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From parental-fetal attachment to a parent-infant relationship: a systematic review about prenatal protective and risk factors

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Abstract

Developing an attachment to an unborn child is considered a milestone in the future parents' developmental trajectory. Furthermore, the quality of the parent-fetus relationship is related to the quality of the postnatal parent-infant relationship.

We have aimed to provide an overview of the recent findings highlighting factors that can influence parental prenatal attachment and the postpartum parent-child relationship. PubMed and PsycINFO were systematically explored looking for longitudinal studies, published from 2005 to 2016, reporting clearly the prenatal attachment measures used.

We found 28 studies heterogeneous for sampling techniques, sample size and periods of assessment. Studies considered a broad range of individual, relational and contextual variables as potential risk or

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protective factors, but no one has of yet evaluated the interaction between them. The main focus remains on mothers. From these studies emerged conflicting and difficult to generalize results, and this does not facilitate the understanding of the phenomenon investigated.

The current literature needs to be integrated with more longitudinal studies using comparable tools and periods of observation, at either a normal or at risk sample. There is also need for additional studies focused on fathers and couples, and considering the effects of the fetal behavior on the development of prenatal attachment.

Keywords: Parental-fetal attachment; Pregnancy; Transition to parenthood.

1. Introduction

Developmental research has firmly established the quality of the relationship between an infant and his or her parent as an important factor influencing the child's later development (DeKleyn & Greenberg, 2008; Lyons-Ruth & Jacobvitz, 2008; Weinfield, Sroufe, Egeland, & Carlson, 2008). When children develop a secure relationship with their parents or caregivers in their first years of life, they generally have better cognitive outcomes, better social interactions, display less behavioral problems and have higher achievements at school (Thompson, 2008). The development of the parent-infant attachment relationship does not start after the child is born, but already exists during pregnancy (Brandon, Pitts, Denton, Stringer, & Evans, 2009).

The term parental-fetal attachment has been created to define the specific bond that parents develop towards the fetus during pregnancy. Several studies have found that the quality of the parent-fetus relationship is related to the quality of the postnatal parent-infant relationship (Siddiqui & Hägglöf, 2000; Theran, Levendosky, Bogat, & Huth-Bocks, 2005). It is assumed that the prenatal parent-infant relationship influences the parent's daily interactions with the child after birth, subsequently affecting the quality of the parent-infant relationship and child development.

Analysis of literature suggests that prenatal attachment during pregnancy is not the same kind of attachment relationship as Bowlby (1969) and Ainsworth, Blehar, Waters and Wall (1978) defined, but rather, is a multi-dimensional construct guided by the caregiving system (Walsh, 2011). "Attachment" traditionally has had a particular meaning as a specific aspect of the relationship that is formed between the infant and parent after birth, which functions to make the infant, and later the child, feel himself safe, secure and protected. The prenatal "attachment" is a different phenomenon, although the same terminology is commonly used. While it is appreciated that "attachment" can be used in this way, the process of the later attachment is quite clearly based on a bidirectional social psychological interaction of an infant with primary caregivers who, it is anticipated, can provide a secure base from which to start exploring. In contrast, the relationship that develops during pregnancy is unidirectional, embodying maternal or paternal cognitions and emotional responses to the pregnancy and the growing fetus (Redshaw & Martin, 2013). Di Pietro, Voegtline, Costigan, Aguirre, Kivlighan and Chen (2013) and Di Pietro, Irizarry, Costigan and Gurewitsch (2004) proposed the bidirectional nature of the maternal-fetal relationship.

The most convincing evidence of a link between maternal psychological functioning and fetal neurobehavior was generated from experimental designs in which the maternal state is experimentally manipulated and the effects on the fetus are observed. While such findings are supportive of the role of the maternal context in affecting prenatal development, the potential upstream effects are generally unacknowledged. These effects, from the fetus to the pregnant woman, may serve as potential regulators of subsequent maternal adaptation to pregnancy and child rearing.

Although parental prenatal attachment is considered to be a multi-dimensional construct, definitions and measurements vary. Cranley (1979) wrote the first literature review of the subject as her dissertation, proposing a multidimensional model composed of six aspects of Maternal-Fetal Attachment (MFA) that she identified in her research. By virtue of this early work and her subsequent development of a scale to measure MFA (Cranley, 1981), Cranley is considered the formal creator of the theoretical construct and credited with its first definition: “The extent to which women engage in behaviors that represent an affiliation and interaction with their unborn child” (1979, p. 282).

Müller (1990) and Condon (1993) found Cranley’s work insufficient in the description of MFA. Müller found this strategy of conceptualizing the phenomenon to be so focused on behaviors that it excluded the thoughts and fantasies that she believed also revealed the growing affiliation between mother and fetus. In her work, she redefined prenatal attachment as “the unique relationship that develops between a woman and her fetus. These feelings are not dependent on the feelings the woman has about herself as a pregnant person or her perception of herself as a mother” (Müller, 1990, p. 11). Müller proposed a new model of attachment in pregnancy, postulating that an expectant mother’s early experiences with her own mother (or primary caregiver) lead to the development of internal representations, which then influence subsequent attachments to family, partner, and friends. Ultimately, this process enables a woman to adapt to pregnancy and attachment to her fetus (Müller & Ferketich, 1993).

Condon went back to adult attachment theory and proposed that Bretherton’s broad view of attachment as an “emotional tie” or “psychological bond” to a specific object was not only applicable to MFA, but added coherence to the construct (Condon, 1993). Condon suggested that prenatal attachment contained the core experience of love and could be described as a developing relationship in which the mother seeks to know, to be with, to avoid separation or loss, to protect, and to identify and gratify the

needs of her fetus. He later formally defined prenatal attachment as simply, “the emotional tie or bond, which normally develops between the pregnant parent and her unborn infant” (Condon & Corkindale, 1997, p. 359).

These three definitions related to the developing construct of prenatal attachment did not have much in common. The most recent conceptualization of prenatal attachment attempted to combine these behavioral, cognitive, and emotional approaches in this working definition: “Prenatal attachment is an abstract concept, representing the affiliative relationship between a parent and fetus, which is potentially present before pregnancy, is related to cognitive and emotional abilities to conceptualize another human being, and develops within an ecological system” (Doan & Zimmerman, 2003, p. 110).

Several mother-fetus relationship scales have been developed: Maternal Fetal Attachment Scale (MFAS) (Cranley 1981; Busonera, Cataudella, Lampis, Tommasi, & Zavattini, 2016a), Maternal Antenatal Attachment Scale (MAAS) (Condon 1993; Busonera, Cataudella, Lampis, Tommasi, & Zavattini, 2016b) and Prenatal Attachment Interview (PAI) (Müller, 1993; Della Vedova, Dabrassi, & Imbasciati, 2008) are more often used in mother-fetus relationship research. Condon (1993) developed a questionnaire to specifically examine the prenatal attachment of fathers toward the unborn baby, known as Paternal Antenatal Attachment Scale (PAAS).

