

## Feto-infant Health and Survival: Does Paternal Involvement Matter?

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**Abstract** Lack of paternal involvement during pregnancy and infancy may account for a significant burden of the adverse pregnancy outcomes among black women and could therefore, represent an important avenue providing the opportunity to improve feto-infant health and survival. This study aimed to review the literature on paternal involvement during the perinatal period and its influence on feto-infant health and survival. Literature for this review was identified by searching the PubMed database from the National Center for Biotechnology Information at the US National Library of Medicine as well as the ISI Web of Knowledge Databases, OVID, and CINAHL. A total of seven papers were identified and included in this review. There is paucity of data in this domain. Overall findings suggest that paternal involvement during pregnancy may have important implications for maternal prenatal health behaviors and feto-infant health. Although results are limited, results suggest that paternal involvement has a positive influence on prenatal care usage, abstinence from alcohol and smoking, and a reduction in low birth weight and small for gestational age infants. None of the papers examined the relationship between stillbirth and paternal

involvement. Additional studies with enhanced measures of paternal involvement are needed to better assess the role of fathers in enhancing prenatal health behaviors and pregnancy outcomes. Efforts should be made to include fathers in future studies and reduce reliance on maternal report and to investigate paternal roles across different racial groups so that appropriate interventions can be developed.

**Keywords** Paternal involvement · Prenatal health behaviors · Infant mortality · Low birth weight

### Introduction

Numerous authors have indicated that family structure, relationship type, and paternal involvement have a favorable effect on academic achievement, cognitive, and behavioral outcomes during childhood (more than 1 year of age) [1, 2]. Paternal involvement also has a positive influence on cognitive development of infants, yet other aspects of the father–mother–infant triad have received little attention [3, 4]. Few studies have examined pregnancy outcomes or maternal health behaviors in relation to paternal involvement. In spite of this gap, related data suggest that paternal involvement may be an important predictor of pregnancy outcome and maternal health behaviors [5, 6]. Women with the greatest likelihood of paternal involvement (i.e., those that are married) have lower rates of low birth weight infants, an association that varies by race [6]. Unmarried black women have a higher proportion of low birth weight infants (14.5%) than unmarried white women (7.9%) [6]. When compared to married women, unmarried women are more likely to smoke during pregnancy, initiate prenatal care late in the

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pregnancy, and miss prenatal care appointments [5, 6]. The aforementioned associations have been poorly explored in relation to paternal involvement, with a paucity of papers evaluating the effects of paternal involvement on infant mortality, low birth weight, or paternal influences on maternal smoking cessation, other substance abuse, and receipt of early prenatal care.

Over the past decade, family structure, dynamics, and societal views of childbearing outside of marriage have changed dramatically, with an increasing number of children born into one-parent households or to cohabitating, rather than married parents [7]. Race has a significant impact on the probability of an infant being born outside of marriage as more than 70% of non-Hispanic black infants in the US are born to unmarried women [7]. This percentage is particularly staggering in relation to the 27% of non-Hispanic white and 50% of Hispanic infants that are born to unmarried women [7]. In addition, non-Hispanic black adolescents are more likely to be teen parents than their non-Hispanic white counterparts [7]. These circumstances have raised the question of the role and importance of paternal involvement during pregnancy and infancy, particularly among blacks as they already face greater socioeconomic hardship and more adverse pregnancy outcomes than whites [5, 6, 8].

Understanding the role of paternal involvement in infant and maternal health is gaining importance as researchers have recognized that maternal prenatal behaviors have an immediate and lifelong effect on the health of the child [9]. Low birth weight infants not only have the immediate elevated risk of infant mortality, but also a lifelong elevated risk for cardiovascular disease, hypertension and diabetes [9]. Consequently, lack of paternal involvement during pregnancy and infancy may account for a significant burden of the adverse pregnancy outcomes, especially among black women, and could therefore, represent an important avenue providing the opportunity to improve fetoinfant health and survival. To this end, we undertook this study the aim of which is to review the literature on paternal involvement during the perinatal period and its influence on fetoinfant health and survival.

