

Full Length Article

Postpartum post-traumatic stress symptoms and mother-infant bonding: A population-based cross-sectional study

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ABSTRACT

Objective: Postpartum post-traumatic stress symptoms are associated with negative outcomes for women's mental health and may disrupt the development of the mother–infant bond. However, previous research has reported inconsistent findings. The aim was to examine the predictive role of postpartum post-traumatic stress symptoms on mother–infant bonding 6 to 12 weeks after birth in a population-based sample.

Method: This population-based cross-sectional study was conducted in 2022 and included 598 women 6 to 12 weeks postpartum. Postpartum post-traumatic stress symptoms were measured using the City Birth Trauma Scale, and mother–infant bonding was assessed with the Postpartum Bonding Questionnaire. Linear regression analysis was used to examine the association between post-traumatic stress symptoms and mother–infant bonding, adjusting for maternal age, parity, mode of birth, educational level, and depressive symptoms.

Results: The mean score on the City Birth Trauma Scale was 8.4, and 5.5 on the Postpartum Bonding Questionnaire. A total of 1.5 % of participants scored above the cut-off for significant bonding difficulties. Higher levels of postpartum post-traumatic stress symptoms were significantly associated with greater bonding difficulties ($B = 0.380$, $p < 0.005$). This association remained significant after adjustment for background variables and depressive symptoms ($B = 0.113$, $p = 0.007$). Primiparity, higher educational attainment, and depressive symptoms were also significantly associated with bonding difficulties ($p < 0.05$).

Conclusion: The findings suggest that postpartum post-traumatic stress symptoms negatively affect the development of the mother–infant bond. A targeted screening of post-traumatic stress symptoms and bonding difficulties is recommended, followed by appropriate support in postpartum care.

Introduction

Childbirth has a profound impact on individuals' lives, marking the beginning of a critical transitional period for both new parents and their newborn. The postpartum phase is particularly significant, as it involves substantial physiological and psychological adjustments for the mother while the infant remains highly dependent on maternal care for early development. The establishment of the mother–infant bond during this period is essential for the child's emotional, cognitive, and social growth. However, various factors, including maternal mental health, can significantly influence the quality of this bonding process.

Postpartum post-traumatic stress symptoms can arise from traumatic childbirth experiences, which might include emergency interventions, perceived or actual threat to the life of the mother or the infant, and a sense of loss of control during labour and birth [1]. According to the Diagnostic and Statistical Manual of Mental Disorders 5 (DSM-5) [2], these symptoms are characterized by intrusive thoughts, hyperarousal, avoidance behaviours, and negative changes in mood and cognition. It is important to distinguish between posttraumatic stress symptoms (PTSS) and posttraumatic stress disorder (PTSD): PTSS refers to clinically significant trauma-related reactions that do not necessarily meet full diagnostic criteria whereas PTSD denotes the DSM-defined disorder

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associated with persistent symptoms and functional impairment [3]. In a recent meta-analysis, the prevalence of postpartum PTSS was estimated at 12.3 %, while the prevalence of postpartum PTSD worldwide was 4.7 % [3]. In recent multi-national study, the prevalence of postpartum PTSD in Iceland was approximately 3 % and 16 % of women perceived their birth as traumatic [4,5]. Although not as commonly acknowledged as postpartum depression, PTSD symptoms can have profound effects on a mother's psychological well-being, including depression [6], fear of future childbirth [7], and difficulties in relationships with the infant and family members, with potential adverse effects on infant development [8].

Mother-infant bonding refers to the emotional connection that a mother perceives towards her infant [9]. This bond is an important part of psychosocial development during pregnancy and continues after birth [10,11]. It is vital for the infant's development and can influence their future relationships and psychological health. Secure attachment, formed through positive mother-infant interactions, is associated with better emotional regulation, social competence, and cognitive functioning in children [10,12]. Consequently, infants of mothers experiencing PTSD symptoms may show insecure attachment patterns, which can have long-term developmental implications [10].