1.1. Prenatal attachment in expectant mothers and fathers: risk and protective factors

Developing an attachment for one’s unborn child is considered an important milestone in the future parents’ developmental trajectory (Kunkel & Doan, 2003; Van den Bergh & Simons, 2009). The transition to parenthood and the period of childbearing is recognized as a challenging period of life, demanding change and adjustments for both women and men (Nyström & Öhrling 2004; Velotti, Castellano, & Zavattini, 2011). This period is widely considered a period of increased vulnerability that is often accompanied by stress. A mismatch between parents’ perception of the available resources for meeting the demands of parenthood and the perceived demands of the parenting role can cause parental stress (Morse, Buist, & Durkin, 2000).

Maternal attachment literature has indicated that attachment intensity increases over time as the pregnancy proceeds (Barone, Lionetti, & Dellagiulia, 2014; Sjogren, Edman, Widstrim, Mathiesen, & Uvnäs-Moberg,

2004) and is also positively correlated with fetal movement (Zeanah, Carr, & Wolk, 1990). High levels of depression or anxiety and low levels of social support impede maternal-fetal attachment (Lindgren, 2001). For instance, findings from a Swedish study showed that emotional warmth experienced by a woman with her own mother during childhood was positively associated with the development of affection toward her unborn baby (Siddiqui & Hägglöf, 2000). Moreover, a woman's feeling of security in family relationships has been found to promote maternal-fetal attachment (Wilson, White, Cobb, Curry, Greene, & Popovich, 2000). Mothers' prenatal representations are stable into the postnatal period and are associated with postnatal parenting behavior (Dayton, Levendosky, Davidson, & Bogat 2010; Theran *et al.*, 2005). Research on prenatal attachment has mainly focused on expectant mothers rather than on fathers.

Nevertheless, not only mothers but also fathers may feel more or less attached or connected to their unborn child (Armstrong, 2002), since for them also, pregnancy is a time of psychological preparation. Condon (1985) described father-fetus bonding as a subjective feeling of love for the unborn child, which is at the heart of a man's experience of early parenting. A limited number of studies have focused on different aspects of fathers' experiences of pregnancy and of the fetus. During the transitional period, expectant fathers may encounter some difficulties, such as feelings of disharmony in their relationship with partners, incredulity with regard to their unborn children and problems in developing a parental identity (Slade, Cohen, Sadler, & Miller, 2009; Genesoni & Tallandini, 2009).

Fathers are, on one hand, expected to develop representations of the unborn baby and to create an attachment relationship with a child they have not met. On the other hand, they do not experience the same physiological changes women undergo during pregnancy. This may make the pregnancy less tangible. In this phase, it may be hard for fathers to experience the unborn baby as a real child. Vreeswijk, Maas, Rijk and Van Bakel (2014) showed that fathers generally showed more disengaged representations of their infants during pregnancy than do mothers, indicating that they are psychologically less involved.

In addition to this, fathers may experience changes in the relationship with their partner, as well as several stressors that are specifically associated with pregnancy, such as concerns for the wellbeing of the unborn child and the mother (Dunkel Schetter, 2011; Whisman, Davila, & Goodman, 2011). These challenges may be time-consuming and may worry the father,

negatively influencing the relationship he is able to form with the unborn baby.

Habib and Lancaster (2010) found that feelings of prenatal attachment increase between the first and third trimesters of pregnancy in first-time expectant fathers. This is in accordance with results found in mothers, who also report increases in feelings of attachment during the course of pregnancy (van Bussel, Spitz, & Demyttenaere, 2010). In addition to psychological changes, physiological and hormonal changes have been observed in men during and shortly after pregnancy. They generally experience significant changes in concentrations of prolactin and cortisol, as well as in concentrations of testosterone pre- and postnatally, in line with patterns found in women (Alvergne, Faurie, & Raymond, 2009; Gettler, McDade, Feranil, & Kuzawa, 2011). These results illustrate that not only do women experience major changes during pregnancy, but expectant fathers are also directly affected in their psychological and physical functioning.

Most of the longitudinal studies on the transition to fatherhood reported in literature have commenced during the third trimester, and have then been followed up with at one or more steps after the birth (Barclay & Lupton, 1999; Strauss & Goldberg, 1999). A few studies commenced at mid-pregnancy (Morse *et al.*, 2000; Buist, Morse, & Durkin 2003; Condon, Boyce, & Corkindale, 2004).

Although one might assume that the way women and men interact with the unborn child may differ, evidence demonstrating that gender differences in feelings of prenatal attachment is not consistent. Studies comparing maternal and paternal antenatal bonding show contradictory results, with some studies showing mothers having more and stronger feelings of bonding towards the fetus compared to their partners (Ustunsoz, Guvenc, Akyuz, & Oflaz, 2010), whereas other studies failed to demonstrate such differences (Wilson *et al.*, 2000) or even yielded opposite findings (White, Wilson, Elander, & Persson, 1999).

Recent studies have determined that a father's support during the prenatal period may play an important role in preventing infant mortality, preterm birth, low birth weight, and small-for-gestational-age birth. Similarly, previous research has determined that obstetric complications, such as anaemia, eclampsia, and placental abruption, are more prevalent among women whose babies' fathers were absent during pregnancy (Padilla & Reichman, 2001; Tan, Wen, Walker, & Demissie, 2004; Alio, Mbah, Grunsten, & Salihu, 2011; Alio, Mbah, Kornosky, Wathington, Marty, & Salihu, 2011).

Moreover, only a few studies have evaluated both the feelings of prenatal attachment in women and their partner concurrently (Lorensen, Wilson, & White, 2004; Ustunsoz *et al.*, 2010). Whether mothers and fathers have the same or different ways of thinking and feeling about their babies at the end of pregnancy is not known.

Literature highlights that prenatal attachment is likely to be contextual (Zimmerman & Doan, 2003). Unfortunately, attempts to link the strength of prenatal attachment to specific parental psychosocial characteristics have generally been unsuccessful (Cannella, 2005; Hjelmstedt, Widström, & Collins, 2007; Van den Bergh & Simons, 2009; Yarcheski, Mahon, Yarcheski, Hanks, & Cannella 2009).

Indeed, although a number of psychosocial variables, such as personality traits and the relationship between partners or with parents, have been studied as correlates of prenatal attachment, they have been inconsistently linked to this variable across-studies, with some showing positive relationships, others negative relationships, and yet others showing no relationship at all (Condon & Corkindale, 1997; Hjelmstedt *et al.*, 2007; Siddiqui, Hägglöf, & Eisemann, 2000). One hypothesis that possibly explains these inconsistent results is that the predictors of prenatal attachment were studied in isolation rather than in interaction (Van den Bergh & Simons, 2009).

