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# The association of attachment style, postpartum PTSD and depression with bonding- A longitudinal path analysis model, from childbirth to six months

## Abstract

**Background:** There is substantial evidence that postpartum depression (PPD) is associated with a poor mother-infant bond, however, fewer studies have examined the role of other postpartum psychopathologies such as birth-related PTSD or relevant trait variables such as adult attachment styles in the quality of the mother-infant bond.

**Methods:** 210 postpartum women were sampled in a maternity ward of a tertiary health care center. Participants completed questionnaires at three-time points. Demographics questionnaire and the Adult Attachment style scale were administered at 1-4 days postpartum, the City Birth Trauma Scale and the Edinburgh Postpartum Depression Scale two months postpartum and the Postpartum Bonding questionnaire at six months postpartum.

**Results:** The associations between adult attachment styles and postpartum bonding were fully mediated by postpartum psychopathology. Avoidant attachment had indirect effects on bonding through general PTSD symptoms (Beta=0.05,  $p=.019$ ) and PPD (Beta=0.06,  $p=.010$ ). Anxious attachment also had indirect effects on bonding through general PTSD symptoms (Beta=0.04,  $p=.044$ ) and PPD (Beta=0.10,  $p=.001$ ). In contrast, birth-related PTSD symptoms were not associated with bonding. The model presented a good fit.

**Limitations:** Women sampled from one health-care center and self-report measures used.

**Conclusions:** Our results suggest that although birth-related PTSD symptoms may cause difficulties, importantly they may not be associated with bonding difficulties six months postpartum. Therefore, women could be reassured that their birth-related PTSD symptoms, may not impact on bonding. Consequently, if interventions are specifically aimed at improving the

mother-infant bond, the general-related PTSD, PPD symptoms and insecure attachment styles should be the focus of treatment.

**Key words:** Postpartum; Depression; PTSD; Attachment; Bonding

## **Introduction**

The concept of maternal bonding refers to emotions and cognitions a mother has towards her infant and herself as a parent and defined as ‘an affective state of the mother’ (Bicking et al., 2013; Billings, 1995). Bonding is believed to develop during pregnancy or immediately after birth (Bicking et al., 2013), and continues to evolve over the first months of the infant’s life (Koniak-Griffin et al., 2006; Muzik et al., 2013). Although sometimes used interchangeably, bonding and attachment are different constructs (Takács et al., 2020), whereas bonding refers to maternal emotions and thoughts toward the child (Bicking et al., 2013), attachment refers to child's internal working model of relationships as measured by the actual relationship pattern with the mother or another caregiver (Bowlby, 1969/1982). Parent-infant bonding is considered central to infant wellbeing and to cognitive and emotional development of the child (Cirulli et al., 2003; Fuchs et al., 2016; Landry et al., 1997; Patock-Peckham and Morgan-Lopez, 2010; Tamis-LeMonda et al., 2001; Tichelman et al., 2019).

Research on potential risk factors associated with maternal bonding has focused on psychiatric morbidity, in particular postpartum depression (PPD). PPD is relatively common postpartum complication with a global pooled prevalence of 17.7% with significant heterogeneity across nations (Hahn-Holbrook et al., 2018). There is now substantial evidence that PPD measured early after birth can predict bonding difficulties as far as one year postpartum (Brockington et al., 2006; Kasamatsu et al., 2020; Kerstis et al., 2016; Moehler et al., 2006; Nonnenmacher et al. 2016). In contrast, there is far

less research examining the association between bonding and other psychopathology such as postpartum PTSD. Postpartum PTSD is less prevalent than PPD with meta-analyses suggesting it affects 3-4% of women (Grekin and O'Hara 2014; Yildiz et al., 2017). Research examining the associations between postpartum PTSD and bonding is inconsistent with some studies reporting an association of postpartum PTSD and bonding (Parfitt and Ayers, 2009) while others failing to report this association (Nakić Radoš et al., 2020). A review of postpartum PTSD and child outcomes concluded that it seems reasonable to determine that there is stronger evidence in support of an association of postpartum PTSD with bonding (Cook et al., 2018). However, it is possible the evidence may vary as a function of how postpartum PTSD is defined and measured (Dekel et al., 2017) and/or whether other symptoms of mood disturbance are included in the tested models (Davies et al., 2008). In particular, the assessment of postpartum PTSD is complicated as studies often fail to differentiate childbirth-related PTSD from postpartum PTSD symptoms due to other antecedent trauma exposures (Dekel et al., 2017).

