Published in final edited form as:

J Midwifery Womens Health. 2013 ; 58(1): 57–68. doi:10.1111/j.1542-2011.2012.00237.x.

Childhood abuse history, posttraumatic stress disorder, postpartum mental health and bonding: A prospective cohort study

Julia S. Seng, PhD, CNM, FAAN, Mickey Sperlich, MA, CPM, Lisa Kane Low, PhD, CNM, FACNM, David L. Ronis, PhD, Maria Muzik, MD, and Israel Liberzon, MD

Abstract

Introduction—Research is needed that prospectively characterizes the intergenerational pattern of effects of childhood maltreatment and lifetime posttraumatic stress disorder (PTSD) on women's mental health in pregnancy and on postpartum mental health and bonding outcomes. This prospective study included 566 nulliparous women in 3 cohorts: PTSD-positive, trauma-exposed resilient, and non-exposed to trauma.

Methods—Standardized telephone interviews with women who were less than 28 gestational weeks ascertained trauma history, PTSD diagnosis, and depression diagnosis. A six-week postpartum interview reassessed interim trauma, labor experience, PTSD, depression, and bonding outcomes.

Results—Regression modeling indicates posttraumatic stress in pregnancy, alone, or comorbid with depression, is associated with postpartum depression ($R^2=.204$, $P<.001$). Postpartum depression alone, or comorbid with posttraumatic stress, was associated with impaired bonding ($R^2=.195$, $P<.001$). In both models, higher quality of life ratings in pregnancy were associated with better outcomes, while reported dissociation in labor was a risk for worse outcomes. The effect of a history of childhood maltreatment on both postpartum mental health and bonding outcomes was mediated by pre-existing mental health status.

Discussion—Pregnancy represents an opportune time to interrupt the pattern of intergenerational transmission of abuse and psychiatric vulnerability. Further dyadic research is warranted beyond six weeks postpartum. Trauma-informed interventions for women who enter care with abuse-related PTSD or depression should be developed and tested.

Keywords

Pregnancy; childhood maltreatment; depression; posttraumatic stress; postpartum mental health; bonding

INTRODUCTION

Posttraumatic stress disorder (PTSD), which affects 8% of pregnant women, is gaining recognition as a common perinatal mental health condition.¹ PTSD is a syndrome of intrusive re-experiencing, avoidance and emotional numbing, and autonomic hyperarousal symptoms that occur in the aftermath of exposure to a traumatic event.² The antecedent trauma exposure most strongly associated with a PTSD diagnosis in pregnancy is childhood

Corresponding author: Julia Seng, PhD, CNM, FAAN, Institute for Research on Women and Gender, 204 S. State Street, University of Michigan, Ann Arbor, Michigan, 48109-1290, telephone: 734.615.0253, fax: 734.647.4279, jseng@umich.edu.

Conflict of Interest: The authors have no conflicts of interest to disclose.

maltreatment.¹ Depression also is a common perinatal mental health condition, with incidence ranging from 3.1 – 4.9% to 15 – 30%,^{3,4} depending on the population studied. PTSD is comorbid with depression in about one third of cases.¹ There is a need to extend the focus of perinatal mental health research to include childhood maltreatment trauma and PTSD—with and without depression—and to evaluate intergenerational patterns of transmission. Pregnancy may be an opportune time to interrupt this intergenerational pattern. Yet, to date, the research on parent-to-child transmission of abuse trauma and psychiatric vulnerability has not crystallized its focus on the childbearing year as a point of opportunity. In this article we 1) review the evidence documenting the intergenerational cycles of abuse and psychiatric vulnerability in a review of the literature, 2) present the results of a prospective cohort study that quantified and modeled this intergenerational pattern, and 3) discuss implications of these findings in terms of opportunities to interrupt the intergenerational pattern during pregnancy.

REVIEW OF THE LITERATURE

A cycle of violence within families has been well documented in the social sciences literature.^{5–7} A family history of psychiatric disorders is acknowledged in medical and psychological sciences as a risk factor for psychiatric diagnoses across the lifespan. Historically, both “nature” and “nurture” have been implicated in theories of transmission of abuse and vulnerability to psychiatric disorders from parents to children. Contemporary understandings implicate heredity, caregiving environment, and epigenetic adaptations in both human studies and via animal model experiments.^{8,9}

Animal studies have demonstrated that biology is *not* destiny when it comes to intergenerational patterns. Offspring born to rat dams with inadequate maternal behaviors and anxious stress-response characteristics who are fostered by dams with adequate maternal behaviors and healthy stress-response characteristics modify their gene expression and exhibit healthy phenotypes observed as non-anxious stress-response characteristics.⁹ The state of the science from these animal models suggests that it is possible to break the cycles at both the biologic and behavioral levels.

Figure 1 schematically depicts pregnancy as a point of intersection between generations. When common abuse-related mental health conditions are present in pregnancy, there is an increased risk for maternal mental health conditions postpartum and for bonding impairment. These in turn impinge upon the developing mother-infant relationship and the infant’s long-term well-being in terms of safety from maltreatment in childhood and lifespan mental health vulnerability. In the following review we provide evidence for each link (arrows A through F) in this chain of events.

A mother’s childhood maltreatment history is associated with depression and PTSD generally¹⁰ and specifically during pregnancy (Figure 1, Relationships A and B), and sometimes re-victimization plays a role as well. One in 3 women report a history of physical or sexual childhood abuse,¹¹ and childhood maltreatment increases the risk for re-victimization in adulthood.¹² Childhood maltreatment conveys a 12-fold risk of having PTSD in pregnancy¹ and is associated with antenatal depression,¹³ and comorbidity of PTSD and depression.¹

A woman’s mental health conditions during pregnancy predict postpartum mental health (Figure 1, Relationship C), and sometimes traumatic birth or adverse birth outcomes play a role. Antenatal depression is significantly associated with the development of postpartum depression.¹³ Antenatal PTSD among survivors of childhood sexual abuse has been associated with subsequent postpartum posttraumatic stress symptomatology.¹⁴ Traumatic experience of birth¹⁵ and giving birth to a high-risk infant¹⁶ are additional predictors of

postpartum PTSD and postpartum depression. Peritraumatic dissociation in labor, especially in conjunction with negative emotions, also has been associated with postpartum PTSD.¹⁷ This suggests the possibility that stressful life events in pregnancy and adverse experiences related to birth may play a role in maintaining or exacerbating rather than initiating the onset of mental health morbidity in the postpartum period.