Parent-infant attachment or bonding develops further after birth and continues to develop beyond the early postnatal period. Several parental, infant, and contextual factors are expected to influence the quality of the bonding process. Surprisingly, empirical research into the determinants, consequences, and stability of postnatal bonding is also limited (Benoit, 2004).

Therefore, knowledge about prenatal risk and protective factors that may be related to the quality of prenatal attachment may lead to opportunities for early detection of parents at risk for parenting problems in the postnatal period.

In a review of 22 studies into maternal-fetal attachment, Alhunsen (2008) highlighted that 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 which means that it is not possible to determine the direction of effects. Alhunsen concluded that significant gaps remain in examining the relationship between maternal-fetal attachment and aspects of prenatal care, suggesting that 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.

Based on these premises, we designed a review study focused on factors that can influence the process of development of parental-fetal attachment also affecting the parent-child relationship after birth. This in order to provide an overview of the most recent results, and with the aim to synthesize and highlight the directions emerging from research in this field.

To achieve this general objective, we directed our analytical attention to longitudinal studies conducted from 2005 to 2016.

The objective was to highlight variables (individual, relational and contextual) identified as risk factors or protective factors for the development of prenatal attachment and which could also have an effect on the postnatal relationship between parents and newborn.

2. Method

The search was conducted in January 2016. Two electronic databases were systematically explored to identify research articles deemed relevant for this review: PubMed and PsycINFO.

Search terms included: prenatal attachment, maternal attachment, paternal attachment, parental attachment, mother-fetus attachment, father-fetus attachment, parents-fetus attachment.

In this review were included studies that meet the following criteria: a) clear definition of methods and tools used to measure prenatal attachment; b) longitudinal design covering the prenatal period or comprising a prenatal and a postnatal step (i.e. a first survey in the third trimester of pregnancy and a follow-up three months after childbirth); c) studies published in English; d) studies published between 2005 and 2016.

The exclusion criteria were: a) studies that despite being focused on the dynamics of the prenatal period, not measured specifically prenatal attachment; b) validation studies of instruments for measuring prenatal attachment; c) cross-sectional studies.

The titles and/or abstracts of each article were reviewed independently by 2 researchers based on the a priori inclusion and exclusion criteria. Disagreements related to inclusion or exclusion were resolved by discussion and consensus. In cases where decisions could not be reached based on title or abstract review, the full-text version of the article was retrieved and reviewed.

The search produced 28 longitudinal studies published from 2005 to 2016.

3. Results

Methodology (sample, instrument and period of assessment, variables), and major findings.

Table 1 - *Twenty-eight longitudinal studies on MOTHERS (1M- 24M), on FATHERS (1F- 3F), on COUPLE (1C)*

<i>MOTHERS (1M- 24M)</i>				
<i>First Author (Year)</i>	<i>Sample initial(T1)/final(T2)</i>	<i>Methodology Instrument and Period of assessment</i>	<i>Variables</i>	<i>Major findings</i>
1M Lai (2006)	N = 364/131 Age <i>M</i> (<i>SD</i>)= 30 (4.41)	<ul style="list-style-type: none"> · Eating Disorder Inventory-2 · General Health Quest. · Spousal Support Scale · Ad hoc questionnaire · Maternal Prenatal Attachment Scale (MPAS)[†] · Body Mass Index <p><i>Period of assessment:</i> T1: during pregnancy (10% I Trimester, 18% II Tr., 72% III Tr.) T2: at six months post-partum</p>	Eating disorder; Distress symptoms; Spousal support; Perceptions of the mother-infant relationship; Body mass.	Prenatal disordered eating, weak maternal-fetal attachment, a low level of spousal support, postnatal depressive symptoms, and a poor mother-infant relationship were significantly related to disordered eating at six months post-childbirth. The transition to motherhood is a period of stress that may either precipitate or exacerbate disordered eating.
2M Kleinveld (2007)	N = 2986/2877 Group 1: 564 Screening offered (NTM; MST); Group 2: 285 NTM offered, accepted, negative screening result. Group 3: 162 MST offered, accepted, negative screening result. Group 4: 359 no screening offered, no screening done Age <i>M</i> = 30	<ul style="list-style-type: none"> · Pregnancy Involvement List · Prenatal Attachment Inventory (PAI) <p><i>Period of assessment:</i> T1: before screening (I Tr.) T2: after the offer (II Tr.) T3: after receiving the negative screening result (II Tr.) T4: in the last trimester of pregnancy</p>	Screening (yes/no); Type of screening; Negative screening result.	Offering prenatal screening seems to temporarily increase attachment. However, this difference is very small. Attachment is not influenced by whether a blood screening or an ultrasound screening is performed.
3M Rowe (2009)	N = 134/68 Age <i>M</i> (<i>SD</i>) = 29.1 (4.7) After the first evaluation with the MMIC, women were divided into Informed and Non-informed groups	<ul style="list-style-type: none"> · Socio-demographic data, reproductive history and feelings about the pregnancy · Multidimensional Measure of Informed Choice · Hospital Anxiety-Depression Scale · Antenatal Attachment 	Age; Years in relationship; Gestation age; N° of pregnancies and other children; Miscarriage; Pregnancy feelings; Unexpected	The informed group had significantly lower attachment scores than that non-informed group prior to testing but scores were similar after test results were known. Lower attachment scores

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		Questionnaire (AAQ) ¹ <i>Period of assessment:</i> T1: after recruitment (12.3 weeks) T2: after the result of screening (20 weeks) T3: at 30 gestational week	pregnancy; Informed choice for maternal serum screening; Anxiety and depression.	were associated with more previous children
4M Spletzer (2009)	N = 90/65 (T2)/67 (T3) Age <i>M</i> = 29.82;	· Sleep/Activity Record · Prenatal Attachment Inventory (PAI) <i>Period of assessment:</i> T1: 35-40 weeks pregnant T2: one week postpartum T3: three months postpartum	Infant sleep.	No significant correlation between mother's PAI score and the one-week-old baby's sleep segment or longest sleep period and at T3. A significant negative correlation between PAI score and baby's total sleep at T2. The study extends current literature on prenatal to postnatal continuity
5M Georgsson-Öhman (2010)	N = 2026/1803 Group 1: Intervention N = 912 Group 2: Control N = 891 Age range: 15-44 years	· Maternal-Fetal Attachment Scale (MFAS) <i>Period of assessment:</i> T1: before 17-20 gestational weeks T2: after 24 gestational weeks	Ultrasound screening for Down Syndrome vs. routine care.	Ultrasound screening for Down Syndrome at T1 may have had a modest positive effect on prenatal attachment in mid-pregnancy, compared with an ultrasound scan at T2
6M Saastad (2011)	N = 1155/951 Group 1: Intervention N = 478 Group 2: Control N = 473 Age <i>M</i> = 30	· Prenatal Attachment Inventory (PAI) <i>Period of assessment:</i> T1: 22-25 gestational weeks T2: 35 gestational weeks	Intervention (fetal movement counting from pregnancy week 28) vs. control.	Fetal movement counting in the third trimester did not stimulate prenatal maternal-fetal attachment.
7M Faucher (2013)	N = 22/18 Age <i>M</i> = not specified	<i>Treatment:</i> Mindfulness yoga for 10 weeks · Five Facet Mindfulness Questi-R · Beck depression Inventory II; · EPDS · Maternal Fetal Attachment Scale (MFAS) <i>Period of assessment:</i> T1: baseline; T2: post intervention	Mindfulness; Depression.	As Beck Depression Inventory -II scores decreased, mindfulness increased and prenatal attachment strengthened. Pre- and post-intervention scores also showed a significant reduction in depression based on the BDI-II and increases in mindfulness and prenatal attachment.
8M Della Vedova (2014)	N = 146\107 Age <i>M</i> (<i>SD</i>) = 31.24 (3.75) Age range: 24-39 years	· Socio-demographic data · CES-D; -STAI Form Y · The 20-Toronto Alexithymia Scale · EPDS; -MSPSS	Education; Stressful events; Marital status; Planned pregnancy; Miscarriage;	Higher scores of maternal prenatal attachment, as well as increasing maternal postnatal attachment towards the baby and

