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The Influence of Maternal-Fetal Attachment and Health Practices on Neonatal Outcomes in Low-Income, Urban Women

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Abstract

Maternal-fetal attachment (MFA) has been associated with health practices during pregnancy, but less is known about this relationship in low-income women, and no identified studies have examined this relationship to neonatal outcomes. This longitudinal descriptive study was conducted to examine the relationships among MFA, health practices during pregnancy, and neonatal outcomes in a sample of low-income, predominantly African-American women and their neonates. MFA was associated with health practices during pregnancy and adverse neonatal outcomes. Health practices during pregnancy mediated the relationships of MFA and adverse neonatal outcomes. The results support the importance of examining MFA in our efforts to better understand the etiology of health disparities in neonatal outcomes.

Keywords

maternal-fetal attachment; health-promoting behaviors; health disparities; African American; birth outcomes

Disparities in neonatal outcomes between African-Americans and non-Latino White Americans are one of the most concerning and chronic health disparities affecting our nation (Alexander, Wingate, Bader, & Kogan, 2008). Many of the health disparities in preterm birth, low birth weight (LBW) and other adverse pregnancy outcomes are more prevalent in ethnic minority and low-income populations (Patrick & Bryan, 2005). Poor and African-American women have twice the rates of preterm births and higher rates of growth restricted neonates than most other women (Mathews, Minino, Osterman, Strobino, & Guyer, 2011). LBW is a major determinant of infant mortality, and LBW neonates die at rates up to 40 times higher than the risk in normal birth weight neonates (Goldenberg & Culhane, 2007). Furthermore, LBW neonates are significantly more likely to have short and long-term

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morbidities including delays in cognitive development and growth, and heightened risk of cardiovascular and respiratory disease (Goldenberg et al., 2007). A significant body of research has been devoted to better understanding the reasons for persisting racial disparities in neonatal outcomes, yet the causes remain largely unknown.

One factor known to influence neonatal outcomes is the health practices that a mother engages in during pregnancy. Positive health practices include abstaining from tobacco, alcohol, and other illegal substances; obtaining regular prenatal care; maintaining a nutritionally-sound diet (Widen & Siega-Riz, 2010); obtaining adequate rest and sleep; engaging in regular exercise (Stutzman et al., 2010); and learning about pregnancy and childbirth (Feinberg, Jones, Kan, & Goslin, 2010). Several variables that correlate with improved health practices during pregnancy include higher socioeconomic status, higher levels of education (Rubio, Kraemer, Farrell, & Day, 2008; Webb, Siega-Riz, & Dole, 2009), and increased social support (Savage, Anthony, Lee, Kappesser, & Rose, 2007). Conversely, negative health practices during pregnancy, such as tobacco and substance use, are higher among young, unmarried, low-income women (Phares et al., 2004). Cigarette smoking is one of the most preventable risk factors associated with adverse perinatal outcomes (Andres & Day, 2000).

Another factor thought to influence health practices during pregnancy is maternal-fetal attachment (MFA). Cranley (1981) created the theoretical construct of MFA and defined it as “the extent to which women engage in behaviours that represent an affiliation and interaction with their unborn child” (Cranley, 1981, p.281). Higher levels of MFA correlate with the aforementioned high-quality health practices (Lindgren, 2001, 2003). However, studies of the associations between MFA and health practices during pregnancy have largely excluded low-income, ethnic minorities (Alhusen, 2008). Furthermore, no longitudinal studies were found of these variables in relation to neonatal outcomes.

An enhanced understanding of the role that MFA plays in neonatal outcomes of those subject to disparities, by virtue of race or socioeconomic status, is necessary to improve understanding of the relationship between health practices and adverse neonatal outcomes. Extant literature supports the influence of maternal health practices on neonatal outcomes, but less is known about factors that contribute to a woman’s ability to engage in those positive health practices.

