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Measuring and conceptualising PTSD following childbirth:

validation of the City Birth Trauma Scale

Abstract

Objective: City Birth Trauma Scale is a recently developed scale specifically designed for evaluation of posttraumatic stress disorder (PTSD) following childbirth based on the DSM-5 criteria (Ayers, Wright, & Thornton, 2018). Previous studies showed a two-factor structure of PTSD symptoms in postpartum women; however, more complex models were not tested. This study aimed to validate the Croatian version of the City Birth Trauma Scale and determine the latent factor structure of postpartum PTSD.

Method: In a cross-sectional study, 603 women completed online questionnaires comprising City Birth Trauma Scale, Impact of Event Scale-Revised (IES-R), Edinburgh Postnatal Depression Scale (EPDS), and the anxiety subscale from the Depression, Anxiety, and Stress Scale (DASS-21).

Results: Confirmatory factor analysis confirmed the bifactor model of Birth-related symptoms (re-experiencing and avoidance) and General symptoms was an excellent fit to the data. Both subscales and the total scale showed high internal consistency ($\alpha = .92$). Convergent and divergent validity testing showed high validity, especially for Birth-related symptoms. Discriminant validity was confirmed with primiparous women and women who gave birth by instrumental vaginal delivery and emergency caesarean section having significantly higher scores on Birth-related symptoms, but not on General symptoms, suggesting high discriminant validity of the Birth-related symptoms subscale.

Conclusions: The City Birth Trauma Scale is a reliable and valid measure. Both total scale score and subscale scores can be calculated. It is highly recommended for use in postpartum population.

Keywords: PTSD; childbirth; scale; validity; factor structure; bifactor

Clinical Impact Statement

City Birth Trauma Scale is specifically designed for evaluation of posttraumatic stress disorder (PTSD) following childbirth based on the DSM-5 criteria (Ayers, Wright, & Thornton, 2018). This study aimed at determining its psychometric characteristics in a sample of postpartum Croatian women. PTSD symptoms have two dimensions: Birth-related symptoms (e.g. distressing memories and avoiding thinking about the birth) and General symptoms (e.g. negative mood, irritability, and tension). Primiparous women and those who had an instrumental vaginal delivery and emergency caesarean section reported more PTSD symptoms. The scale is a reliable, valid measure, and highly recommended for use in the postpartum population.

Introduction

Childbirth is usually an intense experience and significant life event for women and their partners (Bryanton, Gagnon, Johnston, & Hatem, 2008). Childbirth can involve many positive psychological outcomes, such as a sense of accomplishment and personal strength, as well as negative outcomes, such as feelings of failure and inadequacy (Callister, 2005). Also, childbirth can involve morbidity and mortality for women and children (World Health Organization & UNICEF, 2015; World Health Organization, 2018). Up to one-third of women report childbirth as a traumatic experience (Boorman, Devilly, Gamble, Creedy, & Fenwick, 2013; Creedy, Shochet, & Horsfall, 2000; Czarnocka & Slade, 2000; Soet, Brack, & DiIorio, 2003). Recent meta-analyses showed that posttraumatic stress disorder (PTSD) following childbirth occurs in 3-4% of women in community samples and 15-18% of women in high-risk samples, such as those who have a history of sexual abuse, had an emergency caesarean section, preterm delivery or severe pregnancy complications (Dikmen Yildiz, Ayers, & Phillips, 2017; Grekin & O'Hara, 2014).

Some of criteria defined by the DSM-5 (American Psychiatric Association [APA], 2013) changed from the previous version of the DSM (DSM-IV; APA, 1994). Symptoms of PTSD by DSM-5 are conceptualised within four clusters (B - intrusion or re-experiencing the traumatic event; C - avoidance of anything related to the traumatic event; D - negative alterations in cognitions and mood E - arousal and reactivity) instead of three as in DSM-IV. Also, criterion A was changed so that it is no longer necessary for people to both experience the traumatic event (Criterion A1) and intense negative emotions, such as fear, helplessness, or horror (Criterion A2). The removal of the Criterion A2 in relation to postpartum PTSD resulted in somewhat mixed findings: some studies found more postpartum women fulfilled stressor criteria when A2 was removed (Boorman et al., 2013; Devilly, Gullo, Alcorn, & O'Donovan, 2014) whereas other studies did not find a large difference when A2 was

removed (Ayers, Wright, & Thornton, 2018). Another difference in DSM-5 was the removal of emotional numbing symptoms and the addition of the symptoms of Negative alterations in cognitions and mood (Criterion D).