		<ul style="list-style-type: none"> · PBI · Early Infant Temperament Quest. · Prenatal Attachment Inventory (PAI) <p><i>Period of assessment:</i> T1: III Tr. of pregnancy; T2: 3 months postpartum</p>	<p>Delivery; Breastfeeding; Depression; Anxiety; Alexithymia; Postpartum depression; Perceived social support; Parental bonding; Infant temperament.</p>	<p>perceived social support, were significantly related to a baby that was more attentive (persistence) and easy to distract (distractibility) from fussing. Prenatal to postnatal continuity</p>
9M Camberis (2014)	<p>N = 317/240 Age <i>M</i> (SD) = 32.81 (4.60)</p> <p><i>Sample is divided by age:</i> Age ≤ 30, N = 95; Age range 31-36, N = 80; Age ≥ 37, N = 65 <i>and mode of conception:</i> · Spontaneous N = 141; · Assisted conception N = 99</p>	<ul style="list-style-type: none"> · Demographic, reproductive history · The Personal Views Survey · The 14-Item Ego Resiliency Scale · Washington University Sentence Completion Test-SF 81 · Childbearing Attitudes Quest. · Experience of Motherhood Quest · Medical Outcomes Study SF36 · Maternal Fetal Attachment Scale (MFAS) <p><i>Period of assessment:</i> T1: III Tr. of pregnancy T2: 4 to 6 months postpartum</p>	<p>Age; Mode of conception; Education; Fertility treatment; Hardiness; Ego resiliency; Ego development; Maternal identity; Postnatal adjustment; Pre- and postnatal health.</p>	<p>Increasing age is associated with higher levels of psychological maturity. Psychological maturity was related to positive engagement with the developmental tasks of pregnancy. Both maturity and pregnancy adaptation predicted more optimal adjustment to early motherhood, regardless of mode of conception.</p>
10M Rubertsson (2015)	<p>N = 1175/775 (T1)/718 (T2) Age: < 25 years 14.8% 25-35 years 70.2% > 35 years 15%</p>	<ul style="list-style-type: none"> · Demographic, Reproductive history · Hospital Anxiety-Depression Scale · Prenatal Attachment Inventory (PAI) <p><i>Period of assessment:</i> T1: mean gestational week 8-10 T2: mean gestational week 36</p>	<p>Age; Education; Obstetric background; Miscarriage; Assisted conception; Preference for mode of birth; Feelings regarding the approaching birth; Expectations about the first week postpartum; Social support received; Depression and anxiety.</p>	<p>This study identified a number of factors associated with low levels of prenatal maternal-fetal attachment: women who were depressed, had more negative feelings concerning the approaching birth and parenthood, and those who perceived they were lacking support from partner and family. Women over 25 years, with a university level degree and multiparas recorded lower levels of attachment.</p>
11M Dubber (2015)	<p>N = 334/80 Age <i>M</i> (SD) = 32.8 (4.4) Age range: 24-44 years</p>	<ul style="list-style-type: none"> · Socio-demographic data · EPDS; -STAI · Pregnancy Related Anxiety Quest. · Postpartum Bonding Quest. · Maternal-Fetal Attachment Scale (MFAS) 	<p>Education; Pre- and postnatal depression; Anxiety; Pregnancy-related anxiety; Postpartum bonding.</p>	<p>The data indicate an important association between maternal-fetal attachment and maternal postpartum depressive symptoms on postpartum bonding.</p>

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		<p><i>Period of assessment:</i> T1: mean gestational week 32 T2: 3 months postpartum</p>		
12M Chrzan-Dętkoś (2015)	<p>N = 162 (T1)/64(T2) Age <i>M (SD)</i>: 38.96 (3.48) Age range: 20-38 years</p>	<ul style="list-style-type: none"> · Ad hoc questionnaire · EPDS · ASQ · The Postpartum Bonding Quest. · Maternal-Fetal Attachment Scale (MFAS) <p><i>Period of assessment:</i> T1: average week of pregnancy = 31.47 T2: average age of child = 8 weeks</p>	<p>Social and psychological course of pregnancy; Parturition and puerperium depression; Adult attachment; Postnatal maternal attachment.</p>	<p>Mother's romantic attachment style influences her attachment to the baby, though this relationship is more direct during pregnancy than postpartum. In expectant mothers, the anxious-ambivalent romantic attachment style predicted more interaction with and attributing more characteristics to the fetus, secure romantic attachment style was positively correlated with role taking, and avoidant – with attributing more characteristics to the fetus.</p>
13M Mazzeschi (2015)	<p>N = 130/70 Age <i>M (SD)</i> = 32.75 (4.84);</p>	<ul style="list-style-type: none"> · ASQ · DAS · PSI · Maternal Antenatal Attachment Scale (MAAS)¹ <p><i>Period of assessment:</i> T1: 7th month of gestation T2: 3 months post-partum</p>	<p>Adult attachment; Marital satisfaction; Stress associated with the parenting role.</p>	<p>Maternal attachment style (especially relationship anxiety) was negatively correlated with prenatal attachment and with dyadic adjustment; positive correlations resulted between prenatal attachment and dyadic adjustment. Each of the investigated variables was also good predictor of parenting stress 3 months after childbirth.</p>
14M Yoshikawa (2008)	<p>N = not specified/4 Age <i>M</i> = 30.5 <i>Sample at risk:</i> pregnancy unplanned, miscarriages, story of physical maltreatment</p>	<p><i>Treatment:</i> Psycho-educational program; Dohsa-hou relaxation 4 months of pregnancy -2 weeks before birth</p> <ul style="list-style-type: none"> · Self-Rating Depression Scale · Maternal Antenatal Emotional Attachment Scale (MAES)¹ <p><i>Period of assessment:</i> trimester of pregnancy T1: first; T2: second; T3: third</p>	<p>Dohsa-hou relaxation; Depression.</p>	<p>In all participants, after Dohsa-hou relaxation sessions, there was a reduction in feelings of depressive and anxious feelings about pregnancy. The participants' perception of fetal movements was associated with enhanced attachment to their fetuses.</p>