Maternal postpartum mental health morbidity and bonding impairment co-occur (Figure 1, Relationship D). Most studies have focused on postpartum depression predicting impaired maternal bonding.¹⁸ We found only 1 study of PTSD in relation to bonding in which mothers of premature infants who reported high levels of PTSD symptoms were more likely to have distorted representations of their infant and to follow a more 'controlling' pattern of dyadic interaction.¹⁹

Maternal postpartum mental health and maternal bonding impairment are both implicated in affecting the mother-baby dyad (Figure 1, Relationship E). Effects of maternal postpartum depression have been extensively studied in relation to mother-infant interactions and infant development more so than have effects of maternal postpartum PTSD.²⁰ Infants of depressed mothers score more poorly on social engagement measures and exhibit less mature regulatory behaviors.²¹ They are less responsive to faces and voices, and at 3–5 months of age show less response to the still face procedure, a laboratory task assessing the mother's ability to help regulate infant distress.²² The effect on the dyad appears to be long-term, with affected dyads showing lower quality of bonding from 2 weeks to 14 months postpartum,²³ interactional disturbances at 1 year postpartum,²⁰ and insecure attachment at 12–15 months.²⁴

As a result of the impaired dyadic relationships, there is an increased risk for socio-emotional development deficits and maltreatment, which, in turn, predispose these infants to adult psychiatric morbidity (Figure 1, Relationship F). Longitudinal studies have demonstrated the enduring nature of perinatal depression's effects on the mother-baby dyad and on subsequent psychological adjustment of the child.²⁵ Although not specifically focused on PTSD, research on maternal unresolved trauma related to loss or childhood abuse has been associated with insecure or disorganized attachment for the child.²⁶ Long-term socio-emotional development can be disrupted in several ways, with children exhibiting more behavioral problems to age 9²⁷ and lower IQ scores and more attentional problems and difficulties in math reasoning at age 11.²⁸

Additionally, maternal caregiving activities appear to be compromised in depressed mothers, including feeding, breastfeeding, sleep routines, well-child visits, vaccinations and more use of emergency room visits.¹⁸ Similar findings have been noted for women with history of childhood abuse (which did not measure PTSD). Child abuse history was associated with an intrusive parenting style,²⁹ anxieties about intimate parenting,³⁰ more punitive disciplinary style,³¹ and poorer behavioral trajectories for children at ages 4–7.²⁵

Deficits in a mother's ability to interact in healthy patterns with her infant may occur in relation to depression or PTSD, resulting in what is sometimes described as early relational trauma.³² In such a situation, the infant suffers from the mother's frightened, threatening, or dissociative interactions or from the unpredictability of these extreme maternal responses.³³ There also is evidence from the child development literature that having a mother who was abused is associated with a risk for being maltreated, whether by the mother herself,³⁴ or by her intimate partner or a member of her family of origin.³⁵

To date, studies that take an intergenerational perspective on both abuse and psychiatric vulnerability across the perinatal period are rare,^{13,25} and none has considered both depression and PTSD in relation to the outcome of bonding.

STUDY METHODS

The second purpose of this article is to report the effects of the mother's childhood maltreatment trauma itself and the effects of pre-existing depression alone, PTSD alone, and PTSD that is comorbid with depression on postpartum mental health status and bonding.

The Stress, Trauma, Anxiety, and the Childbearing Year Project (STACY), (NIH R01 NR008767, PI Seng), is a prospective, psychobiological, three-cohort outcome study designed to test the hypothesis that PTSD would be associated with adverse perinatal, psychological, and relational outcomes of childbearing. A conceptual framework was used to organize the data collection and statistical modeling in the multiple analyses to be produced from the data set.³⁶ The framework is based on the hypothesis that PTSD is a key link between trauma exposure and adverse childbearing outcomes and that this relationship occurs through behavioral and biologic pathways. The framework also suggests additional factors that need to be taken into account in studying this complex phenomenon, including depression, medical and obstetric factors across the course of pregnancy and labor, and stressors such as sociodemographic disadvantage, poor social support, poor coping, discrimination, and overall poor quality of life. Data collection (Figure 2) included standardized telephone interviews at the time the woman started prenatal care, again late in pregnancy, and finally at six weeks postpartum. A subset of women provided salivary cortisol specimens in pregnancy so that a biomarker of prenatal stress could be included. Saliva for microarray analysis of genetic variants in several biologic stress response systems also was collected. Prenatal and intrapartum clinical information was obtained from the medical record after birth. The telephone interviews lasted on average between 35 minutes (early pregnancy interview) and 20 minutes (late pregnancy and postpartum interviews).

The instruments included in each interview were chosen to measure the components of the conceptual framework. Most were established scales (e.g., the Quality of Life Index, the Peritraumatic Dissociation Experience Questionnaire). Epidemiologic diagnostic instruments were used in the initial interview to determine lifetime and past-month PTSD status and past-year major depressive disorder (MDD) status. The same instrument was used to determine PTSD status postpartum. Clinical screening scales with established diagnostic cut-points were used in the postpartum interview to determine postpartum depression and bonding status. Several reports from the STACY Project have been published including an analysis of the reliability and validity of the PTSD diagnostic interview when used with pregnant women,³⁷ prevalence and risk factors for PTSD and depression comorbidity in pregnancy,¹ disparities in pregnancy PTSD risk by race,³⁸ and effects of PTSD on birth outcomes.³⁹

Design

The STACY Project followed 3 cohorts of women from initiation of prenatal care to six weeks postpartum: 1) women with lifetime diagnosis of PTSD (PTSD cases), 2) women with trauma exposure who did not develop PTSD (trauma-exposed controls), and 3) women with no trauma exposures (non-exposed controls). This design is standard in PTSD research. Trauma-exposed controls are needed to address the alternative hypothesis that it is the trauma exposure itself, rather than the PTSD sequela, that is responsible for adverse outcomes. Participants in the STACY Project had a full range of types of trauma exposures (eg, accidents, disasters, refugee experiences), but the goal of studying intergenerational patterns of abuse and psychiatric vulnerability focused this analysis on childhood maltreatment trauma.

Recruitment occurred from August 2005 to May 2008 at 3 large health systems' prenatal clinics in Michigan. The Institutional Review Boards (IRBs) of the 3 participating medical

centers approved and oversaw the conduct of research for this project, and a Confidentiality Certificate was obtained. Analysis was based on data from all 3 structured telephone interviews (prior to 28 weeks gestation, near 35 weeks gestation, and six weeks postpartum). Details of recruitment, including a diagram of recruitment and retention and of the initial interview procedures have been reported elsewhere¹ but are summarized here, and details of the postpartum interview are provided.

Participants

Participants were recruited from multiple prenatal clinics in order to obtain a sample diverse in racial, ethnic, and socioeconomic characteristics. Women were eligible if they were 18 or older, able to speak English without an interpreter, expecting their first infant, and initiating prenatal care at less than 28 completed weeks of gestation. Eligible women (n=3,148) were invited to participate in “a telephone survey about stressful things that happen to women, emotions, and pregnancy” by the obstetric nurses who conducted the prenatal intake health histories. Interested women (n=2,689) were given a written document with the elements of informed consent, and their contact information was conveyed to the survey research organization (DataStat, Ann Arbor, MI), which specializes in health surveys. A cadre of experienced female research interviewers who received project-specific training conducted the interviews. The computer-assisted telephone interview (CATI) program was enhanced with IRB-approved protocols for responding to distress and to suicidality disclosed among the depression symptoms.