The majority of studies of postpartum PTSD have used measures of PTSD developed in other populations, such as veterans, including, the PTSD Symptom Scale-Self Report (PSS-RS; Foa, Riggs, Dancu, & Rothbaum, 1993), Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1979) or Impact of Event Scale-Revised (IES-R; Weiss & Marmar, 1997). There have been a few attempts to develop measures of PTSD symptoms specifically for postpartum women, such as the Traumatic Event Scale (Wijma, Söderquist, & Wijma, 1997) and Perinatal PTSD Questionnaire (Callahan, Borja, & Hynan, 2006; DeMier et al., 2000; Quinnell, & Hynan, 1999). However, both of these are based on DSM-IV criteria (APA, 1994).

Given the changes in the criteria for PTSD in the DSM-5, there was a need for a new measure of PTSD symptoms that would also be specifically designed for postpartum women. Recently, the City Birth Trauma Scale (City BiTS; Ayers et al., 2018) was developed as the only measure of postpartum PTSD that follows DSM-5 criteria. In the original study, the scale was shown to be highly internally consistent with good psychometric properties (Ayers et al., 2018), although validity was not established because only some aspects of the construct validity were examined, such as factor structure. Findings from exploratory factor analyses suggest that the City BiTS has a two-factor structure. Intrusions and Avoidance symptoms loaded on the first factor as Birth-related symptoms, while Negative cognitions and mood and Hyperarousal symptoms loaded on the second factor as General symptoms (Ayers et al., 2018). Validation of a Hebrew version of the City Birth Trauma Scale also found the same two-factor structure (Handelzalts, Hairston, & Matatyahu, 2018). This two-factor structure is also consistent with previous studies of postpartum PTSD using other measures of PTSD

(Ayers, Harris, Sawyer, Parfitt, & Ford, 2009; Reichenheim et al., 2018; Stramrood et al., 2010). However, not all studies of postpartum PTSD confirmed this two-factor structure (Olde, Kleber, van der Hart, & Pop, 2006) and a systematic review of the PTSD symptoms latent structure in other populations even suggests six or seven-factor models (Armour, Műllerová, & Elhai, 2016).

Except for these lower order factor models, some alternative, more complex, models should also be considered. For instance, a bifactor model could provide an interesting insight into the latent structure of the PTSD symptoms. Bifactor model is comprised of a *general factor* that explains general variance shared by all items and *specific factors* which explain specific variance above the general factor. The general factor is orthogonal to the specific factors, as well as the specific factors mutually (Chen & Zhang, 2018). Bifactor modelling would help understand whether PTSD symptoms after childbirth are better conceptualised as part of general PTSD factor or distinct clusters of symptoms. This also has important implications for measurement of PTSD symptoms and whether there is empirical justification for calculating the total score, or only subscales scores, or that both approaches can be applied. Despite many advantages of the bifactor models (Chen & Zhang, 2018), they have rarely been applied to examine the latent structure of symptoms of psychopathology. A large meta-analysis on PTSD symptoms in populations other than postpartum women collected matrices of correlations from 40 studies and applied the bifactor modelling. This showed that a bifactor model did not have a better fit than lower order models, i.e. than the four-factor model of correlated clusters of symptoms (Yufik & Simms, 2010). On the other hand, the bifactor model of depression and anxiety was shown as a more parsimonious model (Simms, Gros, Watson, & O'Hara, 2008). So far, bifactor modelling was not applied to examine the latent structure of the PTSD symptoms following childbirth and is especially needed now when measures have been developed according to DSM-5 criteria.

