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Assessment of maternal PTSD following childbirth: Psychometric properties of the Swedish version of City Birth Trauma Scale

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Abstract

Objective: City Birth Trauma Scale is an instrument designed to evaluate and diagnose postpartum posttraumatic stress disorder (PTSD) according to the 5th edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-5). No validated Swedish instrument exists to measure postpartum PTSD according to DSM-5. Therefore, the objective of this study was to assess the psychometric properties of the Swedish version of the City BiTS (City BiTS-Swe) and to examine the latent factor structure of postpartum PTSD. **Method:** A total of 619 women, who had given birth at five clinics in the past six to 16 weeks, completed an online version of City BiTS-Swe and the Edinburgh Postnatal Depression Scale (EPDS). Additionally, sociodemographic and medical data was collected. A second questionnaire was answered by 110 women to examine reliability over time. **Results:** The confirmatory factor analysis using the two-factor model gave best fit to the data. We found a high internal consistency ($\alpha = 0.89-0.87$) and good test-retest reliability ($ICC = 0.53 - 0.90$). Divergent reliability with EPDS showed significant correlations with satisfying results for the subscale birth-related symptoms ($r=0.41$). We also found discriminant validity concerning mode of birth, parity, gestational age, mental illness, history of traumatic childbirth and history of traumatic event as expected. **Conclusions:** The City BiTS-Swe is a valid and reliable instrument to assess and diagnose PTSD following childbirth.

Clinical impact statement: PTSD following childbirth can cause considerable suffering for the affected woman, her partner and the child. Having a valid and reliable instrument to assess and diagnose childbirth-related PTSD is of great importance for the detection and treatment of the disease. The results of this study confirms that the Swedish version of City BiTS is a reliable and valid instrument that can be recommended for use in daily clinical practice and for research purposes.

Key words: PTSD, childbirth, trauma, validation, Swedish

Introduction

Childbirth is for most individuals a life-changing event, which can be associated with both positive and negative experiences. Although usually considered a happy occasion, giving birth might induce physiological as well as social and psychological strains. Studies have shown that 20-40% of women giving birth perceive the childbirth as a traumatic experience (Alcorn et al., 2010; Creedy et al., 2000; Soet et al., 2003). Nevertheless, perinatal mental health problems are often overlooked. Postpartum depression is the most recognized condition, having the highest prevalence of 14-17% globally (Liu et al., 2021; Wang et al., 2021). Postpartum women may also experience symptoms of posttraumatic stress disorder (PTSD). The fifth version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) classifies PTSD under “Trauma- and Stressor-Related Disorders” (APA, 2013). A traumatic childbirth can be included in the category of sudden and catastrophic events that can lead to development of PTSD. PTSD is a potentially incapacitating disease that can lead to a major impact on the individual’s life. Childbirth-related PTSD can incorporate increased levels of anxiety and fear of future pregnancy and childbirth (Hofberg & Brockington, 2000). Postpartum PTSD has an impact on both the child and the mothers’ well-being and is associated with lower rates of breastfeeding (Cook et al., 2018; Garthus-Niegel et al., 2018). Furthermore, there is evidence suggesting a negative association between maternal postpartum PTSD symptoms and children's social-emotional development (Garthus-Niegel et al., 2017).

Results from meta-analyses and reviews show that 3-4% of all women giving birth develop postpartum PTSD (Grekin & O'Hara, 2014; Yildiz et al., 2017). The main risk factors for posttraumatic stress symptoms postpartum are fear of childbirth during pregnancy, maternal mental illness including depression, trauma history, low social support, subjective negative perception of childbirth, complications during birth, lack of support and dissociation (Ayers et al., 2016; Dekel et

al., 2017; Grekin & O'Hara, 2014; Grundström et al., 2022). A higher prevalence of postpartum PTSD of 15-19% has been found for women in high-risk groups such as those who have pre-eclampsia or preterm birth (Grekin & O'Hara, 2014; Yildiz et al., 2017). The high comorbidity between postpartum PTSD and postpartum depression is important to keep in mind (Ayers et al., 2016). Moreover, the two diagnoses sometimes have common symptomatic traits which can entail difficulty in separating one from another, resulting in wrong diagnosis (Agius et al., 2016).

Existing questionnaires measuring general PTSD symptoms, such as the Impact of Event Scale (Horowitz et al., 1979), may not be valid or applicable to PTSD following childbirth, since childbirth is different from many other traumatic events. For example, childbirth is typically viewed as a positive and “natural” occasion and it was not until the 1980's that childbirth was recognized as an event that could be experienced as a traumatic stressor i.e. involve actual or perceived threat to the life of women and/or their baby (Olde et al., 2006). Pregnancy, birth and postpartum also involve substantial physiological, psychological, and social change which affect the mother and infant, so are unique circumstances in which trauma might occur and impact on individuals. For example, normal postpartum factors, such as sleep deprivation and vigilance towards the baby, may confound symptoms. Similarly, caring for the baby may make it harder for women to avoid reminders of the birth therein affecting symptoms of avoidance. Consequently, a specific instrument that measures birth-related PTSD is important for clinical use to identify affected individuals and thereby enable treatment.

