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Maternal-foetal attachment independently predicts the quality of maternal-infant bonding and post-partum psychopathology

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JUST ACCEPTED

Maternal-foetal attachment independently predicts the quality of maternal-infant bonding and post-partum psychopathology

Purpose: The aim of this study was to evaluate the association of maternal antenatal attachment and post-partum psychopathology, maternal-infant bonding, while checking for antenatal psychopathology, for lifetime psychiatric diagnosis and for the known risk factors for peripartum depression.

Methods: One hundred-six women recruited at the first month of pregnancy (T0) were evaluated with the structured interview for DSM-IV TR (SCID-I) to assess the presence of lifetime psychiatric diagnosis and with the Perinatal Depression Predictor Inventory-Revised (PDPI-R), the Edinburgh Postnatal Depression Scale (EPDS) and the State-Trait Anxiety Inventory (STAI). At the sixth month of pregnancy (T1) and at the first month post-partum (T2), all patients were evaluated with the PDPI-R, the EPDS, the STAI, at T1, with the Maternal Antenatal Attachment Scale (MAAS), and at T2 with the Maternal Postnatal Attachment Scale (MPAS).

Results: Multivariate regression analyses showed that maternal-foetal attachment was the variable most significantly associated with postnatal symptoms of depression and anxiety and with quality of maternal-infant attachment. The logistic regression analyses showed that antenatal attachment may predict postnatal depressive and anxiety symptoms (respectively OR: 0.83 – IC [0.74-0.95], $p=0.005$, OR:0.88 – IC [0.79-0.98], $p=0.02$), and the quality of maternal postnatal attachment (OR:1.17 – IC [1.08-1.27], $p<0.001$), also after taking into account the known risk factors for perinatal depression, the socio-demographic variables and lifetime psychiatric diagnosis.

Conclusion: The quality of maternal-foetal bonding may independently predict the quality of maternal-infant attachment and post-partum depressive and anxiety symptoms. A comprehensive assessment of maternal risk factors for perinatal psychopathology during pregnancy should include the evaluation of antenatal attachment that could be modifiable by specific interventions promoting the quality of maternal bonding.

Keywords: Antenatal attachment, maternal-foetal bonding, maternal-infant bonding, depression, anxiety, risk factors, peripartum psychopathology

Declaration of Interest: the authors report no conflicts of interest

Introduction

The term perinatal depression is used to describe a continuum of depressive symptoms and diagnoses that occurs during gestation and after childbirth. Depression has been shown to affect approximately from 8.5% to 10% of women during pregnancy and from 6.5% to 12.9% in the first year of the post partum period [1]. Several risk factors, including antenatal psychopathology and personal history of depression, have been identified as predictors of maternal post-partum depression [2]. Some studies have reported that the quality of maternal-foetal attachment during late pregnancy may also play a role [3, 4]. Antenatal attachment has been defined for the first time by Cranley as “the extent to which women engage in behaviors that represent an affiliation and interaction with their unborn child” [5]. More recently, Condon has characterized the antenatal attachment 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 foetus [6] and, within the same theoretical framework, its post-partum counterpart, such as the maternal post-natal attachment, has been defined. The development of the maternal antenatal attachment is important because a poor quality of prenatal attachment has been associated with maternal risky behavior and poor health care [7]. Furthermore, it has been shown that women reporting poor quality of attachment during pregnancy show an increased risk of giving birth to an infant with adverse neonatal outcomes [8] and less optimal early childhood development [3]. The poor quality of maternal attachment may also negatively impact on the child brain regulatory functions thus negatively affecting their subsequent mental health [9].

Perinatal depression has been correlated with the poor quality of maternal bonding during both pregnancy and postpartum [7, 10, 11, 12, 13, 14, 15]. Anxiety symptoms during pregnancy [16, 17, 18, 19, 20] and in the post-partum period [21] have been associated with poorer maternal attachment. However, the role of antenatal bonding in determining post-partum psychopathology remains unclear. Some studies have shown a correlation between antenatal and postnatal maternal-child attachment: the higher quality of bonding during pregnancy seems to predict the higher quality of bonding in the postnatal period [14, 22, 23, 24, 25]. Understanding the mechanisms involved in both the development of maternal psychopathology and of the quality of bonding in the post partum period should be a priority for warranting both mother and infant health.