Interviewers reached 1,931 women and 1,581 were confirmed to be eligible, gave verbal informed consent, and completed the initial interview. The CATI program applied trauma history criteria and lifetime PTSD diagnostic criteria algorithms to determine each completer's match with the cohort definitions. Those who matched were invited to enroll for follow-up (n=1,049), and others were dismissed (n=532). The PTSD-positive cohort (n=319) included women whose trauma exposures included the subjective criteria of experiencing fear, helplessness, or horror *or* who disclosed childhood maltreatment, regardless of subjective response; and they met lifetime diagnostic criteria by reporting at least six symptoms in the required distribution: at least 1 re-experiencing symptom, 3 avoidance or emotional numbing symptoms, and two autonomic hyperarousal symptoms.² The trauma-exposed, resilient cohort (n=380) met the same trauma history criteria but had no more than four PTSD symptoms. The non-exposed cohort (n=350) met neither the trauma history nor PTSD diagnosis criteria. An additional 532 women did not match any of the 3 cohort definitions, and they were not enrolled. Those selected for follow-up were provided with additional informed consent about the longitudinal components of the study. After attrition, 566 women completed the six-week postpartum interview.

Measures

The initial structured diagnostic interview used well-established measures that were piloted and have been analyzed for their reliability and validity for use with pregnant women in a separate publication,³⁷ and so they are only briefly described here. Trauma history was assessed with the Life Stressor Checklist,⁴⁰ a questionnaire designed for use with women, which included five items about childhood maltreatment (physical abuse, molestation, completed rape, emotional abuse, and physical neglect occurring prior to age 16). We summarized this maltreatment history data into two variables: a sum of the types of maltreatment experienced (0–5) and a nominal variable (maltreated, yes or no). PTSD status was assessed with the National Women's Study PTSD Module, a structured interview used in the largest epidemiological study of U.S. women. During the validation study, it had a sensitivity of 0.99 and a specificity of 0.79 when compared with a clinical diagnostic interview.⁴¹ This PTSD diagnostic interview yields both a symptom count (0–17) and a

diagnosis. In this analysis we used the symptom count for correlations and otherwise use the diagnosis as a nominal variable. Past-year MDD also was diagnosed using a structured epidemiological interview, the widely validated Composite International Diagnostic Interview (CIDI) depression module.⁴² The CIDI yields a probability (0–1) of having MDD and a diagnosis. We used the probability for correlations and the nominal diagnosis variable for all other analyses. Demographic information was collected using standard items from the Centers for Disease Control and Prevention (CDC) Perinatal Risk Assessment and Monitoring Survey.⁴³

In this analysis we included 1 measure from the 35-week interview. The Quality of Life Index (QoLi) is a 9 item questionnaire that asks for ratings of satisfaction with work at job, school, or home, standard of living, housing, community, love relationship, family relationships, friendships, leisure activities, and health.⁴⁴ We used this composite measure as a women-centered proxy for sociodemographic stress or well-being and social support.

Several outcomes were assessed in the final interview, which was conducted at approximately 6 weeks after birth. Interim trauma was assessed using the 13 relevant items from the Life Stressor Checklist, with birth added as a potentially traumatic exposure. Dissociation during a stressful or traumatic event is correlated with distress or sense of being overwhelmed⁴⁵ and has been observed in abuse survivors in labor.¹⁷ We used the Peritraumatic Dissociation Experience Questionnaire (PDEQ),⁴⁵ as a proxy for the woman's level of distress or overwhelm in labor. This ten-item scale assesses symptoms of dissociation such as feeling disoriented, confused, and disconnected from the body. Postpartum (past-month) PTSD symptoms and diagnosis were again assessed with the NWS PTSD module. Women meeting the PTSD diagnostic criteria for the first time in the postpartum period were distinguished as new-incident PTSD cases. Postpartum depression was assessed with the Postpartum Depression Screening Scale (PDSS), which is a 35-item measure validated on a normative sample, where a cut-off score of 80 was a sensitive and specific criterion for major depressive disorder with a positive predictive value of 93%.⁴⁶ We used the Postpartum Bonding Questionnaire (PBQ)⁴⁷ to obtain a bonding score in which higher values indicate more impairment, rejection, or anxiety in the relationship with the infant. We also used the cut-off point on the bonding impairment subscale (score >12) which has been validated to correspond with clinically significant bonding impairment. We used the cut-off to create a nominal variable (impaired maternal bonding, yes or no), and we used the score as the main outcome variable.

Analysis plan

The analysis began with assessment of the effect of attrition on representativeness of the remaining sample. We also assessed reliability of the scale instruments using the internal consistency coefficient, Cronbach's alpha. We verified that the distributions on the 2 dependent variables (PDSS score and PBQ score) met the assumption of normality for use in parametric tests in that residual distributions from the regressions were normal. We then compared the maltreated and non-maltreated groups' demographic, trauma history, and pre-existing mental health profiles, including the extent of comorbidity of lifetime PTSD and past-year MDD and their scores on the postpartum outcomes. We assessed the correlation of predictors and outcomes using Pearson's *r* in both bivariate and partial approaches, controlling for the number of types of childhood maltreatment in the woman's history. We then calculated the odds ratios for having each adverse outcome (new onset PTSD, postpartum MDD only, comorbidity of postpartum PTSD and MDD, and impaired bonding) as predicted by maltreatment history, pre-existing PTSD, pre-existing MDD, and comorbidity of PTSD and MDD. We examined incidence of new PTSD cases in the postpartum period. Finally, we estimated two stepwise regression models, organizing entry of predictors chronologically and consistent with the conceptual framework. The first

predicts the postpartum depression score. Predictors were maltreatment history and pre-existing mental health diagnoses, adjusting for quality of life in late pregnancy and peritraumatic dissociation in labor. The second regression added postpartum mental health diagnoses to the same variables to predict the bonding score.

RESULTS

Preliminary analyses

Outcome data were available for 566 of the 1,049 women who were enrolled for follow-up. There were 156 in the PTSD-diagnosed cohort, 220 in the trauma-exposed, resilient cohort, and 190 in the non-exposed cohort. This total reflects 46% attrition. Chi square tests to compare those enrolled with those who completed the third interview indicated that the sample with postpartum outcome data was not significantly different in the proportions within each cohort ($P=.270$) but did have fewer women who were sociodemographically disadvantaged ($P<.001$).

Four scales were used in this analysis, and all demonstrated internal consistency reliability. The QoLi had the lowest alpha, which was more than satisfactory at .795. The PDEQ alpha was .815. The PDSS alpha was highest, .947. The PBQ alpha was .827. Examination of the distribution of the standardized residuals in regression models indicated that the assumption of normal distribution of error variance was met for both of these dependent variables.

Sample Characteristics

Demographic, trauma history, pre-existing mental health characteristics, quality of life rating, labor rating, and labor peritraumatic dissociation experience score for this sample as a whole are shown in Table 1, (total column). Despite greater attrition among disadvantaged women, the sample remained diverse, with 57.4% European Americans, 30.0% African Americans, 5.5% Latinas, 3.4% Middle Eastern ethnicity, 8.8% Asian or Pacific Islanders, 1.2% Native Americans, and 4.1% other racial identities. Fifteen percent were living in poverty, 15.7% were pregnant as teens, 32.5% had high school education or less, and 28.3% lived in zip codes with crime rates higher than the U.S. average. Mean age was 27 (SD=5.4). All were expecting their first infant by our eligibility criteria. Overall, this sample's rate of meeting lifetime PTSD diagnostic criteria was 27.6%, and their rate of meeting past-year depression diagnostic criteria was 12.2%. Nine percent of the women had PTSD that was comorbid with MDD. One in 5 of the women ($n=110$, 19.4%) reported childhood maltreatment.