Previous research has shown a significant association between maternal mental health disorders, such as postpartum depression and anxiety, and impaired mother-infant bonding [11,12]. However, the specific impact of postpartum PTSD or PTSD symptoms on mother-infant bonding remains inconsistent [10,13–15]. Some studies have indicated that mothers with PTSD symptoms are more likely to report difficulties in bonding with their infants and exhibit less optimal parenting behaviours [10,13] while others have not found significant associations [14,15].

Rational for the study and aims

Our study aimed to explore the association between postpartum post-traumatic stress symptoms and mother-infant bonding during the first 6 to 12 weeks postpartum. Understanding this relationship might inform the development of targeted interventions to support affected mothers and promote healthy mother-infant interactions.

Methods

Research design and setting

This population-based study is part of the cross-sectional International Survey of Childbirth-related Trauma (INTERSECT) study conducted in over 30 countries in all continents on mothers 6 to 12 weeks postpartum [5].

Iceland has approximately 383,000 residents and 63 % of the population lives in the capital area [16]. The average annual birth rate is between 4200 and 4500 per year with caesarean birth rates around 15–17 % and perinatal mortality rates of 2.0–4.5 per 1000 births [17]. The Icelandic health care system provides maternity care mostly free of charge. Traditionally, nearly all routine antenatal and postnatal care is provided by midwives, and all births are attended by midwives in collaboration with obstetricians if needed. Approximately 72 % of the births take place at the National University hospital in Reykjavík, around 5 % are home or birth center births but the remaining births take place at nine birth clinics in the rural areas of Iceland [17]. A trend of centralising childbirth services has occurred in Iceland with consequent closures of maternity wards in remote places.

Participants and data collection

All women aged 18 years or older who gave birth to a live child or children in Iceland from March 14th to July 31st, 2022, and had their e-mail addresses registered in the National childbirth registration, were

invited to participate in the online survey 6 to 12 weeks postpartum. The data collection period was chosen to align with the international INTERSECT study protocol, ensuring consistency across participating countries. An e-mail was sent via RedCap software to 1458 women from May 30th to September 19th in 2022 with an information letter and a week later a reminder was sent to non-respondents. Respondents had a choice of an Icelandic language or English version of the online survey. Those who did not respond to background questions or main variables to assess postpartum bonding or postpartum post-traumatic stress symptoms were excluded from the study sample. The final sample was 598 women (Fig. 1).

Measures

The exposure variable, the total score of PTSD symptoms, was assessed with The City Birth Trauma Scale (City BiTS), translated from English to Icelandic language, using a forward-to-back translation. The City BiTS consists of 29 questions and was developed by Ayers et al. to assess postpartum PTSD [18] according to DSM-5 diagnostic criteria [2]. A diagnosis of PTSD using the City BiTS begins with the assessment of Criterion A, which evaluates whether the childbirth experience involved