The aim of this study was therefore to validate the Croatian version of the City BiTS and determine the latent factor structure of postpartum PTSD. More specifically, our objectives were to:

(1) test the four-factor model with four correlated clusters of PTSD symptoms: Intrusion, Avoidance, Negative cognitions and mood, and Hyperarousal; the two-factor model with two correlated dimensions of postpartum PTSD: birth-related symptoms and general symptoms (Ayers et al., 2018; Handelzalts et al., 2018); and a bifactor model;

> **Hypothesis 1**: Based on previous studies of postpartum PTSD, we expected that the two-factor model would yield a better fit to the dataset (H1a). However, due to the lack of previous findings, we could not predict whether the bifactor model would have a better fit over the lower order models (H1b).

(2) determine the reliability of the City BiTS;

> **Hypothesis 2:** We expected the Croatian City BiTS to have high internal consistency.

(3) determine the convergent validity of the City BiTS against the Impact of Event Scale-Revised (IES-R);

> **Hypothesis 3:** We expected the City BiTS to have high convergent validity. More specifically we expected moderate correlations between City BiTS and IES-R.

(4) determine divergent validity of the City BiTS via correlations with the Edinburgh Postnatal Depression Scale (EPDS) and the Anxiety Subscale from the Depression, Anxiety, and Stress Scale (DASS);

> **Hypothesis 4:** We expected the City BiTS to have high divergent validity, by having lower correlations with EPDS (H4a) and DASS (H4b).

(5) test discriminant validity as possible differences in the City BiTS total and subscale scores between known-groups, concerning the type of birth, parity, and traumatic birth experience.

Hypothesis 5: We expected that City BiTS would have high discriminant validity. More specifically, we expected that women who had an operative birth (H5a), who perceived the birth as a traumatic experience (H5b) and were primiparous (H5c) would have higher levels of PTSD symptoms as measured by the City BiTS.

Methods

Participants

In the study, 603 mothers who gave birth within the previous 12 months participated. Inclusion criteria were that women had an infant from 1 to 12 months old and were fluent enough in Croatian to complete the survey. Mothers were on average 30.64 years old (SD = 4.68, range: 20-47 years). Most women were married (82.6%) or cohabiting (16.7%), and 0.7% were single. The majority graduated from the college or university (70.2%) and were from urban areas (76.1%). The majority of women were of average socioeconomic status (48.3%), 11.3% were below average, and 40.4% were above average. A history of psychiatric treatment was reported by 7.8% of women, of whom three (0.5%) reported a history of PTSD. Almost a quarter (24.9%) of woman had score above cut off at Edinburg Postnatal Depression Scale (12/13; Cox Holden, & Sagovsky, 1987).

Mothers on average gave birth 6.12 months ago (SD = 3.39, range: 1-12 months). The majority gave birth to their first child (primiparous: 61.0%), 27.5% gave birth to their second child, 11.5% gave birth to their third child or more (multiparous), and 0.02% gave birth to twins. Most mothers gave birth through spontaneous vaginal delivery (75.1%), 2.0% by instrumental vaginal delivery, 7.8% by planned caesarean section, and 15.1% by emergency caesarean section. Women gave birth on average at 39.35 weeks (SD = 1.74, range: 27-46)

and 6.0% reported to have a preterm delivery. Of the sample, 28.36% reported childbirth as a

traumatic event.

Measures

City Birth Trauma Scale (City BiTS; Ayers et al., 2018) consists of 29 items

measuring birth-related PTSD according to DSM-5 criteria. City BiTS includes criterion A for

the traumatic event (2 items; 0 – *no*, 1- *yes*), frequency of symptoms from B-E criteria over

the previous week (20 items; 0 - *not at all*, 1 - *once*, 2 - *2-4 times,* and 3 - *5 or more times)*, ,

criterion F for the duration of symptoms (1 item; 0 – *less than 1 month*, 1 – *1-3 months*, and *2

– 3 months or more*), criterion G for distress and impairment (2 items; 0 – *no*, 1 – *sometimes*,

2 – *yes*), and exclusion criteria H (1 item; 0 - *no*, 1 – *maybe*, 2 – *yes*). Scores for total

symptoms from B-E criteria ranges from 0 to 60 where a higher score indicates higher levels

of PTSD symptoms. The scale has two subscales: *birth-related symptoms* covering symptoms

of intrusions, avoidance, and two items from Negative cognitions and mood which

specifically relate to birth (9 items) and *general symptoms* covering other items from negative

cognitions and mood and hyperarousal (11 items). Cronbach's α for clusters were high at .83-

.88 for the symptom subscales and .92 for total symptoms (Ayers et al., 2018).