Comparison of maltreated and non-maltreated women

Because childhood maltreatment history is a focus of this analysis, we conducted chi squared tests and t-tests to compare the maltreated and non-maltreated groups in terms of their characteristics during pregnancy and their labor experience (Table 1). These tests show that the group of women who had experienced maltreatment in childhood cohort was demographically similar to the women who had not been maltreated. However, they were statistically significantly different in that the women in the maltreatment group had more lifetime exposures to non-maltreatment trauma, had greater pre-existing PTSD and MDD, reported lower quality of life, and experienced more severe dissociation in labor. A correlation matrix (Table 2) arranged in chronological order depicts the interrelatedness of these factors. The weakest correlation was between the sum of childhood maltreatment types and the bonding score ($r=.077$, $P=.067$). All other correlations were statistically significant. Examination of the correlation coefficients showed the logical increase in correlation strength as the relationships become more proximal in time, with postpartum mental health conditions having stronger correlations with bonding scores than the pre-existing mental

health conditions. The integral relationship of childhood maltreatment exposure to all of these variables was evident in partial correlations (not shown) where controlling for the number of types of maltreatment decreased the strength of the correlations in all instances but did not result in loss of significance.

Postpartum outcomes

Because new-incident PTSD as a result of traumatic birth has been a focal area of research recently,¹⁵ we describe the characteristics of the 9 women who experienced new onset of PTSD in the postpartum period. Overall, 34 women met PTSD diagnostic criteria postpartum (6% incidence). Twenty-five had pre-existing PTSD, making the odds ratio for also having postpartum PTSD 8.5 (95% confidence interval (CI) 3.9, 18.7, $P<.001$). The 9 new incident cases (1.6% incidence) included 5 women who reported their birth as the index trauma in the postpartum interview. One reported the severe complication of uterine inversion, 3 others reported long labors ending in cesarean deliveries, and 1 reported an emergent cesarean delivery. Two of these women also reported fetal distress, infant resuscitation, and neonatal intensive care unit admission for the infant. Four of these new incident postpartum cases had no new (eg, late pregnancy or birth-related) trauma exposure, but their previous sub-clinical level of PTSD symptoms had increased, and they now met diagnostic criteria. All 9 new incident PTSD cases also had postpartum depression.

We calculated odds ratios for each of 4 postpartum outcomes of interest: new incident PTSD, major depression only, *both* major depression and PTSD, and bonding impairment (Table 3). Predictors were maltreatment history, pre-existing PTSD only, pre-existing MDD only, and pre-existing comorbid PTSD and MDD. Overall, maltreatment history and pre-existing PTSD (alone or comorbid with MDD) increased the odds of having postpartum mental health morbidity, but pre-existing MDD alone did not significantly increase the odds of having any of the postpartum mental health outcomes. Only the most severe pre-existing condition, comorbid PTSD and MDD, significantly increased the odds of experiencing impaired bonding.

Multivariate models

To address the aim of integrating attention to both the cycle of violence and the intergenerational transmission of psychiatric vulnerability, we constructed 2 parallel linear multiple regression models (Tables 4 and 5). First, we used a linear regression to model in a stepwise fashion those factors that predict postpartum depression using the PDSS score. Focusing on the depression outcome seemed justifiable because no women with PTSD postpartum were free of depression comorbidity and because the correlation of postpartum PTSD symptom count and PDSS score was very strong ($r=.611$, $P<.001$). In the first step of this model, childhood maltreatment history was predictive. Maltreatment history lost significance in the second step when pre-existing mental health was taken into account. Lifetime PTSD and comorbid PTSD and depression were predictive but past year major depression alone was not. Higher rating of her quality of life in pregnancy was protective. Finally, the greater the extent to which the woman reported dissociating in labor, the higher her postpartum depression symptom level. Overall the model predicted 20.4% of variance in the PDSS score. Half of this variance (9.8%) was explained by the pre-existing mental health variables.

In the second model we used the same steps to predict postpartum bonding but extended the analysis to include as predictors in a fifth step the postpartum mental health outcomes of new incident PTSD, MDD only, and comorbidity of postpartum PTSD and MDD. A similar amount of variance (19.5%) was explained in the bonding outcome where higher PBQ scores indicated greater impairment. Again, in the second step, pre-existing PTSD alone or

comorbid with MDD mediated the association of childhood maltreatment with more impaired bonding. Pre-existing MDD alone was not associated with impaired bonding. Late gestation quality of life and labor dissociation were each independently associated with bonding impairment. In the final step new incident, post-birth PTSD was not associated with impaired bonding. Postpartum MDD alone was significantly associated with more impaired bonding. Postpartum (and not new incident) PTSD, which is comorbid with MDD, also was associated with more impaired bonding.

In summary, the models in this analysis indicated that maternal pre-existing posttraumatic stress alone or comorbid with depression was associated with mental health morbidity postpartum and with more impaired bonding. Higher quality of life in late pregnancy, modeled as a summary variable for potential moderators such as sociodemographic characteristics, partnership quality, family social support, and social network, was a protective factor in relation to both outcomes. Peritraumatic dissociation in labor modeled as a summary variable for a traumatic or overwhelming birth experience was a risk factor in relation to both outcomes. The more proximal measures of postpartum mental health status, MDD alone or comorbid with PTSD, were the strongest predictors of scores indicative of impaired bonding. In models of both outcomes, the independent association of childhood maltreatment history was mediated by pre-existing mental health status.

DISCUSSION

The findings of this study support the idea that the cycle of violence and the intergenerational transmission of psychiatric vulnerability are intertwined in the childbearing year. They indicate that previous studies showing an association between depression with impaired maternal bonding and subsequent adverse infant and child outcomes may have been capturing only part of the phenomenon. PTSD and depression symptoms overlap,² and PTSD that is chronic and severe often is comorbid with depression.^{11,48} So the findings of this analysis do not challenge prior evidence that postpartum depression adversely affects the infant but rather suggest that this evidence was incomplete and may have failed to articulate and quantify the role of the mother's history of childhood maltreatment and PTSD. The findings of this analysis underscore the need to address the sequelae of childhood maltreatment as early in the lifespan as possible, ideally prior to pregnancy. But for the many pregnant maltreatment survivors with unresolved traumatic stress, attention to both PTSD and depression during pregnancy would provide an opportunity to disrupt these intergenerational patterns.