15M Kuo (2013)	N = 190/160 Age <i>M (SD)</i> = 32.42 (4) <i>Sample at risk:</i> women pregnant by in vitro fertilization	<ul style="list-style-type: none"> · Socio-demographic data · The Symptoms Checklist · Pregnancy-Related Anxiety Scale · Chinese Childbearing Attitude Quest. · Awareness of Fetus Scale · The Social Support Apgar · Maternal-Fetal Attachment Scale (MFAS) <p><i>Period of assessment:</i> T1: 9 gestational weeks; T2: 12 w; T3: 20 w</p>	Age; Education; Duration of infertility; Number of IVF treatments; Pregnancy symptoms; Pregnancy-related anxiety; Childbearing attitudes; Awareness of the fetus social support.	Prenatal attachment increased as pregnancy progressed. Chinese childbearing attitude, awareness of the fetus and social support were predictors of prenatal attachment. Pregnancy-related anxiety during the first half of pregnancy, age, education, duration of infertility and number of IVF treatments were not identified as predictors of prenatal attachment.
16M Alhusen (2013)	N = 166/81 Age <i>M (SD)</i> = 23.04 (5.1) <i>Sample at risk:</i> low-income women	<ul style="list-style-type: none"> · Electronic chart review · Health Practices in Pregnancy Quest. - II · EPDS · Ages and Stages Questionnaire · ASQ · Maternal-Fetal Attachment Scale (MFAS) <p><i>Period of assessment:</i> T1: between 24-28 weeks gestation T2: within 48 hours after delivery T3: 14-26 months postpartum</p>	Neonate's gestational age; Birth weight; Health practices; Postpartum depression; Early childhood development; Attachment style.	Women with higher avoidant attachment styles and greater depressive symptomatology were more likely to have children with early childhood developmental delays than were those women with less avoidant styles and less depression. Women with higher prenatal attachment had more secure attachment styles and their children had more optimal childhood development.
17M Spinelli (2013)	N = not specified/142 Age <i>M (SD)</i> : IPT = 30 (6.9); PEP = 28.9 (6.6) <i>Sample at risk:</i> Major Depressive Disorder (MDD) Group 1: IPT N = 72 Group 2: PEP N = 70 GA <i>M</i> : 22 weeks	<p><i>Treatment:</i> Interpersonal Psychotherapy or Parenting Education Program</p> <ul style="list-style-type: none"> · Structured Clinical Interview DSM IV · Hamilton Depression Rating Scale · EPDS · Clinical Global Impressions Scale · Maternal Fetal Attachment Scale (MFAS) <p><i>Period of assessment:</i> T1: baseline; At weeks of treatment T2: 4 w; T3: 8 w; T4: 12 w</p>	Psychopathology; Depression; Severity of disorder.	Less depression is associated with higher levels of maternal-fetal attachment.
18M Massey (2015)	N = not specified/156 Age <i>M (SD)</i> : · Non-smokers: (N = 61)	<ul style="list-style-type: none"> · Time Line Follow Back Interview · Maternal Fetal Attachment Scale MFAS 	Smoking (non-smokers; pregnancy quitters; persistent smokers)	At 30 weeks, pregnancy quitters scored higher on the 'giving of self' subscale of MFAS

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	<p>25.8 (5.8)</p> <ul style="list-style-type: none"> · Pregnancy quitters (quit by 30 weeks through delivery): (N = 32) <p>22.9 (4.3)</p> <ul style="list-style-type: none"> · Persistent smokers: (N = 63) <p>25.3 (4.4)</p> <p><i>Sample at risk:</i> prenatal exposure to smoke</p>	<p><i>Other measures</i></p> <p>Passive drool (saliva sample)</p> <p><i>Period of assessment:</i></p> <p>T1: 30 gestational week (SD = 2 weeks)</p> <p>T2: 35 gestational week (SD = 1 week)</p> <p>T3: 1 day postpartum (SD = 1 day)</p>		<p>compared to persistent smokers. Maternal 'giving of self' differentiated pregnancies exposed to cigarette smoking from those without exposure from 30 weeks through delivery. Women who reported a greater desire to maintain their personal health for the health of their fetus were more likely to quit smoking during pregnancy.</p>
<p>19M Asplin (2015)</p>	<p>N = 67(T1)/56(T3)</p> <p><i>Sample at risk:</i> fetal malformations</p> <p>Age <i>M (SD)</i> = 34.4 (5.3)</p>	<ul style="list-style-type: none"> · Cambridge Worry Scale · STAI · EPDS · Maternal Fetal Attachment Scale (MFAS) <p><i>Period of assessment:</i></p> <p>T1: 30 gestational week T2: two months postpartum T3: one year postpartum</p>	<p>Worries during pregnancy; Anxiety; Depression.</p>	<p>Women carrying a fetus with a prenatally detected malformation had a higher risk of depressive symptoms during both mid-pregnancy (37%) and postpartum at two months (26.5%) and one year (22%) than women with normal pregnancies. Women had slightly higher levels of attachment than women with normal pregnancy. This may be related to the opportunity of being exposed to the fetus offered by several ultrasound examinations. This may moderate some of their concerns about the fetus.</p>
<p>20M Hjelmstedt (2006)</p>	<p>N = 97/90</p> <p>Age <i>M (SD)</i>: IVF = 32.3 (2.1), Control = 31.3 (1.8)</p> <p><i>Sample at risk:</i> (IVF) in vitro fertilization N = 56/52</p> <p><i>Control sample:</i> natural conception N = 41/38</p>	<ul style="list-style-type: none"> · Socio-demographic data · Spielberger Anxiety Inventory · Karolinska Scales of Personality · EPDS · Emotional Responses to Pregnancy Scale · Barnett Scale · Prenatal Attachment Inventory (PAI) <p><i>Period of assessment:</i></p> <p>weeks gestation T1: 26 weeks; T2: 36 weeks</p>	<p>Maternal age; Anxiety; Personality; Postpartum depression; Emotions in pregnancy; Marital relationship.</p>	<p>In vitro fertilization mothers are attached to their unborn children to the same extent as other mothers. Prenatal attachment increases during pregnancy. At the same time, however, individual scores on prenatal attachment seem to be relatively stable. Significant contributors to prenatal attachment are marital satisfaction, age, ambivalence, and detachment. No associations between prenatal attachment and anxiety.</p>