The aim of the present study was to prospectively evaluate possible influence of the antenatal maternal-foetal bonding on post-partum psychopathology and/or on maternal-infant bonding, in a large group of

women during their period of pregnancy/post-partum, while also taking into account the post-partum counterpart, post-partum counterpart, risk factors for perinatal depression and previous psychiatric diagnosis.

Materials and method

The current study included a subsample of participants from the main research plan called Perinatal Research and Screening Unit II (PND-ReScU II). Subjects were recruited during their routine evaluation at the Gynaecological Unit of the University of Pisa, from January 2010 through October 2011, at the first month of pregnancy (n=268) and were prospectively followed up until the 12th month after childbirth, with self-reported questionnaires, sent by ordinary mail. The inclusion criteria were: age > 18 years; willingness to sign an informed consent to the study. The exclusion criteria were: poor knowledge of the Italian language or other limitations related to Italian communication and no fixed residence. The Ethics Committee of the University of Pisa approved the study protocol. The analyses of the present study refer to 106 women who completed all the questionnaires necessary for the purpose of this study at the first (T0) and sixth (T1) month of pregnancy and at the first month post-partum (T2) (figure 1).

All the women were evaluated at T0, T1 and T2 with a set of questionnaires that included the Perinatal Depression Predictor Inventory-Revised (PDPI-R), the Edinburgh Postnatal Depression Scale (EPDS), the State-Trait Anxiety Inventory (STAI), the Maternal Antenatal Attachment Scale (MAAS), at T1, and the Maternal Postnatal Attachment Scale (MPAS), at T2. At T0 and during the follow-up if the EPDS, PDPI, and STAI scores were indicative for the presence of risk factors or of significant depressive and/or anxiety symptoms, they were also evaluated with the Structured Clinical Interview for Axis I Disorders according to the criteria of DSM-IV TR (SCID-I) [26] to assess the presence of current and lifetime psychiatric diagnosis. At T0, all subjects completed a socio-demographic questionnaire, which included age, educational level, marital and socio-economic status, residence, employment, nationality, parity. At T2 subjects completed a questionnaire regarding obstetric data which included the way of lactation, mode of delivery, and tobacco use during pregnancy.

The Postpartum Depression Predictors Inventory-Revised (PDPI-R) [27] was administered to assess the presence of perinatal depression risk factors at T0, T1 and T2. The scale includes 10 items regarding prenatal predictors and 3 items regarding postnatal predictors. Higher scores indicate a greater

likelihood of problems with perinatal depression. The PDPI-R has been used in a previous study in a large sample of Italian women [28]. We evaluated both the total score of the scale and the role of the single risk factors (unplanned pregnancy, unwanted pregnancy, low self-esteem, low social support, marital problems and life stress) in determining post-natal psychopathology.

The Edinburgh Postnatal Depression Scale (EPDS) [29] was administered to assess depressive symptoms at T0, T1 and T2. It is a 10 items questionnaire that can be used during pregnancy and in the postnatal period. The EPDS has been previously used in Italian samples [30]. According to the authors' recommendations, we used the EPDS score > 9 as indicative of significant depressive symptoms.

The State-Trait Anxiety Inventory (STAI) [31] was used to assess anxiety symptoms. We administered the 20 items of the scale that explore state anxiety at T0, T1 and T2. We used the Italian version of the scale [32]. According to the authors' recommendations, a STAI score > 40 is indicative of significant anxiety symptoms.

The Maternal Antenatal Attachment Scale (MAAS) [33] was used to evaluate the antenatal attachment at T1. The 19-item scale focuses on maternal attitudes, thoughts, feelings and behaviors towards the fetus. The total score ranges from 19 to 95 with higher scores indicating the most adaptive mother-foetal bonding style [33]. The MAAS has previously demonstrated reliability and construct validity [34] and it has already been used in Italian samples [35].

The Maternal Postnatal Attachment Questionnaire (MPAS) [34] was used to evaluate postnatal attachment at T2. The 19-items scale measures the mother's reported feelings about her infant. The sum of the 19 items yields the total MPAS score ranging from 19 to 95, with higher scores indicating the most adaptive mother-infant bonding style [34]. We used the Italian adaptation of the scale [36]. The MPAS has previously been used to measure postnatal attachment in comparison to the Maternal Antenatal Attachment Scale (MAAS) [24, 25, 37]. We defined a subgroup of women having low attachment scores, through the identification of the 25 per cent (quartile) of women having the lowest attachment scores, compared with the remainders, according to Condon and Corkindale's [6] indications.

