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## A Literature Update on Maternal-Fetal Attachment

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### Abstract

**Objective**—To critically review and synthesize original research published since 2000 designed to measure factors that influence maternal-fetal attachment.

**Data Sources**—EBSCOhost Research Databases that included PubMed, CINAHL Plus, PsycINFO, and SCOPUS were searched for journal articles published in the past 7 years (2000–2007) that examined variables thought to increase, decrease, or cause no change in level of maternal-fetal attachment. Keyword searches included maternal-fetal attachment, parental attachment, and prenatal attachment.

**Study Selection**—Twenty-two studies were selected that met the inclusion criteria of original research, clear delineation of the measurement of maternal-fetal attachment, measurement of maternal-fetal attachment during pregnancy, and inclusion of women or couples, or both.

**Data Extraction**—Studies measuring maternal-fetal attachment included a broad range of variables as potential risk or protective factors, or both. Factors associated with higher levels of maternal-fetal attachment included family support, greater psychological well-being, and having an ultrasound performed. Factors such as depression, substance abuse, and higher anxiety levels were associated with lower levels of maternal-fetal attachment.

**Data Synthesis**—The large majority of studies reviewed were limited by small, homogenous samples deemed insufficient to detect significant differences, inconsistent measurement of maternal-fetal attachment during gestational periods, and cross-sectional designs.

**Conclusions**—Further research is essential to identify factors influencing maternal-fetal attachment. Specifically, research needs to be conducted on larger sample sizes of greater racial and ethnic diversity.

### Keywords

maternal-fetal attachment; attachment; prenatal attachment

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The significance of the relationship between a mother and her infant, as conceptualized by attachment theory (Bowlby, 1969), is well documented. There has been increased recognition over the past 20 years that the relationship between a mother and her child starts to develop before a child is born; that is, while the child is a fetus. However, the significance of this phenomenon is not as well studied as maternal-infant attachment. In a classic article, Cranley (1981) suggested that during the 9 months of gestation, both physical development of the fetus and transformation of a woman into a mother are occurring. She wrote, “integral to that development is the consideration of the woman’s identity, her role identity, the identity of her developing fetus, and perhaps most important, the relationship between herself and her fetus” (p. 281). The nature of this relationship has been referred to as

prenatal attachment. The development of this relationship is critical with research demonstrating a correlation between prenatal and postnatal attachment (Fleming, Ruble, Gordon, & Shaul, 1988; Leifer, 1980; Muller, 1996). Furthermore, optimal attachment in early infancy has been identified as an integral component in the future development of a child (Oppenheim, Koren-Karie, & Sagi-Schwartz, 2007).

This critical review builds on a recent integrative review of maternal fetal attachment (MFA) literature completed by Cannella (2005). The studies included in the review by Cannella focused on how MFA changes over time in addition to psychosocial and demographic variables with minimal mention of race/ethnicity. While Cannella's review included studies up to 2000, this current review includes studies published between 2000 and 2007. This update also highlights the limitations in the studies reviewed with an emphasis on the lack of research conducted on racial and ethnic minorities. Because there is increasing recognition that MFA is an important requirement to optimal maternal-infant adaptation (Bryan, 2000; Fuller, 1990; Muller, 1996), it is essential for clinicians and researchers to fully understand the implications of MFA levels in culturally diverse populations.

## Methods

Four electronic databases were systematically searched to identify research articles deemed relevant for this review. They included PubMed, CINAHL Plus, PsycINFO, and SCOPUS. The limits placed on the database searches included original research articles published between 2000 and 2007 that studied human participants and were written in English. The following inclusion criteria were used: (a) original research, (b) studies that clearly delineated the measurement of MFA, (c) measurement of MFA during pregnancy, and (d) women or couples, or both, included. Chosen studies were analyzed based upon the quality of research inclusive of design, methods, and clarity of results.

Search terms included maternal-fetal attachment, maternal-fetal relations, maternal-fetal bonding, maternal attachment, parental attachment, and prenatal attachment. Of note, the above terms were searched both with and without hyphenation and yielded slightly different results. The number of citations yielded and subsequently reviewed in each database is outlined in Table 1. The first database searched, PubMed, is a service of the U.S. National Library of Medicine that includes more than 17 million citations from MED-LINE and other life science journals for biomedical articles, dating back to the 1950s (U.S. National Library of Medicine, 2007). The first search was conducted in PubMed as it is the leading health sciences database, yielding the most comprehensive citations. From this search, 536 articles were identified that included the acknowledged search terms.

The second database searched was CINAHL Plus, which provides indexing for more than 3,000 journals from the fields of nursing and allied health, with coverage dating as far back as 1937 (EBSCO Industries, 2007). From this search, 42 articles were identified, of which 40 articles were duplicates of the PubMed search. The third search was conducted via PsycINFO, a database that provides abstracts and citations to more than 2,000 journals in the fields of behavioral sciences and mental health. This search produced 87 articles and 1 article not found in previous searches met inclusion criteria. Finally, SCOPUS, an electronic database containing more than 15,000 peer-reviewed journals highlighting scientific, technical, medical, and social science literature, was searched (Elsivier B.V., 2007). This final search yielded 146 articles, of which 98% were identified in the three previous database searches.