There are several limitations to this analysis. The focus on the aim of assessing evidence for integrated attention to abuse and mental health in relation to bonding led us to use very parsimonious models with summary variables (eg, quality of life score, dissociation in labor) for what are, of course, complex factors. The omission of specific variables about the partner and family of origin relationships from these models is a limitation, which could, unfortunately, leave the false impression that mothers are solely responsible for patterns that are known to be affected by multiple elements across social-ecological levels.⁴⁹ Additionally, the sample was selected for outcomes research on PTSD,³⁹ so we oversampled for trauma-exposed and PTSD-affected women. Thus the proportion of women with depression that is more "endogenous" or less related to trauma and PTSD could have been low and may have resulted in underestimation of the impact of pre-existing depression. We collected data on PTSD symptoms at 3 time points, so women may have learned from these interviews to be more aware of symptoms, and this could have resulted in over-reporting compared with studies that only measure PTSD postpartum. However, our rates are very similar to other studies, suggesting the rates are not erroneously high.^{15,50} Finally, our data collection stopped at 6 weeks postpartum, so the maternal bonding score is our only

indicator that adverse infant outcomes may ensue. Maternal bonding problems are, however, a well-documented first step in the pathway from the mother's childhood maltreatment history to postpartum dyadic dysregulation with her own infant, subsequent risk for her child of maltreatment and development of emotional and behavioral problems in childhood, and lifespan psychiatric vulnerability. More long-term follow-up of this sample is underway (NIH K23 MH080147, PI Muzik) which will examine whether this first sign of difficulty and risk does, in fact, continue into adverse outcomes.

Strengths of this study included the use of established epidemiological measures for diagnosing pre-existing PTSD and MDD and use of postpartum depression and bonding scales with diagnostic cut-off points validated against structured clinical interview diagnoses in large perinatal samples.^{46,47} The diverse sample was also a strength. Oversampling of disadvantaged women fosters generalizability despite a high level of attrition from early pregnancy enrollment to postpartum follow-up.

Our findings have implications for future research. Studies that evaluate the mother's partner and her parents as additional influences on infant outcomes are needed. Postpartum mental health and mother-infant bonding were measured at the same time point in this study, but researchers in 1 small study in Portugal found that low prenatal attachment was predictive of postpartum depression.⁵¹ This suggests that more research on the relationship between postpartum mental health status and bonding is needed, as it is possible that poor bonding is an additional cause of postpartum morbidity rather than only an effect of postpartum morbidity. If so, addressing parenting concerns and impaired or delayed maternal attachment during pregnancy could decrease the risk of both postpartum mental health morbidity and postpartum bonding impairment. This type of analysis should be extended to women with other types of trauma exposure.

Childhood maltreatment history appears to be the largest risk factor for meeting PTSD diagnostic criteria in pregnancy,¹ and associations between prenatal PTSD and the perinatal outcomes of lower birth weight and shorter gestation were stronger for women whose PTSD was subsequent to abuse.³⁹ However, our sample did not include many women from other highly traumatized subgroups, such as those with war zone exposure or refugee experiences. Further research is needed to determine whether other types of trauma exposure also have implications for perinatal mental health, bonding, and child outcomes.

A final purpose of this article is to draw attention to implications for current clinical practice and service delivery. These findings provide an evidence base to foster changes in maternity care service delivery models and in the clinical practice of all perinatal professionals. Awareness of the strength of the links between maltreatment history, pre-existing PTSD and depression, pregnancy stressors, overwhelming labor experiences, postpartum PTSD and depression and impaired bonding can lead to secondary and tertiary prevention and treatment for the mother and primary prevention for the infant. This can start with something as simple as adding both a trauma history questionnaire and PTSD screening tool to the depression screening likely already taking place at the intake to prenatal care.

Adapting current perinatal mental health specialty services, which likely are focused primarily on depression, to incorporate attention to maltreatment history and PTSD also is warranted. There are evidence-based treatments for PTSD, including variations tailored for treating childhood abuse survivors.⁵²⁻⁵⁴ However, there is a need to test the safety, efficacy, and effectiveness of PTSD-specific treatments for abuse survivors who are pregnant. In the meantime, focusing on psychoeducation for skills building, especially in relation to symptom management and parenting, could be a positive first step.^{55,56} Planning interventions that emphasize mother-infant dyadic outcomes also seems warranted.⁵⁷

Ultimately, if other researchers confirm this integrative view of cycles of abuse and psychiatric vulnerability intertwining during the childbearing year, integrating maternity, mental health, and parenting support services to provide seamless trauma-informed programs across the childbearing year may be strongly warranted.

Acknowledgments

This study was funded by the National Institutes of Health, National Institute for Nursing Research grant number NR008767 (Seng, PI), "Psychobiology of PTSD & Adverse Outcomes of Childbearing." The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Nursing Research or the National Institutes of Health. The authors wish to thank the obstetric nurses and participants who made this study possible and Nico Brauer Curtis for graphic design assistance.

Biographies

Julia Seng, PhD, RN, FAAN is Research Associate Professor at the University of Michigan Institute for Research on Women and Gender, Associate Professor of Nursing and Women's Studies, and Research Assistant Professor of Obstetrics and Gynecology.

Mickey Sperlich, MA, CPM is a Doctoral Fellow at the Wayne State University School of Social Work and the Merrill Palmer Skillman Institute.

Lisa Kane Low, PhD, CNM, FACNM is Assistant Professor of Nursing and Women's Studies at the University of Michigan.

David Ronis, PhD is a Research Scientist at the University of Michigan School of Nursing

Maria Muzik, MD is Assistant Professor of Psychiatry and Research Assistant Professor of Human Growth and Development

Israel Liberzon, MD is the Theophile Raphael Collegiate Professor of Neurosciences, and Professor of Psychiatry and Psychology at the University of Michigan

REFERENCES

1. Seng JS, Kane Low LM, Sperlich MI, Ronis DL, Liberzon I. Trauma history and risk for PTSD among nulliparous women in maternity care. *Obstet Gynecol.* 2009; 114:839–847. [PubMed: 19888043]
2. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders.* Washington, DC: American Psychiatric Association; 2000.
3. Gaynes, BN.; Gavin, N.; Meltzer-Brody, S., et al. Perinatal Depression: Prevalence, Screening Accuracy, and Screening Outcomes. Evidence Report/Technology Assessment No. 119. Rockville, MD: Agency for Healthcare Research and Quality; 2005 Feb.
4. Setse R, Grogan R, Pham L, et al. Longitudinal study of depressive symptoms and health-related quality of life during pregnancy and after delivery: The Health Status in Pregnancy (HIP) Study. *Matern Child Health J.* 2009; 13:577–587. [PubMed: 18931832]
5. Child Welfare Information Gateway. [Accessed July 7, 2012] Long-term consequences of child abuse and neglect. Factsheet. http://www.childwelfare.gov/pubs/factsheets/long_term_consequences.cfm. Published 2008.
6. National Council on Child Abuse and Family Violence. [Accessed July 7, 2012] Child abuse information. 2012. <http://www.nccafv.org/child.htm>. Updated July, 2012.
7. Schuetz P, Eiden RD. The relationship between sexual abuse during childhood and parenting outcomes: modeling direct and indirect pathways. *Child Abuse Negl.* 2005; 29:645–659. [PubMed: 15979707]