Postpartum PTSD may differ from other traumas as birth is a common event which is culturally perceived as positive. In addition, normal postpartum symptoms may complicate measurement. Evidence suggests that childbirth-related PTSD may be best conceptualized by two symptom clusters of birth-related symptoms and general symptoms (Ayers et al., 2009; Ayers et al., 2018; Handelzalts et al., 2018; Nakić Radoš et al., 2019;). This conceptualization allows for the differentiation between symptoms directly linked with childbirth (e.g. re-experiencing the birth and trying to avoid reminders) and more general PTSD symptoms (e.g. negative cognitions and mood, hyperarousal). Further, this conceptualization may partly explain the inconsistent research on the associations between postpartum PTSD and parenting variables in

general, and with postpartum bonding in particular. There is emerging evidence to support this. Two studies using this conceptualization found that whereas general PTSD symptoms were associated with impaired bonding (Handelzalts et al., 2019; Nakić Radoš et al., 2020), birth-related PTSD symptoms were not (Nakić Radoš et al., 2020), or were associated with better bonding (Handelzalts et al., 2019).

In contrast to psychopathology, very few studies have examined the role of precipitating personality traits in bonding. A key trait with relevance to parenting and bonding is adult attachment style. Experiences in early attachment relationships provide a framework for understanding and engaging in close relationships later in life. According to Bowlby and Ainsworth, children internalize attachment relationships with their primary caregivers, creating a prototype for later relationships (e.g., Ainsworth, 1991; Bowlby, 1969/1982). Attachment theory suggests that these prototypes, or internal working models of self and others, may guide expectations of care and interactive patterns in close relationships later in life, including in parenting (Bartholomew, 1990; Bowlby, 1969/1982; Hazan and Shaver, 1987; Jones et al., 2015). There is evidence to support this, showing insecure attachment styles are associated with maladaptive coping (Fearon et al., 2010) and psychopathology, including depression (Warfa et al., 2014) and PTSD (Woodhouse et al., 2015).

Attachment styles are also associated with parenting variables (Jones et al., 2015). However, there is limited research on the associations between adult attachment styles and bonding. Evidence that is available is not always consistent. For example, although some studies find associations between insecure adult attachment styles and bonding difficulties (Hairston et al., 2018; Nonnenmacher, et al. 2016; Van Bussel et al., 2010) others find no association (Chrzan-Dętkoś and Lockiewicz, 2015).

## **Aims and hypotheses**

The aim of this research was to examine the relationship between adult attachment styles, postpartum psychopathology and the mother-infant bond using a comprehensive longitudinal mediation model of insecure avoidant and anxious attachment styles associations with postpartum bonding, mediated by postpartum PTSD and PPD.

The research hypotheses were that both anxious and avoidant insecure attachment styles as measured at 1-4 days postpartum would be associated with poorer bonding at six months postpartum, mediated by PPD measured at two months postpartum. We further studied possible mediation by postpartum PTSD (measured as general symptoms and birth-related symptoms) at two months postpartum, though due to the inconsistencies in the literature this was an exploratory hypothesis.

## **Method**

### ***Sample***

The final sample included 210 postpartum women who gave birth in the maternity wards of a large tertiary health center (removed for blind review) and had full sets of data at three time points. Information about recruitment, data collection and dropout rate can be seen in Figure 1. Comparing dropouts to women who completed all three time points showed that completers were less avoidant ( $M=2.5$ ,  $SD=0.9$  vs  $M=2.8$ ,  $SD=1.0$ ,  $F(1,527)=9.1$ ,  $P=.002$ ) and older ( $M=32.0$ ,  $SD=4.7$  vs  $M=31.0$ ,  $SD=5.4$ ,  $F(1,587)=4.5$ ,  $P=.035$ ). In addition, non-(removed for blind review) were less likely to complete (18% vs 43%,  $P<.001$ ), as were women with less than university educational level (28% vs 47%,  $P<.001$ ) and with below average income (35% vs 49%,  $P<.001$ ). Eligibility criteria included at least 37 weeks gestation, a singleton pregnancy and (removed for blind review) speaking.

The average age of the participants was 32.14 ( $\pm 4.66$ ), most (94.3%) were married, 84.3% were born in (removed for blind review) and 94.8% were (removed for blind review). Participants reported their income as below average (19.5%), average (33.8%), or above average (45.2%). Most were educated, with 75.2% who had completed university education or above. On average, they completed the baseline measures at 3.04 ( $\pm 1.31$ ) days postpartum, 24.8% were primiparous. Most women (74.3%) had vaginal births, 9.0% had elective cesarean section, 11.4% had emergency cesarean sections, and 5.2% had an assisted vaginal births. Just over half of women (53.3%) were administered an epidural, and 42.4% had Oxytocin for labour augmentation.