Of note, each database search yielded articles unique to that database. After articles were obtained through computerized searches, reference lists from these articles were evaluated

for nonidentified sources. Additionally, a detailed hand search from 2000 to March 2007 was accomplished to ascertain any missing literature from the following journals: the *Journal of Obstetric, Gynecologic, & Neonatal Nursing* and *American Journal of Maternal/Child Nursing*. These two journals were selected as they are regarded as premier resources for health care professionals committed to clinical scholarship that advances the health care of women and newborns with a focus on nursing practice. From this hand search, one additional article was obtained.

After completion of database searches as well as a hand review, articles were identified that met inclusion criteria and were considered appropriate for further examination. The in-depth review yielded a total of 22 articles identified for inclusion in this review. This review will begin with an overview of MFA including the instruments used in the selected studies. Next, a review of studies will be summarized according to the main concepts studied. Finally, a discussion of the findings as well as clinical implications and recommendations for future research will be highlighted.

Table 1 outlines the literature search results. Table 2 summarizes the quantitative and qualitative study methods in the reviewed studies including sample population and demographics, and Table 3 highlights the major findings related to MFA including those factors related to higher MFA, lower MFA, or indicative of no change in MFA.

## Definition and Measurement of MFA

Kennell, Slyter, and Klaus's (1970) observations of the intense grief displayed by mothers of infants who died during birth marked one of the first empirical suggestions that a prenatal connection existed between a mother and her unborn child. Further work by Klaus et al. (1972) demonstrated the deleterious effects of early separation between a mother and her child thereby focusing their efforts on interventions to enhance early postnatal attachment. These findings undoubtedly fueled the creation of the construct of prenatal attachment.

Difficulty arises in measuring MFA as a range of definitions exist in the literature. Rubin (1967) is frequently credited for her pioneering work on a woman's attainment of the maternal role. Rubin (1967) posited that the immediate bond between a mother and her neonate existed as a result of prenatal processes. Furthermore, she identified progressive stages of the process that begin during pregnancy and defined maternal identity as the endpoint in maternal role taking. Since its inception, Rubin has refined her theory of maternal role attainment; however, the basic premises have paved the way for other researchers.

In 1981, nursing researcher Cranley created the theoretical construct of MFA and defined MFA as "the extent to which women engage in behaviours that represent an affiliation and interaction with their unborn child" (Cranley, 1981, p. 282). Cranley developed the first antenatal attachment scale, the Maternal-Fetal Attachment Scale (MFAS), using the six aspects she had conceptualized during her dissertation work (Differentiation of Self from Fetus, Giving of Self, Role Taking, and Nesting). This instrument continues to be used most frequently by researchers interested in prenatal studies (Beck, 1999).

Muller (1990), another prenatal nurse researcher, defined prenatal attachment as "the unique, affectionate relationship that develops between a woman and her fetus" (p. 11). She developed the Prenatal Attachment Inventory (PAI), an instrument that measures prenatal attachment, based on previous attachment and adaptation to pregnancy literature. The PAI was designed to measure affectionate attachment: the personal, unique relationship that develops between a mother and her fetus (Muller, 1996).

Condon, an Australian researcher, also sought to explain MFA. Condon defined prenatal attachment as “the emotional tie or bond which normally develops between the pregnant parent and her unborn child” (Condon & Corkindale, 1997, p. 359). Condon also developed an instrument as he believed existing instruments were insufficient in differentiating the attitude toward the fetus from the attitude toward the state of pregnancy and motherhood. His instrument, the Maternal Antenatal Attachment Scale, focuses exclusively on thoughts and feelings about the baby.

The studies reviewed for this critique investigated a wide spectrum of variables as impacting MFA. Thus, studies will be discussed in logical groupings in response to variables studied as they relate to MFA.

## The Role of Technology and Diagnostics in MFA

It is only within the past 30 years that visualizing the living fetus has been possible. Previously, its life was often acknowledged once “quickening” developed, when the pregnant woman first felt her baby moving within her uterus. The option and ability to view the fetus as an independent being at an earlier point in pregnancy likely contributes to the maternal-fetal relationship developing at a much earlier point in fetal development (Stormer, 2003).

Five studies reviewed examined how the use of ultrasound impacted MFA. The majority of the studies examined the differences in levels of MFA when a three-dimensional (3D) or four-dimensional (4D) ultrasound was incorporated, while one study sought to evaluate the impact of ultrasound consultation on MFA. The majority of the studies did not find increased MFA in those women undergoing 3D or 4D ultrasound; however, Boukydis et al.’s (2006) study, which added a component of ultrasound consultation, noted increased MFA in the consultation group. There was also evidence in those studies that measured MFA prior to the performance of any type of ultrasound that MFA was increased based upon having an ultrasound (as opposed to type of ultrasound) (Righetti, Dell’Avanzo, Grigio, & Nicolini, 2005).

The length of time spent performing an ultrasound, expertise of the technician, opportunity to ask questions, and amount of information provided to patients are all important considerations when assessing the influence of ultrasound on MFA. Specifically, one would expect a longer duration of viewing one’s baby and a greater opportunity to ask questions pertaining to the ultrasound would influence the overall experience of an ultrasound. Other methodological factors that may have contributed to the discrepant findings included that several of the studies were either inconsistent in their reports of time spent with patients undergoing two-dimensional (2D) versus 4D ultrasound examinations or failed to discuss the time dedicated to the ultrasound experience in control groups undergoing 2D ultrasound as compared to those who were provided 3D/4D ultrasound (Pretorius et al., 2006; Righetti et al., 2005; Rustico et al., 2005). Additionally, it is difficult to assess the impact of 3D versus 2D ultrasound when the 3D ultrasound group is simultaneously provided a 2D ultrasound (Sedgmen, McMahon, Cairns, Benzie, & Woodfield, 2005).

