mother; the lack of an association here may underscore this characteristic of many preterm births.

Hypothesis 2c*: Infants of unmarried residential fathers who report higher levels of pregnancy wantedness will have a lower likelihood of low birth weight and preterm birth, regardless of maternal wantedness, as compared with those fathers reporting lower levels of wantedness. Infants of couples with concordant wantedness of pregnancy will have a lower likelihood of low birth weight and preterm birth than infants of couples with discordant wantedness of pregnancy.*



This hypothesis is not supported. Whether or not couples shared a desire for the pregnancy had no bearing on low birth weight or preterm birth. These results are unexpected and do not support those of Hohmann-Marriott (2009), who found that the risk for preterm birth was increased when there was discordant pregnancy

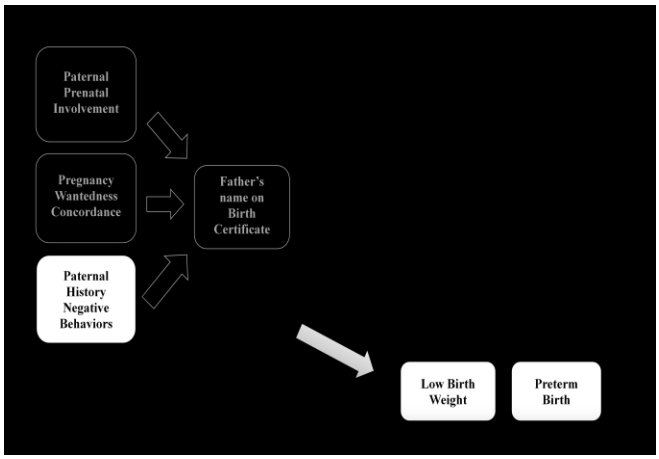
wantedness or when neither partner wanted the pregnancy. Hohmann-Marriott's study differs from the present study in that it used a sample composed of all residential fathers, and also included pregnancy *timing* with wantedness. These differences suggest that marital status and intention (a combination of timing and wantedness) of pregnancy have an effect on this association. Another study of youth showed that when the wantedness was discordant, and it was the father who did not want the pregnancy, the infant had worse outcomes (Korenman et al., 2002).

In each of the aforementioned studies the feelings of the father had a bearing on the outcomes. From this study's findings we see that the father desires relative to the mother's may have a protective effect against preterm birth. Though not significant at the $p<.05$ level, we were able to document a marginal effect ($p<.1$) of father wantedness on preterm birth. When fathers wanted the pregnancy but mother did not, the risk of preterm birth was reduced by half.

Though each of the studies on this topic has produced different results, they all lead us to believe that preterm birth is more affected by the father's desire for the pregnancy than the mother's desire. This line of research, looking at the pregnancy desires and intentions of *both* partners, warrants further study.

When mothers did not respond to the survey items about pregnancy wantedness, they were almost three times as likely to deliver preterm. This suggests that the nonresponse of this small number of women was not random. Because the survey was administered after the child's birth it is unclear if they opted not to answer the items *because* they had a poor birth outcome, or if the poor birth was related to the reason they did not answer the items.

Hypothesis 2d*: Infants of unmarried residential fathers who have a more significant history of negative behaviors will have a greater likelihood of low birth weight and preterm birth than infants of fathers who have a less significant history of negative behaviors.*



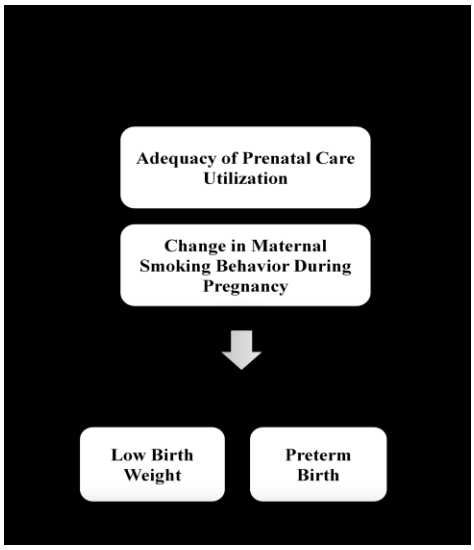
This hypothesis is not supported. The negative behaviors that a father engaged in – and presumably the stress or lack of support to the mother that may accompany those behaviors – did not affect the outcome of the pregnancy, according to this study. One perspective is that the history of negative behaviors does not accurately reflect the current situation. The father may no longer be engaged in negative behaviors from the past, and therefore may be seen as a suitable father figure by the mother. The mere fact that he answered the survey indicates some current level of responsibility. Another perspective is that the mother may not be affected by the negative behaviors that occurred in the past. For instance, this study does not take into account the history of the mother's negative behaviors. Mothers who themselves have some history of these types of behaviors may be more tolerant of fathers with similar histories.

An alternative perspective is that fathers with a history of most negative behaviors are, in fact, not involved in the pregnancy. This line of reasoning is

supported by the earlier findings that fathers with a history of negative behaviors were less likely to be named on the birth certificate. The absence of this "bad dad" (Furstenberg, 1998) may not be detrimental to birth outcomes. Let's assume the fathers with the worst behaviors are not involved during the pregnancy. In such cases, the mothers and children would be shielded from contact with an individual who may not bring support to the pregnancy. In turn, they may also be protected from negative birth outcomes.

These results taken together with the results of the correlates of paternity acknowledgement show the need for a cautious approach for future investigations of father involvement and birth outcomes. Although fathers who exhibited negative behaviors were less likely to be named on the birth certificate, neither negative behaviors nor a name on the certificate was associated with birth outcomes. Again, this may be evidence that father's name on the birth certificate is not an appropriate proxy for paternal involvement.