<p>21M Tsartsara (2006)</p>	<p>N= 35/23 Age <i>M (SD)</i> = 30.4 (6.1) <i>Sample at risk:</i> miscarriage story N = 10/5 <i>Control sample:</i> no miscarriage story N = 25/18</p>	<ul style="list-style-type: none"> · Demographic/reproductive history questionnaire · Pregnancy Outcome Quest. · Maternal Antenatal Attachment Scale (MAAS)¹ <p><i>Period of assessment:</i> T1: I Tr. of pregnancy T2: III Tr. of pregnancy</p>	<p>Miscarriages; Anxiety</p>	<p>Women with a miscarriage history reported significantly higher pregnancy-specific anxiety during the I trimester than did women with no miscarriage history. All mothers scored similarly in the I trimester on the prenatal attachment scale. Prenatal attachment significantly rose by the III trimester for all women. Having a miscarriage history may not have a long-lasting adverse effects on women's psychological adaptation during the course of a subsequent pregnancy.</p>
<p>22M Chen (2011)</p>	<p>N = 125/110 Age < 36: ITP = 88.3% NP = 92,3% Age > 36: ITP = 11.7% NP = 7.7% <i>Sample at risk:</i> infertility-treated pregnant (ITP) N = 60/51 <i>Control sample:</i> naturally pregnant (NP) N = 65\59</p>	<ul style="list-style-type: none"> · Demographic Quest. · Maternal Attachment Inventory · Maternal Fetal Attachment Scale (MFAS) <p><i>Period of assessment:</i> T1: III Tr. of pregnancy T2: 1 to 2 months postpartum</p>	<p>Age; Education; Parity; Participation in prenatal education; Fetus' gender conformed with the mother; Maternal-infant attachment.</p>	<p>Women who became pregnant after fertility treatment had higher prenatal attachment than did those who experienced natural conception. Pregnancy mode, level of education were the main factors having a significant effect on prenatal attachment.</p>
<p>23M McFarland (2011)</p>	<p>N = 189/161 Age <i>M (SD)</i>: MDD = 28.31 (6.06) Non-MDD = 29.63 (4.61) <i>Sample at risk:</i> (MDD) N = 65 <i>Control sample:</i> non-MDD N = 96</p>	<ul style="list-style-type: none"> · Structured Clinical Interview for DSM-IV (SCID-I/NP) · Timeline Follow Back interview · <i>Self-report questionnaire:</i> · Socio-demographic data · Hamilton Rating Scale for Depression · Hollingshead Four Factor Index of Social Status · Maternal Fetal Attachment Scale (MFAS) <p><i>Period of assessment:</i> T1: 26-28 gestational week T2: 36-38 gestational week</p>	<p>Psychopathology; Medication adherence to treatment for MDD; Caffeine, tobacco and alcohol use; Age; Race; N° of living children; Depression; Social status</p>	<p>A clinical diagnosis of Major Depressive Disorder is related to significantly lower levels of prenatal attachment as measured across the second and third trimesters. Anxiety, maternal age, number of living children and maternal race were not significantly related to prenatal attachment.</p>

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<p>24M Beauquier-Maccotta (2016)</p>	<p>N = 83/77 Age range: 31-34 years <i>Sample at risk:</i> Uncomplicated Monochorionic pregnancies (UMC) N = 29 Complicated Monochorionic pregnancies with a Twin to Twin Transfusion Syndrome (TTTS) N = 31 <i>Control sample:</i> Dichorionic pregnancies (DC) N = 23</p>	<p><i>Self-report questionnaire:</i> · Post-Traumatic Checklist Scale · EPDS; STAI · Prenatal Attachment Inventory (PAI) <i>Period of assessment:</i> T1: arrival in the department T2: announcement of TTTS (ANN) T3: around 20 gestational week T4: around 26 gestational week T5: around 30 gestational week T6: 3 month post-partum</p>	<p>Post-traumatic stress disorder; Depression; Anxiety.</p>	<p>In high-risk pregnancies, as Monochorionic (MC) twin pregnancies, Twin to Twin Transfusion Syndrome announcement constitutes a traumatic event during a pregnancy with an important risk of post-traumatic stress disorder, high level of anxiety and an alteration of the prenatal attachment.</p>
<p><i>FATHERS (1F- 3F)</i></p>				
<p>1F Habib (2010)</p>	<p>N = 115/78 Age M (SD) = 31 (6.0)</p>	<p>· The Pie · Short narratives or vignettes · Paternal Antenatal Attachment Scale (PAAS)¹ <i>Period of assessment:</i> T1: I Tr. of pregnancy T2: III Tr. of pregnancy</p>	<p>Father Identity (status prominence and father status content).</p>	<p>There was no change in the identity measures. Paternal fetal attachment increased with the imminent birth, predicted by the father's identity: father status prominence and content appeared to predict the attachment to the fetus.</p>
<p>2F Condon (2013)</p>	<p>N = 311/204 Age M (SD) = 29 (5.0)</p>	<p>· Mental Health Index · Positive, Negative Affect Schedule · EPDS; DAS; PBI · Self-Assessment Irritability Scale · Infant Characteristics Quest. · The Bem Sex Role Inventory · Social Support Quest. · Intimate Bond Measure · Paternal Postnatal Attachment Scale · Paternal Antenatal Attachment Scale (PAAS)¹ <i>Period of assessment:</i> T1: 23 gestational week T2: 6 months; T3: 12 months</p>	<p>Mental health affectivity; Depression; Irritability; Perception of the infant masculinity/femininity; Marital satisfaction; Social support; Intimate bond; Parental bonding; Postnatal attachment.</p>	<p>Strong continuity of attachment across these 3 assessment points, as well as the important influence of the man's partner relationship and mental well-being on his attachment. The strongest predictors of subsequent father postnatal attachment score were father antenatal attachment score and quality of the partner relationship.</p>
<p>3F Hjelmstedt (2007)</p>	<p>N = 90/86 <i>Sample at risk:</i> IVF N = 53\51 <i>Control sample:</i> natural conception N = 37\36 Age M (SD):</p>	<p>· Socio-demographic data · Spielberger STAI; - EPDS · Karolinska Scales of Personality · Emotional Responses Pregnancy Scale · Barnett Scale · Paternal Fetal Attachment</p>	<p>Age; Educational level; Anxiety; Personality; Depression; Emotions about pregnancy; Marital relationship.</p>	<p>IVF fathers were attached to their fetuses to the same extent as other fathers. Prenatal attachment increased during pregnancy. Variables that showed significant correlations with prenatal</p>