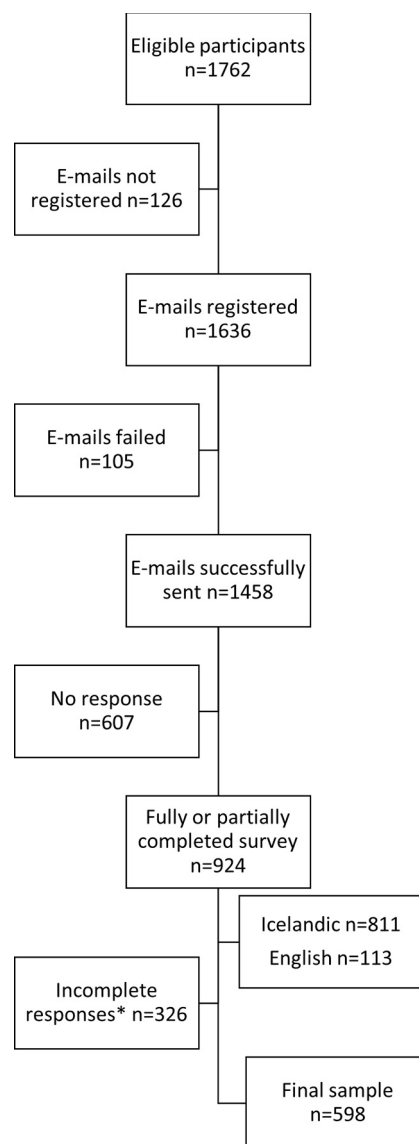


Fig. 1. Flowchart of included and excluded participants in the study.

* Not responding to $\geq$ one background, City BiTS, EPDS or PBQ questions

actual or perceived threat to life or serious injury to the mother or infant, or whether the birth was associated with intense feelings of fear, helplessness, or horror. Following this, symptoms are assessed across the four symptom clusters: B – intrusion or re-experiencing the traumatic event; C – avoidance of things related to the traumatic event; D – negative alterations in cognition and mood; E – arousal and reactivity. Each symptom is rated according to its frequency over the past week, on a 4-point Likert scale ranging from 0 (not at all) to 3 (5 or more times), with higher scores indicating greater symptom severity. The total score for symptom clusters B–E ranges from 0 to 60. Items relating to Criterion A, as well as questions about subjective distress, functional impairment, and potential physical explanations, are answered with “yes” or “no”, and in some cases, a “maybe” option is included. These items are used to determine whether the diagnostic criteria are met but are not included in the symptom severity total score. The City BiTS can be used as a continuous measure of symptoms or as a diagnostic tool and it has been translated and validated in multiple languages [19], showing a good reliability and validity. Findings from factor analyses indicate that the City BiTS has a two-factor structure of birth-related symptoms (a total of 9 items from clusters B and C and two from cluster D) and general symptoms (a total of 11 items from clusters D and E) [4,18,19]. Based on this structure, scores on City BiTS can either be calculated as a total sum score or as two subscale scores [19].

The outcome variable, maternal-infant bonding, was assessed using the Postpartum Bonding Questionnaire (PBQ) [20]. The instrument was developed to measure maternal feelings and emotions towards the infant and includes 25 statements in four subscales; 1) general factors (score range 0–60, cut-off ≥ 12), 2) rejection and pathological anger (scores 0–35, cut-off ≥ 17), 3) anxiety about the infant (scores 0–30, cut-off ≥ 10) and 4) incipient abuse (scores 0–10, cut-off ≥ 3) [20]. The PBQ was translated from English to Icelandic language, using a forward-to-back translation. Respondents can choose from six responses, ranging from *allways* to *never*. Positive responses were scored from 0 (always) to 5 (never) and negative responses from 5 (always) to 0 (never) (Appendix). Higher scores on PBQ indicate more bonding difficulties where a score of ≥ 26 indicates difficulties in the mother-infant relationship [20]. A psychometric evaluation of PBQ indicates that the instrument is valid and reliable for assessment of mother-infant bonding [21].

Sociodemographic information collected included age (18–25 years, 26–35 years and ≥ 36 years), education (no formal education/elementary school, high school/college, and higher education), and relationship status (married/co-habiting/in relationship and single). Birth-related information consisted of data about parity (primipara, multipara) and birth mode (spontaneous vaginal birth, instrumental vaginal birth, elective or emergency caesarean birth) which was recoded in two categories (spontaneous vaginal birth vs operative birth) for statistical analysis.

The ten-item, Edinburgh Postnatal Depression Scale (EPDS) developed by Cox et. al. [22] was used to assess depressive symptoms. The response options for EPDS range from 0 to 3 with a total sum score of 0–30. A cut-off score of 11 or above is considered optimal for identifying individuals at risk of perinatal depression [23]. EPDS has been translated and validated to many languages, including Icelandic language, to use both prenatal and postpartum and has shown good psychometric properties [23].