Hypothesis 3a*: Mothers who do not lessen their smoking during pregnancy and have less than adequate prenatal care will have an increased risk of low birth weight and preterm birth than mothers who lessen their smoking during pregnancy and have adequate prenatal care.*



This hypothesis is not supported. Neither a reduction in smoking during pregnancy nor adequate prenatal care was associated with reduced levels of low birth weight or preterm birth in this sample.

The finding related to adequate prenatal care was unexpected but not entirely surprising. As discussed in the Literature Review (Chapter 2), there is a debate about the effectiveness of prenatal care utilization to reduce rates of low birth weight and preterm labor (Alexander & Kotelchuck, 2001). The failure of prenatal care may be, as Misra & Guyer (1998) point out, that it is not able to fully address the social and environmental factors of women who are at the highest risk for adverse pregnancy outcomes. They also suggest that pre-pregnancy health conditions are often inadequately addressed by prenatal care (Misra & Guyer, 1998). Although this study attempted to control for these contributors to poor birth outcomes, some (e.g. pre-pregnancy conditions) were beyond the scope of this study. In addition, categories of inadequate and intermediate care were combined because there were too few women

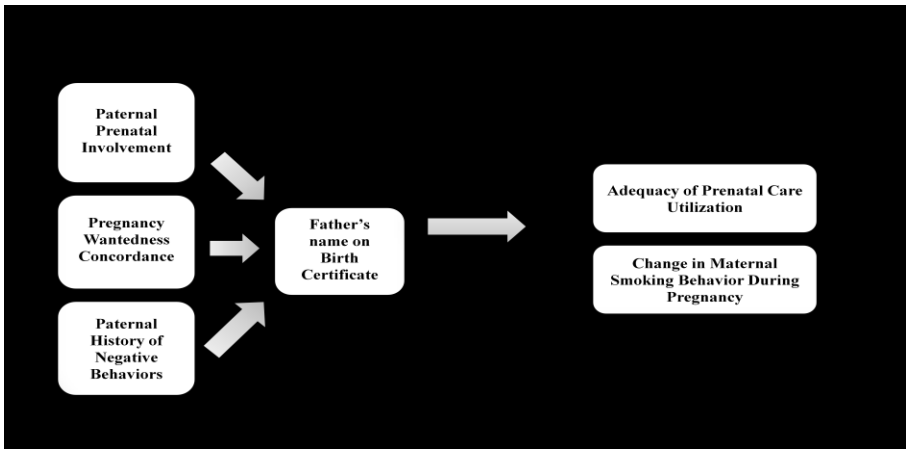
whose prenatal care was deemed inadequate to analyze separately. Thus the comparison is not as clear-cut as one might wish because prenatal care was generally good.

The finding on the change in smoking behavior is less clear. As discussed in the Literature Review (Chapter 2) smoking during pregnancy is considered one of the primary pathways to low birth weight, restricting growth in utero (March of Dimes, 2008). However, this study did not capture the total amount of cigarette smoking. Rather, the interest lay in the effect the father had on the mother's reduction in smoking through the fatherhood constructs under investigation (see discussion on Theory of Reasoned Action, Chapter 2). As a result, a mother who smoked 20 cigarettes per day prior to pregnancy and reduced smoking to 15 cigarettes per day in the last trimester of pregnancy would be coded as having reduced smoking. The change is in the direction one would hope for, and could be a result of father's influence; however, the overall amount of smoking may still result in adverse birth outcomes.

Yet, some studies have shown evidence that a reduction in smoking during pregnancy is associated with a reduced rate of low birth weight and preterm birth (Jadoe et al., 2008; Ricketts et al., 2005). While those studies looked solely at smoking mothers, in the present study two categories of smokers -- mothers who reduced their smoking during pregnancy, and mothers who smoked the same amount or increased their smoking during pregnancy – are compared with nonsmokers. An alternate analytic approach that removes nonsmokers from the analysis, and looks only at smoking mothers by comparing those who reduced smoking to those who did

not, may elicit results similar to those found in other studies. In addition, cigarette smoking – considered a less desirable health behavior during pregnancy – may be under-reported (see Limitations, below).

Hypothesis 3b*: Infants of fathers who engage in more prenatal paternal involvement behaviors, had a less significant history of negative behaviors, were named on the birth certificate, or whose fathers wanted the pregnancy, will be more likely to have mothers who lessen their smoking during pregnancy and have adequate prenatal care. This is compared to infants with fathers who engage in less prenatal involvement behaviors, have a more significant history of negative behaviors, are not named on the birth certificate, or whose fathers did not want the pregnancy or the couples did not want the pregnancy.*



This hypothesis is partially supported. With the exception of father's name on the birth certificate, fatherhood constructs were associated with either adequacy of prenatal care or change in maternal smoking behavior during pregnancy in the directions hypothesized using the theory of reasoned action as a guide. Children with fathers who were more involved during pregnancy also had mothers who received adequate prenatal care. This is a very strong association, with a 74% increased odds of adequate prenatal care for each additional behavior a father demonstrated. Although these findings support those of Martin et al. (2007), a distinction is that the

current study examined only unmarried residential fathers whereas Martin used all residential fathers.

The theory of reasoned action suggests that when fathers take part in activities related to the pregnancy (e.g. going to childbirth classes), mothers, too, have a better attitude towards these activities. A mother may see prenatal care as more important and positive when the father is also involved, compared to when the father is not involved. The mother also may be more intent to attend the appointments, knowing that the father's subjective norm is that she will go and he will accompany her (to hear the baby's heartbeat, for example) Finally, mothers may generally feel more excited about prenatal care appointments when the father shows interest in things like seeing a sonogram and hearing the heartbeat. From a practical point of view, involved fathers are also in a position to remind the mother about prenatal care appointments, transport her to appointments, and perhaps share the cost. Of course, given the cross-sectional nature of this study, reverse causality may be a factor – it may be the mother who is affecting the father, rather than vice versa. For example, because the mother is going to her prenatal care appointments, the father becomes more engaged. It is important to highlight the marginally significant association this study found between the absence of the father's name on the birth certificate and the mother's decreased likelihood of receiving adequate prenatal care ($p<.1$). This finding, though not statistically significant, supports those of other studies (Guadino et al., 1999; Tan et al., 2004; Teitler, 2001). It's possible that the current study did not have the sample size necessary to detect a significant effect.