## Methods

Literature for this review was identified by searching the PubMed database from the National Center for Biotechnology Information at the US National Library of Medicine as well as the ISI Web of Knowledge Databases, OVID, and CINAHL with the following search terms: “male involvement and birth outcomes”, “father involvement”, “paternal involvement”, and “father involvement and pregnancy.” Searches were limited to publications in English. Bibliographies of the relevant articles were also scrutinized in order

to identify additional articles. Qualifying articles were reviewed and evaluated for related content. Studies were included if they discussed paternal involvement during pregnancy and its effect on either low birth weight, preterm birth, infant mortality, fetal growth restriction, or maternal health behaviors such as prenatal care attendance and initiation, smoking status, and alcohol or other drug use. Studies focusing on teen pregnancy were also excluded because these pregnancies are inherently more complex than those of adults in terms of the importance of familial and paternal support as well as sources of financial and emotional support [10, 11]. Papers were excluded if they examined maternal health behaviors and fetoinfant morbidity and mortality only in relation to marital status as marital status is not indicative of involvement nor is it a good measure of financial or social support. In other words, unmarried women constitute a diverse group as they may be cohabitating, residing alone, or residing with other family members just as married women may or may not reside with their partner. A total of seven articles examined paternal involvement as defined and are included in this review.

## Results

Few papers evaluated paternal involvement during the perinatal period and its influence on fetoinfant health and survival. Those that did employed a host of different constructs to measure paternal involvement (Table 1). Although the study was not limited to research done in the US, all seven studies that met the inclusion criteria were conducted in the US. More details about each study are presented in Table 2.

### Infant Mortality

Two papers examined infant mortality in relation to factors that would indicate a lack of paternal involvement, with both suggesting that paternal involvement is beneficial. Using Georgia vital statistics records, Gaudino et al. [12] evaluated whether failure to acknowledge paternity on the birth certificate (indicated by completeness of paternal variables) is a risk factor for infant mortality. Although listing father’s name on the birth certificate is optional for married couples, unmarried fathers must sign an acknowledgement, therefore, failure to list father’s name on the birth certificate likely indicates a lack of involvement or absence of the father [12]. After controlling for marital status, the risk of infant mortality was higher among those infants whose father was unnamed as compared to those who had a father’s name listed on the birth certificate [RR (relative risk) = 1.8, 95%CI (confidence interval) = 1.6, 2.0] [12]. Similarly, stratified analyses

**Table 1** Constructs used to assess paternal involvement

Indicator of paternal involvement	References
Paternal completion of self-administered questionnaires	[17]
Paternity acknowledgement, contributions during pregnancy, and intentions to contribute as obtained from in-hospital interviews shortly after birth	[18]
Missing paternal information in vital statistics records	[12, 13]
Partner or spousal-specific support as identified by the Norbeck Social Support Questionnaire	[14]
Evaluated father involvement with three different indicators: mother's relationship with the father, paternal suggestion of an abortion, and financial support from the father	[16]
Composite score derived from living arrangements and frequency of contact	[18]

**Table 2** Overview of studies linking paternal involvement to pregnancy outcomes and maternal prenatal behaviors

	Sample size/design	Population/region	Outcomes assessed
Gaudino et al. [12]	Retrospective cohort study including 216,941 infants	Linked birth and death certificates for all singleton infants delivered to Georgia resident women in 1989–1990	Primarily focused on infant mortality, but touched on low birth weight, SGA, maternal prenatal smoking, prenatal care usage
Tan et al. [13]	Retrospective cohort study including 304,466 twins	Used the multiple birth file from the National Center for Health Statistics, Centers for Disease Control and Prevention	Infant morbidity, mortality, prenatal care usage, and maternal prenatal smoking
Norbeck and Anderson [14]	Clinic-based prospective study including 208 women	Low risk, low-income, 18–39-year-old women were recruited from two university clinics	Gestational age
Teitler [15]	Hospital-based cohort study including 2,325 births. However, it was restricted to 1,779 unmarried parents for most analyses	Data from interviews of parents from one of seven cities participating in the Fragile Families and Child Wellbeing study. Data collected shortly after birth	Low birth weight, maternal prenatal behaviors (smoking, prenatal care use, drug and alcohol use)
Padilla and Reichman [16]	Hospital-based cohort study including 1,678 mothers	Baseline data from interviews with unwed parents participating in the 7-cities Fragile Families and Child Wellbeing study. Restricted to women who identified themselves as Mexican American, non-Hispanic black, non-Hispanic white, or other Hispanic	Maternal prenatal behaviors (smoking, prenatal care use, drug and alcohol use), low birth weight
Martin et al. [17]	Early childhood longitudinal study-birth cohort: 5,404 women who resided with the biological father at the time of study	Sample of infants born in 2001 were selected from National Center for Health Statistics, so it includes women from 46 states (not specified) and DC; data collected when infant was 9 months of age	Maternal prenatal smoking and prenatal care usage
Zambrana et al. [18]	Cohort study including 107 primiparous women	Women with <12 years of education were interviewed at Los Angeles prenatal care clinics in 1988. Medical chart review was done to determine eligibility. All women had to currently reside in the US	Prenatal care usage, pre-pregnancy substance abuse