This study was designed to examine the associations between MFA, health practices during pregnancy, and neonatal outcomes in a highly vulnerable sample of predominantly African-American pregnant women reporting low educational attainment and low socioeconomic status. Preterm birth and LBW are key predictors of neonatal complications and mortality (Halfon & Lu, 2010; Lu et al., 2010; Oken, Kleinman, Rich-Edwards, & Gillman, 2003). Thus, in this study neonatal measures of birth weight and gestational age were collected. This longitudinal study addressed a significant gap in the current literature by examining the following hypotheses:

After controlling for income, pregnancy wantedness, preeclampsia, and gestational diabetes:

1. Higher MFA will be negatively related to adverse neonatal outcomes.
2. Higher MFA will be positively related to improved health practices during pregnancy.
3. Improved health practices during pregnancy will be negatively related to adverse neonatal outcomes.

4. Health practices during pregnancy will mediate the relationship between MFA and adverse neonatal outcomes.

Theoretical Model

The transition to motherhood is a major developmental life event. This transition requires restructuring goals, behaviors and responsibilities. This study of factors that facilitated or inhibited this transition drew from Rubin's (1967) theory of maternal role attainment (MRA) as well as Mercer's expansion on this theory, which she termed "Becoming a Mother (BAM)" (Mercer, 2004). Although both theories largely focus on processes necessary for the establishment of maternal identity that occur once the child is born, Mercer's first stage, which entails a commitment and attachment to the unborn baby, recognizes the long-term implications of poor attachment (Mercer & Walker, 2006). A woman's active involvement in this stage has been consistently linked to engaging in healthier behaviors that benefit both the woman and her unborn child (Lindgren, 2001, 2003). Women demonstrating higher levels of MFA are presumed to be more vested in taking care of themselves during pregnancy in an effort to improve both the health of their fetus and pregnancy outcomes. Furthermore, researchers have suggested that prenatal attachment facilitates adaptation to the role of motherhood and may even act as a protective factor against perinatal depression (Brandon, Pitts, Denton, Stringer & Evans, 2009).

The successful attainment of a maternal identity includes the development of an emotional tie between the mother and unborn child as well as an innate desire to protect the unborn child, later described as MFA (Cranley, 1981). This developmental and interactional process occurs over time (Rubin, 1984). Maternal role attainment and subsequently BAM acknowledge barriers and facilitators to this process, and were therefore ideal theories to direct this study of MFA in a high-risk population where health disparities persist.

Methods

Sample

A convenience sample of pregnant women from three urban obstetrical clinics in the Mid Atlantic region were recruited for the study. The three clinics were all affiliated with a major university health system and all served predominantly poor (>95% receiving Medicaid), African-American (>95%) inner-city populations. To be eligible for inclusion in the study, participants had to be 16 years or older, between 24–28 weeks gestation with singleton pregnancies, and able to speak English. This gestational time frame was chosen as research on MFA has demonstrated MFA increases as a pregnancy progresses, and this time period marks the beginning of fetal viability thereby allowing for accurate assessment of neonatal outcomes (Ramsay & Santella, 2010; Seri & Evans, 2008). Participants who met these initial criteria were excluded if prior to data collection they had been treated with tocolytic therapy, diagnosed with pre-eclampsia or gestational diabetes, diagnosed with a chronic medical condition (e.g. chronic hypertension, diabetes mellitus), or received an abnormal diagnostic result (e.g. known fetal anomaly, abnormal results on first or second trimester screening tests) during the current pregnancy. Additionally, women reporting a history of fetal (spontaneous abortion after 24 weeks gestation) or infant death were excluded. These exclusion criteria were selected given their known contribution to adverse neonatal outcomes (Institute of Medicine, 1988;Mathews et al., 2011).

Of the 174 eligible pregnant women approached to participate, 167 (96%) completed the study instruments. One participant delivered at an outside hospital, which precluded our ability to obtain accurate birth outcomes. Therefore, the final sample consisted of 166 low-income women (93% African-American) receiving prenatal care from one of the three

participating clinics and their neonates, resulting in a 95.4% participation rate. Of note, 84% of the sample initiated prenatal care by 14 weeks gestation, 96% by 18 weeks gestation, and 100% by 24 weeks gestation. As seen in Table 1, the sample consisted of predominantly poor, unmarried, African-American younger women.