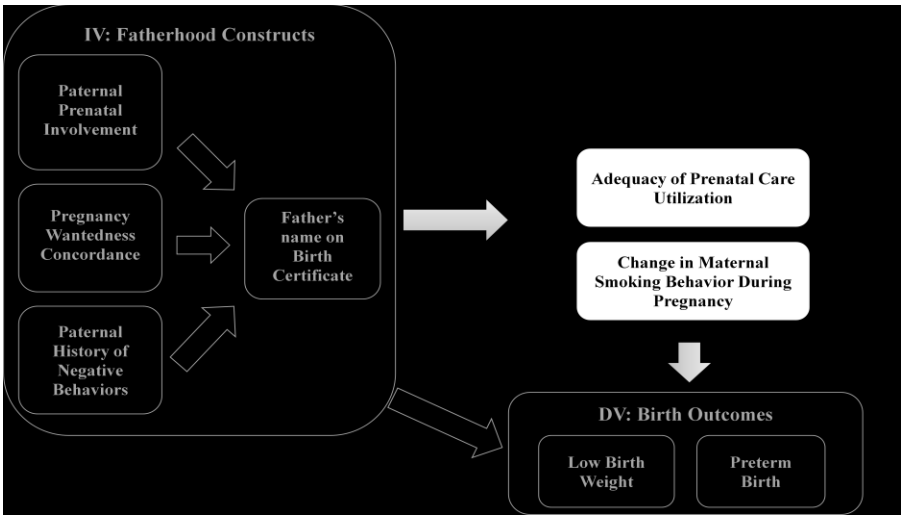
With regard to smoking behavior, there were several significant associations seen with the fatherhood constructs. Children of fathers who have a history of some (one or two) negative behaviors also had mothers who were less likely to decrease smoking during their pregnancy and less likely to be nonsmokers from the start. Fathers who were previously engaged in negative behaviors may also be fathers who smoke. Because there is a high concordance for smoking with couples (Kendrick et al., 1995), it would be reasonable to believe that if a residential father is smoking, the mother may also be smoking. Pregnant women who live with a partner or others who smoke are less likely to quit smoking during pregnancy (McBride, Pirie, & Curry, 1992). In these situations, even if the father encourages the mother to reduce her smoking (as asserted in the discussion of Theory of Reasoned Action, Chapter 2), if he is not reducing his own smoking, then the mother may be less likely to do so.

When both parents are invested in the pregnancy, they may work together to have a healthy pregnancy. Mothers were more likely to smoke less (or be a nonsmoker) only when *both* parents wanted the pregnancy. When the mother alone wanted the pregnancy, her smoking did not reduce. Theory of Reasoned Action asserts that intention to change a behavior may be driven by the influence of a 'significant other'. For a mother who wants the pregnancy, that influence may be stronger from a father who has concordant desires for the pregnancy as opposed to one who has discordant desires. Thus, messages to stop smoking may hold more weight when coming from a father who wants the pregnancy. And, if the father is also a smoker, his desire for the pregnancy may drive him to reduce or quit his own smoking, which in turn may help the mother to do the same. Finally, when maternal

wantedness was unknown, she was more likely to reduce smoking or be a nonsmoker. It is difficult to know how to interpret this finding.

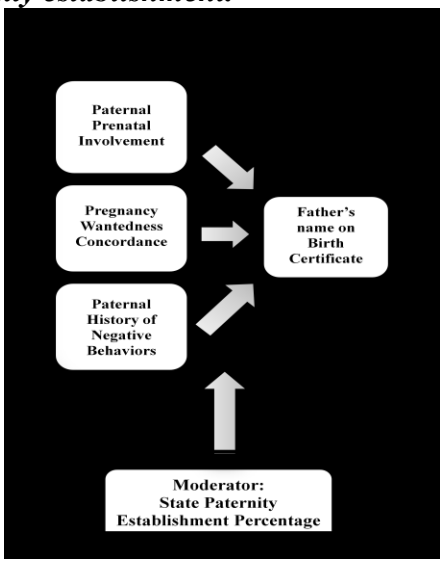
Father involvement behaviors did not influence smoking reduction in the same clear way they did with prenatal care in this study. Smoking differs fundamentally from prenatal care in that it includes a physiological component. Many smokers have the perception that smoking in times of stress can calm nerves (Little, 2000). Women who feel they are not being supported in the way they need may continue to smoke during a pregnancy as a coping mechanism. Smoking is also used to suppress appetite (Gonseth, Jacot-Sadowski, Diethelm, Barras, & Cornuz, 2012)**.** Mothers who are unhappy with the body changes they are experiencing during pregnancy may continue to smoke in an attempt to stop weight gain. Feelings of stress and body image perception can both be influenced by those around the mother, including the father. Finally, no matter what fathers do, they may be no match for the addictive nature of nicotine. Adding another layer of complexity to quitting is that many of the pharmaceuticals available to assist in smoking cessation are not safe for use during pregnancy. As a result, mothers may just feel they cannot handle the changes of quitting smoking and being pregnant at same time.

Hypothesis 3c*: Change in smoking behavior during pregnancy and adequacy of prenatal care will mediate the association between fatherhood constructs and birth outcomes. The inclusion of maternal health behaviors will reduce the association between fatherhood constructs and birth outcomes.*



This hypothesis is not supported. Maternal health behaviors were not considered mediators of the relationship between paternal involvement constructs and birth outcomes. This study did not find a significant association between the mediators (reduction in smoking and adequate prenatal care) and the birth outcomes. Moreover, when mediators were added to the full model, there were no significant changes in the associated risks between fatherhood constructs and birth outcomes. As such, mediation is not evident (Baron & Kenny, 1986). These findings are surprising as other studies have shown these associations. The lack of associations is likely due to 1) a small sample size that limited the categorical analysis of the adequacy of prenatal care variable and 2) the conceptualization of smoking change during pregnancy that did not account for overall amount of smoking. Future research will should remedy these issues as well as look into alternate explanations of the pathways between paternal involvement and birth outcomes (see Future Research Directions, below).