Data analysis

Descriptive data for categorical variables was reported as absolute and percentage frequencies. Scores on City BiTS, PBQ and EPDS were described as mean values with standard deviation. To investigate if trauma symptoms were related to maternal-infant bonding, a linear logistic regression analysis was performed. To adjust for background factors, the model included demographic variables (age, relationship status and education) and birth-related factors (birth mode and parity). Age was entered to the model as a continuous variable and to include the

categorical predictors, dummy variables were created with one category as the reference group (Table 2). Odds ratio (OR) was calculated with a 95 % confidence interval (CI). A p-value of 0.05 or less was considered to be of statistical significance. All analyses were performed with R studio (version 4.4.2).

Results

Descriptive findings

The final sample included 598 women (Fig. 1). Descriptive demographic and birth-related characteristics are shown in Table 1. Approximately 44 % of participants were first-time mothers and 95 % had a partner. The majority (79.3 %) had a vaginal birth while 11.8 % had a caesarean birth and 8.9 % an instrumental birth.

The distribution of the City BiTS score is shown on Fig. 2. The mean sum score was 8.4 (SD 9.5) and in Table 1 the stratified mean score is reported with Standard Deviation. Primiparous women had higher score than multiparous women, as well as single women and those who had instrumental or emergency caesarean birth.

The distribution of the scores on the PBQ is shown on Fig. 3. The mean score was 5.5 (SD 5.76) and 1.5 % scored 26 or more, indicating difficulties in maternal-infant bonding. The mean score on EPDS was 6.34 (SD 4.94) where 12.2 % scored 12 or higher, indicating depression symptoms.

Postpartum PTSD and bonding

Linear regression analysis showed that higher PTSD scores on the City BiTS were associated with higher scores on mother-infant bonding scores on the PBQ. For each point of increase in the PTSD score, the mother-infant bonding score increased by 0.38 points in the unadjusted model (Table 2). This positive association suggests that as PTSD symptoms severity increases, so does the score on PBQ, indicating a significant predictive association between postpartum posttraumatic stress symptoms and mother-infant bonding difficulties. The association remained significant after adjusting for depressive symptoms (EPDS),

Table 1

Descriptive characteristics of participants in the Icelandic part of the INTERSECT study 6 to 12 weeks postpartum in 2022 and stratified mean score on the City BiTS with Standard Deviation.

	n = 598 (%)	City BiTS mean (SD)
Parity (n = 598)		
Primipara	266 (44.5)	10.2 (10.6)
Multipara	332 (55.5)	7.0 (8.2)
Age (n = 598)		
≤ 25 years	69 (11.5)	9.7 (9.7)
26–35 years	413 (69.1)	8.5 (9.2)
≥ 36 years	116 (19.4)	7.5 (10.2)
Education level (n = 598)		
Elementary school or less	50 (8.4)	9.3 (10.1)
High school	126 (21.1)	9.7 (10.8)
University	422 (70.6)	8.0 (9.0)
Marital status (n = 598)		
In relationship	567 (94.8)	8.3 (9.2)
Single	31 (5.2)	11.5 (13.9)
Birth mode (n = 598)		
Vaginal	474 (79.3)	7.8 (8.8)
Instrumental	53 (8.9)	10.1 (11.4)
Emergency caesarean	45 (7.5)	14.5 (12.1)
Planned caesarean	26 (4.3)	7.1 (8.5)

n: number; SD: Standard Deviation

Table 2

Linear regression model, predictors of postpartum bonding difficulties 6 to 12 weeks postpartum (n = 598).