### ***Recruitment and Procedure***

The study is part of a larger longitudinal study aimed at understanding associations between factors associated with birth and postpartum mental health during the first six months postpartum conducted between July 2018 and July 2019. Ethical approval for this study was obtained from the (removed for blind review) institutional review board. Research assistants approached all women at the maternity ward on a random day of the week and after giving informed consent, the participants answered questionnaires at three time points:

T1 (1-4 days postpartum) in person at the maternity ward- obstetric data were taken from the medical files and women completed demographic and adult attachment measure (Experiences in Close Relationships Scale; ECR).

T2 (two months postpartum) using online questionnaires the participants completed the depression (Edinburgh Postnatal Depression Scale, EPDS) and postpartum PTSD (City Birth Trauma Scale, BiTS) measures.



T3 (six months postpartum) using online questionnaires as in T2, the participants completed the bonding measure (Postpartum Bonding Questionnaire, PBQ).

Participants who did not respond to the email invitation were reminded once with a phone call. Questionnaires and data output were generated using Qualtrics© 2015 (Qualtrics, Provo, UT, USA. <http://www.qualtrics.com>).

### ***Measures***

*Sociodemographic questionnaire* included questions about age, education level, marital/co-habiting relationship, income level (as compared to the national average per household at the time of the study), religious affiliation, country of origin and the history or current existence of psychiatric disorders.

*Obstetric data* were extracted from medical records, recording number of previous births, infertility treatments, pregnancy risks, past abortions or miscarriages, and current birth data: type of birth as well as Epidural and Oxytocin administration.

*Attachment style* was assessed by the Experiences in Close Relationships Scale (ECR, Brennan et al., 1998) which assesses the dimensions of anxious and avoidant adult attachment. For the purpose of the study we used an abbreviated, validated version (removed for blind review) which consists of 24 items divided into two dimensions: anxious (12 items, e.g., "I worry about being abandoned"), and avoidant (12 items, e.g., "I feel discomfort when others get close to me"). Participants rated the extent to which an item described themselves on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). A high score indicates more anxious or avoidant attachment style. This scale has been used in previous studies with postpartum women (e.g. Iles et al.,

2011; Marques et al., 2018). In the current study, the internal reliability was good ( $\alpha = .85$  for anxiety and  $\alpha = .84$  for avoidance).

*Postpartum depression* was measured using a validated (removed for blind review) version of the Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987). The EPDS was developed as a screening tool for postpartum depression and consists of 10 items rated on a 4-point scale, ranging from 0 to 3, with a maximum score of 30. Responses are summed with higher scores reflecting greater risk for depression. A score over 10 indicates symptoms of depression and a score over 12 indicates significant depressive symptoms (Cox et al., 1987; Murray and Carothers, 1990). In the current study, the internal reliability was good ( $\alpha = .85$ ).

*Postpartum PTSD* was assessed by validated (removed for blind review) version of the City Birth Trauma scale (BiTS; Ayers et al., 2018): The BiTS consists of 31 items developed on the basis of DSM-5 criteria for PTSD (APA, 2013). Twenty-three of the items assess frequency of symptoms over the last week, scored on a scale ranging from 0 ('not at all') to 3 ('5 or more times') and cover four symptom clusters of DSM-5: 're-experiencing', 'avoidance', 'negative mood and cognitions' and 'hyperarousal'. For this analysis, we used the BiTS two symptom factors: birth-related symptoms (covering symptoms of intrusions, avoidance, and two items from Negative cognitions and mood but specifically related to birth) (9 items; range 0-27) and general symptoms (covering other items from negative cognitions and mood and hyperarousal) (11 items; range 0-33). These factors were found in factor analysis in the study of the original scale (Ayers et al., 2018) and translations (Handelzalts et al., 2018; Nakić Radoš, et al., 2019). In the current study internal reliability was good ( $\alpha = 0.88$  for general symptoms and  $\alpha = 0.86$  for birth-related symptoms).

*Maternal bonding* was assessed by the (removed for blind review) version of the Postpartum Bonding Questionnaire (PBQ; Brockington et al., 2001). This 25-item scale assessed the mother's feelings or attitudes toward her baby (e.g., "I feel close to my baby"). Statements are presented on a 6-point scale, ranging from 0 (always) to 5 (never), with reverse coding of positive items. Responses are summed so that higher scores denote **greater** bonding difficulties (poorer bonding). Two items relating to the risk of abuse were not included due to ethical considerations (Muzik et al., 2013). Internal reliability of the total scale was good ( $\alpha = .89$ ).