Hypothesis 4: In states with higher rates of paternity establishment there will be an increased association between fatherhood constructs and the father being named on the birth certificate for unmarried residential fathers than in states with lower rates of paternity establishment.



This hypothesis was not supported. Prior to testing for an interaction, an association between the state Paternity Establishment Percentage and father's name on the birth certificate was tested. Children born in a high PEP state were more than 2.5 times as likely to have fathers named on their birth certificate as children born in a low PEP state. This finding is expected, as high PEP states have, by definition, higher paternity establishment success than other states. Studies that use father's name on the birth certificate should consider the effect of the state of child's birth when conducting their analyses.

The increased odds of paternity establishment at birth for children born in high PEP states provides a rationale for exploring an interaction between fatherhood constructs and the appearance of a father's name on the birth certificate. However, this study did not find varying associations of father's name on the birth certificate and the fatherhood constructs between states that were more or less successful in paternity establishment. Thus, no interaction was demonstrated.

States with higher rates of paternity establishment likely have policies and practices in place that are more successful at getting unmarried fathers to acknowledge their paternity (for instance, they may have less procedural barriers in place or have better outreach to unmarried fathers), and hence, ultimately have higher rates of paternity establishment. Yet, establishment of paternity is still a choice for unmarried parents (and in some regard, the mother solely a gatekeeper of that action). Costs and benefits of paternity acknowledgement must be weighed by the mother and the father. For instance, concerns about financial support, child custody, and marriage are relevant, regardless of the policies and programs state of the child's birth. As a result, the complex decision-making rationale and the associated maternal and paternal barriers outlined using social exchange theory remain applicable and may hinder any efforts put forth by policies and programs aimed at establishing paternity, even for the most involved fathers.

Since the state PEP is run by the child support enforcement system, unmarried fathers who are involved during the pregnancy may be less likely to enter the child support system – and, therefore, not be the target of programmatic or policy efforts. Using this rationale, we would expect to see an increased likelihood of paternity acknowledgement for "bad dads" – those with a history of negative behaviors – in high PEP states. The lack of support for that hypothesis may be evidence of the resolve of some parents to not formalize paternity in light of child support enforcement concerns, a major "cost" as posited using the social exchange theory. It may also be evidence of reduced childbearing by those fathers who would not remain

in the picture within states with stricter child support enforcement policies (Plotnick, Garfinkel, McLanahan, & Ku, 2002).

Study limitations

The findings of this study add to the growing body of literature aimed at learning more about the role of fathers during pregnancy and their influence on maternal health behaviors and birth outcomes. As with all research, there are several limitations that must be considered when interpreting the findings of this study. In particular, the results of this study should be considered in the context of the research methodology, potential for bias, use of birth certificate data, selectivity, generalizability of the findings, and missing data in sample.

Cross-sectional research methodology

This study is cross-sectional in nature. Because this is a snapshot in time, causation cannot be determined. In other words, although associations have been identified between the variables, we cannot infer that one caused another to occur. The way that the study was designed, we are able to ascertain an order to some events and there are instances when reverse causality should be considered. For instance, we know that a birth follows a pregnancy. Yet it is impossible to determine without a doubt the sequence of many other events. Take, for example, a pregnancy involving many complications. A fearful father may decide to withdraw his involvement from such a pregnancy. If a preterm birth occurred in such a case, the birth outcome could be attributed to pregnancy complications but it could also indicate (and perhaps incorrectly) a lack of father involvement.

A longitudinal study would better enable us to gauge the sequence of events. Though the ECLS-B is designed as a longitudinal study, the variables of interest were such that only one wave of data was needed. Use of a qualitative approach or a mixed-method study to interview fathers about their involvement during pregnancy is certainly warranted to supplement the research in this field.

Recall Bias and Under/Over-reporting

Recall bias is another potential limitation associated with this study. Parents were asked to respond to many questions regarding the prenatal period at approximately 9 months post-natal. Given the range for which the survey was administered, however, the time that had elapsed since birth could be upwards of 18 months. At the time of the interview, it is possible that parents could not accurately recall the behaviors they had engaged in during pregnancy. Inaccurate responses may have occurred inadvertently (for example, fathers may not have been able to remember whether they purchased items for the baby during the pregnancy or after the child was born). It is also possible that some parents intentionally under-reported or over-reported what actually happened during the pregnancy once the child was born (for example, in the post-partum period, a mother or father could be hesitant to respond that a pregnancy was unwanted). Under-reporting or over-reporting may be a particularly salient issue for parents of infants with poor birth outcomes (for example, a mother may under-report the amount they smoked during pregnancy if they are worried that it resulted in their baby's low birth weight).

The ECLS-B interview protocol attempted to prevent bias of this nature by asking participants to answer questions of a sensitive nature using computer-assisted

technology. These items, asked of participants in a self-administered questionnaire, allowed respondents to answer in complete confidence (in other words, they did not have to tell their answers to the interviewer, nor did anyone within earshot hear the questions being asked) by listening to the question over earphones and then inputting their response directly into a computer.

Use of Birth Certificate data

Despite the reliability of data recorded as part of the National Vital Statistics System (NVSS), there are some limitations that should not be ignored. Birth certificate data are submitted by states to the NVSS and vary in their completeness and accuracy. The National Center for Health Statistics pinpoints two reporting areas – Washington state and the District of Columbia – that were of "particular concern" in 2001 (Centers for Disease Control and Prevention, 2003, p.20).