	B value Estimate	CI 95 %	p- value
Unadjusted model*			
Post-traumatic stress symptoms (City BiTS score)	0.38	0.33;0.44	<0.001
Adjusted model**			
Post-traumatic stress symptoms (City BiTS score)	0.113	0.031; 0.194	0.007
Depression symptoms (EPDS score)	0.681	0.527; 0.836	<0.001
Age	0.003	−0.117; 0.122	0.966
Primipara	1.397	0.218; 2.577	0.020
Operative birth	0.612	−0.727; 1.951	0.370
Marital status single	0.288	−2.139; 2.716	0.816
Elementary school	−2.860	−4.847; −0.871	0.005

City BiTS, EPDS, and age entered as continuous variables.

Categorical (dummy) variables were defined as follows: parity (primiparous = 1, multiparous = 0), mode of birth (operative (caesarean or instrumental) = 1, spontaneous vaginal = 0), marital status (single = 1, in relationship/married/cohabiting = 0), educational level (elementary or less = 1, secondary or higher = 0).

* Adjusted $R^2 = 0.21$.

** Adjusted $R^2 = 0.31$.

age, parity, mode of birth, marital status, and level of education (Table 2), although the association became weaker. In the adjusted model, for each one-point increase in PTSD score, there was an increase of 0.11 points in the mother–infant bonding difficulty score, indicating a positive linear relationship between the severity of postpartum post-traumatic stress symptoms and the likelihood of bonding difficulties. The adjusted model explained 31 % of the variance in the outcome variable, mother–infant bonding.

Depression, background factors and bonding

The linear regression model also showed a significant association between PBQ total score and EPDS total score, indicating that as the score on the EPDS list increases, the score on the PBQ also increases by 0.68 points. Furthermore, parity was significantly associated to PBQ, where first-time mothers seem to be more likely to score higher on PBQ, indicating that they are more likely to experience problems in mother–infant bonding than multiparous women. Finally, there appears to be a significant association between the total score on the PBQ and the level of education where individuals with elementary education or less, score lower on the PBQ compared to individuals with higher education (secondary education and/or higher education).

Discussion

Our population-based study is the first to evaluate mother–infant bonding levels in Iceland contributing to a growing body of evidence indicating a significant relationship between mothers' postpartum PTSD symptoms and disturbances in mother–infant bonding. This association remained significant after adjusting for depressive symptoms, age, parity, mode of birth, marital status, and education. Disturbances in mother–infant bonding also showed significant associations with depressive symptoms, parity, and level of education.

The participants in our study reflected the general population of childbearing women in Iceland in terms of age, parity, and birth mode [17]. However, more participants in our study had higher education compared to the general population. This is a known phenomenon as individuals with higher education might be more likely to participate in scientific research [24].

In our study, the mean score of PTSD symptoms was lower (8.4) than in previous studies using the City BiTS as a measure at similar time postpartum. In a Turkish sample the mean score was 11.12 [25] and in a UK sample it was 11.7 [18]. Furthermore, our study showed that the prevalence of postpartum bonding difficulties was lower (1.5 %) than in previous studies from Spain (2.9 %) [26] and Japan (5.3 %) [27]. The