Lawson and Turriff-Jonasson (2006) sought to examine MFA in groups who received favorable maternal serum screening (MSS) or amniocentesis results as well as a control group. Maternal-fetal attachment was lowest in women receiving favorable MSS results; however, MSS, unlike amniocentesis, does not provide women with definitive diagnostic results. Also, the women were more than 35 years of age, largely married, and White (more than 92%). Age is a consideration as findings have been conflicting when examining the relationship between maternal age and MFA (Lindgren, 2001; Muller & Mercer, 1993; Zachariah, 1994).

Several studies have highlighted factors that are influential in the development of MFA. Gestational age and the perception of fetal movement have been frequently associated with MFA; that is, findings that MFA increases both throughout the gestational period and once fetal movements were noted are well documented (Berryman & Windridge, 1996; Bloom, 1995; Wailand & Tate, 1993; Zachariah, 1994). These findings highlight the importance of accounting for gestational age as well as a mother's perception of fetal movement when measuring MFA. Several studies compared women with substantially varied levels of gestational length (greater than 10 weeks), while other studies only reported the mean gestational age (Boukydis et al., 2006; Lawson & Turriff-Jonasson, 2006; Pretorius et al., 2006).

Finally, none of the studies examining the impact of ultrasound on MFA included a description of race/ethnicity in their samples. Boukydis et al. (2006) described the sample as "low risk," while Pretorius et al. (2006) noted that their sample was obtained from a largely middle- and upper-class population. The failure to include considerations regarding race and ethnicity certainly limits the generalizability of all the studies reviewed and fails to add to the understanding of the influence of race, ethnicity, or culture on the development of MFA (Boukydis et al.; Pretorius et al.; Righetti et al., 2005; Rustico et al., 2005; Sedgmen et al., 2005).

## Demographic Variables

It is widely known that much of the health disparity in preterm delivery, low birth weight, and other poor pregnancy outcomes are associated with those racial and ethnic groups exposed to poor social, economic, and health conditions (Patrick & Bryan, 2005). Similarly, MFA has been shown to predict engagement in health practices with higher levels of MFA correlating with high-quality health practices (Walker, Cooney, & Riggs, 1999), such as receiving prenatal care (Lowry & Beikirch, 1998), maintaining a nutritionally sound diet (Abrams, Altman, & Pickett, 2000; Cnattingius et al., 2000), and getting regular exercise (Clapp, 2000; Koniak-Griffin, 1994). Given these associations, one would expect an abundance of research examining MFA in those groups predisposed to poor pregnancy outcomes. Unfortunately, this is not the case; rather, there is a dearth of research examining MFA as it relates to those individuals at higher risk of health disparities.

Two pilot studies were reviewed with one examining MFA in relation to ethnicity (Ahern & Ruland, 2003) and the other examining MFA in low-income women. Ahern and Ruland found no significant differences in MFA between African American and Hispanic American but appropriately acknowledged key variables not included in the interpretation of findings included family support systems and socioeconomic status. Additionally, the two groups were not comparable in educational level or marital status (100% of African American participants were single as compared to 40% of Hispanic American participants). Zachariah's (2004) prospective study included a convenience sample of Medicaid eligible women and found greater psychological well-being, in late pregnancy, was associated with higher levels of MFA; however, there was a high dropout rate that becomes critical when interpreting correlations such as psychological well-being and MFA.

## Mood State Influence on MFA

There is growing evidence that depression and anxiety disorders can begin prenatally and that the prevalence of depression during pregnancy is comparable to postpartum rates (Austin, 2003, 2004; Evans, Heron, Francomb, Oke, & Golding, 2001; Green, 1998). Hart and McMahon (2006) sought to examine the impact of depression and anxiety on MFA and found that those women characterized as having low quality of fetal attachment reported significantly higher levels of anxiety (state and trait) and depression. However, results must

be interpreted with caution given the small sample size, wide-ranging gestational ages, and homogeneity of the sample (majority highly educated, married, and employed).

Lindgren (2001, 2003) studied the relationship between MFA, prenatal depression, and health practices in pregnancy while considering variables such as pregnancy risk status, ethnicity, income, geographic location, and marital status. Among the findings were that women with lower depression scores had higher levels of MFA and MFA had significant direct effects on health practices. Both studies, as with all the studies reviewed, were limited by the reliance on self-report questionnaires and studied MFA over a wide gestational time period. However, the three studies (Hart & McMahon, 2006; Lindgren, 2001; Zachariah, 2004) taken together support the association of psychological well-being/distress and MFA.

## **Influence of Risks or Perceived Risks to the Pregnancy**

### **Previous Fetal Loss or Abnormality**

Perinatal loss is a traumatic event that can profoundly affect the lives of families. When a mother experiences such a loss she may grieve for many years, and a subsequent pregnancy may evoke great trepidation thereby disrupting attachment. Likewise, the diagnosis of a fetal abnormality may be devastating to a woman and her partner as abnormalities detected in utero rarely have options for treatment (Kenner & Dreyer, 2000; Sandelowski & Corson Jones, 1996a, 1996b).