Additionally, gestational age information is a particular data point that has been problematic in its quality and consistency (Northam & Knapp, 2006). As NCHS has found, reporting problems for this item may occur more frequently among births with shorter gestations (Martin et al., 2002).

Selectivity

This sample did not include children who died prior to the first parent interview (approximately around the first 9 months of life). This may have led to a sample of children and their parents who differ from those children and their parents that were unable to be selected due to the infant death. Approximately two-thirds of infant deaths occur during the neonatal period, in the first 28 days of life (Arias,

Anderson, Hsiang-Ching, Murphy, & Kochanek, 2003). The leading cause of neonatal deaths is low birth weight or preterm birth (Arias et al., 2003). There may be a distinction between children with low birth weight and preterm birth who survived until 9 months and those children who did not.

Furthermore, fathers were selected into the sample only if the mothers identified them and gave permission to ECLS-B staff to contact them. Again, there is a selectivity issue to consider for those children whose fathers were not contacted for interviews because the mothers did not allow it, compared to those children whose mothers did allow the interview to occur.

Finally, states would not authorize the ECLS-B access to birth certificates of children born to mothers under the age of 15 for inclusion in their initial sample population (NCES, 2011a). Therefore, births to the youngest teen mothers (and likely, teen fathers) are underrepresented.

Generalizability of findings

The findings from this study cannot be generalized to all fathers. The sample consisted only of children of unmarried residential fathers. In comparing unmarried residential fathers with unmarried nonresidential fathers, there are clear and significant differences between the two groups (see Table 3, Chapter 4). It may be, given the cohabiting status of the parents, that the findings from this study are more generalizable to children of married parents, however this is speculation. Research on a sample of children living with their married fathers is needed.

Missing data in sample

A major limitation in this study is that approximately half of the unmarried residential father sample could not be used in analyses because of missing data. Missing data is a common concern when working with data on fathers. As a primary objective for this research was to learn more about factors associated with the father's name on the birth certificate, the current study required a sample of unmarried fathers. Furthermore, the content of the nonresidential father survey as compared to residential survey was quite limited, with few questions asked of nonresidential fathers that would enable a robust review of the father's name on the birth certificate variable if they were to be included in the sample. Finally, a combination of item-level and case-level missing items resulted in a smaller sample size than originally planned. As such, several categories within variables had to be collapsed (e.g. adequacy of prenatal care, household income, and maternal education). This is usually not optimal, as it does not allow for us to see differences between groups. Because of the complex survey design, imputation of data is generally not advised for the ECLS-B. Despite this limitation it was determined that data were missing completely at random and thus the analysis was able to be conducted (see Missing Data under Chapter 3, Methods).

Implications for research, programming and policy

This study's findings have implications for research, programming and policy. A discussion of future directions for research will first be presented, followed by recommendations for policy and programming.

Future directions for research

Examine additional pathways. Future research is needed to address gaps in the field of paternal involvement during pregnancy. In particular, the pathways between paternal involvement during pregnancy and birth outcomes is an area that is poorly understood. A promising pathway that warrants further research is the effect of stress, a factor that has been associated with preterm birth (Dole et al., 2003; Hobel, 2004; Kramer et al., 2001). The father's impact on maternal stress during pregnancy should be examined in more depth. Fathers have been identified as sources of stress or of support for pregnant women (Mullings et al., 2001), leading to poor maternal health behaviors such as smoking or less-than-adequate prenatal care (Ghosh, Wilhelm, Dunkel-Schetter, Lombardi, & Ritz, 2010). The present study was not able to capture maternal stress directly, but looked at negative behaviors in fathers as well as some stress-related behaviors of the mother, such as smoking. Studies such as the National Survey of Family Growth have collected biomarkers for testing stress levels. Though an approach of this nature may be cost-prohibitive for most studies, an alternative method could include administering one of several instruments to assess mothers' stress levels during pregnancy.

Finally, a second look at the contribution of adequacy of prenatal care and smoking in the association between fatherhood constructs and birth outcomes is warranted. In other studies these variables have been associated with the birth outcomes in question; however, sample size (adequacy of prenatal care) and variable construction (change in smoking behavior) may have prevented an association in the current study.

Better conceptualize paternal involvement during pregnancy. Although the current study adds to the limited amount of research on paternal prenatal involvement, further research is needed to expand on what we have been learning in this field. Despite testing of several constructs in this study, measurements of paternal prenatal involvement are underdeveloped and narrow in scope. Strategies to collect more information in different ways are warranted. For instance, smaller qualitative studies may provide more in-depth information into the many ways that fathers are involved during pregnancy – ways that are not being captured now in quantitative data. And alternative research approaches would enable a crisper view of the types and quantity of involvement behaviors being engaged in by fathers during pregnancy. For instance, pregnant mothers could complete random 24-hour paternal involvement recall instruments (either by phone, internet, or in person), similar in design to those used to collect nutritional information. Mothers, fathers, or even medical providers could also track paternal involvement using mobile phone technology. This is an area of enormous growth, with numerous companies using mobile phones to collect data on various projects (many of which are health-related) all over the world.

The current study did not fully assess how each of the fatherhood constructs is associated with each other. For instance, it would be helpful to understand if a paternal history of negative behaviors predicted paternal prenatal involvement. Expanding upon this research would be useful as the field moves toward increased understanding of the paternal prenatal influence on maternal health behaviors and birth outcomes.

Account for differences by race/ethnicity. The findings from this study add another dimension to the vast amount of literature on low birth weight. In considering future research, the impact of race/ethnicity on the association between father involvement and low birth weight should be explored further. Some studies (Alio et al., 2010b; Ngui et al. 2009) have found higher rates of adverse pregnancy outcomes for black women, possibly related to a lack of paternal prenatal involvement. Furthermore, it is worthwhile to consider how definitions of paternal involvement differ by race/ethnicity (The Commission on Paternal Involvement in Pregnancy Outcomes, 2010). Incentives and barriers to paternal involvement may vary by race/ethnicity. For instance, some studies have described the influential role of the maternal grandmother as gatekeeper to paternal involvement (with infants) within African American families (Cherlin & Furstenberg, 1990). This topic warrants further exploration.