The City BiTS was translated to Croatian by the back-translation method (Brislin,

1970). First, two translators who are experts in the field translated the scale into Croatian.

Another independent translator and linguist then translated it back to English. As expected,

both the original and back-translated English versions were similar because they were

translated by experts familiar with the symptoms from DSM-5 in both languages.

Impact of Event Scale-Revised (IES-R; Weiss & Marmar, 1997) is a 22-item scale that

assesses the symptoms of traumatic stress from three clusters according to DSM-IV: Intrusion

(8 items), Avoidance (8 items), and Hyperarousal (6 items). Each item is scored on a 5-point

scale (0 – *not at all* to 4 – *extremely*) with the total possible score that ranges from 0 to 88,

where higher score relates to higher levels of symptoms. Internal consistency of Cronbach's α

was .94, .87, and .91 for the intrusion, avoidance, and hyperarousal, respectively. However,

the one-factor structure was suggested with the high internal consistency of the whole scale

with α = .96 (Creamer, Bell, & Failla, 2003). The IES-R has been translated and validated for

use in Croatian war veterans (Ljubotina & Muslić, 2003) and the instruction to answer in

relation to birth-related trauma in postpartum women has been previously applied (Nakić

Radoš, Sawyer, Ayers, & Burn, 2018). In the current study, a one-factor structure was

obtained and Cronbach's α was .96.

Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987) is a 10-item scale that

assesses depression symptoms. It was developed for peripartum women in that it does not

include somatic symptoms of depression which may be normal in the peripartum period. Each

item is scored on a 4-point scale with specific answers for each item. The total score ranges

from 0 to 30 where a higher score indicates higher levels of depression. Cronbach's α in the

original study was .87. The EPDS was previously translated and validated in Croatian

postpartum women where the unidimensional structure was shown as the most appropriate

and Cronbach's α was .86 (Nakić Radoš, Tadinac, & Herman, 2013). In the current study,

one-factor structure was obtained and Cronbach's α was .90.

Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995)

comprises three subscales for the assessment of depression, anxiety, and stress symptoms. It

consists of 42 items; however, a shorter scale of 21 items was proposed where each subscale

score is multiplied with 2 to be comparable with the full scale. Each item is rated on a 4-point

scale (0 – *did not apply to me at all* to 3 – *applies to me very much or most of the time*).

Possible scores range from 0-42 where a higher score indicates more symptoms. The DASS

was validated in a peripartum population with Cronbach's α of .84, .77, and .86 for the

depression, anxiety, and stress subscales respectively (Miller, Pallant, & Negri, 2006). The

scale was previously translated to Croatian (Reić Ercegovac & Penezić, 2012). In this study,

only the anxiety subscale was used, which had a one-factor solution and α = .89.

Sociodemographic sheet comprised questions on maternal age, marital status,

education level, place of living, socioeconomic status, and a history of psychiatric treatment.

Obstetric questions referred to parity, type of delivery (spontaneous vaginal delivery,

instrumental vaginal delivery, emergency or planned caesarean section), infant age, preterm

delivery (<37 gestational weeks), and evaluating birth as traumatic (*yes/no*).

Procedure

This cross-sectional study was conducted online during November and December 2018.

Invitations to take part in the study were posted on Facebook groups for mothers and infants

and shared via personal contacts. Participation in the study was anonymous, and participants

read the informed consent before completing the questionnaires. The study was approved by

the Ethical Committee of the Catholic University of Croatia.

Statistical analysis

Before conducting the analyses, we screened data for multivariate outliers, which is one of the

pre-steps for conducting the confirmatory factor analysis (CFA) (Kline, 2011). Based on

Mahalanobis distances we excluded 48 participants (7.96%). Therefore, the CFA was

conducted on a sample of 555 mothers. Given that examining symptoms in a non-clinical

sample usually yields a skewed distribution, all other analyses were conducted on all 603

participants.

The CFA was conducted by Mplus 8.1 software (Muthén & Muthén, 1998-2017).