Ayers et al. (2018) developed and psychometrically validated the City Birth Trauma Scale (City BiTS): a self-report questionnaire to specifically measure and diagnose birth-related PTSD (Ayers et al., 2018). According to the latest criteria in the DSM-5, City BiTS is divided in four main symptom clusters: re-experiencing, avoidance, hyperarousal, and negative cognitions and mood (APA, 2013). Instead of a four-factor structure, a two-factor structure consisting of birth-related symptoms (BRS) and general symptoms (GS) was found in exploratory factor analysis in the

original validation of the City BiTS (Ayers et al., 2018). Several translations have subsequently been validated with similar results supporting the two-factor model in all published validation studies of the City BiTS to date (Ayers et al., 2018; Bayri Bingol et al., 2021; Caparros-Gonzalez et al., 2021; Handelzalts et al., 2018; Nakic Rados et al., 2020; Osorio et al., 2021; Sandoz et al., 2021; Weigl et al., 2021), suggesting the factor-structure of childbirth-related PTSD differs from PTSD in other populations. However, an even better data fit was found using a bifactor model in two of the aforementioned validations which indicated a general factor explaining all PTSD-symptoms (Nakic Rados et al., 2020; Sandoz et al., 2021) as well as an underlying specific 2-factor model of BRS and GS.

Despite the high prevalence and potential negative impact on women and infants, there is no validated measure to assess or diagnose postpartum PTSD in Sweden. The City BiTS is the only instrument to assess postpartum PTSD based on the DSM-5 criteria. Furthermore, there is no research on the current rate of postpartum PTSD in a Swedish population. The aim of this study was to assess the psychometric properties of the Swedish version of the City BiTS (City BiTS-Swe) and to examine the latent factor structure of postpartum PTSD.

Method

Participants

Study participants were recruited from five maternity clinics in Sweden (one university hospital in a big city, one district hospital in a middle-sized city, two country hospitals in small cities, and one private clinic in a big city). Eligible women were aged 18 years or older, who had given birth within 6 to 16 weeks prior to inclusion. Cases of stillbirth were excluded. A total of 619 women participated in the study. The majority reported having a higher education (79.5%), living in a large city (58.1%), belonging to the majority ethnic group in Sweden (84.5%) and having given vaginal

birth (71.8%). Mean reported age was 32.77 years (SD = 4.50, range 18-47 years), and mean time from childbirth was 10.76 weeks (SD = 2.17, range 6-16 weeks).

Measures

Sociodemographic and clinical characteristics

Information concerning sociodemographic and obstetric information was self-reported. The questionnaire included questions regarding age, relationships status, ethnicity, level of education, number of children, gestational age, birth method and complications during birth and information of previous and current psychological conditions and treatments.

The City Birth Trauma Scale (City BiTS)

The City BiTS is constructed of a total of 29 items (Ayers et al., 2018). It is mainly composed of items measuring the four clusters of symptoms according to the DSM-5: Re-experiencing, avoidance, negative cognitions and mood, and hyperarousal during the last week which account for 20 items. Additional items evaluate stressor criteria, duration of symptoms, level of distress, disability, dissociative symptoms, and other possible explanations for the symptoms. The items are answered by yes/no or by a four-graded Likert scale from 0 (not at all) to 3 (five or more times). A total score of 0-60 points is calculated, where a higher score indicates higher levels of PTSD symptoms. The two symptom cluster subscales (birth-related symptoms and general symptoms) of the two-factor model are composed of item 3-12 and 13-22 respectively.

Furthermore, the scale can be used for diagnosing birth-related PTSD based on eight criteria according to DSM-5: A) stressor criteria, (B) re-experiencing symptoms, (C) avoidance, (D) negative cognitions and mood, (E) hyperarousal, (F) duration, (G) distress and impairment, (H) exclusion (Ayers et al., 2018).

The translation of the City BiTS into Swedish was done in accordance with guidelines for translation and cultural adaptation for patient-reported outcomes (Wild et al., 2005). First, two separate translations of the questionnaire into Swedish were done. One translation was made by a

professional translating company, and the other was made by a person outside the research group but working in the medical field, who was a native Swedish speaker resident in Sweden, and whose second language was English. Secondly, the instrument was translated back into English by another professional translating company, and by another person working in the medical field, but not in the research group, who was a native English speaker resident in Sweden, and whose second language was Swedish. The back-translations was then examined for consistency with the original version by the authors, who were experts in the field of perinatal mental health. Based on the result, a second Swedish version was constructed. This version was pre-tested on a group of six women who had given birth 8-14 weeks earlier, to evaluate the instrument in a Swedish cultural context. The instrument was perceived as relevant, easy to understand and reasonably long, taking 2-5 minutes to complete.

The Edinburgh Postnatal Depression Scale (EPDS)

The EPDS is a 10-item self-report scale used for screening for postnatal depression. The instrument is answered on a four-graded Likert scale ranging from 0 to 3, resulting in a total score of 0-30 points. Higher values indicate a higher level of depression symptoms (Cox et al., 1987). The scale has been translated and validated in a Swedish context (Wickberg & Hwang, 1996).

Previous trauma

Previous trauma was measured using the trauma checklist from the Post-Traumatic Stress Diagnostic Scale (Foa et al., 1997). The checklist includes the following pre-defined traumas: severe diseases, physical assault, sexual abuse, experience of military battlefield or war zone, childhood abuse, grave accidents, natural disaster. Self-defined traumas were not included in this analysis. This checklist was freely translated and validated by a researcher with expertise in the psychiatric field. The checklist was supplemented by one additional item measuring previous traumatic birth experiences.