Include fathers in more large-scale research studies. The ECLS-B study is valuable to the field of maternal and child health in that it is among the only nationally representative datasets that collects paternal information directly rather than from maternal reports (Kotelchuck, 2009). The success that the ECLS-B has had in paternal data collection shows that paternal data can be collected (Kotelchuck, 2009). However, identification of ways to retain fathers in research warrants further study. Despite initial success seen with the ECLS-B, more recent waves have discontinued father surveys as these instruments were increasingly missing items or entire cases (University of Maryland ECLS-B workshop, personal communication, 2012).

Programming and Policy implications

Researchers have disagreed about what it means to be an "involved father." Lamb and colleagues first identified father involvement in childhood as a concept encompassing *engagement, accessibility,* and *responsibility* (Lamb, Pleck, Charnov, & Levine, 1987). Engagement is defined as direct activities with the child. Accessibility is defined as the presence or availability of the father to the child. Responsibility is defined as the father actively participating in day-to-day decisions for the child. It is unclear how these paternal involvement dimensions manifest in the pregnancy period. Using these dimensions as a framework, practical applications to increase prenatal father involvement through policy and programming could be developed.

Practice/programming implications

The findings from this study support the value of **engaging** fathers during the prenatal period. Although Lamb defines engagement as direct contact with the child (Lamb et al., 1987), during the pregnancy period a more appropriate definition may be contact with and support of the mother during pregnancy-related activities. An ideal point of entry for engaging fathers with the pregnancy is the health care field. The medical community should work toward making the prenatal care and birth experiences more father-friendly spaces. One area of intervention is the typical prenatal care visit. In an effort to increase paternal engagement in the medical aspects of pregnancy, health care providers can adjust the routine prenatal care appointment to be more convenient for fathers.

A wide range of changes could help achieve this goal, such as providing male-centric magazines in the examination rooms, offering some routine medical care to fathers during pregnancy, and shifting the focus of health counseling from the mother to both parents. In some Scandinavian countries, parent groups specifically targeting the expectant father have also seen success (Blom, 1996). Lu et al. (2010) also outline several best practice programs for increasing father involvement during pregnancy, with a specific focus on African American and teen parents. Given the already strained health care field, changes to include fathers may not readily occur without financial incentives. Several federal programs that financially support health care programs for pregnant women (e.g. Title X Family Planning Program; Federal Qualified Health Centers; or Women, Infants and Children (WIC) programs) could incorporate specific father-friendly practices as a requirement for continued funding.

Programs can also work to empowering fathers to also take on **responsibilities** related to the pregnancy and impending birth as another avenue for increasing paternal involvement. Responsibility, as defined for fathers during childhood, is the extent to which a father arranges for resources to be available to the child, including organizing and planning children's lives (Lamb et al., 1987). As challenging as this may be for fathers during their child's development, enhancing responsibility during pregnancy can prove to be more difficult. Pregnancy is often conceptualized as if the woman were an isolated individual (Dunkel-Schetter, Sagrestano, Feldman & Killingsworth, 1996), and this focus can lead to the father acting as a back-up to the mother; following her lead rather than proactively taking on responsibility (Donovan, 1995; Jordan 1990). From lack of clear relevance, fathers

may feel disconnected from the pregnancy, take on fewer responsibilities, and be less involved.

Programs with access to expectant mothers and fathers should work to change the perception that pregnancy is solely the domain of the mother. They can do this by helping mothers understand that many expectant fathers feel just as pregnant as their wives (Shapiro, 1995). Mothers can instill responsibility in fathers by reinforcing the important role they play in providing emotional support to them and the pregnancy. Mothers and fathers can also be encouraged to work together in choices as seemingly mundane as clothing purchases for the child or wall color for the nursery. Fathers can be encouraged to be proactive in supporting the mother and the pregnancy. They can support her by taking on responsibilities often left to the mother, which may include caring for other children, cleaning, or cooking (Lamb, 2000). Each can participate in educational activities such as reading baby books or attending child care and breastfeeding classes. Baby showers can even be celebrated with both parents rather than just the mother. By supporting a sense of responsibility of the father, programs can help fathers to feel more connected with the pregnancy and ultimately with his role as a father.

Policy implications

Accessibility, as described by Lamb (2000), is conceptualized as the father being accessible or present for the child. A modification of this definition for discussing paternal prenatal involvement is for fathers to be available and present for the pregnancy. Several changes to existing policies or platforms could better support

greater paternal accessibility during the pregnancy. These include expanding workplace paternity leave; and eliminating financial penalties for family formation.

Expand paternal workplace leave policies. Support for more flexible workplace leave policies would enable fathers to be present for prenatal care appointments and other activities related to the pregnancy. The Family and Medical Leave Act (FMLA), our national parental leave policy, provides for up to 12 weeks of unpaid leave to mothers and fathers for childbirth, adoption, foster care or to care for a child. FMLA provides coverage for fathers to attend prenatal care appointments, or even to care for the mother if she is sick during pregnancy (U.S. Department of Labor, 2009). Limitations in this policy result in many U.S. workers not being covered. Moreover, FMLA does not mandate paid leave. As a result, FMLA excludes many fathers or creates a financial hardship for families. Many states have now adopted policies that enable parents to extend their leave and be paid a percentage of their earnings while they are away from work. The findings from this study support the need for this type of flexibility to support fathers' presence during pregnancy, childbirth, and child rearing.