### ***Statistical Analysis***

Data were analyzed using the statistical software package SPSS 25.0 (SPSS Inc., Chicago, IL). Path analysis models were analyzed using AMOS 25.0 (SPSS Inc., Chicago, IL). The Pearson correlation coefficient (for continuous variables) or the  $\chi^2$  (for categorical variables) tests were used to test the associations between the demographic and outcome variables. Dropout characteristics were tested using one-way Anova (for continuous variables) or the  $\chi^2$  test (for categorical variables). Results were considered significant at  $P < .05$  and close to significant at  $P .05 - .10$ .

### **Results**

Sample characteristics and associations with bonding are presented in Table 1. It can be seen that bonding difficulties were significantly associated with being multiparous, having an unexpected type of birth (i.e. assisted vaginal or emergency caesarean section birth), having a past or current psychiatric diagnosis, university education and not being married. Descriptive statistics and correlations between the main study variables are presented in Table 2. We found that other than the correlation between avoidant attachment and birth-related PTSD symptoms, all correlations among the

study variables were significant (all  $P$ 's<.01). Specifically, all variables significantly correlated with bonding.

The mediation model is shown in Figure 2. In the first stage, demographic and obstetric variables that had significant ( $P$ <.05) or close to significant ( $P$ <.10) relationship with bonding were considered as potential covariates and included in the model. Thus, based on the correlations presented in Table 2, the model initially included parity, marital/co-habiting status, birth type, university education and having a psychiatric diagnosis as covariates. In the second stage, the contribution of the covariates was tested and those that did not significantly contribute to the model at  $P$ <.05 were removed. Therefore, although not shown in Figure 2, the final model controlled for university education and birth type as covariates (university education: Beta=0.19,  $p$ =.005, birth type: Beta=0.18,  $p$ =.009).

Figure 2 presents the model. It can be seen that the direct links between insecure adult attachment styles and postpartum bonding were not significant, and so the association between them was fully mediated by postpartum psychopathology. All other direct links were significant, with the exception of the link between avoidant attachment and postpartum birth-related PTSD symptoms, and the link between postpartum birth-related PTSD symptoms and bonding. Avoidant attachment had indirect effects on bonding through general PTSD symptoms (Beta=0.05,  $p$ =.019) and PPD (Beta=0.06,  $p$ =.010). Anxious attachment also had indirect effects on bonding through general PTSD symptoms (Beta=0.04,  $p$ =.044) and PPD (Beta=0.10,  $p$ =.001).. The model was a good fit to the data with good fit indices (Chi-Square (5)=8.7,  $p$ =.120, NFI=.98, TLI=.95, CFI=.99, RMSEA=.06).

## **Discussion**

This study aimed to examine the relationship between adult attachment styles, postpartum psychopathology and the mother-infant bond. Results confirm that the effect of adult attachment style on the mother-infant bond was fully mediated by postpartum psychopathology, specifically PPD and general PTSD symptoms but not by birth-related PTSD symptoms.

This study adds support to the emerging evidence that postpartum bonding is associated with precipitating individual differences (Handelzalts et al., 2019; Oddo-Sommerfeld et al., 2016; Robakis et al., 2015) and specifically with insecure attachment styles. In this longitudinal study we found the both anxious and avoidant attachment styles measured 1-4 days postpartum were associated with impaired bonding six months postpartum. These findings are broadly consistent with studies reporting an association between insecure adult attachment and bonding, although there is some variation in the specific insecure attachment styles that are examined and associated (Hairston et al., 2018; Nonnenmacher, et al., 2016; Van Bussel et al., 2010). Our findings are not consistent with one study that reported no association, though this was a small pilot study (Chrzan-Dętkoś and Lockiewicz, 2015).

The current results are also consistent with the broader literature linking different insecure attachment styles (as measured by different measures) and parenting variables (Jones et al., 2015). It was previously suggested that the general conclusion that parenting is associated with insecure attachment styles is very broad and oversimplified and that specific attachment styles may correlate differently with various parenting measures therefore different parenting variables should be studied with regard to the different attachment styles (Jones et al., 2015). Our study results point specifically to the possibility that **both** avoidant and anxious attachment style may be associated with the affective state of bonding with the infant. This could be explained

by the fact that the construct of bonding (i.e. emotions and cognitions a mother has towards her infant and herself as a parent) is expected to be associated with both anxious and avoidant attachment styles as avoidant attachment working models are characterized by distrust of relationship partners and a desire for self-reliance and anxious attachment working models are characterized by internal working models of helplessness and fear of being alone (Mikulincer and Shaver, 2007). Both of these may be associated with bonding difficulties. The fact that we have used the ECR (Brennan et al., 1998) for the measurement of attachment styles, which was found to be a good tool for measuring the anxious and avoidant dimensions distinctively (Cameron et al., 2012) in a longitudinal large sample study, strengthens our conclusion though further research clearly is needed.