Procedure

This multi-centered cross-sectional study was conducted as a part of the International Survey of Childbirth-related Trauma (INTERSECT). Data were collected between September 2021 and February 2022. A contact person at each clinic provided a list with social security numbers of all women who had given birth at the clinic in the last 4-8 weeks. From these lists, a total of 2000 women were randomly selected using a random selection tool in Excel. The proportion of participants from each clinic was dependent on the size of the clinic. The participants' addresses were received from the Swedish state personal address register. Participant information with a link and a QR code to the online version of City BiTS-Swe was sent by post. The retest questionnaire was sent three weeks after the first mailing to those who had completed the survey at that time. A reminder was sent to the rest, together with a printed version of the questionnaire.

All participants gave informed written consent by entering their unique study code on the first page of the questionnaire after reading the participant information sheet. The study was approved by the Swedish Ethical Review Authority on August 20, 2021 (Dnr 2021–03968).

Statistical analysis

First, descriptive analyses were conducted to ensure that the data were appropriate for factor analysis. The data were then screened for outliers. The four-factor, two-factor and bifactor structure of the City BiTS-Swe were tested with confirmatory factor analysis (CFA). Several fit indices were used to evaluate the model: χ^2 and degrees of freedom (df), root mean square error of approximation (RMSEA), comparative fit index (CFI), Tucker-Lewis index (TLI), and standardized root mean square residual (SRMR). A non-significant χ^2 value generally indicates a good fit. However, a non-significant χ^2 test is rarely obtained when the sample is large (Hu & Bentler, 1999). $\chi^2/df < 3$ was regarded as a good fit. Additionally, a good fit was regarded as a RMSEA < 0.08 , CFI > 0.90 , TLI > 0.95 , and SRMR < 0.08 . Factor loadings should be above 0.40 for the items to indicate a good fit (Kline, 2015).

Cronbachs' α coefficients were calculated to assess the internal consistency. Values between > 0.70 and < 0.95 were considered as satisfactory internal consistency (Terwee et al., 2007).

Reliability over time was examined by test-retest reliability with intra class correlation (ICC) according to Koo and Li (2016). As a rule of thumb, a minimum of 30 participants should be included in a test-retest reliability analysis. ICC estimates and their 95% confident intervals (95% CI) were calculated based on an average rating, absolute-agreement and a two-way mixed-effects model. Differences in mean scores between the two measurements are analyzed using paired samples t-test. An ICC value < 0.50 was considered as poor reliability, 0.51-0.75 as moderate reliability, 0.76-0.90 as good reliability, and > 0.90 was considered as excellent reliability. (Koo & Li, 2016)

Construct validity was assessed by divergent validity with the EPDS using Pearson's correlation coefficient, and by discriminant validity. For good divergent validity, correlations should be below 0.5 between any pre-defined dimensions (Nunnally, 1994).

Discriminant validity was examined by the known-groups differences with a series of Kruskal Wallis tests to compare mode of birth, parity, gestational age, mental illness, history of traumatic childbirth and history of traumatic event. Paired tests for variables with more than two groups were carried out using Dunn's test.

CFA for the four- and two-factor analyses were made in Amos SPSS 28, and bifactorial CFA in M2plus. All other statistical processing was performed using IBM SPSS 28. A p -value $< .05$ was regarded as significant, unless stated otherwise.

Results

Descriptive statistics

The whole range (0 to 3) was used for all items answered by Likert-scale of the City BiTS-Swe. Based on Mahalanobis distance, 15 participants were defined as outliers and were thereby excluded from the CFA using an alpha level of 0.001 applied on subscale scores. The retest was sent to 183 participants and 110 answered (response rate 60%). The remaining analyses were conducted on the full study population of 619 participants. Sample characteristics are presented in Table 1.

The mean score for the City BiTS-Swe was 7.94 ± 8.74 , and 80.8% of the participants reported at least one symptom. Further, 23 participants, 3.8%, fulfilled the diagnostic criteria for PTSD.

Confirmatory Factor Analyses

The four-factor solution (Figure 1) comprised of re-experiencing, avoidance, negative cognitions and mood, and hyperarousal, provided a poor fit to the data: $X^2(164) = 1407.22$, $X^2/df = 8.58$, $p = < 0.001$, RMSEA = 0.111 (90% CI 0.105-0.116), SRMR = 0.083, CFI = 0.761 and TLI = 0.724. Most items showed high loadings to their respective factor. However, there were several high correlations between the factors (r -range: 0.28-0.95), the highest being between re-experiencing symptoms and negative cognition and mood ($r = 0.95$), as well as between negative cognitions and mood and avoidance ($r = 0.87$). Only the factor correlation between avoidance and hyperarousal

was shown to be lower than 0.50 ($r = 0.28$) (Table 2). Given the indices showing poor fit of the model in combination with high correlations between the factors, the four-factor model was rejected.

The two-factor model was tested with the two correlated factors birth-related symptoms and general symptoms (Figure 2). This model yielded a better fit to the data: $X^2(169) = 459.68$, $X^2/df = 2.72$ $p = <0.001$, RMSEA = 0.074 (90% CI 0.069-0.080), SRMR = 0.026, CFI = 0.915, TLI: 0.905. Hence, all indices in the two-factor model indicated a good fit except the TLI, which was slightly below cut-off values for a good fit with a value of 0.905. The birth-related symptoms and the general symptoms showed a low correlation ($r = 0.36$), indicating good discriminant validity. The birth-related symptoms explained 49.7% of the total variance, and general symptoms explained 50.3%. Item 2 (Bad dreams or nightmares about the birth) and item 8 (Not able to remember details of the birth) presented low factor loadings for the birth-related symptoms, as did item 16 (Feeling self-destructive or acting recklessly) for the general symptoms (Table 3).