Data Collection Procedures

Institutional Review Board approval was obtained prior to participant recruitment. Eligible participants were approached about enrollment in the study during their prenatal care visits. If a woman expressed an interest in participating, but had not reached 24 weeks gestation, her contact information was obtained. The first author re-contacted her and met with her to complete study instruments prior to a scheduled appointment that between 24 and 28 weeks gestation.

After a complete description of the study, informed consent was obtained from those women who agreed to participate. Participants were interviewed in a private space at each of the three study clinic sites. Interviews lasted approximately 30 minutes. The interviews were conducted by the first author or one of two undergraduate nursing students who received research compliance and study procedures training. Participants were compensated $15 for their participation. Measures related to neonatal outcomes (i.e., birth weight and gestational age) were extracted from electronic chart review within 48 hours after delivery. Measures specific to maternal physical health risk factors (i.e. preeclampsia and gestational diabetes) were also extracted from electronic chart review during the same time period, in the event these risk factors developed after the initial data collection (Bodnar, Ness, Markovic, & Roberts, 2005; Catalano, Kirwan, Haugel-de Mouzon, & King, 2003).

Measures

Maternal-fetal attachment—MFA was measured with the Maternal-Fetal Attachment Scale (MFAS; Cranley, 1981). The MFAS is a 24-item measure that asks women to respond to questions or thoughts indicative of MFA. The scale contains 5-point Likert-type items with response options ranging from 1 (*definitely no*) to 5 (*definitely yes*). Examples of MFAS items include “I talk to my unborn baby” and “I do things to try to stay healthy that I would not do if I were not pregnant.” The total score ranges from 24–120 with higher scores indicative of higher levels of MFA. This instrument is one of the most frequently used measures of MFA in prenatal studies and has been used in diverse populations including samples of culturally diverse and low SES adolescents (Ahern & Ruland, 2003; Hart & McMahon, 2006; Lindgren, 2003). Content validity was assessed by an expert panel review. In a study of MFA in ethnic minorities a content validity index of .91 was found (Ahern & Ruland, 2003). The Cronbach’s alpha coefficient reported by Cranley (1981) was .85 and for the current study was .88.

Health practices—The Health Practices in Pregnancy Questionnaire-II (HPQ-II; Lindgren, 2005) is a 34-item measure designed to address adequacy of health practices in six areas: balance of rest and exercise, safety measures, nutrition, avoiding use of harmful substances, obtaining health care, and obtaining information. In addition, 1 item addresses overall pregnancy health practices. Responses range from 1 (*never*) to 5 (*always or daily*) or a word or phrase that indicates the woman’s level of engagement in a specific activity (e.g., 1- *No alcoholic drinks while pregnant* to 5- *More than 3 alcoholic drinks at one sitting*). Negatively worded items were reverse coded. Examples of HPQ-II items include “Since becoming pregnant I drink more than two caffeinated beverages in a day” and “Since becoming pregnant I have smoked cigarettes.” The total score ranges from 34–170 with a high score indicating a higher quality of health practices. Content validity was established

by clinical experts and pregnant women (Lindgren, 2001, 2005). The Cronbach's alpha coefficient reported by Lindgren (2003) was .81 and for the current study was .90.

Neonatal outcomes—Neonatal outcomes were collected from electronic chart review by the first author. Two undergraduate nursing students collected neonatal data on a random 25% sub-sample to assess inter-rater reliability. A kappa statistic of 1.0 was noted indicating excellent agreement (Landis & Koch, 1977). Neonatal outcomes collected included the neonate's gestational age and birth weight. Small for gestational age (SGA) was calculated using comprehensive reference values of birth weight at 22 through 44 completed weeks of gestation that were established by Oken et al. (2003) based on a national sample of over 6 million infants. The presence of LBW (<2500 grams), preterm birth (<37 completed weeks gestation), or SGA (<10^{th} percentile weight adjusted for gestational age) was coded as an adverse neonatal outcome during data collection.