Three studies (two quantitative and one qualitative) investigated the relationship of prenatal loss on MFA in subsequent pregnancies or the effect of detected prenatal abnormalities on MFA. One of two qualitative studies in this literature review was a phenomenological study undertaken to understand the lived experience of pregnancy while carrying a child with a known, nonlethal abnormality (Hedrick, 2005). The participants knowledge of the fetal abnormality did not compromise the development of MFA; rather, a theme of “the baby is not perfect, but (s)he is still mine” arose. Of note, participants were interviewed between 4 and 18 weeks after diagnosis, which may have influenced results.

The two quantitative studies both found that MFA was not negatively influenced by a history of previous fetal loss; however, Armstrong’s (2002) convenience sample was quite homogenous with more than 90% of participants being married, White, with upper middle income. Tsartsara and Johnson’s (2006) results were based on a small sample size ( $n = 35$ ) with a significant dropout rate in those participants with a history of fetal loss at the time of the second data collection ( $n = 5$ ; 14%), and while there was no mention of race/ethnicity, the majority of the sample were in married or cohabitating relationships. In all these studies, the availability of spousal or family support, or both, was likely beneficial to the women.

### **Assisted Reproduction**

A pregnancy achieved through in vitro fertilization (IVF) often marks the end of a lengthy period of childlessness and multiple medical procedures. Since the inception of IVF, there has been a dramatic increase in the number of women who conceive in this manner. One could hypothesize that women conceiving from IVF would demonstrate higher levels of MFA given the lengthy periods of infertility they have endured thereby raising their investment in the pregnancy. However, Hjelmstedt, Widström, and Collins (2006) found no differences in MFA between women conceiving via IVF versus those who conceived naturally though the baseline PAI scores collected at 26 weeks gestation when the fears of miscarriage and fetal abnormalities are decreased. The sample characteristics only included mean age and education level, which limited generalizability. And as with many of the studies reviewed, 100% of the participants were married or cohabitating (Hjelmstedt, Widström, and Collins).

### **Multifetal Pregnancies**

Damato's (2004) study assessed MFA in mothers of twins and failed to find attachment differed in twin versus singleton pregnancies. Of note, nearly 50% of the sample conceived through infertility treatments and more than 96% were married and White. Additionally, the convenience sample was recruited through mothers of twins' support group meetings. As with many of the studies, knowledge of how recruitment was carried out is important in interpreting results as those choosing to attend prenatal classes or support groups are more likely to receive adequate prenatal care.

### **Substance Use/Prior Custody Loss**

Prenatal illicit drug use is associated with poor maternal and infant outcomes including preterm labor, low birth weight, maternal and infant neurologic, cardiac and respiratory complications, and infant cognitive, motor, and psychological developmental delays (Bauer et al., 2002; Mehta et al., 2001; Singer et al., 2002). Substance use during pregnancy severely reduces a woman's ability to accomplish those maternal developmental tasks deemed vital to successful attachment: acting on the welfare and developing a loving relationship with the fetus, reducing risk behaviors, and ensuring a safe prenatal journey for the baby (Rubin, 1984).

Four studies reviewed examined perceived barriers to MFA including substance use and prior custody loss. Shieh and Kravitz (2002, 2006) studied a small sample of self-reported drug users and found no differences in MFA between groups differing on type of drug reportedly used (marijuana vs. cocaine/heroin), while their qualitative findings indicated women struggled with MFA often voicing guilt, uncertainty, and concern. These studies were limited by a small, convenience sample of self-reported drug users assessed after the detection of fetal movement without a comparison group of nonusers.

Lewis (2006) analyzed the impact of prior custody loss on MFA as compared to a nonloss control group, and while results indicate higher levels of MFA among those women experiencing a prior custody loss, the small sample size in the loss group ( $n = 9$ ) did not provide sufficient power to detect differences. Finally, a large study was conducted to examine MFA in smokers at varying levels of stages of change classifications versus nonsmokers (Slade, Laxton-Kane, & Spiby, 2006). While attachment scores in the smoking group were highest among those in the contemplation phase, it was not possible to determine the direction of cause and effect (i.e., is there an activation of attachment processes as a mother progresses toward quitting or is a mother who manifests greater attachment qualities more likely to move forward through the stages of change).

### **Early Family Influence on MFA**

It is becoming increasingly evident that the quality of the mother-infant relationship is strongly correlated with the way a mother remembers her own childhood experiences (Fonagy, Steele, & Steele, 1991; Main & Hesse, 1990; Ward & Carlson, 1995). Siddiqui, Hägglöf, and Eisemann's (2000) study provided support with the mothers' childhood memories of their own upbringing a significant determinant in the quality of prenatal attachment. Again, the study was primarily middle class and only 0.6% of the sample reported being single while the pregnancy was planned in more than 75% of the sample. The only longitudinal study in this review and one of the few addressing paternal attachment was conducted to explore relationships among family dynamics, paternal-fetal attachment, and MFA, and infant temperament (Wilson et al., 2000). Among the findings were that mutuality was associated with greater fetal attachment for both mothers and fathers. Mutuality involves a security in familial relationships that may promote the acceptance of a new member in the family (Wilson et al.). Race was the only statistically significant demographic

variable with African American women reporting lower MFA scores; this is consistent with other research that used Cranley's (1981) MFAS (Bloom, 1995; Fuller, Moore, & Lester, 1993; Mercer et al., 1991). Because the MFAS measures behaviors representative of an affiliation with the fetus, it is important to consider how these behaviors may be indicative of cultural differences thus limiting the usefulness of such measures across different racial, ethnic, and cultural groups. Questions regarding the validity of the MFAS in African Americans have not been sufficiently examined (Wilson et al.).