8. Uddin M, Aiello AE, Wildman DE, et al. Epigenetic and immune function profiles associated with posttraumatic stress disorder. *Proc Natl Acad Sci*. 2010; 107:9470–9475. [PubMed: 20439746]
9. Meaney MJ. Epigenetics and the biological definition of gene x environment interactions. *Child Dev*. 2010; 81:41–79. [PubMed: 20331654]
10. Widom CS, DuMont K, Czaja SJ. A prospective investigation of major depressive disorder and comorbidity in abused and neglected children grown up. *Arch Gen Psychiatry*. 2007; 64:49–56. [PubMed: 17199054]
11. Cogle JR, Timpano KR, Sachs-Ericsson N, Deough ME, Riccardi CJ. Examining the unique relationships between anxiety disorders and childhood physical and sexual abuse in the National Comorbidity Survey-Replication. *Psychiatry Res*. 2010; 177:150–155. [PubMed: 20381878]
12. Barnes JE, Noll JG, Putnam FW, Trickett PK. Sexual and physical revictimization among victims of severe childhood sexual abuse. *Child Abuse Negl*. 2009; 33:412–420. [PubMed: 19596434]
13. Leigh B, Milgrom J. Risk factors for antenatal depression, postnatal depression, and parenting stress. *BMC Psychiatry*. 2008; 8:24. [PubMed: 18412979]
14. Lev-Wiesel R, Chen R, Daphna-Tekoah S, Hod M. Past traumatic events: are they a risk factor for high-risk pregnancy, delivery complications, and postpartum posttraumatic symptoms? *J Womens Health*. 2009; 18:119–125.
15. Söderquist J, Wijma B, Thorbert G, Wijma K. Risk factors in pregnancy for post-traumatic stress and depression after childbirth. *BJOG*. 2009; 116:672–680. [PubMed: 19220236]
16. Shaw RJ, Bernard RS, DeBlois T, Ikuta LM, Ginzburg K, Koopman C. The relationship between acute stress disorder and posttraumatic stress disorder in the neonatal intensive care unit. *Psychosomatics*. 2009; 50(2):131–137. [PubMed: 19377021]
17. Olde E, van der Hart O, Kleber R, van Son M, Wijnen HA, Pop VJ. Peritraumatic dissociation and emotions as predictors of PTSD symptoms following childbirth. *J Trauma Dissociation*. 2005; 6:125–142. [PubMed: 16172085]
18. Field T. Postpartum depression effects on early interactions, parenting, and safety practices: a review. *Inf Behav Dev*. 2010; 33:1–6.
19. Forcade-Guex M, Borghini A, Pierrehumbert B, Ansermet F, Muller-Nix C. Prematurity, maternal posttraumatic stress and consequences on the mother-infant relationship. *Early Hum Dev*. 2011; 87:21–26. [PubMed: 20951514]
20. Hipwell AE, Goossens FA, Melhuish EC, Kumar R. Severe maternal psychopathology and infant-mother attachment. *Dev Psychopathol*. 2000; 12:157–175. [PubMed: 10847622]
21. Feldman R, Granat A, Pariente C, Kanety H, Kuint J, Gilboa-Schechtman E. Maternal depression and anxiety across the postpartum year and infant social engagement, fear regulation, and stress reactivity. *J Am Acad Child Adolesc Psychiatry*. 2009; 48(9):919–927. [PubMed: 19625979]
22. Field T, Diego M, Hernandez-Reif M. Depressed mothers' infants are less responsive to faces and voices. *Inf Behav Dev*. 2009; 32:239–244.
23. Moehler E, Brunner R, Wiebel A, Reck C, Resch F. Maternal depressive symptoms in the postnatal period are associated with long-term impairment of mother-child bonding. *Arch Womens Ment Health*. 2006; 9:273–278. [PubMed: 16937313]
24. McMahon CA, Barnett B, Kowalenko NM, Tennant CC. Maternal attachment state of mind moderates the impact of postnatal depression on infant attachment. *J Child Psychol Psychiatry*. 2006; 47(7):660–669. [PubMed: 16790001]
25. Collinshaw S, Dunn J, O'Connor TG. Avon Longitudinal Study of Parents and Children Study Team. Maternal childhood abuse and offspring adjustment over time. *Dev Psychopathol*. 2007; 19(2):367–383. [PubMed: 17459175]
26. Lyons-Ruth K, Block D. The disturbed caregiving system: relations among childhood trauma, maternal caregiving, infant affect, and attachment. *Infant Ment Health J*. 1996; 17:257–275.
27. Luoma I, Tamminen T, Kaukonen P, et al. Longitudinal study of maternal depressive symptoms and child well-being. *J Am Acad Child Adolesc Psychiatry*. 2001; 40(12):1367–1374. [PubMed: 11765281]
28. Hay DF, Pawlby S, Sharp D, Asten P, Mills A, Kumar R. Intellectual problems shown by 11-year-old children whose mothers had postnatal depression. *J Child Psychol Psychiatr*. 2001; 42(7):871–889. [PubMed: 11693583]