indicated that within each racial ethnic group, the risk of infant mortality was elevated among infants whose birth certificates did not have a father listed [12]. Infants born to black non-Hispanic women who did not have a father listed on the birth certificate were 1.7 times as likely to die during infancy than their counterparts with a named father [12].

Elevated risks for mortality among infants with no reported father's name as opposed to those with a father's name listed remained even after adjustment for confounders including low birth weight, adequacy of prenatal care, birth defects, smoking, education, maternal age, gestational age, pregnancy complications, and marital status [12].

**Table 3** Impact of relationship type and the likelihood of paternal involvement on probability of delivering a low birth weight infant

Relationship type	Pregnancy outcome	
Non-romantically involved, not cohabitating	Lower rates of low birth weight (11%) than women who are romantically involved with their partners [11]	Low ↓ Paternal Involvement ↓ High
Romantically involved, not cohabitating	1.5 Times more likely to have a low birth weight infant than those that are cohabitating (17–18%) [13, 14]	
Unmarried, cohabitating	12–13% Have low birth weight infants; better outcomes than those that are romantically involved, but non-cohabitating [13, 14]	
Married, cohabitating	Least likely to have a low birth weight infant (8%) [13, 14]	

Similar findings were reported in analyses that aimed to use matched multiple birth files from the National Center for Health Statistics, Centers for Disease Control and Prevention to describe maternal characteristics and pregnancy outcomes associated with missing paternal information [13]. The authors evaluated two levels of missingness (totally and partially missing paternal information on age and race) and compared it to records with complete paternal information (age and race variable present) [13]. Neonatal and post-neonatal mortality were elevated for both levels of missingness when compared to complete records, though to a greater degree among infants with paternal data completely missing [13]. When compared to infants with complete paternal information, those with completely missing information had an increased risk of neonatal mortality (RR = 2.00) and an increased risk of post-neonatal mortality (RR = 2.43) [13].

#### Infant Morbidity

The effects of father involvement on preterm birth or growth restriction were evaluated in two papers, whereas four authors included in this review evaluated the effects of paternal involvement on low birth weight as a heterogeneous construct. A study including 208 low-income women recruited from obstetric clinics found that spousal or partner support accounted for about 9% of the variance in gestation, but the effect was only observed among black women, not white or Hispanic women [14]. Tan et al. [13] noted an increased risk of low birth weight as well as increased risks of preterm birth and fetal growth restriction among infants who were missing partner information in their vital records as compared to infants with complete paternal information.

Similarly, after stratifying by marital status, absence of father's name on the birth certificate was associated with a higher proportion of infants born low birth weight in the aforementioned vital statistics-based study in Georgia [13]. For example, 10% of births to unmarried women without a reported father's name on their birth certificate were

between 1,500 and 2,499 g whereas among unmarried women with the father's name listed, only 8.6% of births were between 1,500 and 2,499 g. Similar figures were reported among married women with 9.4% of infants without father's name listed being between 1,500 and 2,499 g and 4.3% of infants to married women with fathers name listed falling in the same weight category [12]. The proportion of infants born small for gestational age (SGA) was more similar for unmarried women, regardless of presence of father's name on the birth certificate (14.0 for no father's name and 13.7% for infants with father's name listed). However, among married women the difference in proportion of SGA infants was more staggering, with 15.2% of infants with no father's name being SGA and only 4.3% of infants with father's name listed being SGA [12]. Conversely, a multi-city study (fragile families and child well-being study) that measured father involvement as paternity acknowledgement, contributions during pregnancy, and intentions to contribute found that involvement of unmarried fathers does not impact birth weight [15]. However, the interview was conducted shortly after birth and the extent to which adverse pregnancy outcome impacted participation was unclear. In addition, participation varied by relationship status; only 39% of fathers who were not romantically involved with the mother participated whereas, 87% of married fathers participated [15]. Using data from the same study, Padilla and Reichman [16] evaluated father involvement with three different indicators: mother's relationship with the father, paternal suggestion of an abortion, and financial support from the father, but in this sample, relationship status and financial support were highly correlated among cohabitating partners, and consequently were not included simultaneously in the models. Mothers that were romantically involved with the father, but do not reside with them are more likely to have a low birth weight infant than those who reside with their partners [16]. However, in this study, a lack of a mother–father relationship was also protective against low birth weight [16]. In addition, financial support also decreased the likelihood of having a low birth weight infant [16]. Table 3 provides a