Given that the items on the City BiTS are ordinal we used WLSMV estimator (Brown, 2014;

Li, 2016). Several fit indices were used to evaluate the model: Root Mean Square Error of

Approximation (RMSEA), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and

Standardized Root Mean Square Residual (SRMR). The nonsignificant χ^2 value indicates a

good fit, but when the sample is large, as in the present study, a nonsignificant χ^2 test is rarely

obtained (Barrett, 2007). The RMSEA below .06, CFI and TLI values above .95, and SRMR

below .08 indicate a good fit (Hu & Bentler, 1999).

Reliability was examined as the internal consistency by Cronbach's α coefficient.

Convergent and divergent validity were tested by Pearson's correlation coefficient.

Discriminant validity was examined by the known-groups differences with a series of one-

way ANOVA. These analyses were conducted by SPSS Statistics 21.0 for Windows.

Results

Descriptive statistics

Descriptive analysis (mean, standard deviation, range, skewness and kurtosis) of the 20 items

covering Criterion B-E showed all items covered the full range from 0 to 3, and none of the

items exceeded the proposed cut-off of 3 for skewness and 10 for kurtosis (Kline, 2011).

Confirmatory factor analyses

The four-factor solution with correlated dimensions of Intrusions, Avoidance, Negative

cognitions and mood, and Hyperarousal (Figure 1a) was tested first. This provided a poor fit

to the data ($\chi^2(164) = 1369.96$, $\chi^2/df = 8.35$, RMSEA = .115, SRMR = .116, CFI = .951, TLI =

.943). Given that all indices, except for CFI, showed the poor fit of the model, the four-factor

model was rejected.

The two-factor model with two correlated dimensions (birth-related symptoms and

general symptoms) was a better fit to the data according to all fit indices ($\chi^2(169) = 620.63$,

$\chi^2/df = 3.67$, RMSEA = .069, SRMR = .060, CFI = .982, TLI = .979) as hypothesised in H1a.

All indices indicated a good fit except the RMSEA index which was slightly above cut-off

values for a good fit (> .06) with the value of .069. However, the 90% confidence interval for

the RMSEA (.064 - .075) was below .08 which is considered an upper level for adequate

model fit (Browne & Cudeck, 1993). The two factors of birth-related symptoms and general

symptoms were moderately correlated ($r = .506$).

Based on these findings, we further tested the bifactor model with a general factor and

two specific factors of birth-related symptoms and general symptoms (Figure 1b). Each item

loaded both on the general factor and on one of the two specific factors. The bifactor model

showed the excellent fit to the data ($\chi^2(150) = 451.36$, $\chi^2/df = 3.01$, RMSEA = .060, SRMR =

.032, CFI = .988, TLI = .984).

The general factor explained approximately one-third of total common variance (38%)

as well as the birth-related symptoms (34%) and general symptoms (38%) factors (Table 1).

By evaluating the proportion of variance contributed to each subscale by the general factor,

we can conclude that the general factor explains more variance of the items that correspond to

birth-related symptoms (42%) than general symptoms (34%). Examination of item-factor

loadings revealed that item 8 ('Not able to remember details of the birth') has a low factor

loading on the corresponding specific factor of birth-related symptoms (.187). However, most

items have high loadings, both on the specific and general factors.

Reliability

Analysis of the internal consistency by Cronbach's α revealed very high reliability of .921,

.916, and .925 for the Birth-related subscale, General symptoms' subscale, and the total

symptoms scale, respectively, as expected (H2). Inter-item correlations were between .43-.79

for the Birth-related and .34-.72 for the General symptoms' subscales. Only item 8 had lower

correlations with other items (range .16-.33).

Convergent and divergent validity

Convergent validity of the City BiTS was tested via correlations with the Impact of Event

Scale-Revised (IES-R) (Table 2). The IES-R had significant moderate correlations with City

BiTS total scale and the subscales. However, the correlation of IES-R was significantly higher

with the Birth-related symptoms than with the General symptoms subscale ($z = 4.35$, $p <$

.0001). These results are in line with the third hypothesis.

Divergent validity of the City BiTS was tested via correlations with depression

(EPDS) and anxiety (DASS). The EPDS and DASS both had significantly higher correlations

with General symptoms than with Birth-related symptoms ($z_{EPDS} = -8.44$, $p < .0001$; $z_{DASS} = -$

5.75, $p < .0001$). All these results are as hypothesised but only for Birth-related symptoms

subscale (H4).