Furthermore, the bifactor model was tested with the two specific factors birth-related symptoms and general symptoms, as well as an overall PTSD factor (Figure 3). This model provided similar indices of fit as found in the two-factor model: $X^2(150) = 545.28$, $X^2/df = 3.64$ $p = <0.001$, RMSEA = 0.067 (90% CI 0.060-0.072), SRMR = 0.048, CFI = 0.914, TLI: 0.891, with X^2/df and TLI being slightly above the cutoffs for good fit. All items loaded on the overall PTSD factor, but the items belonging to the birth-related symptoms presented higher loadings (Table 4). Several of the factor loadings were low, especially for the general symptoms items. The overall PTSD factor contributed to 24% of the variance in birth-related symptoms, and 13% in general symptoms. Item 2 and 7 on the birth-related symptoms did not load to that scale. Hence, the two-factor model was retained as it provided the best fit to data.

Reliability

Internal consistency assessed by Cronbach's alpha showed satisfactory reliability of $\alpha = 0.89$ for the total score, $\alpha = 0.89$ for the birth-related symptoms and $\alpha = 0.87$ for the general symptoms. Inter-item correlations ranged between 0.070 - 0.76 for the total score, 0.12 - 0.76 for the birth-related symptoms and 0.20 - 0.61 for general symptoms.

The test-retest reliability was tested for the total scale, for the two subscales, and item per item (Table 5). The median time between answering the two questionnaires was 22 days (max 55 – min 14). The total score and the birth-related symptoms showed excellent test-retest reliability. The general symptoms showed good reliability. The ICC concerning the items ranged between 0.53 and 0.90, indicating good to moderate reliability. Overall, there were no significant differences in the mean scoring when comparing the two measurements, except for item 17 (Feeling tense and on edge) which showed a decreased mean score from 0.56 (SD = 0.88) to 0.48 (SD = 0.70).

Divergent validity

Divergent validity of the City BiTS-Swe was tested via correlations with EPDS total score. Significant correlations ($p < .001$) with the total score and both subscales were found: $r = 0.73$ for the total scale, $r = 0.41$ for the birth-related symptoms and $r = 0.77$ for general symptoms.

Discriminant validity

Discriminant validity of the City BiTS-Swe total score and subscales was examined via known-group differences (Table 6). The total score and the birth-related symptoms were sensitive to mode of birth, parity, gestational age, mental illness, history of traumatic childbirth and history of traumatic event. The general symptoms were sensitive to parity, mental illness, history of traumatic childbirth and history of traumatic event. Women who were primiparous scored higher on the total score and both subscales, compared to multiparous women. Those who had a preterm birth scored higher on the total score and the birth-related symptoms but not on the general symptoms, while those with mental illness scored higher on total score and both subscales. Women with history of traumatic childbirth or traumatic event scored higher on the total score and both subscales.

As illustrated in Table 7, the post hoc tests showed no differences in City BiTS-Swe scores between vaginal birth and planned caesarean section, nor between instrumental vaginal birth (i.e. vacuum extractions or forceps) and emergency caesarean section. Women who had undergone instrumental vaginal birth or emergency caesarean section scored higher on the total score and birth-related symptoms compared with women with vaginal birth. Furthermore, those with instrumental vaginal birth scored higher than those with planned caesarean section in the birth-related symptoms, while women with emergency caesarean section scored higher than those with planned caesarean section on total score and birth-related symptoms.

Known groups comparisons were made between women who fulfilled diagnostic criteria for PTSD with those who did not fulfil diagnostic criteria (Table 8). Comparisons were consistent with the results above, showing that women with PTSD were more likely to have complicated modes of birth (e.g. more instrumental or emergency caesarean sections) or preterm birth. They were also more likely to be primiparous, have a history of previous traumatic events and mental illness.

Discussion

The City BiTS is a relatively new scale designed to diagnose and measure postpartum PTSD. It was originally designed and validated in English by Ayers et al (Ayers et al., 2018). The aims of this study were to assess the psychometric properties of the Swedish version of the City BiTS in a large community sample of Swedish-speaking women who had recently given birth and to evaluate the latent structure of postpartum PTSD. This was done by analyzing the reliability and the construct validity, as well as performing confirmatory factor analyzes of the suggested four-factor, two-factor and bifactor model. Result showed that the scale was both reliable and valid, which is in line with previous validations of the English, Turkish, Spanish, Hebrew, Croatian, Brazilian, French, and German versions (Ayers et al., 2018; Bayri Bingol et al., 2021; Caparros-Gonzalez et al., 2021; Handelzalts et al., 2018; Nakic Rados et al., 2020; Osorio et al., 2021; Sandoz et al., 2021; Weigl et

al., 2021). The prevalence of childbirth-related PTSD in our sample of 3.8% is consistent with previous reviews and meta-analyses (Dikmen Yildiz et al, 2017).