schematic of the association between paternal involvement and probability of delivering a low birth weight infant. Discrepancies in these studies likely stem from methodological differences and definitions of paternal involvement.

#### Mother's Prenatal Health Behaviors

Paternal involvement is consistently associated with healthier maternal prenatal behaviors, such as receipt of early prenatal care, reduced smoking and abstinence from alcohol. Both studies that noted correlations between birth outcomes and missing paternal information in vital statistics records also reported correlations with mother's health behaviors. One study found that women with missing partner information were more likely to be black, unmarried, to report prenatal smoking, and to have inadequate prenatal care [13]. Analyses using Georgia vital statistics indicated that married women who did not report father's name on the birth certificate were more likely to be smokers (37.0%) than married women who reported father's name (14.2%;  $P < 0.001$ ) [11]. Likewise, unmarried women listing father's name were less likely to be smokers (18.9%) than unmarried women not listing father's name (20.2%) [12].

The Early Childhood Longitudinal Study-Birth Cohort was one of very few studies where measures of paternal involvement were obtained directly from fathers via self-administered questionnaires [17]. In this study, paternal involvement was associated with an increased likelihood of obtaining early prenatal care (OR = 1.42, 95%CI = 1.01, 1.99) [17]. Women who smoked, but had involved partners were also 36% more likely to reduce cigarette consumption than smokers with less involved partners [17]. Although the fragile families and child well-being study did not find an association between father involvement and birth weight, results demonstrate the positive influence of paternal involvement on maternal adoption of healthy pregnancy behaviors [13]. The study found that the indicators used to determine involvement (paternity acknowledgement, contributions during pregnancy, and intentions to contribute), presence of the father's name on the infant's birth certificate, as well as whether the child took the father's surname were all positively associated with early prenatal care usage [15]. A study including Blacks, Mexican-Americans, and recent Mexican immigrants used living arrangements and frequency of contact with the father as a measure of paternal involvement and found that increased paternal involvement was positively associated with prenatal care usage [18].

#### Discussion

The findings of this review suggest that paternal involvement during pregnancy may have important implications

for maternal prenatal health behaviors and feto-infant health. Although very few papers have focused specifically on paternal involvement in connection with maternal and feto-infant health, related studies support the importance of paternal involvement. Studies assessing the effects of family structure, marital status, relationship dynamics, and living arrangements generally point toward the importance of paternal involvement. For example, a nationwide study of women 21–28 found that women who resided with their partners or husbands were more likely to get early prenatal care and abstain from alcohol use during pregnancy [19]. Other studies noted elevated rates of small for gestational age and low birth weight infants among unmarried mothers [20, 21].

Although our review generally found that paternal involvement had a favorable effect on pregnancy outcome, we did not attempt to contact authors about possible unpublished results. As a result, publication bias cannot be excluded as a possible explanation for our results. Our review is also limited by variations in the measurement of paternal involvement. The different measurements may capture diverse aspects of involvement or may measure this construct with varying levels of accuracy. Of particular concern is the ability of studies to capture measures of involvement from both resident and non-resident fathers. The study by Martin et al. [17] only included resident fathers and it is non-resident fathers that are least likely to be involved.

We did not include teen pregnancies because of inherent limitations in measuring paternal involvement and the multitude of factors impacting involvement that differ from those of adults. Teen pregnancies are unique situations in which paternal involvement may be impeded by parents and lack of ability to assist financially. Further, teen mothers may get the support they would normally get from the infant's father from their own family, thus mitigating the need for involved fathers.