The statistical analysis was performed using SPSS. Results were expressed as Mean \pm Standard Deviation (SD) or the percent value. The Shapiro Wilk Test was used to check the normality of the variables. Differences in means between prenatal and postnatal periods were assessed using t-tests for normally distributed variables, or the Mann-Whitney U/Wilcoxon Test for not-normally distributed variables. The Box-Cox transformation was used for not-normally distributed variables. Mean p-values

were adjusted for the number of tests using the Bonferroni correction with a significance of $p < .05$. Univariate and/or logistic regression analyses were performed in order to test the correlations of postnatal depressive, anxiety symptoms and maternal-infant bonding and the antenatal variables. Multiple linear or logistic regression models were then built in order to study the determinants of depressive, anxiety symptoms and maternal-infant bonding in the post-natal period. In the case of a significant correlation between the values and dependent variables of the univariate analyses, the values were used as independent variables. Socio-demographic and obstetric variables were also considered in the models. All the multiple regression models were checked for multicollinearity. A variable was excluded from the model if it had a variance inflation factor greater than 10 and a condition number greater than 100 in the Eigen values of Centered

Results

The mean age of the sample was 33.93 ± 4.0 years. Almost all of women were Italian (97.1%, $n=103$) and were married or living with a partner (94.3%, $n=100$). The majority of women lived in urban (45.3%, $n=48$) or suburban (51.9%, $n=55$) areas, almost half of the women (49.1%, $n=52$) had completed a college education, were employed (92.4%, $n=98$) and had a medium socio-economic status (92.5%, $n=98$). The majority of women were at their first pregnancy (71.7%, $n=76$) and had vaginal deliveries (61.3%, $n=65$). Half of the women breastfed (52.8%, $n=56$), and one-third ($n=33$) used a mixed way of lactation. The great majority of women didn't use tobaccos during pregnancy (89.6%, $n=95$).

The descriptive statistics of the rating scales used in this study (MAAS, MPAS, STAI, EPDS and PDPI-R) are shown in Table 1. The lifetime psychiatric diagnosis evaluated at T0 showed that the 27.3% ($n=29$) of subjects reported at least one lifetime psychiatric diagnosis, particularly almost half of them (14.1% $n=15$) reported a lifetime mood disorder and a lifetime anxiety disorder. A current major/minor depressive episode was present in 1.8% ($n=2$) and in 2.8% ($n=3$) of the subjects at T0 and T1 respectively, and in 3.8% ($n=4$) of the subjects at T2.

Antenatal determinants of post-partum depressive symptoms

In the logistic regression analyses there were no correlations between post-partum depressive symptoms expressed by the EPDS score and socio-demographic factors such as marital, employment and socio-economic status (respectively $p=0.48$, $p=0.98$, $p=0.75$), level of education, residence or nationality

(respectively $p=0.99, p=0.79, p=0.58$). No correlations were also observed with pregnancy and obstetric factors such as being at the first pregnancy, smoking during pregnancy, type of feeding or type of delivery (respectively $p=0.83, p=0.12, p=0.94, p=0.84$).

Among the lifetime psychiatric diagnosis, the presence of lifetime mood disorders predicted post-partum depressive symptoms (coeff.=2.07, $p=0.008$).

The multiple regression model between post-partum depressive symptoms and the antenatal variables such as the quality of maternal attachment, depressive and anxiety symptoms, and perinatal risk factors, respectively MAAS score at T1, PDPI, STAI, PDPI-R scores at T0 and T1, was significant ($F=8.48, p<0.0001$) and revealed that the maternal-foetal attachment (MAAS score at T1) and perinatal depression risk factors (PDPI-R total score at T1) were the variables significantly associated with post-partum depressive symptoms (respectively coeff: -0.17, $p=0.003$, coeff: 0.52, $p=0.02$).

The logistic regression analysis revealed that the quality of maternal-foetal bonding at sixth month of pregnancy predicted post-partum depressive symptoms (OR: 0.82 – IC [0.73-0.92], $p=0.001$). The multiple logistic backward regression analysis on post-partum depressive symptoms, with the MAAS and the PDPI-R score at T1 as independent variables and the lifetime diagnosis of mood disorder as covariate, revealed that the mother-foetus quality of attachment still independently predicted post-partum depressive symptoms (OR: 0.84 – IC [0.73-0.96], $p=0.01$).