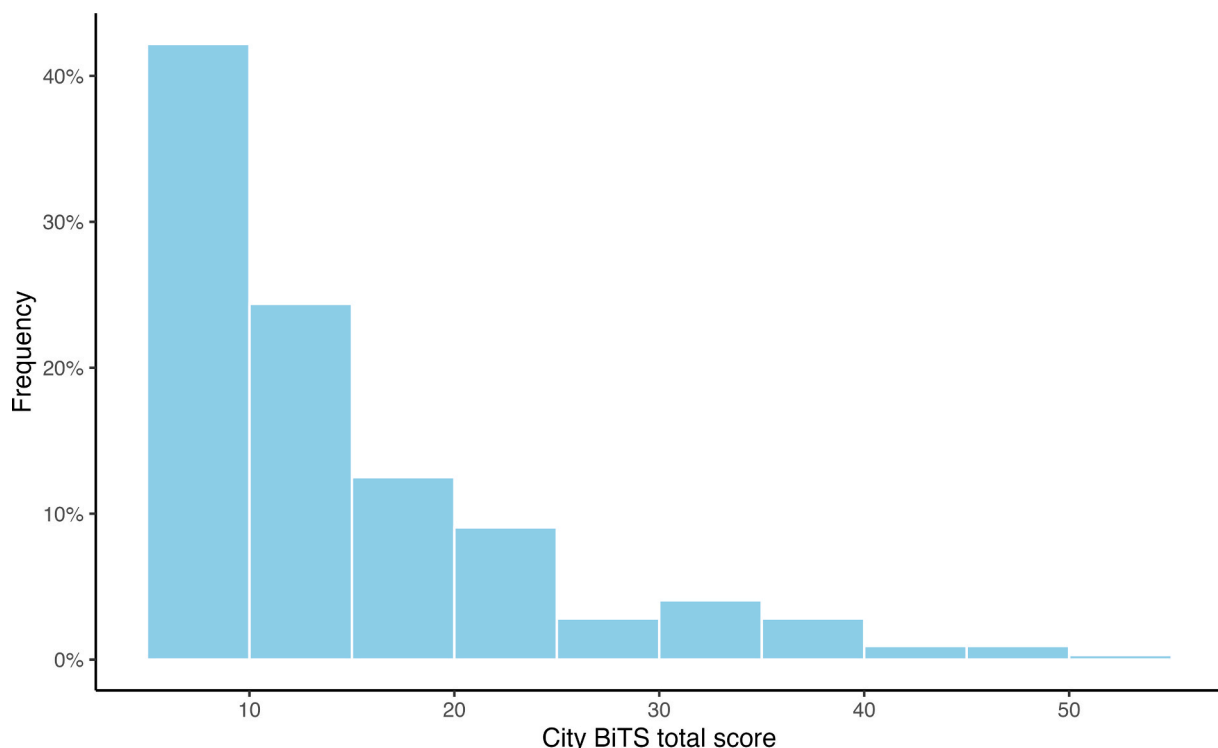


Fig. 2. Distribution of post-traumatic stress symptoms on City BiTS 6 to 12 weeks postpartum.