The finding that the association between insecure attachment and maternal bonding is mediated by psychopathology variables of PPD is consistent with a large body of evidence showing PPD is associated with a range of poorer mother-infant outcomes including the mother-baby bond (Tichelman, et al., 2019), maternal sensitivity (Murray et al., 2015), poorer mother-infant interaction (Field, 2010; Lovejoy et al., 2000) and child outcomes (Goodman et al., 2011; Grace et al., 2003; Liu et al., 2017). Current findings are also consistent with previous research showing that PPD partially mediates the relationship between insecure attachment and bonding (Nonnenmacher et al., 2016; Tietz et al., 2014).

The results of this study add to emerging evidence on the varying associations of postpartum PTSD with bonding difficulties (Handelzalts et al., 2019; Nakić Radoš et al., 2020), which suggest that birth-related PTSD symptoms are not associated with bonding difficulties. The fact that these results were obtained in a longitudinal design, rather than cross-sectional like previous research, further augment the robustness of the

results. This might explain why previous findings regarding the relationship between postpartum PTSD and bonding were inconsistent because research did not differentiate between birth-related PTSD symptoms and general PTSD symptoms. For example, recent research reported that maternal attachment (which is close but not identical to bonding) was lower for women with childbirth-related postpartum -PTSD than for women with non-childbirth PTSD and women with no PTSD at all (Dekel et al., 2019). Although this previous study differentiated between childbirth and non-childbirth PTSD, it did not differentiate between general PTSD symptoms and birth-related PTSD symptoms. Our study is now the third study finding different associations of the two postpartum PTSD factors with bonding and showing that general PTSD symptoms are associated with bonding difficulties while birth-related symptoms are not (Handelzalts et al., 2019; Nakić Radoš et al., 2020).

When looking at the specific general PTSD symptoms, they include arousal and most of the symptoms of negative cognitions and mood. These symptoms refer to feeling irritable and tense, having problems concentrating and feeling detached from other people. Feelings of detachment may be especially important with relation to the mother-infant bond. Although the scale items ask about detachment in general, this may tap into possible feelings of detachment from the infant and by that, associated with bonding. Other symptoms, such as tension, irritability and aggressiveness may also interfere with the mother-baby bond (Brockington et al., 2006).

Other general PTSD symptoms were feeling negative about oneself, loss of interest in things that were important and not being able to feel positive emotions. These symptoms are similar to core symptoms of depression (i.e. low mood and anhedonia) which could explain the very high correlation (0.73) between general PTSD symptoms and PPD found in our research. It is possible that some of the relationship between

general PTSD symptoms and poor bonding is due to shared symptoms (and therefore variance) with PPD. However, results of the current study suggest general PTSD symptoms remain associated with bonding when PPD is controlled for in the model. This remaining relationship perhaps represents the effect of symptoms of detachment and hyperarousal as outlined above. However, this is speculative at this point and requires more detailed examination.

In contrast, birth-related PTSD symptoms were not associated with bonding in the model, once insecure attachment styles, PPD and general related PTSD symptoms were included. When looking specifically at birth-related PTSD symptoms they include the core PTSD symptoms of re-experiencing, avoidance, and two of the items from negative cognitions and mood that directly refer to the birth (blame about things that happened during birth, and strong negative emotions about the birth). Although these symptoms can be very distressing to women and important to treat, it seems that in our sample such symptoms were not associated with a poor maternal bond.

This finding is not consistent with qualitative studies in which women with postpartum PTSD report struggling to bond with their baby (Ayers et al., 2006; Elmier et al., 2010; Fenech and Thomson, 2014; Nicholls and Ayers, 2007). There are a number of possible explanations for this. First, it could be that women who struggle to bond with their baby are those with more general PTSD symptoms rather than birth-related PTSD symptoms. Qualitative literature on postpartum PTSD has not distinguished between these symptom groups so it is important to examine this directly. Second, it is possible that if postpartum PTSD and re-experiencing symptoms are associated with a threat to the life of the baby this might prompt women to form a stronger or more protective bond. Third, it seems that while the baby may be a constant reminder of the trauma of childbirth, it is difficult for the mother to avoid and reject the child as a stimulus to the



trauma (unless in extreme cases). Thus, in essence, the baby may be generally a positive result of the possible negative trauma (marked by a threat to the mother and/or the baby). So, while avoidance and re-experiencing birth-related PTSD symptoms may cause stress at two months postpartum, they may be unrelated to bonding at six months postpartum. It has also been suggested in other studies that some women may feel more strongly bonded to the baby as a result of perceived threat to herself or her baby during birth (Handelzalts et al., 2019; Nakić Radoš et al., 2020).