In this study, the four-factor model (re-experiencing symptoms, avoidance, negative cognitions and mood, and hyperarousal) suggested by the DSM-5 demonstrated a poor fit to the data. This is consistent with the original validation study (Ayers et al., 2018). A high correlation between symptoms of negative cognitions and mood and re-experiencing was established, similar to the results of Sandoz et al (Sandoz et al., 2021). Moreover, a high correlation was also found between symptoms of negative cognition and mood and symptoms of avoidance. The high correlations indicate that these factors may measure the same underlying construct.

The two-factor model (birth-related symptoms and general symptoms) yielded an overall good fit, according to all indices of fit except one (TLI: 0.905), and low correlations between the birth-related symptoms and the general symptoms. The two symptom cluster subscales explained close to 50% each of the variance. These results are in line with several previous validation studies including the original scale (Ayers et al., 2018; Caparros-Gonzalez et al., 2021; Handelzalts et al., 2018; Nakic Rados et al., 2020; Weigl et al., 2021).

Two previous validations of the City BiTS (the Croatian and the French versions) included a bifactor CFA with a general factor and two specific factors in their analysis (Nakic Rados et al., 2020; Sandoz et al., 2021). Both studies found the bifactor model to have the best fit, which indicates the existence of a general factor explaining all symptoms of PTSD. In this study, however, the bifactor model provided similar indices of fit as the two-factor model, but showed very low factor loadings. Considering the low factors loadings, our data provides more support to the two-factor model.

The results showed very good internal consistency for the total score and for each of the two subscales with values of Cronbach's alpha above 0.8. The test-retest analysis showed a significant decrease in the score of Item 17 (feeling tense and on edge) between test and retest. However,

results also showed a non-significant difference in the mean scoring as well as a very strong correlation between the two test-retest time points for the total scale and both subscales, indicating a general stability in scores over time. Test-retest reliability has earlier been tested in the Turkish and Brazilian validations with similar results, but in smaller samples (Bayri Bingol et al., 2021; Osorio et al., 2021). In summary, the City BiTS-Swe showed high reliability.

Divergent validity was assessed via analysis of correlation with depression scores. There was a considerably lower correlation for the birth-related symptoms ($r = .41$) than for the total score ($r = .73$) and the general symptoms ($.77$). These findings suggest that the birth-related symptoms are more associated with the specific symptoms of birth-related postpartum PTSD, whilst the general symptoms in fact evaluate dysphoric symptoms postpartum and are to a larger extent related to depression. Similar results have been found in the French, German and Croatian validations (Nakic Rados et al., 2020; Sandoz et al., 2021; Weigl et al., 2021)

The total score and score of both subscales were compared within pre-defined groups to further examine the construct validity of the scale by evaluating the discriminant validity. The total score and both subscales showed good discriminant validity for parity, mental illness, history of traumatic childbirth and history of traumatic event. The discriminant validity was better for the total score and the birth-related symptoms, being sensitive for all tested variables. In summary, earlier studies have found discriminant validity for the City BiTS in mode of birth, history of traumatic childbirth, history of traumatic event which are all confirmed by the findings in this study (Nakic Rados et al., 2020; Osorio et al., 2021; Sandoz et al., 2021). In conclusion, the City BiTS-Swe showed good construct validity.

Women who had undergone instrumental vaginal birth and emergency caesarean section reported significantly higher total score and birth-related symptoms in comparison to vaginal birth and planned caesarean section, which is partly in accordance with the Croatian validation study (Nakic Rados et al., 2020). This pattern was also observed in women with diagnostic PTSD who

were proportionally more likely to have instrumental vaginal birth and emergency caesarean section compared to women without diagnostic PTSD. Moreover, this supports the result of previous studies that interventions during childbirth such as caesarean section and instrumental births increase the risk of developing postpartum PTSD (Ayers et al., 2016; Dekel et al., 2017). No significant difference was found when comparing vaginal birth with planned caesarean section, and instrumental vaginal birth with emergency caesarean section, suggesting that these birthing methods have similar impact on symptoms of postpartum PTSD.

Women with self-reported ongoing mental illness scored higher on the total scale and both subscales. Previous studies have found maternal mental illness before and during pregnancy to be a risk factor for postpartum PTSD (Dekel et al., 2017). Even though it was not differentiated between debut of mental illness pre-partum and post-partum, results of this study are in line with a previous meta-analysis suggesting an association between postpartum PTSD and poor coping, stress, and depression after birth (Ayers et al., 2016).

Furthermore, a higher score was reported in primiparous women, preterm births, women with history of traumatic childbirth and history of traumatic event according to DSM-5 criteria of trauma. A previous meta-analysis found history of trauma including previous traumatic childbirth to be an important risk factor for postpartum PTSD, and that primiparous women are at greater risk of developing PTSD, which is in accordance with findings in this study (Dekel et al., 2017).