Antenatal determinants of post-partum anxiety symptoms

In the logistic regression analyses there were no correlations between post-partum anxiety symptoms expressed by the STAI score and socio-demographic factors such as marital, employment and socio-economic status (respectively $p=0.54, p=0.32, p=0.44$), level of education, residence or nationality (respectively $p=0.65, p=0.09, p=0.69$). No correlations were also observed with pregnancy and obstetric factors such as being at the first pregnancy, smoking during pregnancy, type of feeding or type of delivery (respectively $p=0.39, p=0.39, p=0.55, p=0.31$).

Among the lifetime psychiatric diagnosis, lifetime mood disorders predicted post-partum anxiety symptoms (coeff=2.67, $p<0.001$).

The multiple regression model with post-partum anxiety symptoms as the dependent variable, and the antenatal variables such as maternal –foetal attachment, anxiety and depressive symptoms, and perinatal depression risk factors (respectively MAAS at T1, PDPI, STAI, PDPI-R at T0 and T1) as independent

variables, was significant ($F=10.63$, $p<0.0001$) and revealed that the maternal-foetal attachment was the variable significantly associated with anxiety symptoms at the first month post-partum.

The logistic regression analysis revealed that the antenatal attachment predicts post-partum anxiety (OR:0.86 – IC [0.79-0.95], $p=0.002$). The multiple logistic backward regression analysis on postnatal anxiety symptoms, with the MAAS at T1 as the independent variable and the lifetime diagnosis of mood disorder as covariate, revealed that antenatal attachment still predicted post-partum anxiety (OR:0.88 – IC [0.79-0.98] $p=0.02$) together with lifetime diagnosis of mood disorders (OR: 11.87-IC [2.42-58.31], $p=0.002$).

Antenatal determinants of post-partum bonding

When considering socio-demographic and obstetric factors, in the logistic regression analyses there only was a positive correlation between maternal infant quality of attachment, expressed by MPAS score, and marital status (married/de facto coeff=1.19, $p=0.04$). Particularly we found that being single (OR: 7.1-IC [1.22-41.3], $p=0.03$) and having a lifetime diagnosis of mood disorders (OR: 3.32-IC [1.1-10.29]) predicted a poorer maternal-infant attachment.

The multiple regression model with quality of postnatal bonding as a dependent variable and antenatal factors such as maternal –foetal attachment, anxiety and depressive symptoms, and perinatal risk factors for maternal psychopathology, (respectively MAAS at T1, PDPI, STAI, PDPI-R at T0 and T1) as independent variables, was significant ($F=8.72$, $p<0.001$). The maternal –foetal quality of bonding at T1 was the variable significantly associated with maternal-infant quality of bonding (coeff=0.34, $p<0.001$).

The logistic regression analyses revealed that the quality of antenatal bonding at sixth month of pregnancy predicted the quality of postnatal attachment (OR:1.17 – IC [1.08-1.27], $p<0.001$). The multiple logistic backward regression analysis on maternal-infant attachment, expressed by MPAS score, and the MAAS score at T1 as the independent variable, the lifetime diagnosis of mood disorder and the marital status as covariates, revealed that the quality of maternal –foetus attachment independently predicted the quality of maternal-infant attachment (OR:1.17 – IC [1.08-1.27], $p<0.001$).

Discussion

To the best of our knowledge, this was the first prospective study evaluating the association between antenatal maternal attachment/psychopathology, and post-partum psychopathology and quality of bonding in a group of women during pregnancy and early post-partum, while also taking into account for known risk factors for perinatal depression and lifetime psychiatric diagnosis. The socio-demographical and obstetric characteristics reported by the majority of the women in our sample was correlate with a lower risk of psychopathology in the perinatal period, as previously shown in other studies [2, 27, 38]. Around 14% of the subjects in our sample reported a lifetime depressive episode. This rate is in line with the prevalence of depression reported in women of the general population [39], but is lower than those registered during pregnancy which is around 23 % [40]. Rates of depressive symptoms reported at the antenatal and postnatal assessments in our sample were also lower than those usually reported in literature [41, 42], but were comparable to those found in a previous prospective study assessing both the quality of bonding and depression in the perinatal period [15]. Consistently with the literature [43] in our sample between 15% to 18% of the women referred anxiety symptoms in the prenatal period and 9.5% referred anxiety symptoms at the first month of postpartum. These data are in line with literature data showing that anxiety levels are higher during pregnancy when compared to the post-partum period [4, 44, 45, 46].