Our results corroborate many other studies suggesting that PPD levels predict poorer bonding with the infant in the first year of life (Brockington et al., 2006; Kasamatsu et al., 2020; Kerstis et al., 2016; Moehler et al., 2006; Nonnenmacher et al. 2016). In our model, Both PPD and general PTSD symptoms mediated the associations between both insecure attachment styles and bonding, suggesting that both constructs explain different variance in bonding levels as described above.

Anxious attachment style was associated with both PPD, PTSD general and birth-related symptoms, while avoidant attachment style was associated only with PPD and general-related PTSD. Our results are consistent with the conclusions of two recent meta-analyses reporting that anxious attachment styles may play a more prominent role than avoidant attachment with regard to PTSD (Lim et al., 2019; Woodhouse et al., 2015). We found that only anxious attachment style was associated with both general and birth-related PTSD symptoms (all of the PTSD symptoms), such as re-experiencing, avoidance, arousal and negative cognitions and mood. In contrast, avoidant attachment style was associated only with the general PTSD symptoms of arousal and most of the symptoms of negative cognitions and mood. In that sense, it can be suggested that people high in avoidant attachment style may experience less re-experiencing and avoidance PTSD symptoms. These results echo the suggestion in

the literature that avoidant attachment style may be even beneficial in the context of recovering from traumatic events and that the defensive façade that commonly underlies attachment avoidance may even be functional in certain life stressors (Lim et al., 2019; Woodhouse et al., 2015).

Both insecure attachment styles were found to be associated with general PTSD symptoms such as arousal or negative cognitions. This suggests that either avoidant internal working model characterized by distrust of relationship partners and a desire for self-reliance (Mikulincer and Shaver, 2007) or anxious internal working model characterized by helplessness and fear of being alone (Mikulincer and Shaver, 2007), may be associated with these general PTSD symptoms that in turn may be responsible for poorer bonding.

Finally, both insecure attachment styles were found to be associated with PPD. Although the literature suggests that anxious attachment style was more consistently associated than avoidant attachment style with depression in general and PPD in particular (Ein-Dor and Doron, 2015; Warfa et al., 2014), there are studies who report that avoidant attachment style is associated with PPD (Ein-Dor and Doron, 2015) and our study results suggest that both may be important with regard to PPD.

### **Strengths and Limitations**

We believe that our six months' longitudinal design helps establish the indirect associations of mother's both anxious and avoidant insecure adult attachment styles with bonding at the first six months postpartum mediated by postpartum PTSD and PPD measured at two months.

Our study is not without limitations. Although our study was longitudinal, thus allowing us to make inferences about causality, all our participants were sampled from one tertiary health care center, thus limiting the generalizability of the findings. The generalizability was further compromised by the fact that women in the final sample were older, more educated, their income level was higher and they had less avoidant attachment style than women who dropped-out. In addition, Non- (removed for blind review) women had higher rates of drop-out. Future studies should aim for a more representative samples of different populations and/or clinical samples allowing to draw conclusions relevant to women suffering from diagnosed postpartum PTSD or bonding difficulties.

A second limitation was that although the self-report scales used for this research are valid, reliable and widely used in the literature, a different measurement of attachment (such as the adult attachment interview measuring attachment representations) or postpartum PTSD and PPD (such as psychiatric interview) could augment the reliability of the results.

A final limitation concerns the analyses chosen for this work. We chose to analyze bonding as a whole construct rather than analyze specific bonding difficulties. We further chose to analyze childbirth PTSD and PPD concurrently as mediating the attachment-bonding link rather than the interplay between childbirth PTSD and PPD. We believe that future studies could shed light on these specific points.

### **Conclusion and clinical implications**

Our results have some specific clinical implications. As precipitating insecure attachment styles were found to be associated with postpartum bonding difficulties, specific mother-infant bonding interventions could be offered to women with insecure attachment who may possibly be susceptible to future bonding difficulties. In addition,

our results highlight the importance of diagnosing postpartum PTSD using specific measures and suggesting it is general PTSD symptoms and not birth-related symptoms that should be identified in order to help women bond better with their infant. Birth-related symptoms can be distressing and should be treated to reduce their debilitating effect on women. However, if interventions are specifically aimed at improving the mother-infant bond the general-related PTSD and PPD symptoms should be the focus of treatment. Women suffering from birth-related PTSD symptoms could also be reassured that their symptoms, although debilitating, are not associated with the quality of their relationship with the baby, which may alleviate feelings of guilt and shame. Future research is clearly needed to examine the nuances of the impact of different symptoms on the mother-baby bond, as well as the potential role of the nature of the threat during trauma i.e. whether threat to the baby results in different maternal-infant relationship behaviours compared to threat to the mother.