The results of this study should be interpreted in relation to the strengths and limitations of the study. Strengths include the big community sample from different sized cities and hospitals, which is representative of the background population. The sample had a mean age (32.8) in proximity to the national statistics of mean age in women giving birth (30.9) (National Board of Health and Welfare, 2020). Rates of emergency and planned caesarean section and instrumental vaginal birth were also in accordance with Swedish prevalence rates (National Board of Health and Welfare, 2020). It should be noted that the high educational level in the study sample exceeds national means

of women of corresponding age (Westling, 2021). Furthermore, the proportion of primiparous women (54 %) exceeds the overall Swedish prevalence rates (43.1%) (National Board of Health and Welfare, 2020). The construct validity was assessed with relatively extensive discriminant validity, but the validation would be improved by broader divergent validity analysis with other scales than the EPDS. Additionally, we did not look at convergent validity, which is a limitation of the study. Another limitation is that the self-report design does not enable clinical diagnosis. The test-retest analysis offers limited information about the trajectory of the symptoms, and longitudinal studies would contribute to more insight in the topic of alterations of postpartum PTSD symptoms over time. Osorio et al (2021) suggest possible clinical cut off levels for the City BiTS, but future studies should investigate this further (Osorio et al., 2021).

In summary, the City BiTS-Swe was validated with robust psychometric properties in a large community sample. The results of this study confirm the two-factor structure of birth-related symptoms and general symptoms found in previous studies of the City BiTS. The scale is valuable to both clinicians and researchers, being the only available scale measuring postpartum PTSD according to the DSM-5 criteria.

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Conflict of interest statement

There are no conflicts of interest.

Author contribution statements

Conceptualization (H.G., K.N., A.M.); Formal analysis (G.S., H.G.); Investigation (G.S., H.G., K.N.); Methodology (G.S., H.G., S.A., K.N., A.M.); Project administration (H.G., S.A.), Validation (S.A., K.N., A.M.); Writing - original draft (G.S., H.G.); Writing – review and editing (S.A., A.M., K.N.).

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Tables

Table 1. Sample Characteristics

Characteristic	M (SD)	n (%)
Maternal age (n=619)	32.77 (4.50)	
Relationship status (n=617)		
Married or living with a partner		599 (97.1)
In a relationship but not living together		2 (0.3)
Single		10 (1.6)
Separated/divorced		5 (0.8)
Other		1 (0.2)
Ethnicity (n=614)		
Swedish majority		525 (85.5)
Swedish minority		62 (10.1)
Not sure/don't want to answer		27 (4.4)
Educational level (n=615)		
Higher education		494 (80.3)
Secondary school		113 (18.4)
Primary school		7 (1.1)
No education		1 (0.2)
Residential area (n=617)		
Large city		361 (58.5)
Medium/small city		178 (28.8)
Countryside		78 (12.6)
Weeks since birth (n=619)	10.76 (2.17)	
Primiparous (n=619)		336 (54.3)
Gestational age, full weeks (n=614)	39.5 (1.8)	
Mode of birth (n=619)		
Vaginal birth		458 (74.0)
Instrumental vaginal birth		48 (7.8)
Emergency caesarean section		71 (11.5)
Planned caesarean section		42 (6.8)
History of traumatic event (n=619)		196 (31.7)
History of traumatic birth* (n=283)		108 (38.2)

M=mean SD=standard deviation %=valid percent *Among multipara

Table 2. Standardized Factor Loadings for the Four-Factor Model of the City BiTS-Swe (n = 604)

Item	INT	AVO	NCM	HYP
<i>Re-experiencing</i>				
1. Recurrent unwanted memories of the birth (or parts of the birth) that you can't control	0.06			
2. Bad dreams or nightmares about the birth (or related to the birth)	0.42			
3. Flashbacks to the birth and/or reliving the experience	0.46			
4. Getting upset when reminded of the birth	0.86			
5. Feeling tense or anxious when reminded of the birth	0.87			
<i>Avoidance</i>				
6. Trying to avoid thinking about the birth		0.92		
7. Trying to avoid things that remind me of the birth (e.g. people, places, TV programs)		0.64		
<i>Negative cognitions and mood</i>				
8. Not able to remember details of the birth			0.45	
9. Blaming myself or others for what happened during the birth			0.69	
10. Feeling strong negative emotions about the birth (e.g. fear, anger, shame)			0.83	
11. Feeling negative about myself or thinking something awful will happen			0.43	
12. Lost interest in activities that were important to me			0.40	
13. Feeling detached from other people			0.41	
14. Not able to feel positive emotions (e.g. happy, excited)			0.39	
<i>Hyperarousal</i>				
15. Feeling irritable or aggressive				0.70
16. Feeling self-destructive or acting recklessly				0.43
17. Feeling tense and on edge				0.76
18. Feeling jumpy or easily startled				0.54
19. Problems concentrating				0.75
20. Not sleeping well because of things that are not due to the baby's sleep pattern				0.60
<i>% of variance contributed by each latent factor</i>	24.7	16.4	26.6	32.3

INT = re-experiencing symptoms, AVO = avoidance, NCM = negative cognitions and mood, HYP = hyperarousal. The bold values represent factor loadings ≥ 0.40 .