Discriminant validity

Discriminant validity of the City BiTS total scale and subscales was examined via known-

groups differences (Table 3). Birth-related symptoms were more sensitive than General

symptoms. Birth-related symptoms were sensitive to the *type of delivery*, *parity* and the

traumatic birth, while General symptoms were sensitive only to *traumatic birth*. Women with

instrumental vaginal delivery and emergency caesarean section had significantly higher levels

of Birth-related symptoms than women with unassisted vaginal delivery and planned

caesarean section. Concerning *parity*, primiparous women reported higher levels of Birth-

related symptoms, while women who evaluated the birth as traumatic had significantly higher

levels of both Birth-related and General symptoms than women who did not evaluate birth as

traumatic. There were no differences in the total or the subscale scores between women who had term or preterm births. Above mentioned results are in line with the hypothesis (H5) but more for the Birth-related symptoms subscale.

PTSD Criteria

Over a quarter (26.70%) of women believed that she or her baby would be seriously injured during the childbirth, and 19.73% thought that she or her baby would die. In total, 31.18% fulfilled criterion A. Criterion B for Intrusions was fulfilled by 57.38%, Criterion C for Avoidance by 32.34%, and most women fulfilled the Criterion E for Hyperarousal (70.65%). Criterion F for duration fulfilled by 53.40% and Criterion G for distress and impairment fulfilled by 52.57% of women. After applying the exclusion criterion H (5.14%), all DSM-5 Criteria (from A to H) for PTSD were fulfilled by 11.77% of the sample.

Furthermore, of the women reporting PTSD symptoms, the majority reported onset within the first six months postpartum (78.3%). One in two women reported having symptoms for more than three months (47.7%).

Discussion

The City Birth Trauma Scale (Ayers et al., 2018) was recently designed specifically to measure postpartum PTSD based on DSM-5 criteria (APA, 2013). Given that only two validation studies of the City BiTS have been conducted so far, this study provides an important contribution in terms of its psychometric properties. Results show the scale is reliable and valid and examines the latent factor structure in more detail. The bifactor model yielded an excellent fit with the general factor and two specific factors of the Birth-related symptoms and General symptoms. Psychometric characteristics are discussed further in detail.

One of the changes from the DSM-IV (APA, 1994) to the DSM-5 (APA, 2013) was that symptoms were no longer conceptualised through three clusters of Re-experiencing, Avoidance and numbing, and Hyperarousal symptoms. A fourth cluster of symptoms was added, labelled Negative cognitions and mood. However, this theoretical four-cluster model was not empirically supported in this study as the four-factor model had a poor fit to the data. This is consistent with other studies of postpartum PTSD (Ayers et al., 2018; Handelzalts et al., 2018; Reichenheim et al., 2018; Stramrood et al., 2010). The two-factor model with two correlated dimensions of Birth-related symptoms and General symptoms had a good fit, consistent with both previous studies of the City BiTS questionnaire (Ayers et al., 2018; Handelzalts et al., 2018) and other studies using non-specific measures of PTSD symptoms applied in postpartum samples (Ayers et al., 2009; Reichenheim et al., 2018; Stramrood et al., 2010).

However, the best fit was observed in a bifactor model, with a general factor and two specific factors of Birth-related symptoms and General symptoms. This is an important addition to the previous studies on the factor structure of postpartum PTSD symptoms both from the theoretical and practical standpoint. This provides an insight into the latent factor structure, implying that there is a general factor explaining all PTSD symptoms, i.e. that there is a global PTSD construct. Moreover, each of the two specific factors explains more than a third of the variance of each factor's items after accounting for the general factor. This means these domain specific factors (birth related symptoms and general symptoms) make a contribution that is over and above the general factor (Chen & Zhang, 2018). Therefore, it confirms that the use of the total score of the scale is justified, but that subscale scores also have additional value. More specifically, Intrusions and Avoidance symptoms were incorporated within the factor of Birth-related symptoms, while Hyperarousal symptoms were incorporated within the factor of General symptoms. However, symptoms from the Negative

cognition and mood cluster, which was added in the DSM-5, split across the two factors. Three items from the Negative cognitions and mood cluster loaded on the factor of Birth-related symptoms, and the rest of the items loaded on the General symptoms factor. This is similar to previous validation studies (Ayers et al., 2018; Handelzalts et al., 2018).