Demographic and pregnancy background—A measure of demographic and obstetrical data was developed for use in this study. Demographic data included age, race, marital status, insurance status, employment status, educational history, and income status. Pregnancy history included an assessment of current and previous pregnancies (e.g., was this a planned pregnancy; is this pregnancy wanted, unwanted or ambivalent; number of previous pregnancies, term births, number of therapeutic and/or spontaneous abortions, and number of live children).

Data Analysis

Data were analyzed using PASW Statistics 18, Release Version 18.0.0 (SPSS: An IBM Company). Data analysis began with descriptive and exploratory statistical analyses. Study variables were examined to assess distributions, to identify outlying or extreme observations, and to determine the need for transformation. There were no missing data. The sample size was based on an a priori power analysis with a specified power of 80% to detect a meaningful difference in MFA between participants delivering LBW neonates and participants delivering neonates >2500 grams. Pearson correlation, and point biserial correlation coefficients were calculated to address hypothesis 1–3. Mediation of the relationship between MFA and adverse neonatal outcomes by health practices during pregnancy was tested with an analytic approach specific to dichotomous outcomes, using the bootstrap with biased-corrected confidence intervals (MacKinnon, Fairchild, & Fritz, 2007). Separate logistic regression equations were conducted sequentially to first examine the relationship between MFA and adverse neonatal outcome and then to determine the extent to which health practices mediated this relationship. The level of significance was set at $\alpha = .05$.

Neonatal outcomes were dichotomized as adverse outcome or no adverse outcome; therefore, multiple logistic regression was used to test the relationships between MFA, health practices, and neonatal outcomes. Because income and pregnancy wantedness were related to the outcome variable of an adverse neonatal outcome, they were included in subsequent regression analyses to control for their potential confounding effects. Income was dichotomized using the median of <$10,000 or >$10,000 total household income per year. Pregnancy wantedness was dichotomized per participant's response that the current pregnancy was wanted or participant was ambivalent about current pregnancy. Additionally, gestational diabetes and preeclampsia were controlled for in the regression models, given their known contribution to adverse neonatal outcomes.

Results

After initial data collection, 7.8% (n=13) of study participants were diagnosed with preeclampsia, and 1.2% (n=2) were diagnosed with gestational diabetes. Forty-one percent (n=68) of study neonates were classified as having an adverse outcome. Table 2 demonstrates the number of neonates born with adverse outcomes of LBW, preterm birth, SGA, or a combination thereof.

The mean score on the MFAS was 84.1 (SD = 14.2, range 52 – 116), and the median was 83.5. Analysis of the HPQ-II scores revealed a mean score of 121.2 (SD = 19.6, range 78 – 159), and the median was 122.0.

Bivariate correlations, and point biserial correlations among the main study variables are presented in Table 3. As hypothesized, there was a significant negative relationship between MFA and adverse neonatal outcomes supporting our first hypothesis. Health practices during pregnancy (mediator variable) was significantly related to MFA, the independent variable, and adverse neonatal outcomes, the dependent variable thereby supporting hypotheses two and three, respectively.

The results of the logistic regression are shown in Table 4. In univariate logistic regression, MFA was regressed on adverse neonatal outcome and MFA was significantly related to adverse neonatal outcome; the odds ratio for this equation indicated that a one point increase in MFA was associated with a 9% decreased likelihood of an adverse neonatal outcome. In the second model, health practices was regressed on adverse neonatal outcome while controlling for MFA and health practices was noted to be significantly related to adverse neonatal outcome , indicating that a one point increase in the health practices scale score was associated with a 9% decreased likelihood of an adverse neonatal outcome. The proportion of the total effect of MFA on adverse neonatal outcomes mediated by health practices during pregnancy was 0.91. Additionally, the total indirect effect (−0.56) through health practices was 10 times larger than the direct effect (−0.5) between MFA and adverse neonatal outcomes. The total indirect effect through health practices remained significant with bootstrap analysis, while direct effects between MFA and adverse neonatal outcomes were non-significant, suggesting complete mediation through health practices. Thus, the fourth hypothesis was also supported.