The relationship between maternal antenatal attachment and post-partum depressive symptoms was still significant, while checking for lifetime psychiatric diagnosis, antenatal psychopathology and risk factors for perinatal psychopathology. Particularly, in line with previous research [3, 4, 47], maternal antenatal attachment independently predicted post-partum depressive symptoms. Analogously, the association between maternal-fetus attachment and post-partum anxiety symptoms was significant even after having controlled for socio-demographical characteristics, the known risk factors for perinatal psychopathology, lifetime psychiatric diagnosis, and antenatal psychopathology. Only few studies have evaluated the relationship between antenatal attachment and anxiety, yielding mixed results [4, 19, 48, 49]. In our sample, maternal-foetus attachment and the lifetime diagnosis of mood disorders were the variables that most strongly predicted postnatal anxiety. In summary, these data provided evidence that a good quality of maternal antenatal attachment may play a protective role for the development of both depressive and anxiety symptoms in the early post-partum period. In line with previous research [3, 4, 23, 24, 37, 49, 50], maternal antenatal attachment predicted the quality of the maternal-infant attachment, even after controlling for potential confounders such as anxiety and depressive symptoms. This observation

provided further evidence of the early antenatal roots of the postpartum mother-to-infant bond [37]. Our results seem to indicate the importance of the identification of women with poor quality of attachment during pregnancy, in order to provide an adequate support that may help in reducing the risk of depressive, anxiety symptoms and mother-infant attachment problems in the post-partum period. Risk factors for post-partum psychopathology include biological and psycho-social variables, that are mostly not modifiable, as for example the history of depression, which is one of the main risk factors for post-partum depression. Therefore, a comprehensive assessment of maternal risk factors for perinatal psychopathology during pregnancy should include the evaluation of antenatal attachment. Research into the causes of the poor quality of maternal-foetal bonding could be of interest and may include the study of adult attachment style, affective temperament and personality traits.

These results should be interpreted in the context of several limitations. First of all, for our purpose we evaluated a subsample of women who had a relatively high level of education, employment and socio-economic status that limits the generalizability of the findings. Secondly, the scales used to assess antenatal and post-natal attachment, even if they had been already compared in previous studies, were not directly comparable, making it difficult to assess differences between the antenatal and postnatal bonding. In conclusion, understanding the mechanisms involved in the development of maternal psychopathology and of the quality of bonding in the post partum period should be a priority in order to warrant both mother's and infant's health.

The evaluation of antenatal attachment would be of importance in order to prevent maternal psychopathology and/or the poor quality of postnatal bonding: differently from the other known risk factors for perinatal depression, maternal-foetal attachment could be modifiable by specific interventions promoting the quality of maternal bonding.

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Table 1. Psychometric variables

<i>Subjects N=106</i>	<u>1th month pregnancy</u> <u>T0</u>	<u>6th month pregnancy</u> <u>T1</u>	<u>1th month post-partum</u> <u>T2</u>	p
<i>SCID-I current depression %</i>	2.8%	1.9%	3.8%	0.77
<i>Perinatal Risk factor Scale</i>				
PDPI-R score	2.2±2.1	2.4±2.7	3.7±3.8	0.88
<i>Depression Scale</i>				
EPDS score	4.5±3.8	3.01±3.8	3.5±4.2	0.65
Depressive symptoms %	9.3%	4.7%	7.5%	
<i>Anxiety Scale</i>				
STAI score	33.9±7.0	32.5±8.6	31.0±8.6	0.68
Anxiety symptoms %	18.5%	15.1%	9.4%	
<i>Attachment scales</i>				
MAAS-MPAS score	-	79.7±7.03	83.4±5.15	0.05

Note. Data are reported as mean ± standard deviation and percent values-SD. Legend: MAAS: Maternal Antenatal Attachment Scale, MPAS: Maternal Postnatal Attachment Scale, EPDS: Edinburg Postnatal Depression Scale, STAI: State trait Anxiety Inventory, PDPI-R: Postnatal Depression Predictor Inventory-Revised.

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Fig 1. Flow-chart of enrollment procedure