Moreover, more distinctions between the two subscales were found when examining convergent and discriminative validity. More specifically, General symptoms correlated more with measures of depression and anxiety, thus representing dysphoria symptoms. On the other hand, Birth-related symptoms correlated more with the other measure of PTSD symptoms (IES-R). These findings, together with the result from a bifactor model that the General factor accounts for Birth-related symptoms better than General symptoms, imply that Birth-related symptoms are more specifically related to the core of PTSD following childbirth and represent a specific traumatic stress response. On the other hand, General symptoms may explain the high comorbidity between PTSD and depression after birth (Ayers, Bond, Bertullies, & Wijma, 2016; Dikmen Yildiz et al., 2017; Nakić Radoš et al., 2018; White, Matthey, Boyd, & Barnett, 2007).

Both subscale scores of the City BiTS were significantly higher in women evaluating birth as traumatic, which is not surprising given that evaluating birth as traumatic overlaps greatly with the DSM Criterion A. However, the Birth-related symptom subscale showed better discriminant validity as it was sensitive to the type of birth and parity, compared with the General symptoms subscale. More specifically, women who had birth by instrumental vaginal delivery and emergency section had significantly higher levels of Birth-related symptoms. This is consistent with the validation of the Hebrew version of the City BiTS in postpartum women in Israel (Handelzalts et al., 2018), with the exception that in the latter study only women who underwent the emergency section reported higher levels of symptoms. Reviews and meta-analyses suggest women who experience intervention during delivery

(both instrumental vaginal delivery and emergency section) are at greater risk of developing PTSD following childbirth (Olde, van der Hart, Kleber, & Van Son, 2006), although there are studies that do not find this (Andersen, Melvaer, Videbech, Lamont, & Joergensen, 2012; Vossbeck-Elsebusch, Freisfeld, & Ehring, 2014). Also, primiparous women had significantly higher scores on the Birth-related symptoms, but not on the General symptoms' subscale. This is consistent with previous research suggesting that primiparous women report more fear for baby, more negative emotions related to birth and more traumatic birth (Ayers & Pickering, 2005; Czarnoka & Slade, 2000).

In this study, the rate of 11.8% of women fulfilling all PTSD criteria in the current study is higher than the prevalence of 3-4% in the community samples found in recent meta-analyses (Dikmen Yildiz et al., 2017; Grekin & O'Hara, 2014). The same meta-analyses pointed out that the rates can be higher in the high-risk samples, around 15-18%, including women who had an emergency caesarean section, preterm delivery or severe pregnancy complications. However, in our sample, the rates of emergency section (15.1%) and preterm delivery (6.0%) were similar to the national statistics (Rodin, Draušnik, Cerovečki, & Jezdić, 2018). A previous comparison of the rates of PTSD after childbirth between samples recruited online or in the community revealed almost 10 times higher prevalence rates among the online sample (21% vs 2.5%; Ayers et al., 2009), which could be the case in the current sample as well. Therefore, future studies should be replicated with samples recruited in the community.

The findings of this study have to be considered in the light of some limitations. First, the sample was recruited online, which provides the benefit of being able to access large samples within a short time. However, it also restricts participants to those who use technology and social networks through which the study was advertised. Also, it should be noted that women in the sample were mostly highly educated, and of average or above

average socioeconomic status. Reliability was estimated as internal consistency only, and future studies would benefit from the test-retest reliability as a measure of stability. Furthermore, it is possible that the time since birth affected the level of PTSD symptoms reported. Longitudinal research is therefore needed to examine whether that trajectories of PTSD change across the peripartum period (Dikmen-Yildiz et al. 2018; Muzik et al. 2016). Also, in future studies, clinical interviews should be administered alongside the City BiTS so that its diagnostic validity can be evaluated, and possible cut-off scores determined which would be useful for screening.