Discussion

To our knowledge, this is the first study that provides strong support for the role that MFA plays both in health practices during pregnancy, and more importantly, in neonatal outcomes in a highly vulnerable population of predominantly African-American women from a low-income, urban community. Prior researchers found support for a relationship between MFA and health practices among primarily Caucasian samples (Lindgren, 2001, 2003). However, none have examined the longitudinal association between MFA and neonatal outcomes. The findings of this study highlight the significance of MFA as a predictor of neonatal health and wellbeing and, potentially, health care costs. Neonates born SGA or at LBW tend to have longer post-partum hospitalizations and more chronic illnesses than infants born at normal weight. Thus, MFA may be an important factor contributing to the increased health care expenditures related to adverse neonatal outcomes noted in the United States.

In addition, our findings support the validity of MFA as in important health construct for African-American, low-income women. Despite considerable resources devoted to understanding and remediating the problem of perinatal health disparities, we understand relatively little about the determinants of adverse neonatal outcomes. Great effort has been focused on promoting prenatal care as a primary strategy for improving neonatal outcomes.

Yet, this sample of women with a high rate of poor outcomes was receiving prenatal health care, although the content and quality of care was not assessed. The impact of MFA in this sample suggests that MFA is an important factor in our search for additional strategies beyond prenatal care.

The mediating role of health practices on the relationship between MFA and adverse neonatal outcomes was an important finding. Health practices such as assuring adequate sleep, limiting caffeine consumption, practicing safe sex, seeking advice from health care providers or social networks and engaging in relaxing behaviors receive less attention in the literature in relation to birth outcomes than behaviors such as tobacco use, alcohol use, and other illicit drug use. Given our knowledge that increased social support is correlated with higher MFA and overall health practices during pregnancy, an enhanced understanding of how social support may influence the aforementioned health behaviors could be important in tailoring intervention programs (Cranley, 1984; Savage et al., 2007).

The high percentage of women whose neonates had an adverse outcome warrants special attention. In the United States, African-American women are nearly twice as likely as Non-Hispanic White women (13.7% vs. 7.2%) to have a LBW baby (Mathews et al., 2011). In this sample, 21% of neonates were classified as LBW demonstrating a higher prevalence rate for LBW than previously reported though this sample was all low-income (Mathews et al., 2011). The impact of income equality on neonatal outcomes is a critical area of inquiry in the United States, due to a widening gap between rich and poor (Olson, Diekema, Elliott & Renier, 2010). Researchers have demonstrated that income and income inequality are associated with adverse neonatal outcomes with the poorest neonates experiencing the worst outcomes (Olson et al., 2010). This is particularly concerning given recent evidence that the wealth gap between Whites and African-Americans is the largest it has been since the government began publishing such data 25 years ago (Kochar, Fry, & Taylor, 2011). Further research is necessary to better understand the contribution of income, income inequality, and financial strain to both MFA and health practices.

This study has two important limitations. First, MFA and health practices were collected via self-report measures in a cross-sectional manner making inference about their causal relationships impossible. Tobacco use and substance use, factors known to contribute to poor neonatal outcomes, may have been underreported. Second, these results are based on a convenience sample and therefore cannot be generalized beyond this group of women.

Nonetheless, this study provides compelling evidence of an important relationship among MFA, health practices, and adverse neonatal outcomes in a low-income, predominantly African-American sample. Understanding risk factors for adverse neonatal outcomes is essential to eliminate the disparities in perinatal health across racial and ethnic minorities. In this sample of mainly poor, African-American women living in an urban environment, women with higher MFA also noted better health practices and had better neonatal outcomes. Birth outcomes were explained largely by actions taken during a woman's pregnancy (e.g., substance use, maintaining prenatal appointments, risky sexual behaviors). Perhaps a more comprehensive examination of risk factors, including stress, emotional health, and financial strain, not only over the course of a pregnancy but from the pre-conception period, would reveal their influence on both MFA and birth outcomes. Future research is needed to examine additional predictors of MFA, particularly in racial and ethnic minorities at higher risk for disparate birth outcomes.