## Discussion

The principle findings of this systematic review reveal that there are certain factors that threaten MFA including depression, anxiety, and substance abuse, while others appear to enhance MFA. Unfortunately, those factors deemed favorable to MFA are often highly correlated with higher socioeconomic status such as improved access to timely and comprehensive prenatal care (ultrasound) and the presence of stable family relationships and support systems. The scarcity of research on MFA in ethnic minorities was both surprising and disappointing.

Most of the studies had methodological or design limitations that preclude a more comprehensive understanding of MFA. Limitations include inadequate operational definition of the construct, small homogenous samples, and insufficient consideration of culture. Maternal-fetal attachment, as measured by the scales in the reviewed studies, is consistently related to the planning of pregnancy, strength of marital relationship, and gestational age (Shieh, Kravitz, & Wang, 2001). Many of the studies neither accounted for nor adequately addressed those aspects deemed especially relevant to MFA. The overwhelming majority of studies did not include any mention of spousal or partner support, and many used a wide spectrum of gestational ages thereby diminishing the validity of findings.

While the majority of studies examining differing types of ultrasound found no difference in MFA based upon type of ultrasound, there was a consistent finding of increased MFA after an ultrasound was performed or after consultation was provided. Unfortunately, these studies do not take into account the very populations most at risk for poor outcomes. Racial inequality may function as a limiting factor in access to quality health care (Jackson, Phillips, Hogue, & Curry-Owens, 2001). Minority women reported that they receive less prenatal education on topics such as sexually transmitted infections, family planning, and factors contributing to preterm birth.

Additionally, they are also less likely to receive diagnostic evaluations such as ultrasound examination or amniocentesis (Patrick & Bryan, 2005). Unfortunately, the majority of studies addressing racial and ethnic disparities in prenatal care have investigated a limited number of measures, namely the onset of prenatal care and number of appointments attended as opposed to assesses how the content or relevance of medical care, received prenatally, varied by race and ethnicity (Gavin, Adams, Hartmann, Benedict, & Chireau, 2004).

## Clinical Implications and Future Directions

While research on MFA has increased over the past 20 years, significant gaps remain in examining the relationship between MFA and aspects of prenatal care. A critical aspect of MFA, which has been inadequately addressed, is the relationship between MFA and health practices during pregnancy. Lindgren's (2001, 2003) research illustrated the link between the two; however, she rightfully acknowledged that the cross-sectional designs prevent

causal inferences. Other factors that likely impact MFA yet remain understudied or yet unstudied include how a history of child abuse or the experience of intimate partner violence influence MFA. While there has been a steady accumulation of research on the impact of trauma on infant development, inclusive of attachment, similar yields have not been noted when examining MFA. There are suggestions that low levels of prenatal attachment may be related to forms of fetal abuse; however, only two studies to date have examined this relationship thus highlighting the need for further research (Laxton-Kane & Slade, 2002; Pollock & Percy, 1999).

The measures of MFA warrant further investigation. Several studies using the MFAS calculated subscale scores for analysis that report lower reliability as compared to overall scores (0.52–0.73 vs. 0.85) (Beck, 1999). Also, the two most commonly used instruments in measuring MFA for this review capture different aspects of MFA; that is, the MFAS emphasizes behaviors indicative of MFA, while the PAI emphasizes affiliation (Muller & Mercer, 1993).

Future studies should include longitudinal designs to augment our understanding of the maternal-fetal and maternal-infant relationship over time as well as how other variables influence the maternal attachment process. Finally, there is a need for more qualitative studies to be conducted, particularly in ethnic minority groups, in an effort to further expand constructs while consequently improving measurement tools for these populations. Nurses are ideally suited to contribute to furthering research on MFA by expanding research on the relations of MFA, health practices in pregnancy, and implications of poor MFA in ethnically diverse populations. If poor levels of MFA are identified during the course of a woman's pregnancy, then appropriate interventions should be implemented to assist a woman in achieving a physically and psychologically sound pregnancy in an effort to best optimize maternal and fetal health.

## Conclusions

The transition to motherhood is both complex and challenging. It requires extensive effort psychologically, socially, and physically. Maternal-fetal attachment has been considered both a developmental task of pregnancy and an indicator of adaptation to pregnancy, as well as being positively associated with prenatal health practices (Callister, 2002; Lindgren, 2001). As health care providers, it is our responsibility to work tirelessly in conducting and using research as the basis for the elimination of barriers and inequities in prenatal care thereby offering each woman the most favorable opportunities for a healthy pregnancy and healthy child.