Eliminate financial penalties of family formation. Elimination of financial penalties related to cohabitation or marriage could result in the presence of more fathers during pregnancy and beyond. Eligibility for some social services (e.g. Temporary Assistance for Needy Families) is tied to income, and as a result, many families feel it behooves them to live apart or not marry. Tax benefits, including the Earned Income Tax Credit, can also be lost through cohabitation or marriage as a result of changing income (The Commission on Paternal Involvement in Pregnancy

Outcomes, 2010). While the current study does not tout marriage as the answer for paternal involvement, there is certainly need to reconsider how these marriage-related financial losses may play out in the accessibility of the father during pregnancy.

Conclusion

As a whole, the findings from this study support that notion that fathers are quite important to maternal and child health. Though the exact pathways and mechanisms are not understood, it appears that fathers can act as an important protective factor in improved pregnancy outcomes. This study adds to the literature on paternal prenatal involvement by pointing to his behaviors – both positive and negative – that impact the pregnancy. Positive behaviors of dads during pregnancy predicted better prenatal care and lowered the risk of low birth weight. Negative behaviors kept fathers from being named on the birth certificate and increased the likelihood of the mother smoking during pregnancy.

Few studies have examined the correlates of a father being named on the birth certificate. Those that lend support for use of this variable as a valid measure of paternal involvement during pregnancy have relied on limited populations and involvement constructs. In an evolving field, researchers have traditionally relied on this indicator when more detailed information on the father-to-be was not available. The findings of this study enable a better understanding as to what a father's name on the birth certificate means, at last for unmarried residential fathers. At the same time, these findings question the use of this variable as a proxy for paternal involvement during pregnancy. Although it seems that paternity acknowledgement does represent

a domain of fathers' involvement, using it as a proxy is also likely over-including or under-including fathers. The findings suggest that the father's actions to support the mother – rather than a document with his name on it – should serve as a stronger measure to examine for its relationship with child outcomes such as low birth weight.

Paternal involvement researcher Jermane Bond has stated, "The history of the role of men in pregnancy and childbirth has evolved from being drivers of their wives to the hospital, to the waiting room, and now to the birthing room" (2010). Fathers now have more opportunities than ever before to get involved in the pregnancies of their unborn children. This research indicates that facilitating the involvement of fathers during pregnancy may be a missing link needed to see improvement of birth outcomes for children of unmarried parents.

Appendix A: State Paternity Establishment Percentages (FY2001)

Appendix A. State Paternity Establishment Percentages (FY 2001)			
STATES	IV-D PEP	STATEWIDE PEP	PEP[1]
ALABAMA	**58.25**		**Low**
ALASKA		**87.77**	**Low**
ARIZONA	**54.68**		**Low**
ARKANSAS	**81.46**		**Low**
CALIFORNIA		**142.48**	**High**
COLORADO		**103.15**	**High**
CONNECTICUT	**78.63**		**Low**
DELAWARE	68.26		
DIST. OF COL.		59.83	
FLORIDA		**85.64**	**Low**
GEORGIA		**83.25***	**Low**
GUAM		136.47	High
HAWAII	**100.5**		**High**
IDAHO	**94.93**		**Low**
ILLINOIS		**108.55**	**High**
INDIANA	**62.13**		**Low**
IOWA		**94.58**	**Low**
KANSAS		77.21	
KENTUCKY	**70.59**		**Low**
LOUISIANA	**53.1**		**Low**
MAINE	**92.24**		**Low**
MARYLAND		119.97	
MASSACHUSETTS		**92.19**	**Low**
MICHIGAN		**119.06**	**High**
MINNESOTA	**79.57**		**Low**
MISSISSIPPI	**69.22**		**Low**
MISSOURI		**86.74**	**Low**
MONTANA	104.3		
NEBRASKA		**90.21**	**Low**
NEVADA	**68.77**		**Low**
NEW HAMPSHIRE	144.56		
NEW JERSEY		**113.4**	**High**
NEW MEXICO		**130.31**	**High**
NEW YORK		**95.4**	**Low**
NORTH CAROLINA	**81.58**		**Low**
NORTH DAKOTA	84.35		
OHIO		**108.89**	**High**
OKLAHOMA		**86.34**	**Low**
OREGON		**85.73**	**Low**
PENNSYLVANIA		137.09	
PUERTO RICO		136.01	
RHODE ISLAND	**69.74**		**Low**
SOUTH CAROLINA	**76.8**		**Low**
SOUTH DAKOTA	116.25		
TENNESSEE		**73.79**	**Low**
TEXAS		**81.81**	**Low**
UTAH		**99.91**	**Low**
VERMONT	101.51		
VIRGIN ISLANDS		110.71	
VIRGINIA		**85.97**	**Low**
WASHINGTON	**98.73**		**Low**
WEST VIRGINIA		**89.38**	**Low**
WISCONSIN	**86.57**		**Low**
WYOMING		**79.53**	**Low**

Source: Forms OCSE-157, OCSE-34A, and OCSE-396A (Administration for Children and Families, 2002)

Table Notes:

[1] High PEP indicates state is in top 25% for all states.

*Georgia taken from FY 2002 report as FY 2001 figure was not reported.

States that are shaded are those represented in the ECLS-B.

Appendix A continued

Additional information regarding Paternity Establishment Percentages (PEP)
The Social Security Act provides states with two options for calculating and reporting their Paternity Establishment Percentage (PEP) rates. Each option has advantages and disadvantages that a state must consider when determining the method to use. The methods are respectively known as the "IV-D PEP" and the "statewide PEP." Both methods compare the number of children born out of wedlock with paternity established or acknowledged to the total number of children born out of wedlock. However, the IV-D PEP only counts children born out of wedlock within the IV-D agency's caseload, while the statewide PEP considers all children born out of wedlock within the state. Approximately half the states use the IV-D method, while the remaining states use the statewide method (YoungWilliams, n.d.).

The following definitions summarize information provided in the Social Security Act (Section 452 [42 U.S.C. 652]) (Social Security Act, 2012)

Statewide PEP

The term "statewide paternity establishment percentage" means the ratio (expressed as a percentage) that the total number of minor children who have been born out of wedlock, and the paternity of whom has been established or acknowledged during the fiscal year, bears to the total number of children born out of wedlock during the preceding fiscal year.