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Table 1: Sample characteristics and correlations with the outcome variable

	N (%)	M (SD), Range	Correlation with Bonding
Age		32.1 (4.6), 20.0-43.0	.02
Primiparous			-.21**
Yes (1)	52 (25)		
No (0)	158 (74)		
Birth type <sup>a</sup>			.27**
Expected (0)	175 (83)		
(Vaginal, Elective CS)			
Unexpected (1)	35 (17)		
(Vaginal Assisted, Emergency CS)			
Epidural			-.05 (calculated for known values only)
Yes (1)	112 (53)		
No (0)	62 (30)		
Unknown	36 (17)		
History or Current Psychiatric Diagnosis			-.18**
Yes (1)	10 (5)		
No (0)	200 (95)		
Marriage/Co-habiting			-.20**
Yes (1)	198 (94)		
No (0)	12 (6)		
Religion			.03
XXX (1)	199 (95)		
Non-XXX (0)	11 (5)		
Place of Birth			-.06
XXX (1)	177 (84)		
Other (0)	33 (16)		
University Education			.12†
Yes (1)	158 (75)		
No (0)	52 (25)		
Income			.10
Below Average (1)	41 (20)		
About or Above Average (0)	207 (80)		

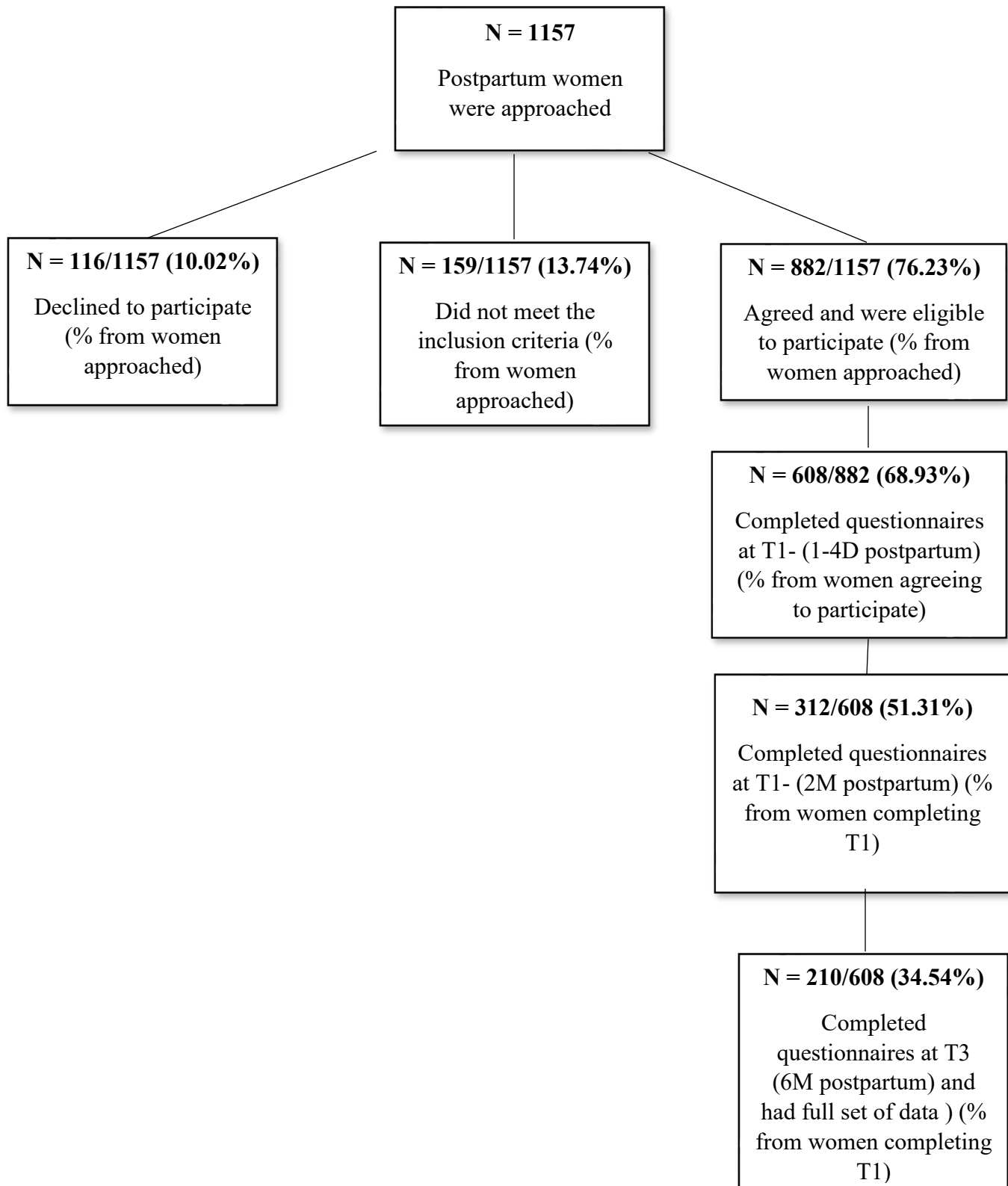
<sup>a</sup> We treated "birth type" as a dichotomous variable for statistical reasons, and according to relevant literature which claims that the importance of the birth type variable is whether it was expected or not (Handelzalts et al., 2017; Kjerulff & Brubaker, 2018; Zanardo et al., 2016). Thus, vaginal birth and elective cesarean sections are considered "Expected birth", while emergency cesarean section and vaginal assisted birth are considered "Unexpected birth". †  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$