Mechanisms by which paternal involvement circumvents adverse pregnancy outcomes have not been clearly defined, but previous authors have described key components of paternal involvement and child cognitive and behavioral development [22, 23]. Although it has not been used to characterize involvement during the prenatal period, we propose extending this construct to include pregnancy, providing a framework to describe the involvement of fathers with their partners during pregnancy [22, 23]. The three levels of paternal involvement identified include: engagement, accessibility, and responsibility [22, 23]. Engagement refers to direct father-child interaction, thus during pregnancy it would include involvement in pregnancy-related activities such as attending birth classes or prenatal care visits with the mother [22, 23]. It is generally supported by data that married women are less likely to

receive no or late prenatal care [16]. However, a greater proportion of unwanted or unintended pregnancies occur among unmarried women, and intendedness is a predictor of prenatal care usage [24, 25]. Thus, if pregnancy wantedness and intendedness impacts prenatal care initiation, it is possible that paternal engagement acts psychosocially and encourages healthy behaviors [16, 24]. Accessibility refers to presence, outside of direct interaction, whereas responsibility reflects a father's commitment to ensuring the child's care and welfare. During pregnancy, responsibility includes assisting the mother with tasks such as driving her for doctor's appointments and offering financial support. Previous studies have demonstrated that paternal financial support increased as the relationship became more "marriage-like" [15, 16]. Cohabiting, but unwed fathers are more likely to plan on being involved than fathers who were romantically involved, but not cohabitating [15].

Given this premise, one can visualize how the gradations of father involvement correlate with the closeness of the mother–father relationship in terms of marital status and living arrangements. Fathers with pregnant wives (assuming they are cohabitating) have the greatest opportunity for accessibility, responsibility, and engagement. Fathers that are involved with the pregnant mother but do not cohabit are inherently not as accessible, may have insufficient opportunities to engage in pregnancy-related activities with the mother, and may or may not have financial responsibility. Similar scenarios can be ascribed to the other types of relationship phenotypes.

Other possible mechanisms by which paternal involvement may improve maternal health behaviors and pregnancy outcomes include reduced stress and increased wantedness of the pregnancy. Partner support positively influences maternal commitment to the pregnancy and onset of prenatal care [26–28]. Stress may also increase the risk of low birth weight and preterm birth, but conflicting results make inferences challenging [29–31]. However, evidence indicates that stress causes dysregulation of the hypothalamic–pituitary–adrenal (HPA) axis and the sympathetic nervous system alters the production of stress hormones such as cortisol and corticotropin-releasing hormone. This impacts fetal development and pregnancy maintenance [32] with elevated levels of these hormones triggering preterm birth and fetal growth restriction [33–35].

Regardless of the mechanism by which paternal involvement influences maternal and feto-infant health, a host of barriers and predictors of paternal involvement, including employment, relationship status and cohabitation, involvement prior to birth, and relationship with the infant's maternal grandmother have been identified [36–39]. This provides an array of intervention opportunities in this domain. Fathers could benefit from assistance in obtaining and maintaining employment, securing better

education, and increasing participation at prenatal care visits. Providing fathers with resources and the ability to contribute and be involved during pregnancy may help to ensure that paternal involvement is positive and not resource-draining. Future research should strive to overcome challenges imposed by including fathers in epidemiologic studies (e.g. maternal acknowledgement of the father). Additional programs aimed at encouraging paternal involvement during pregnancy should also be implemented as it is an important factor for maternal, fetal, and infant health. More studies evaluating paternal involvement and birth outcomes and maternal prenatal behaviors are needed. In particular, interventional studies that aim to increase paternal involvement may enhance our understanding of how paternal involvement impacts pregnancy outcome. Records-based retrospective studies have inherent limitations that preclude the examination of type of paternal involvement and the impact of cohabitation.

## Conclusion

Current studies indicate an association between lack of paternal involvement and poor birth outcomes. However, additional studies with enhanced measures of paternal involvement are needed to better assess the role of fathers in enhancing prenatal health behaviors and pregnancy outcomes, including stillbirth, an outcome which has so far not been evaluated in this respect. Furthermore, research should focus on paternal roles among different racial groups, particularly those that already have a higher frequency of adverse pregnancy outcomes, such as non-Hispanic blacks. Lastly, efforts need to be made to establish and sustain involvement of fathers at all stages of feto-infant development.

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