Finally, future researchers should test culturally-relevant interventions aimed at improving the maternal-fetal relationship. Technological advances now allow women to detect their pregnancies earlier, and they are able to view ultrasound images of their fetus at earlier

dates. Advanced technology, such as fetal imaging, prenatal diagnostics, and genetic screening, individuate the fetus from the expectant mother. Incorporating technology, with an appropriate educational component, into an intervention may serve as the impetus for adopting positive health practices at an earlier time period in pregnancy. More importantly, women at risk for poor MFA may benefit from this education thereby facilitating adequate preparation for motherhood. The limited research aimed at increasing MFA has not been supported empirically, although the samples have been quite small and lacking ethnic and/or racial diversity (Carter-Jessop, 1981; Davis & Akridge, 1987). As research on the implications of poor MFA grows, there is a critical need for early identification and appropriate intervention.

Conclusion

This study provides an important contribution to understanding the influence of MFA on health practices during pregnancy, and ultimately neonatal outcomes, in a sample of urban, low-income, predominantly African-American women. Women with lower MFA were less likely to engage in health promoting practices during pregnancy, and consequently, more likely to deliver neonates with adverse outcomes. Although significant strides have been made in improving maternal and infant outcomes, continued concern is needed about the widening gap in pregnancy outcomes. Continued research on the manner in which individual, environmental, and societal factors interact to contribute to poor pregnancy outcomes requires multidisciplinary research. Nurses are well positioned to lead the challenge in ensuring every woman is afforded the same opportunity for favorable maternal and neonatal outcomes.

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Table 1

Demographic Characteristics of the Study Sample (n=166)

		n	%
Race	African American	155	93
	White non-Hispanic	9	5
	Other	2	2
Education	Less than High School	110	67
	High School Graduate/GED	45	27
	Some College/Trade School	5	3
	College/Trade School Graduate	6	3
Marital Status	Single	90	54
	Partnered/Not Married	56	34
	Married	17	10
	Other	3	2
Employment Status	Unemployed	127	77
	Employed Full Time	25	15
	Employed Part Time	14	8
Household Income	Under $10,000	76	46
	$10,001–$20,000	66	40
	$20,001–$30,000	12	7
	$30,001–$40,000	8	5
	>$40,000	4	2
Gravidity	Primigravida	54	32

Table 2

Classification of Adverse Neonatal Outcomes (n= 68/166)

Adverse Outcome[a]	***n***	**%**
SGA	27	16.3
LBW and SGA	16	9.6
Preterm, LBW, and SGA	6	3.6
Preterm and LBW	13	7.8
Preterm	6	3.6
Total	68	41.0

[a]The categories of adverse outcome are mutually exclusive

SGA = Small for Gestational Age
LBW = Low Birth Weight

Table 3

Correlations among the Main Study Variables (n = 166)

Variable	1	2	3	4
1. MFA	-			
2. Health Practices	.86*	-		
3. Adverse Neonatal Outcome[a]	−.52*	−.63*	-	
4. Pregnancy Wantedness[b]	−.28*	−.34*	.19*	-
5. Income[c]	.25*	.31*	−.23*	−.18*

*p <.05

[a]Referent group was no adverse outcome

[b]Referent group was pregnancy was wanted

[c]Referent group was income <$10,000/yr

Table 4

Summary of Logistic Regression Analyses Predicting Adverse Neonatal Outcomes[a] (n=166)

Predictor Variable	Odds Ratio	95%CI	Adjusted Odds Ratio*	95%CI
MFA	.91	[.88,.94]	.99	[.94, 1.05]
Health Practices	.91	[.89,.94]	.91	[.88,.96]

[a] Referent group was no adverse outcome

* Controlling for pregnancy wantedness, income, gestational diabetes and preeclampsia