Table 2: Means, Standard Deviations and Correlations between the Main Study Variables

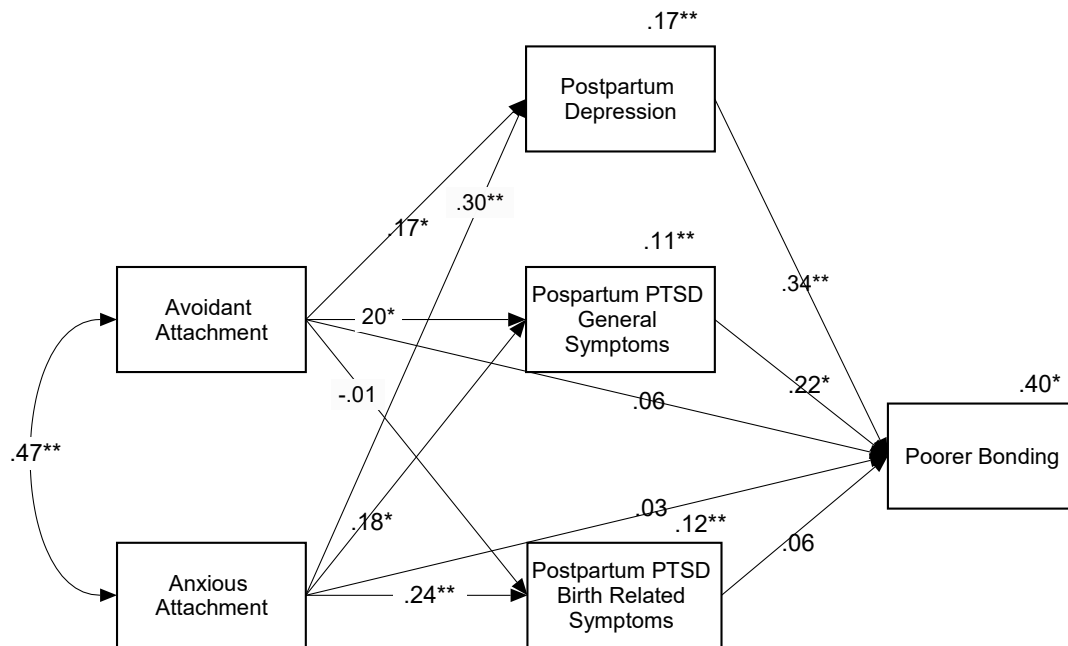
	Anxious attachment	Birth- related PTSD symptoms	General PTSD symptoms	Depression	Bonding	M (SD)
Avoidant attachment style	.48**	.12	.29**	.29**	.24**	30.0 (11.0)
Anxious attachment style		.26**	.28**	.35**	.28**	30.7 (12.8)
Birth-related PTSD symptoms			.45**	.40**	.36**	1.8 (3.4)
General PTSD symptoms				.73**	.52**	3.1 (4.7)
Depression					.57**	3.1 (3.7)
Bonding						9.1 (8.7)

\* p<.05, \*\* p<.01

**Figure 1. Recruitment and data collection**



**Figure 2: Mediation model of the effect of attachment style poorer bonding by psychological distress.**



Numbers above the lines are standardized coefficients. Numbers above the endogenous variables names are squared multiple correlations. Although not shown in the figure, the model included having higher education and birth type as covariates. \*  $p < .05$ , \*\*  $p < .01$