Table 3. Standardized Factor Loadings for the Two-Factor Model of the City BiTS-Swe (n=604)

Item	BRS	GS
<i>Re-experiencing</i>		
1. Recurrent unwanted memories of the birth (or parts of the birth) that you can't control	0.68	
2. Bad dreams or nightmares about the birth (or related to the birth)	0.36	
3. Flashbacks to the birth and/or reliving the experience	0.41	
4. Getting upset when reminded of the birth	0.80	
5. Feeling tense or anxious when reminded of the birth	0.80	
<i>Avoidance</i>		
6. Trying to avoid thinking about the birth	0.72	
7. Trying to avoid things that remind me of the birth (e.g. people, places, TV programs)	0.42	
<i>Negative cognition and mood</i>		
8. Not able to remember details of the birth	0.38	
9. Blaming myself or others for what happened during the birth	0.62	
10. Feeling strong negative emotions about the birth (e.g. fear, anger, shame)	0.84	
11. Feeling negative about myself or thinking something awful will happen		0.58
12. Lost interest in activities that were important to me		0.68
13. Feeling detached from other people		0.75
14. Not able to feel positive emotions (e.g. happy, excited)		0.68
<i>Hyperarousal</i>		
15. Feeling irritable or aggressive		0.69
16. Feeling self-destructive or acting recklessly		0.38
17. Feeling tense and on edge		0.72
18. Feeling jumpy or easily startled		0.48
19. Problems concentrating		0.68
20. Not sleeping well because of things that are not due to the baby's sleep pattern		0.55
<i>% of variance contributed by each latent factor</i>	49.7	50.3

BRS = birth-related symptoms, GS = general symptoms. The bold values represent factor loadings ≥ 0.40 .

Table 4. Standardized Factor Loadings for the Bifactor Model of the City BiTS-Swe (N =604)

Item	BRS	GS	GF
<i>Re-experiencing</i>			
1. Recurrent unwanted memories of the birth (or parts of the birth) that you can't control	0.41		0.56
2. Bad dreams or nightmares about the birth (or related to the birth)	0.01		0.54
3. Flashbacks to the birth and/or reliving the experience	0.26		0.33
4. Getting upset when reminded of the birth	0.65		0.47
5. Feeling tense or anxious when reminded of the birth	0.62		0.50
<i>Avoidance</i>			
6. Trying to avoid thinking about the birth	0.42		0.61
7. Trying to avoid things that remind me of the birth (e.g. people, places, TV programs)	-0.06		0.70
<i>Negative cognitions and mood</i>			
8. Not able to remember details of the birth	0.28		0.25
9. Blaming myself or others for what happened during the birth	0.50		0.38
10. Feeling strong negative emotions about the birth (e.g. fear, anger, shame)	0.74		0.46
11. Feeling negative about myself or thinking something awful will happen		0.52	0.24
12. Lost interest in activities that were important to me		0.64	0.25
13. Feeling detached from other people		0.75	0.18
14. Not able to feel positive emotions (e.g. happy, excited)		0.67	0.19
<i>Hyperarousal</i>			
15. Feeling irritable or aggressive		0.67	0.19
16. Feeling self-destructive or acting recklessly		0.25	0.40
17. Feeling tense and on edge		0.66	0.27
18. Feeling jumpy or easily startled		0.38	0.34
19. Problems concentrating		0.62	0.26
20. Not sleeping well because of things that are not due to the baby's sleep pattern		0.44	0.36
<i>% of variance contributed by GF to each scale</i>	24	13	

BRS = birth-related symptoms, GS = general symptoms, GF = general factor. The bold values represent factor loadings ≥ 0.40 .

Table 5. Test-retest Reliability of the City BiTS-Swe for the Total Score, Subscales and Each Item
(n=110)

Sale, Subscales and Items	ICC	CI95%	<i>p</i> -value*
Total score	0.91	0.86-0.94	0.53
Birth-related symptoms	0.91	0.87-0.94	0.65
General symptoms	0.86	0.79-0.90	0.49
Items			
1. Recurrent unwanted memories of the birth (or parts of the birth) that you can't control	0.76	0.65-0.84	0.75
2. Bad dreams or nightmares about the birth (or related to the birth)	0.76	0.65-0.83	0.37
3. Flashbacks to the birth and/or reliving the experience	0.66	0.51-0.77	0.05
4. Getting upset when reminded of the birth	0.83	0.76-0.89	1.00
5. Feeling tense or anxious when reminded of the birth	0.80	0.71-0.87	1.00
6. Trying to avoid thinking about the birth	0.90	0.86-0.93	0.60
7. Trying to avoid things that remind me of the birth (e.g. people, places, TV programs)	0.78	0.68-0.85	0.35
8. Not able to remember details of the birth	0.53	0.31-0.68	0.68
9. Blaming myself or others for what happened during the birth	0.67	0.51-0.77	0.56
10. Feeling strong negative emotions about the birth (e.g. fear, anger, shame)	0.86	0.79-0.90	0.08
11. Feeling negative about myself or thinking something awful will happen	0.62	0.44-0.74	0.61
12. Lost interest in activities that were important to me	0.57	0.38-0.71	0.14
13. Feeling detached from other people	0.69	0.54-0.79	0.69
14. Not able to feel positive emotions (e.g. happy, excited)	0.70	0.56-0.80	0.40
15. Feeling irritable or aggressive	0.65	0.49-0.76	0.07
16. Feeling self-destructive or acting recklessly	0.74	0.62-0.82	0.41
17. Feeling tense and on edge	0.68	0.53-0.78	0.01
18. Feeling jumpy or easily startled	0.78	0.69-0.85	0.75
19. Problems concentrating	0.73	0.60-0.81	0.34
20. Not sleeping well because of things that are not due to the baby's sleep pattern	0.75	0.64-0.83	1.00

ICC = intra class correlation, CI95% = 95% confidence interval, * t-test comparing the two measurements

Table 6. Differences in the City Birth Trauma Scale and Subscales Between Known Groups (n=619).