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**Table 1**

## Literature Search Results

<b>Database Searched</b>	<b>Citations Retrieved</b>	<b>Original Abstracts Reviewed</b>	<b>Articles Selected</b>
PubMed	536	124	17
CINAHL Plus	42	11	2
PsychINFO	87	8	1
SCOPUS	146	5	1
Hand search		9	1

**Table 2**

## Quantitative and Qualitative Study Methods in Studies Examining Maternal-Fetal Attachment

First Author (Year)	Area of Study	Data Collection Method	Sample Population and Demographics	Location
Rustico (2005)	Role of technology: u/s	Self-completed questionnaire (MAAS) administered after 2D or 4D u/s	<i>N</i> = 100 (convenience), mean age = 32.3 years, no description of race/ethnicity	Maternal-Fetal Medicine Clinic; Milan, Italy
Righetti (2005)		Self-completed questionnaire (MAAS/PAAS) administered before 2D or 4D u/s and 2 weeks later	<i>N</i> = 88 (convenience), mean age = 33.7 years, no description of race/ethnicity; all couples ( <i>N</i> = 44)	Hospital Vittore Buzzi, Milan, Italy
Pretorius (2006)		Self-completed questionnaire (MFAS) administered after 2D and after 3D/4D u/s (potential time lapse between 2D and 3D/4D for some)	<i>N</i> = 142 (convenience), 89 mothers and 53 fathers, no description of any other demographic variables, 'most' women between 18 and 28 weeks gestation	San Diego, California— inferred from author's correspondence/affiliation
Sedgmen (2005)		Self-completed questionnaire (MAAS) administered prior to and 1–3 weeks after 2D or 2D + 3D u/s	<i>N</i> = 68 (convenience), all age greater than 18 years, no description of any other demographic variables, <i>N</i> = 24 scanned between 12 and 14 weeks and <i>N</i> = 44 scanned between 18 and 22 weeks	Nepean Hospital Western Sydney
Boukydis (2006)		Self-completed questionnaire (MFAS) administered immediately before and after routine u/s (SC) or u/s with consultation (UC)	<i>N</i> = 52 (convenience): 24 SC and 28 UC, mean age = 23.3 years (no SD reported), no description of race/ethnicity; SES; partner status; education; sample described as "low risk," mean gestational age = ~19.6 (no SD reported)	Obstetric Ultrasound Unit, Hutzel Hospital, Detroit, Michigan
Lawson (2006)	Role of technology: MSS	Self-completed questionnaire (PAI)—time of administration/completion not outlined	<i>N</i> = 101 (convenience): 31 amniocentesis, 32 MSS, and 38 control, age greater than 35 years; 92% White, 95% married/common law relationship; gestational age = 16–40 weeks	Two midwestern urban settings
Lindgren (2001)	Demographic variables and mood state	Self-completed questionnaire (MFAS) returned in mail	<i>N</i> = 252 (convenience), mean age = 29.5 years, SD = 6.13; 77.4% White, 22.3% ethnic minority; gestational age = 20–40 weeks	Two midwestern urban settings
Lindgren (2003)		Self-completed questionnaire (MFAS) returned in mail; Secondary Data Analysis of Lindgren (2001) study	<i>N</i> = 252: 197 SU, 55 innercity; mean age = 31 years (SU), 24.1 years (innercity); 90% White (SU), 57.4% African American (innercity); 83.8% partnered (SU), 29.1% partnered (innercity)	Two midwestern cities
Ahern (2003)		Self-completed questionnaire (MFAS); pilot study	<i>N</i> = 40 (convenience); 50% African American, 50% Hispanic; age range	Two prenatal clinics located in two mid-Atlantic states

First Author (Year)	Area of Study	Data Collection Method	Sample Population and Demographics	Location
			= 18–36 years; gestational age = 20–32 weeks (significant difference between two groups); 100% of African Americans were single, 40% of Hispanics were single	
Zachariah (2004)		Self-completed questionnaire (PAI) administered between 14 and 22 weeks (T1) gestation and 28–42 weeks gestation (T2); pilot study	<i>N</i> = 49 (convenience); 25 completed questionnaire at T2; 48.9% African American, 26.7% White, 6.7% Hispanic; 26.7% less than high school education, 40% with high school education	Prenatal clinic in an urban area in the midwestern United States
Hart (2006)		Self-completed questionnaire (MFAS)	<i>N</i> = 53 (convenience), age range = 21–44 years, No description of race/ethnicity, more than 94% in partnered relationship	Midwives clinic at a teaching hospital in Sydney, Australia
Armstrong (2002)	Risks or perceived risks to pregnancy: previous fetal loss or abnormality	Self-completed questionnaire (PAI) administered between 16 and 32 weeks gestation	<i>N</i> = 103 (convenience): 40 couples pregnant after previous loss, 33 couples first pregnancy, and 30 couples hx successful pregnancies; age range = 18–45 years; 90% White, 93% married, mostly upper middle income; gestational age = 16–32 weeks	Prenatal clinics, education classes, private medical practices, and perinatal loss support groups, within United States (large percentage in Kentucky)
Hedrick (2005)		Qualitative study with individual interviews taking place 4–18 weeks after diagnosis of fetal abnormality	<i>N</i> = 15 (convenience), age range = 18–44 years; ~73% White, ~20% African American; ~2/3 married; gestational age = 24–36 weeks	Outpatient perinatal center at large midwestern hospital
Tsartsara (2006)		Self-completed questionnaire (MAAS) returned by mail between 8 and 12 weeks (T1) gestation and during third trimester (T2)	<i>N</i> = 35 (convenience): 24 completed questionnaire at T2, age range = 19–44 years, ~86% married or cohabitating, no description of race/ethnicity	Community midwife centers of a General Hospital in the Midlands, United Kingdom
Hjelmstedt (2006)	Risks or perceived risks to pregnancy: assisted reproduction/multifetal pregnancies; substance use/prior custody loss	Self-completed questionnaire (PAI) administered at 26 weeks (T1) and 36 weeks (T2) gestation	<i>N</i> = 97 (convenience): 56 in vitro fertilization and 41 control, age range = 29–36 years, all women partnered	Stockholm, Sweden
Damato (2004)		Self-completed questionnaire (PAI) returned by mail between 11 and 40 weeks gestation	<i>N</i> = 214, age range = 18–47 years, more than 96% White, more than 98% married, majority high SES	41 of the United States