IV-D PEP

The term "IV-D paternity establishment percentage" means the ratio (expressed as a percentage) that the total number of children who have been born out of wedlock, with respect to whom assistance is being provided under the State, and the paternity of whom has been established or acknowledged, bears to the total number of children born out of wedlock and with respect to whom assistance was being provided under the State.

Appendix B: Definitions of fatherhood constructs

Four fatherhood constructs were used in the current study: 1) paternal prenatal involvement; 2) pregnancy wantedness concordance; 3) paternal history of negative behaviors; and 4) father's name on the birth certificate. Provided below are brief descriptions for each construct. Full definitions can be found in Chapter 3.

Paternal prenatal involvement

Paternal prenatal involvement was developed as a continuous variable with a minimum value of and maximum value of 7. Seven behaviors were reviewed and then summed. Each were coded as 1 if the father had reported doing them during pregnancy, 0 if he reported not doing them. Missing responses were included in the continuous variable and treated as a 0. The items were:

Attendance at a childbirth or Lamaze classes with the child's mother
Seeing a sonogram or ultrasound of the baby
Feeling the baby move
Discussing how his spouse/partner's pregnancy was going with her
Buying things for the child
Listening to the baby's heartbeat
Being in delivery room/room where the child was born

Pregnancy wantedness concordance

Pregnancy wantedness was determined with questions asked of the mother and father assessing if he or she wanted a pregnancy "at some time". The answers were then combined to create four categories of pregnancy wantedness concordance: **both want pregnancy, neither want pregnancy, father want pregnancy solely, mother want pregnancy solely**. The table below provides a summary of the development of the categories for this variable.

	Father wanted pregnancy	**Father did not want pregnancy**
Mother wanted pregnancy	Both want pregnancy	Mother want pregnancy solely
Mother did not want pregnancy	Father want pregnancy solely	Neither want pregnancy

Finally, in an effort to obtain as large of a sample as possible, several mothers who did not answer the questions about pregnancy wantedness but otherwise had complete data were retained in the sample. Those mothers were coded as not wanting the pregnancy, and then controlled for using a variable called **maternal wantedness unknown**.

Paternal history of negative behaviors

Paternal history of negative behaviors was developed as a categorical variable. Each behavior was coded as 1 if the father had reported doing them, 0 if he reported not doing them. Missing responses were treated as a 0. Fathers were asked if they had ever

Been suspended or expelled from school
Been fired or laid off from a job because of behavior, attitude, or work performance
Been in a facility overnight for a psychological or mental health problem
Had a drinking or drug problem or have other people thought he had one
Been convicted of driving while intoxicated or drunk driving
Been put in jail, arrested or convicted of a crime, other than drunk driving

In total there were six items. They were divided into three categories: **significant history of negative behaviors** (3 or more behaviors); **some history of negative behaviors** (1-2 negative behaviors); **no history of negative behaviors** (0 negative behaviors).

Father's name on the birth certificate

The variable, **father's name on the birth certificate**, was derived after assessing whether father's age was listed on the birth certificate or not. If father's age was *missing,* father's name on the birth certificate was coded as 1. If father's age was listed, father's name on the birth certificate was coded as 0.

Appendix C. Institutional Review Board application approval

UNIVERSITY OF MARYLAND
INSTITUTIONAL REVIEW BOARD

Initial Application Approval

To:	Principal Investigator, Dr. Sandra L. Hofferth, Family Science Student, Barbara Jones Singer, Family Science
From:	James M. Hagberg IRB Co-Chair University of Maryland College Park
Re:	IRB Protocol: 11-0288 - The influence of paternal involvement during pregnancy on infant health outcomes
Approval Date:	July 22, 2011
Expiration Date:	July 22, 2014
Application:	Initial
Review Path:	Exempt

The University of Maryland, College Park Institutional Review Board (IRB) Office approved your Initial IRB Application. This transaction was approved in accordance with the University's IRB policies and procedures and 45 CFR 46, the Federal Policy for the Protection of Human Subjects. Please reference the above-cited IRB Protocol number in any future communications with our office regarding this research.

Recruitment/Consent: For research requiring written informed consent, the IRB-approved and stamped informed consent document will be sent via mail. The IRB approval expiration date has been stamped on the informed consent document. Please note that research participants must sign a stamped version of the informed consent form and receive a copy.

Continuing Review: If you intend to continue to collect data from human subjects or to analyze private, identifiable data collected from human subjects, beyond the expiration date of this protocol, you must submit a Renewal Application to the IRB Office 45 days prior to the expiration date. If IRB Approval of your protocol expires, all human subject research activities including enrollment of new subjects, data collection and analysis of identifiable, private information must cease until the Renewal Application is approved. If work on the human subject portion of your project is complete and you wish to close the protocol, please submit a Closure Report to irb@umd.edu.

Modifications: Any changes to the approved protocol must be approved by the IRB before the change is implemented, except when a change is necessary to eliminate an apparent immediate hazard to the subjects. If you would like to modify an approved protocol, please submit an Addendum request to the IRB Office.

Unanticipated Problems Involving Risks: You must promptly report any unanticipated problems involving risks to subjects or others to the IRB Manager at 301-405-0678 or jsmith@umresearch.umd.edu

Additional Information: Please contact the IRB Office at 301-405-4212 if you have any IRB-related questions or concerns. Email: irb@umd.edu

The UMCP IRB is organized and operated according to guidelines of the United States Office for Human Research Protections and the United States Code of Federal Regulations and operates under Federal Wide Assurance No. FWA00005856.

1204 Marie Mount Hall
College Park, MD 20742-5125
TEL 301.405.4212
FAX 301.314.1475
irb@umd.edu
http://www.umresearch.umd.edu/IRB

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