29. Moehler E, Biringen Z, Poustka L. Emotional availability in a sample of mothers with a history of abuse. *Am J Orthopsychiatry*. 2007; 77(4):624–628. [PubMed: 18194042]
30. Douglas AR. Reported anxieties concerning intimate parenting in women sexually abused as children. *Child Abuse Negl*. 2000; 24:425–434. [PubMed: 10739085]
31. Schuetze P, Eiden RD. The relationship between sexual abuse during childhood and parenting outcomes: Modeling direct and indirect pathways. *Child Abuse Negl*. 2005; 29:645–659. [PubMed: 15979707]
32. Schore AN. Relational trauma and the developing right brain: an interface of psychoanalytic self psychology and neuroscience. *Ann N Y Acad Sci*. 2009; 1159:189–203. [PubMed: 19379241]
33. Hesse E, Main M. Frightened, threatening, and dissociative parental behaviour in low-risk samples: description, discussion, and interpretations. *Dev Psychopathol*. 2006; 18:309–343. [PubMed: 1660057]
34. Spieker SJ, Bensley L, McMahon RJ, Fung H, Osslander E. Sexual abuse as a factor in child maltreatment by adolescent mothers of preschool aged children. *Dev & Psychopathol*. 1996; 8:497–509.
35. McCloskey LA, Bailey JA. The intergenerational transmission of risk for childhood sexual abuse. *J Interpers Violence*. 2000; 15:1019–1035.
36. Seng JS. A conceptual framework for research on lifetime violence, posttraumatic stress, and childbearing. *J Midwifery Womens Health*. 2002; 47(5):337–346. [PubMed: 12361345]
37. Seng JS, Rauch SA, Resnick H, et al. Exploring posttraumatic stress disorder symptom profile among pregnant women. *J Psychosom Obstet Gynaecol*. 2010; 31(3):176–187. [PubMed: 20482290]
38. Seng JS, Kohn-Wood LP, McPherson MD, Sperlich M. Disparities in trauma history and posttraumatic stress disorder in a community sample of pregnant women. *Arch Womens Ment Health*. 2011; 14(4):295–306. [PubMed: 21573930]
39. Seng JS, Kane Low LM, Sperlich M, Ronis DL, Liberzon I. Posttraumatic stress disorder is associated with lower birth weight and shorter gestation. *BJOG*. 2011; 118:1329–1339. [PubMed: 21790957]
40. Wolfe, J.; Kimerling, R. Gender issues in the assessment of posttraumatic stress disorders. In: Wilson, JP.; Keane, TM., editors. *Assessing Psychological Trauma and PTSD*. New York: Guilford Press; 1997. p. 192-238.
41. Resnick HS, Kilpatrick DG, Dansky BS, Saunders BE, Best CL. Prevalence of civilian trauma and posttraumatic stress disorder in a representative national sample of women. *J Consult Clin Psychol*. 1993; 61(6):984–991. [PubMed: 8113499]
42. Wittchen HU. Reliability and validity studies of the WHO--Composite International Diagnostic Interview (CIDI): a critical review. *J Psychiatr Res*. 1994; 28(1):57–84. [PubMed: 8064641]
43. Beck LF, Morrow B, Lipscomb LE, et al. Prevalence of selected maternal behaviors and experiences, Pregnancy Risk Assessment Monitoring System (PRAMS), 1999. *MMWR Surveill Summ*. 2002; 51(2):1–27. [PubMed: 12004983]
44. Frisch MB, Cornell J, Villanueva M, Retzlaff PJ. Clinical validation of the Quality of Life Inventory. A measure of life satisfaction for use in treatment planning and outcome assessment. *Psychol Assess*. 1992; 4(1):92–101.
45. Marmar, CR.; Weiss, DS.; Metzler, TJ. The Peritraumatic Dissociative Experiences Questionnaire. In: Wilson, JP.; Keane, TM., editors. *Assessing Psychological Trauma and PTSD: A Practitioner's Handbook*. New York: Guilford Press; 1997. p. 412-428.
46. Beck, CT.; Gable, RK. *Postpartum Depression Screening Scale*. Los Angeles: Western Psychological Services; 2002.
47. Brockington IF, Oates J, George S, et al. A screening questionnaire for mother-infant bonding disorders. *Arch Womens Ment Health*. 2001; 3(4):133–140.
48. Breslau N, Davis GC, Peterson EL, Schultz L. Psychiatric sequelae of posttraumatic stress disorder in women. *Arch Gen Psychiatry*. 1997; 54:81–87. [PubMed: 9006404]
49. World Health Organization. [Accessed July 7, 2012] WHO multi-country study on women's health and domestic violence against women. http://www.who.int/gender/violence/who_multicountry_study/summary_report/summary_report_English2.pdf. Published 2005

50. Olde E, van der Hart O, Kleber R, van Son M. Posttraumatic stress following childbirth: a review. *Clin Psychol Rev.* 2006; 26:1–16. [PubMed: 16176853]
51. Figueiredo B, Costa R. Mother's stress, mood and emotional involvement with the infant: 3 months before and 3 months after childbirth. *Arch Womens Ment Health.* 2009; 12:143–153. [PubMed: 19259772]
52. Forbes D, Creamer M, Bisson JJ, et al. A guide to guidelines for the treatment of PTSD and related conditions. *J Traum Stress.* 2010; 23:537–552.
53. Cloitre M, Stovall-McClough KC, Noonan K, et al. Treatment for PTSD related to childhood abuse: a randomized controlled trial. *Am J Psychiatry.* 2010; 167:1–10.
54. Becker CC, Zayfert C. Integrating DBT-based techniques and concepts to facilitate exposure therapy for PTSD. *Cogn Behav Pract.* 2001; 8:107–122.
55. Sperlich M, Seng JS, Rowe H, et al. The Survivor Moms' Companion: report of safety, feasibility, and acceptability of a pilot posttraumatic stress psychoeducation program for pregnant survivors of childhood maltreatment and sexual trauma. *Intl J Childbirth.* 2011; 1:122–135.
56. Seng JS, Sperlich M, Rowe H, et al. The Survivor Moms' Companion: report of an open pilot of a posttraumatic stress psychoeducation program for pregnant survivors of childhood maltreatment and sexual trauma. *Intl J Childbirth.* 2011; 1:111–121.
57. Muzik M, Marcus SM, Flynn HA. Psychotherapeutic treatment options for perinatal depression: emphasis on maternal-infant dyadic outcomes. *J Clin Psychiatry.* 2009; 70:1318–1319. [PubMed: 19818252]

Figure 1. Schematic depiction guiding literature presentation on intergenerational patterns of abuse and psychiatric vulnerability intertwining during the childbearing year. Capital letters correspond to elements of the literature review.

Figure 2.
STACY Project data collection process and sample sizes at each time point, with data used in this analysis highlighted in gray.

Table 1

Sample description overall and by maltreatment history, including all independent variables in the multivariate models.

	Total (n=566)	Maltreated in childhood 19.4% (n=110)	Not maltreated 80.6% (n=456)	p
Sociodemographic risk factors	% (n)	% (n)	% (n)	
African American	30.0 (170)	33.6 (37)	29.3 (133)	.359
Pregnant as a teen (<21)	15.7 (89)	19.1 (21)	14.9 (68)	.280
Poverty (income <\$15,000)	15.0 (85)	20.9 (23)	13.6 (62)	.054
Low education (<= high school)	32.5 (184)	39.1 (43)	30.9 (141)	.101
High crime zip code (>US average)	28.3 (160)	30.9 (34)	27.6 (126)	.493
Trauma history	mean (SD)	mean (SD)	mean (SD)	
Sum of non-maltreatment trauma, 0–24	3.7 (3.0)	6.2 (3.7)	3.1 (2.4)	<.001
Mental health status (4 mutually exclusive groups)	% (n)	% (n)	% (n)	
Neither PTSD nor MDD	69.3 (392)	34.5 (38)	77.6 (354)	<.001
Pre-existing PTSD-only	18.6 (105)	40.9 (45)	13.2 (60)	
Pre-existing MDD-only	3.2 (18)	2.7 (3)	3.3 (15)	
Comorbid PTSD and MDD	9.0 (51)	21.8 (24)	5.9 (27)	
Late gestation context	mean (SD)	mean (SD)	mean (SD)	
Quality of life rating, 0–45	40.7 (4.2)	38.6 (4.6)	41.3 (3.7)	<.001
Labor experience	mean (SD)	mean (SD)	mean (SD)	
Rating of labor experience, 1=horrible, 10=wonderful	5.9 (2.7)	5.7 (2.9)	6.0 (2.6)	.301
PDEQ score, 10–40	13.8 (4.9)	15.2 (5.7)	13.4 (4.6)	.003

Abbreviations: PTSD, posttraumatic stress disorder; MDD, major depressive disorder; PDEQ, Peritraumatic Dissociation Experience Questionnaire, reporting about labor dissociation.

Table 2

Correlations of interval-level variables representing factors modeled in the regressions.