First Author (Year)	Area of Study	Data Collection Method	Sample Population and Demographics	Location
Shieh (2002)		Semistructured interview with 26 open-ended questions based on items from MFAS and PAI	<i>N</i> = 41 (convenience), age range = 16–37 years; 65% African American, 17.5% Hispanic, 17.5% White; more than 87% single	Prenatal clinic of large tertiary medical center in the northeastern United States
Shieh (2006)		Self-completed questionnaire (MFAS) administered prior to substance abuse history interview during second or third trimester	<i>N</i> = 40 (convenience): 19 marijuana, 21 cocaine/heroin; mean age = 23.4 years (marijuana), 29.4 years (cocaine/heroin); 79% African American, 21% Hispanic (marijuana); 53% African American, 33% White, 14% Hispanic (cocaine/heroin); more than 86% single in both groups	Prenatal clinic of large tertiary medical center in the northeastern United States
Slade (2006)		Self-completed questionnaire (MAAS) administered at mean gestation age of 14.1 weeks ( <i>SD</i> = 2.8)	<i>N</i> = 637 (convenience): categorized according to stage of change for smoking status, mean age = 28.3 years ( <i>SD</i> 5.3), no description of race/ethnicity, more than 95% partnered	Hospital maternity services in the United Kingdom
Lewis (2006)		Self-completed questionnaire (MFAS) administered after 27 weeks gestation	<i>N</i> = 67 (convenience): 9 hx custody loss, 58 nonloss; mean age = 32 ± 7.6 (loss), 26.8 ± 4.9 (nonloss); ~78% African American, 22% Hispanic (loss); ~55% African American, 31% Hispanic, 10% biracial (nonloss)	Four New York City hospital neighborhood clinics
Siddiqui (2000)	Family influence	Self-completed questionnaire (PAI), revised version, administered in third trimester	<i>N</i> = 171 (convenience), no description of mean age, race/ethnicity; 0.6% single mothers	Sweden —inferred from author's affiliation
Wilson (2000)		Self-completed questionnaire (MFAS) administered in third trimester	<i>N</i> = 218: 156 women and 62 partners (time 1 only relevant), mean age = 24 years, women = ~76% White and ~21% African American	Nine rural counties in Florida

*Note.* 2D = two dimensional; 3D = three dimensional; 4D = four dimensional; u/s = ultrasound; SU = small urban; MSS = maternal serum screening; MFAS = Maternal-Fetal Attachment Scale; MAAS = Maternal Antenatal Attachment Scale; PAI = Prenatal Attachment Inventory; SES = socioeconomic status; PAAS = paternal antenatal attachment scale; SC = standard care; UC = ultrasound consultation.