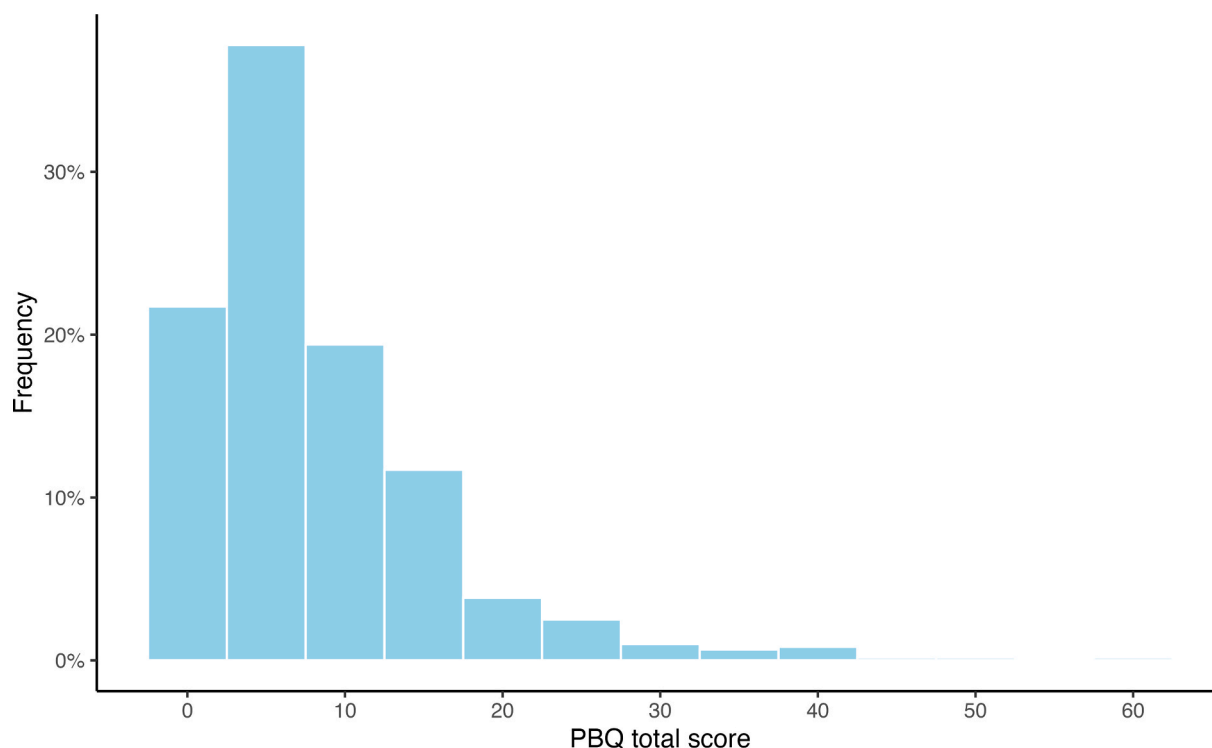


Fig. 3. Distribution of bonding scores on PBQ 6 to 12 weeks postpartum.

time of measure might be of importance in this context as bonding was measured 4–6 weeks postpartum in the Spanish study and previous research indicates that bonding increases with time [11]. Therefore, the difference in prevalence might in some cases be explained by the assessment period, as bonding difficulties might be more common shortly after birth compared to 6–12 weeks postpartum, given that bonding tends to strengthen over time. However, the Japanese study [27] was conducted approximately three months postpartum, similar to our study. The psychometric properties for the PBQ screening tool have not yet been evaluated in Icelandic language. However, in a previous study, the threshold for mother–infant bonding difficulties is suggested as a score at or above 26 [20].

The study's results suggest that PTSD symptoms can predict mother–infant bonding difficulties as higher City BiTS scores were associated with higher PBQ scores. This association remained significant after adjusting for background variables (depressive symptoms, age, parity, mode of birth, marital status, and education). Previous studies have yielded mixed results [8] where some align with our findings of a significant association between PTSD symptoms and bonding difficulties [10,13] while others have not [15]. In Kjerullf's et. al. study in the US on primiparous mothers one month postpartum, the significance persisted after adjustment for background variables [13] like in our study. On the other hand, Handelzalts et. al. found no significant relationship between PTSD symptoms and bonding six months postpartum in an Israel sample, using the same measurement as in our study [15]. These mixed results might therefore be explained partly by a variety of measurement tools [8] and a different time point of measurement as there is a tendency that bonding improves over time [11]. The measurement in the Israel study was six months postpartum [15] while in our study bonding was measured six to 12 weeks postpartum. Moreover, cultural differences between Israel and Iceland might also play a role. A variety in maternity care systems might also play a role in the prevalence of bonding difficulties. In Iceland, postpartum care involves a widespread use of midwifery home services for the first 10 days following birth, creating an opportunity for early detection of mental health and bonding difficulties, as well as providing an appropriate support in mother–infant

bonding if needed [28]. Our findings therefore highlight the importance of early detection of PTSD symptoms in the postpartum period, which may facilitate timely intervention and ensure that women experiencing bonding difficulties receive appropriate treatment and support.

In our findings, the predictive role of PTSD symptoms in bonding difficulties remained significant after adjustment for postpartum depression symptoms which is one of the most acknowledged factors in bonding difficulties [11]. Previous studies have mixed results on this where in Kjerulff et.al. [13] study similar findings were reported while in Stuijzand et. al. [14] study the relationship between PTSD symptoms and bonding difficulties became non-significant after adjustment for postpartum depression. Our findings contribute to the knowledge on the role of PTSD symptoms in bonding difficulties, however, highlighting the need for further research to clarify these relationships.