	Sum of five child abuse types	Pre-existing PTSD symptom count	Pre-existing MDD	QoLi score	PDEQ score	Postpartum PTSD symptom count	PDSS score	PBQ score
Sum of five child abuse types	1	.591	.324	-.287	.209	.419	.219	.077
Pre-existing PTSD symptom count		1	.389	-.404	.272	.542	.335	.169
Pre-existing MDD			1	-.172	.191	.288	.257	.121
QoLi score				1	-.263	-.356	-.275	-.252
PDEQ score					1	.442	.361	.303
Postpartum PTSD symptom count						1	.611	.407
PDSS score							1	.472
PBQ score								1

Abbreviations: PTSD, posttraumatic stress disorder; MDD, major depressive disorder; QoLi, Quality of Life Index; PDEQ, Peritraumatic Dissociation Experiences Questionnaire; PDSS, Postpartum Depression Screening Scale; PBQ, Postpartum Bonding Questionnaire.

All *P* values were <.001 except for two: The correlation between pre-existing MDD and bonding score was significant at *P* = .004, and The correlation between the sum of childhood abuse types with the bonding score was significant at *P* = .067.

Table 3

Odds Ratios for 4 Postpartum Outcomes Based on Maltreatment History and Pre-Existing Mental Health Status

	New Incident PTSD, 1.6% (n=9)	Postpartum Depression Only, 16.3% (n=92)	Postpartum PTSD AND Depression, 6.0% (n=34)	Impaired Bonding, 22.1% (n=125)
Maltreatment History				
Abused, n=110	2.7% (3)	20.9% (23)	17.3% (19)	22.7% (25)
Not abused, n=456	1.3% (6)	15.5% (69)	3.3% (15)	21.9% (100)
OR (CI)	2.1 (.5, 8.5)	1.5 (.9, 2.5)	6.1 (3.0, 12.5)	1.0 (.6, 1.7)
<i>P</i> value	<i>p</i> =.387	<i>p</i> =.140	<i>p</i> <.001	<i>p</i> =.856
Pre-Existing PTSD Only				
PTSD-positive, n=105	by definition,	20.0% (21)	13.3% (14)	27.6% (29)
PTSD-negative, n=461	n/a	15.4% (71)	4.3% (20)	20.8% (96)
OR (CI)	n/a	1.4 (.8, 2.4)	3.4 (1.7, 7.0)	1.5 (.9, 2.4)
<i>P</i> value	n/a	<i>p</i> =.249	<i>p</i> <.001	<i>p</i> =.130
Pre-Existing MDD Only				
MDD-positive, n=18	0.0% (0)	27.8% (5)	0.0% (0)	22.2% (4)
MDD-negative, n=548	1.6% (9)	15.9% (87)	6.2% (34)	22.1% (121)
OR (CI)	(1.0, 1.0)	(.7, 5.9)	1.0 (1.0, 1.0)	1.0 (.3, 3.1)
<i>P</i> value	<i>p</i> =.584	<i>p</i> =.178	<i>p</i> =.276	<i>p</i> =.989
Pre-Existing Comorbidity				
PTSD & MDD, n=51	by definition,	41.2% (21)	21.6% (11)	35.3% (18)
All others, n=515	n/a	13.8% (71)	4.5% (23)	20.8% (107)
OR (CI)	n/a	4.4 (2.4, 8.1)	5.9 (2.7, 12.9)	2.1 (1.1, 3.8)
<i>P</i> value		<i>p</i> <.001	<i>p</i> <.001	<i>p</i> =.017

Abbreviations: PTST, post-traumatic stress disorder; MDD, major depressive disorder; OR, odds ratio; CI, confidence interval.

Table 4

Stepwise linear regression model predicting postpartum depression (PDSS) score.

Model		Beta	p
Step 1: Starts with maltreatment history	R ² =.035, p<.001		
	Childhood maltreatment sum	.188	<.001
Step 2: Adds pre-existing PTSD and depression	R ² =.133, R ² =.097, p<.001		
	Childhood maltreatment sum	.074	.082
	Had pre-existing MDD ONLY	.057	.152
	Had pre-existing PTSD ONLY	.159	<.001
	Had comorbid PTSD & MDD	.317	<.001
Step 3: Adds late gestation quality of life as a women-centered proxy for sociodemographic stress or well-being and social support	R ² =.149, R ² =.017, p=.001		
	Childhood maltreatment sum	.055	.197
	Had pre-existing MDD ONLY	.037	.350
	Had pre-existing PTSD ONLY	.126	.003
	Had comorbid PTSD & MDD	.278	<.001
	Quality of Life Index score	-.142	.001
Step 4: Adds peritraumatic dissociation as a proxy for experiencing labor as overwhelming	R ² =.204, R ² =.054, p<.001		
	Childhood maltreatment sum	.048	.244
	Had pre-existing MDD ONLY	.036	.350
	Had pre-existing PTSD ONLY	.102	.015
	Had comorbid PTSD & MDD	.233	<.001
	Quality of Life Index score	-.096	.023
	Dissociation in labor	.246	<.001

Abbreviations: PTSD, posttraumatic stress disorder; MDD, major depressive disorder.

Table 5

Stepwise linear regression predicting bonding (PBQ) impairment.

Model		Beta	p
Step 1: Starts with maltreatment history	R ² = .013, p=.007		
	Childhood maltreatment sum	.113	.007
Step 2: Adds pre-existing PTSD and depression	R ² = .041, R ² = .028, p=.001		
	Childhood maltreatment sum	.050	.267
	Had pre-existing MDD ONLY	.050	.233
	Had pre-existing PTSD ONLY	.097	.030
	Had comorbid PTSD & MDD	.164	<.001
Step 3: Adds late gestation quality of life as a women-centered proxy for sociodemographic stress or well-being and social support	R ² = .076, R ² = .035, p<.001		
	Childhood maltreatment sum	.022	.616
	Had pre-existing MDD ONLY	.021	.607
	Had pre-existing PTSD ONLY	.050	.262
	Had comorbid PTSD & MDD	.107	.016
	QoLi total score	-.205	<.001
Step 4: Adds peritraumatic dissociation as a proxy for experiencing labor as overwhelming	R ² = .128, R ² = .052, p<.001		
	Childhood maltreatment sum	.016	.720
	Had pre-existing MDD ONLY	.020	.617
	Had pre-existing PTSD ONLY	.027	.543
	Had comorbid PTSD & MDD	.064	.149
	Quality of Life Index score	-.160	<.001
Step 5: Adds postpartum mental health status			
	R ² = .195, R ² = .067, p<.001		
	Childhood maltreatment sum	-.010	.806
	Had pre-existing MDD ONLY	.019	.623
	Had pre-existing PTSD ONLY	.004	.932
	Had comorbid PTSD & MDD	.009	.846
	Quality of Life Index score	-.123	.004
	Dissociation in labor	.169	<.001
	New incident PTSD postpartum	.046	.315
	Only MDD postpartum	.188	<.001
	Both PTSD & MDD postpartum	.217	<.001

Abbreviations: PTSD, posttraumatic stress disorder; MDD, major depressive disorder.