Table 3

## Results by Study (Higher MFA, No change in MFA, and Lower MFA)

First Author (Year)	Major Findings Related to MFA	Limitations
Studies demonstrating factors-associated with higher levels of MFA		
Siddiqui (2000)	Higher MFA, as measured by PAI, in those women recalling more emotional warmth from mothers during childhood. Recall of rejection from fathers also contributed to higher total PAI scores	Wide variation in maternal age (21–50 years); sample highly partnered; questionnaires completed late in pregnancy (third trimester); amount/type of prenatal care received prior to data collection not included; race/ethnicity not included
Wilson (2000)	Higher MFA, as measured by MFAS, in those families with reported “mutuality.” African American women reported lower levels MFA	Family dynamics measure, used to measure mutuality-isolation, requires two adults in family (study added committed to each other but how “commitment” measured not outlined); 21.2% of women were African American, while 6% of “father” participants were African American; questionnaires completed late in pregnancy (third trimester)
Zachariah (2004)	Stronger MFA, as measured by PAI, noted in late pregnancy in those with greater psychological well-being. MFA increased from early to late pregnancy	Pilot study with very high dropout rate at T2 questionnaire; wide variation in T1 administration, perception of fetal movement not assessed; amount/type of prenatal care received prior to data collection not included
Pretorius (2006)	Higher MFA, as measured in subscale of MFAS, for mothers only after completion of 3D/4D u/s	Cranley (developed MFAS) cautions against using subscales for results interpretation; varied time between 2D and 3D/4D u/s; wide variation in gestational age; small sample size ( $n = 89$ mothers completed both questionnaires); no demographic variables included
Sedgmen (2005)	Higher MFA, as measured by MAAS, after both 2D and 3D u/s effect moderated by timing of exposure with those receiving u/s at 12 weeks showing greatest change	Very small sample size after adjusting for gestational age at u/s exposure; time spent performing scans (for differences in gestational age as well as type of u/s not included); very limited demographic variables included
Boukydis (2006)	Higher MFA, in overall MFAS scores, for those women in the u/s consultation group	Only reported mean gestational age; small sample size; limited demographic variables
Lewis (2006)	Higher MFA, as measured by MFAS, in those women with a hx of previous custody loss compared to those women without a hx of custody loss	Extremely small sample size in loss group; ~1/2 of loss group reported voluntary relinquishment of children; wide range in incidence of loss (1–6), wide range of last incident of loss (5 months to 13 years)
Slade (2006)	Higher MFA, as measured by MAAS, in those women in preparation stage for smoking cessation compared to those women in other stages or nonsmokers	Determination of direction of cause and effect not possible; cross-sectional; race/ethnicity not included; amount/type of prenatal care received prior to data collection not included (i.e., amount of smoking education provided by HCP’s)
Studies demonstrating no difference in MFA		
Armstrong (2002)	Previous perinatal loss not associated with differing levels of MFA, by PAI, as compared to those pregnant for the first time or those pregnant with history of successful pregnancies	Amount/type of prenatal care received prior to data collection not included; homogenous sample except for wide variation in maternal age; loss group recruitment included support groups
Lindgren (2003)	No significant differences in MFAS scores between innercity versus urban dwelling women. For innercity women only, lower MFA scores indicated lower health practices	Small sample size of innercity women; variation in gestational age; amount/type of prenatal care received prior to data collection not included
Ahern (2003)	No significant differences in total MFAS scores between African American and Hispanic women	Pilot study; wide variation in gestational age between groups; major differences in key demographic variables (partner status and education)
Damato (2004)	No significant differences in MFA, measured by PAI, in twin versus singleton pregnancies. Twin attachment factors quite similar to those in singleton pregnancies (gestational age, fetal movement, and maternal age)	Women recruited through mothers of twins support groups; highly homogenous sample (more than 96% White and more than 98% married); amount/type of prenatal care received prior to data collection not included
Righetti (2005)	No difference in MAAS scores between 2D versus 4D u/s immediately prior to scan and 2 weeks postscan; “global and quality scores showed statistically significant increase pre-post test (though not outlined by type of ultrasound)	Time spent performing each scan not included; small sample size; race/ethnicity not included; all participants partnered

First Author (Year)	Major Findings Related to MFA	Limitations
Hedrick (2005)	MFA not impacted, through phenomenological study, in those women pregnant with a child with a known, nonlethal congenital abnormality. Theme, related to MFA, arose —“The baby is not perfect, but s(he) is still mine”	Wide variation between diagnosis of fetal abnormality and time of interview; all patients received prenatal care/ diagnostic testing in first or second trimester
Rustico (2005)	No difference in MAAS scores between 2D versus 2D plus 4D u/s	Wide variation in gestational age; 4D group also received 2D u/s at time of MAAS measurement; discrepancy on time estimates spent with each group; race/ethnicity not included
Tsartsara (2006)	No difference in MFA, by MAAS, between those women with hx of miscarriage and those without	Small sample size with significant dropout rate at T2 in those women with hx miscarriage (T1 = 10 and T2 = 5); large majority married or partnered; race/ethnicity not included
Hjelmstedt (2006)	No difference in MFA, by PAI, for those women who conceived naturally versus those who conceived through in vitro fertilization. Increase in MFA noted in both groups between T1 and T2	Assessed fairly late in pregnancy at T1 and T2; amount/type of prenatal care received prior to data collection not included; women all deemed low risk, all partnered
Shieh (2006)	No difference in MFA, by MFAS, between women reporting marijuana use versus women reporting cocaine/heroine use	Small sample size; wide variation in gestational age; differences in demographics between 2 groups; severity of drug use collected by self-report; initiation of prenatal care calculated; no discussion of abnormal fetal or maternal health measures
Studies demonstrating factors-associated with lower levels of MFA		
Lindgren (2001)	Women with lower levels of MFA (by MFAS) reported fewer positive health practices. Depression significant predictor of MFA. Increased maternal age correlated with lower MFA scores	Wide variation in gestational age; cross-sectional design making cause-effect determination impossible; all instruments self-report
Shieh (2002)	MFA not found to necessarily be higher or lower; rather, characterized as a struggle with discernible guilt, concern, and uncertainty. Semistructured interview based on items from MFAS and MAAS. Pregnant women using illicit drugs interviewed	All women had experienced quickening; amount/type of prenatal care received prior to data collection not included; limited information on drug-use history (length/frequency of use, treatment experiences, and current counseling)
Hart (2006)	Higher scores of trait and state anxiety related to more negative quality of attachment by MAAS (not significant for intensity and global scores)	Small sample size; wide variation in maternal age and gestational age; homogenous sample with respect to partner status, education, employment; race/ethnicity not included
Lawson (2006)	Lower MFA, by PAI, in MSS group as compared to amniocentesis and no testing groups	Wide variation in gestational age; description of questionnaire administration time versus testing time not included; previous diagnostic testing experiences not included; highly homogenous sample

*Note.* 2D = two dimensional; 3D = three dimensional; 4D = four dimensional; MFA = maternal-fetal attachment; MSS = maternal serum screening; MFAS = Maternal-Fetal Attachment Scale; MAAS = Maternal Antenatal Attachment Scale; PAI = Prenatal Attachment Inventory; HCP = health care provider; hx = history.