In addition to the predictive role of PTSD symptoms in bonding difficulties, a significant relationship was between depression symptoms, being a first-time mother and higher education level, and bonding difficulties. These findings of the connection between depression and bonding difficulties align with previous research, including a recent systematic review [11]. Our finding about first-time mothers being more likely to experience bonding difficulties is also consistent with previous Japanese studies [29,30]. Surprisingly, mothers with higher education were more likely to perceive bonding difficulties than those with lower education. This has also been revealed in Kinsey et al. study [31] and the authors suggested that higher-educated women might be more honest in reporting their bonding experiences.

All the above findings have been described in a phenomenological study, suggesting mothers with PTSD symptoms are struggling with bonding, perceive a disconnection to their infants and lack confidence in parenting [32].

Strengths and limitations

The main strength of our study was that it was population-based study and questionnaires were sent to all women who had given birth in the country during the study period. The response rate was good with

63.4 % of the women who received the questionnaire participating, and 41.2 % responded to all the questions regarding symptoms of postpartum PTSD and bonding. The study sample represented the population well in terms of age, parity, relationship status, and mode of birth. A psychometric evaluation for City BiTS in Icelandic language supports the applicability of the City BiTS in perinatal mental health research [4]. However, the study had some limitations. First, it was a self-report questionnaire measuring the prevalence of symptoms of postpartum PTSD which might be different from clinical diagnostic interviews. However, it would not have been feasible to interview such a large sample as was included in this study. A second limitation is the use of the 6 to 12 weeks postpartum timeframe, which was selected to ensure consistency with the international INTERSECT study protocol. While this enhances cross-national comparability, it may also limit direct comparability with studies using different postpartum periods. Additionally, the cross-sectional design limited our ability to assess changes in bonding over time. Finally, the psychometric properties of the Icelandic version of PBQ has not yet been published.

Conclusion

This study provides important insights into the relationship between maternal PTSD symptoms and bonding difficulties. Our findings indicate that postpartum PTSD symptoms are a significant predictor of disturbances in mother-infant bonding, even after adjusting for key socio-demographic and psychological factors. Additionally, depressive symptoms, primiparity, and higher education levels were significantly associated with bonding difficulties. Compared to other countries with similar maternity care systems, Iceland demonstrated lower rates of traumatic birth experiences, childbirth-related PTSD and bonding difficulties. This might be partly explained by the availability of comprehensive postpartum midwifery home services, which facilitate early identification and intervention for mental health and bonding challenges. These findings emphasize the importance of early detection and intervention for maternal PTSD symptoms and bonding difficulties, ensuring that mothers receive the necessary psychosocial support to enable healthy mother-infant relationships. Ongoing research in this field is essential to refine screening and intervention strategies, ultimately improving maternal and infant well-being postpartum. Early identification and support for mothers experiencing PTSD symptoms could enhance their well-being and foster a secure mother-infant bonding, ultimately contributing to better developmental outcomes for children.

Ethical statement

The study was approved by the National Bioethics Committee (VSNb2021120007/03.01) and was reported to the Icelandic Data Protection Authority.

Author agreement

We declare that this manuscript is original, has not been published before and is not currently being considered for publication elsewhere. We confirm that all authors have seen and approved the manuscript being submitted. We abide by the copyright terms and conditions of Elsevier.

CRediT authorship contribution statement

Valgerður Lísa Sigurðardóttir: Writing – original draft, Validation, Supervision, Project administration, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Guðrún Anna Hákonardóttir:** Writing – review & editing, Writing – original draft, Validation, Methodology, Formal analysis, Conceptualization. **Stefanía Birna Arnardóttir:** Writing – original draft, Validation, Methodology,

Conceptualization. **Linda Bára Lýðsdóttir:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Emma Marie Swift:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary material

The Icelandic version of Postpartum Bonding Questionnaire. Supplementary data to this article can be found online at <https://doi.org/10.1016/j.srhc.2025.101140>.

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