Variables	Total score	Birth-related symptoms	General symptoms
	M (SD)	M (SD)	M (SD)
Mode of birth			
Vaginal birth (n = 450)	6.97 (7.48)	2.42 (3.96)	4.55 (5.44)
Vaginal instrumental birth (n = 48)	11.94 (13.37)	6.27 (7.94)	5.67 (6.69)
Emergency caesarean section (n = 70)	12.06 (10.81)	6.84 (6.82)	5.21 (5.61)
Planned caesarean section (n = 42)	6.83 (7.87)	2.33 (4.52)	4.50 (4.90)
	X ² (3) = 19.82, p < .001	X ² (3) = 50.84, p < .001	X ² (3) = 2.23, p = .526
Parity			
Primipara (n = 336)	9.44 (9.91)	4.23 (5.87)	5.24 (5.89)
Multipara (n = 283)	6.13 (6.67)	2.07 (3.69)	4.1 (5.01)
	X ² (1) = 18.16, p < .001	X ² (1) = 32.69, p < .001	X ² (1) = 7.15, p = .008
Gestational age			
Preterm birth (n = 25)	12.20 (12.07)	6.48 (6.74)	5.72 (6.56)
Term birth (n = 576)	7.72 (8.51)	3.05 (4.96)	4.67 (5.47)
	X ² (1) = 4.25, p = .039	X ² (1) = 13.38, p < .001	X ² (1) = 0.38, p = .536
Mental illness			
Yes (n = 67)	13.85 (11.78)	5.13 (6.67)	8.72 (6.88)
No (n = 507)	6.76 (7.77)	2.90 (4.73)	3.85 (4.84)
	X ² (1) = 31.10, p < .001	X ² (1) = 8.28, p = .003	X ² (1) = 34.80, p < .001
History of traumatic childbirth*			
Yes (n = 108)	7.62 (6.43)	2.39 (3.49)	5.24 (4.92)
No (n = 175)	5.20 (6.66)	1.87 (3.80)	3.40 (4.94)
	X ² (1) = 13.59, p < .001	X ² (1) = 6.25, p = .012	X ² (1) = 12.51, p < .001
History of traumatic event			
Yes (n = 192)	11.15 (10.29)	4.53 (6.07)	6.62 (6.16)
No (n = 418)	6.46 (7.49)	2.62 (4.44)	3.83 (5.0)
	X ² (1) = 35.64, p < .001	X ² (1) = 16.68, p < .001	X ² (1) = 32.67, p < .001

M=mean SD=standard deviation p < 0.05 = significant.*Among multipara

Table 7. Pairwise Comparisons for Mode of Birth with Dunn's Test (n= 619).

Mode of birth		Total score	Birth-related symptoms
		M (SD)	M (SD)
Vaginal birth	Planned CS	6.97 (7.48) – 6.83 (7.87) ns	2.42 (3.96) – 2.33 (4.52) ns
Vaginal birth	Instrumental VB	6.97 (7.48) – 11.94 (13.37)*	2.42 (3.96) – 6.27 (7.94)**
Vaginal birth	Emergency CS	6.97 (7.48) – 12.06 (10.81)**	2.42 (3.96) – 6.84 (6.82) **
Planned CS	Instrumental VB	6.83 (7.87) – 11.94 (13.37) ns	2.33 (4.52) – 6.27 (7.94)**
Planned CS	Emergency CS	6.83 (7.87) – 12.06 (10.81)*	2.33 (4.52) – 6.84 (6.82)**
Instrumental VB	Emergency CS	11.94 (13.37) – 12.06 (10.81) ns	6.27 (7.94) – 6.84 (6.82) ns

M=mean SD=standard deviation CS = caesarean section. *p < 0.05, ** p < .001, ns = non significant.

Table 8. Known-Group Differences Between Participants Who Do and Do Not Fulfill PTSD Criteria

<i>Variables</i>	<i>Fulfill all diagnostic criteria for PTSD</i>	<i>Do not fulfill all diagnostic criteria for PTSD</i>	<i>Statistic, p-value</i>
	<i>N = 23</i>	<i>N = 587^a</i>	
Mode of birth			
Vaginal birth	6	444	$X^2(7) = 41.26, p = .000$
Vaginal instrumental birth	8	40	
Emergency caesarean section	8	61	
Planned caesarean section	1	42	
Parity			
Primiparous	18	318	$X^2(3) = 5.54, p = .019$
Multiparous	5	278	
Gestational age			
Preterm birth	4	21	$X^2(3) = 10.50, p = .001$
Term birth	19	557	
Mental illness			
Yes	9	58	$X^2(3) = 18.97, p = .000$
No	13	494	
History of traumatic childbirth (multiparas only)^b			
Yes	3	103	$X^2(3) = 1.02, p = .312$
No	2	169	
History of traumatic event			
Yes	15	177	$X^2(3) = 12.62, p = .000$
No	8	410	

^aMissing data means N ranges from xx – xx. ^bAnalysis based on multiparous women only so the small numbers mean this should be interpreted with caution.

$p < 0.05$ was regarded as significant. . *Among multipara

Figure legends

Figure 1. The four-factor solution comprised of re-experiencing (INT), avoidance (AVO), negative cognitions and mood (NCM), and hyperarousal (HYP).

Figure 2. The two-factor model with the two correlated factors birth-related symptoms (BRS) and general symptoms (GS).

Figure 3. The bifactor model with the two specific factors birth-related symptoms (BRS) and general symptoms (GS), and a general factor (GF).