	IVF = 34.1 (4.2) Control = 33.3 (2.6) <i>Socio-economic status:</i> medium-high	Scale (PFAS) <i>Period of assessment:</i> gestational week T1: 13 w; T2: 26 w; T3: 36 w		attachment score in gestational week 26 were ambivalence (-) and psychastenia (+), while in gestational week 36, it was detachment (-)
<i>COUPLE (1C)</i>				
1C Cairo (2012)	N = not specified/62 <i>Inclusion criteria:</i> French-speaking and not already parents <i>Sample at risk:</i> in vitro fertilization <i>Control sample:</i> not included; it is used a reference sample of another longitudinal study <i>Age M (SD):</i> Mothers = 32.33 (2.83) Fathers = 34.34 (4.27)	· Prenatal LTP · LTP · DAS · Parent to infant attachment · Antenatal Bonding Questionnaire (ABQ) ¹ <i>Period of assessment:</i> T1: fifth month of pregnancy T2: 9 months after birth	Prenatal family alliance; Postnatal family alliance; Marital satisfaction; Parent-infant attachment.	Marital satisfaction decreased over the period and parent-baby attachment increased; neither prenatal marital satisfaction nor parent-fetus attachment predicted the postnatal family alliance

Note: Table 1 shows all 28 studies divided by parents (focus on mothers, fathers or couples)

¹Although in these studies the term used for prenatal attachment instrument is different, the instrument is the same and has the same bibliographic reference

As showed in Table 1 the focus of studies remained centred on the mothers (24/28, 86% on mothers; 3/28, 11% on fathers; 1/28, 3% on couples). This may be due to the choice of the researchers or the difficulty of involving fathers in studies concerning this phase of life.

The analysis of the variables investigated by studies and summarized in Table 2, allowed us to highlight a picture of the different variables: individual (i.e. personality, age, etc), relational (i.e. marital relationship, family alliance) and contextual (prenatal screening, treatment IVH, etc).

Table 2 - *Outcomes of 28 studies. Main results for risk, protective and other variables analyzed for the Mothers, Fathers and Couples*

<i>Risk, Protective and other variables</i>	<i>Main results</i>
<i>MOTHERS</i>	
Personality	Prenatal attachment is positively related to psychological maturity (9M) and it is negatively related to: detachment and ambivalence (20M), level of depression symptomatology, major depressive disorder (10M, 11M, 17M, 23M) and disordered eating behaviors (1M). Anxiety is not related to prenatal attachment (15M, 20M, 23M).

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Attitude pregnant	Those that quit smoking during pregnancy score higher on the ‘giving of self’ subscale of Maternal Fetal Attachment Scale (MFA) compared to persistent smokers (18M). Childbearing attitude and awareness of the fetus play an important role in development of MFA in In Vitro Fertilization (IVF) sample (15M). Mindfulness yoga in pregnancy increases mindfulness and prenatal attachment (7M).
Relationship with partner	Marital satisfaction is positively related to prenatal attachment; women reporting higher MFA have more secure attachment styles, and their children have more optimal early childhood development than do those women reporting lower MFA and less secure attachment styles (13M, 16M). The maternal romantic attachment style predicts attachment with the baby in the antenatal, but not in the postpartum period (12M).
Social Support	Lack of support from own parents and from partner is associated with lower prenatal attachment (10M, 15M).
Socio-demographic data: Pregnancy	Maternal race is not related to prenatal attachment (23M). MFA increased as pregnancy progress regardless pregnancy mode (15M, 20M, 24M).
Child characteristics	Prenatal attachment is positively related to persistence (8M), dimension of the infant's temperament and good early childhood development (16M), while it is negatively related to baby's total sleep at one week (4M).
Contrasting data on: Characteristics of Pregnancy (Infertility, parity, miscarriages, fetal movement, fetus malformation) and Prenatal Screening	<p>Duration of infertility number of IVF treatments are not related to prenatal attachment (15M, 20M) OR fertility treatment increases MFA compared to natural conception (22M); parity is not related to prenatal attachment (23M) OR multiparous have less attachment to the fetus (3M, 10M); previous miscarriages are not associated with prenatal attachment (21M); fetal movement counting is not related to prenatal attachment (6M) or fetal movement counting has a significant positive effect on MFA (14M).</p> <p>Women carrying a fetus with a prenatally detected malformation have high level of prenatal attachment (19M). Twin to Twin Transfusion Syndrome (TTTS) and Dichorionic pregnancies (DC) have a similar prenatal attachment while Monochorionic pregnancies (MC) mothers express a significantly higher attachment to their fetuses and express it earlier (24M).</p> <p>Accepting or refusing screening; the type of screening and negative screening are not associated with prenatal attachment (2M) or ultrasound screening for Down Syndrome in the 1st trimester may have a modest positive effect on MFA in mid-pregnancy, compared with an ultrasound scan in the 2nd trimester (5M).</p>
Age, Education level	<p>Insignificant (15M) or significant negative correlations between age and prenatal attachment (10M, 20M, 23M).</p> <p>Level of education is not related to prenatal attachment (15M) OR women with a university level of education record lower levels of prenatal attachment (10M, 22M).</p>

<i>FATHERS</i>	
Personality	Paternal–fetal attachment is predicted by father identity (1F). Correlations with prenatal attachment score in gestational week 26 are ambivalence (-) and psychastenia (+), while in gestational week 36, it was detachment (-) (3F).
Relationship with partner	Quality of the partner relationship predict subsequent father postnatal attachment (2F).
Gestational age of the partner	Prenatal attachment increases during pregnancy, in particular with the imminent birth (1F, 3F).
<i>COUPLE</i>	
Postnatal family alliance	Parent-fetus attachment doesn't predict the postnatal family alliance (1C).

Among these variables those that are negatively related to prenatal attachment are:

- for the Mother, disordered eating behaviors and depression, detachment and ambivalence, smoking during pregnancy, lack of social support;
- for the Father, ambivalence, psychoastenia and detachment.

The studies show contrasting data only for the mother on: age, characteristics of pregnancy (mode of conception, previous miscarriage, prenatal screening, fetal malformations).

The studies agree on identifying some variables that promote the development of prenatal attachment. These variables are:

- for the Mother, childbearing attitude and awareness of the fetus, psychological maturity, marital satisfaction, perception of support from partner, secure attachment styles with partner;
- for the Father, psychological maturity, marital satisfaction.

The variables identified as risk and protective factors for the development of prenatal attachment partially confirm the findings of previous research: parental psychopathology, lack of social support, maternal behaviors harmful to the fetus during pregnancy (i.e. the exposure to smoke) emerge as factors that affect the construction of the bond with the fetus and subsequently with the child. In contrast, mother's and father's psychological maturity and a good quality of the marital relationship seem to positively affect the construction of the bond with the fetus. The lack of studies on parental couple does not allow us to understand the complexity of the experience lived, respectively, by the father and mother and their mutual influence in the construction of the bond with the fetus and thus the complexity of the transition from the dyad to the triad.

Table 2 shows other variables related to prenatal and post-natal attachment. These variables are: gestational age (prenatal attachment increases during pregnancy for mothers and fathers), child characteristics (prenatal attachment is positively related to infant's temperament and good early childhood development), and continuity between prenatal and postnatal period.

These variables confirm the complexity of a process that, for both mothers and fathers, begins in pregnancy, is influenced by the characteristics of the fetus/newborn and goes on after birth, as a continuum.

The mismatch of the studies about the role of some maternal variables is of considerable interest for two reasons: 1) involves variables primarily related to pregnancy, highlighting how a different management of risk situations (i.e. birth defects, etc.) from both by the mother and the medical team (prenatal screening) can lead to different outcomes. This is especially interesting for planning prenatal interventions; 2) the mismatch of the results led us to develop a reflection on the methodology of the studies analyzed (table 3, table 4).

Table 3 - Methodology: Characteristics of the samples of the studies

Studies	Samples					
	Sample Size (Final sample) % studies (N/N tot)			Drop out of studies		Studies with at-risk samples
	Small	Medium	Large	%	%	%
	≤ 50 Ss	50 < Ss ≤ 200	> 200 Ss	Studies with specified initial/ final sample (N/N tot)	Ss at the end of studies (Final N tot/Initial N tot)	N studies with at-risk samples/ N studies tot
24 on Mothers	12.50% (3/24)	66.67% (16/24)	20.83% (5/24)	87.50% (21/24)	79.67% (7952/9993)	45.83% (11/24)
3 on Fathers	0.00% (0/3)	66.67% (2/3)	33.33% (1/3)	100.00% (3/3)	71.31% (368/516)	33.33% (1/3)
1 on Couple	0.00% (0/1)	100.00% (1/1)	0.00% (0/1)	0.00% (0/1)	/	100.00% (1/1)
Tot 28	10.71% (3/28)	67.85% (19/28)	21.42% (6/28)	85.71% (24/28)	79.17% (8320/10509)	46.42% (13/28)

Table 4 - *Methodology: Period of assessment and measures used (Self Report, SR; Observation, O; Interviews, I; Graphical method, G)*

Studies	% Studies with period of assessment (N/N tot)		% Studies with Measures (N/N tot)			
	Prenatal	Prenatal/ Postnatal	only SR	SR/G	SR/O	SR/I
24 on Mothers	50.00% (12/24)	50.00% (12/24)	83.33% (20/24)	.00% (0/24)	4.17% (1/24)	12.50% (3/24)
3 on Fathers	66.67% (2/3)	33.33% (1/3)	66.67% (2/3)	33.33% (1/3)	.00% (0/3)	.00% (0/3)
1 on Couple	.00% (0/1)	100.00% (1/1)	.00% (0/1)	.00% (0/1)	100.00% (1/1)	.00% (0/1)
Tot 28	50.00% (14/28)	50.00 % (14/28)	78.57 % (22/28)	3.58% (1/28)	7.14% (2/28)	10.71% (3/28)

4. Discussion

Research on the correlates of prenatal attachment is important, considering that it can be viewed as the earliest form of parenting (Habib & Lancaster, 2010). In agreement with Alhunsen (2008), this review highlights that most of the studies have methodological limitations that preclude a more comprehensive understanding of prenatal attachment and the effect on fetus/child development.

Our objective was to highlight variables (individual, relational and contextual) identified as risk factors or protective factors for the development of prenatal attachment and the effects on the post-natal period.

Literature analyzes the effect of several variables (individual, relational, contextual) on prenatal attachment, but there are no studies evaluating the interaction between the variables analyzed. Studies show conflicting data, especially on socio-demographic variables related to the prenatal period. Although the reasons for inconsistent results are not always clear, the fact that prenatal attachment is measured during different time periods of pregnancy, using different measures in pregnant women whose ages varied across the different samples, may have played a role. The literature shows that although there is a constant interest in research into prenatal attachment, the studies into the father, and in particular into the couple, are still few in number.

There are methodological limitations, which have already been discussed, that make it difficult to generalize the results and understanding of the

phenomenon: different periods of assessment, different measures used, mainly self-report.

The process of becoming a parent involves profound changes, and love is essential to the survival of the baby. Pregnancy and the first year after birth are both periods that are very complex and are characterized by constant physiological and psychological changes that occur in women, men and couples. These changes influence the development of prenatal attachment and caregiving after birth. Thus, it would require homogeneity between studies to allow for comparability of the results. While much attention has been devoted to maternal “programming” effects on the fetus (Barker, 1998), there is increasing evidence of the role that the fetus plays in its own development, which includes providing feedback to maternal systems (Glynn & Sandman, 2011). Attention to the effects of the behavior of the fetus on the development of prenatal attachment is still inadequate. The prenatal period remains one of the last developmental frontiers and leaves much to be discovered about the complex dynamic between the fetus and the pregnant woman and the implications for the subsequent psychophysiological regulations of each.

We have highlighted four areas in particular as being crucial. First, more longitudinal studies, from pregnancy to after birth, are required. It is necessary to make comparable the periods of observation and tools used and to investigate mediators and moderators in order to explore mechanisms by which parental prenatal attachment might have an impact, or be impacted by, psychological health or ill health. Only this type of study will enable us to develop an understanding of process, which is vital in developing efficient, effective, and meaningful screening and support programs.

Second, more studies with two samples, normal and at risk, are required. The literature (Cataudella & Zavattini, 2015) highlights risk factors that, if present in a woman’s life, intensify during pregnancy, compromising the mental and physical health of the mother and child with consequences in the short- medium- and long-term. The risk factors are: individual (history of maltreatment, parental psychopathology, maternal age, use of smoking/drugs/alcohol), relational (domestic violence, impaired mother-infant interaction), environmental (social disadvantage), and newborn characteristics (low birth weight, prematurity, handicap).

Third, more studies on fathers, couples and the fetus are required.

Factors that, among pregnant women, could constitute an obstacle to the development of their attachment to their developing baby could be reversed by family alliance, marital satisfaction and spontaneous fetal movements,

which may serve as potential regulators of subsequent maternal adaptation to pregnancy and child-rearing.

Fourth, it would be useful to use narrative tools to explore parents' ideas about becoming and being mothers and fathers and the place of prenatal fetal bonding in parenthood narratives, to integrate into theory, research and practice.

Perinatal mental health problems are very common, affecting up to 20% of women at some point during the perinatal period (Bauer, Parsonage, Knapp, Iemmi, & Adelaja, 2014). They are also of major importance as a public health issue, not just because of their adverse impact on the mother but also because they have been shown to compromise the healthy emotional, cognitive and even physical development of the child, with serious long-term consequences. The perinatal period provides a uniquely favorable opportunity for health services to reduce the scale of morbidity and mortality associated with mental ill health. The potential benefits of intervention are particularly high during the perinatal period, reflecting the evidence already analyzed that maternal mental health conditions during pregnancy and early motherhood have major implications not just for the well-being of the mother but also for the healthy emotional, behavioral and cognitive development of the child.

In agreement with Alhusen (2008), 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. Healthy child development is considered a necessary foundation for reducing health and social inequities across the lifespan.

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