In conclusion, the City Birth Trauma Scale (Ayers et al., 2018) seems to be a reliable and valid measure of postpartum PTSD using DSM-5 criteria (APA, 2013). Although the total scale score can be calculated, findings from the divergent and discriminant validity analysis imply that calculating two subscale scores might be more informative and indicative. Given that Birth-related symptoms proved to be both sensitive to obstetric events and discriminative from other constructs, and that these symptoms include re-experiencing and avoidance so appear to reflect the core features of PTSD following childbirth.

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Table 1.

F*actor loadings for the bifactor model of the City Birth Trauma Scale (*N = 555*)*

Items	General factor	Birth-related symptoms	General symptoms	R^2_{GF}	$R^2_{B\text{-}RS}$	R^2_{GS}
Intrusions						
1. Recurrent unwanted memories of the birth that you can't control	.553	.673		.31	.453	
2. Bad dreams or nightmares about the birth	.621	.531		.39	.282	
3. Flashbacks to the birth and/or reliving the experience	.457	.632		.21	.399	
4. Getting upset when reminded of the birth	.597	.795		.36	.632	
5. Feeling tense or anxious when reminded of the birth	.638	.727		.41	.529	
Avoidance						
6. Trying to avoid thinking about the birth	.762	.564		.58	.318	
7. Trying to avoid things that remind me of the birth	.813	.498		.66	.248	
Negative mood and cognitions						
8. Not able to remember details of the birth	.513	.187		.26	.035	
9. Blaming myself or others for what happened during the birth	.732	.384		.54	.147	
10. Feeling strong negative emotions about the birth	.726	.586		.53	.343	
11. Feeling negative about myself or thinking something awful will happen	.714		.336	.51		.113
12. Lost interest in activities that were important to me	.676		.558	.46		.311
13. Feeling detached from other people	.593		.612	.35		.375
14. Not able to feel positive emotions	.685		.543	.47		.295
Hyperarousal						
15. Feeling irritable or aggressive	.454		.782	.21		.612
16. Feeling self-destructive or acting recklessly	.593		.653	.35		.426
17. Feeling tense and on edge	.458		.768	.21		.590
18. Feeling jumpy or easily startled	.529		.697	.28		.486
19. Problems concentrating	.455		.674	.21		.454
20. Not sleeping well	.566		.416	.32		.173
Proportion of variance contributed to each set of items by the corresponding latent factor.	.38	.34	.38			
Proportion of variance contributed to each scale by the general factor		.42	.34			

Notes: R^2_{GF} - the proportion of item variance accounted for by the general factor; $R^2_{B\text{-}RS}$ - the proportion of item variance accounted for by birth-related symptoms factor; R^2_{GS} - the proportion of item variance accounted for by general symptoms factor

Table 2.

Intercorrelations of the City Birth Trauma Scale total scale and subscales, and correlations with PTSD symptoms, depression and anxiety (N = 603)

	M (SD)	1.	2.	3.	4.	5.	6.
1. Birth-related symptoms	5.45 (7.11)	-	.44**	.82**	.73**	.38**	.36**
2. General symptoms	9.21 (8.23)		-	.87**	.59**	.71**	.61**
3. City BiTS Total scale	14.65 (13.03)			-	.77**	.65**	.58**
4. IES-R	36.83 (17.51)				-	.56**	.58**
5. EPDS	8.80 (6.24)					-	.68**
6. DASS - Anxiety	5.61 (8.24)						-

Note: * $p < .05$, ** $p < .01$. IES-R – Impact of Event Scale-Revised; EPDS – Edinburgh Postnatal Depression Scale; DASS – Depression, Anxiety, and Stress Scale – Anxiety subscale.

Table 3.

*Differences in the City Trauma Birth Scale and subscales between known groups (*N = *603)*

	Groups	Birth-related symptoms M (SD)	General symptoms M (SD)	Total score M (SD)
Type of delivery	Unassisted vaginal (*n* = 453)	4.85 (6.71)	8.80 (8.16)	13.65 (12.51)
	Instrumental vaginal (*n* = 12)	11.33 (9.18)	12.42 (8.37)	23.75 (14.78)
	Emergency c.s. (*n* = 91)	8.65 (8.14)	10.36 (8.11)	19.01 (14.16)
	Planned c.s. (*n* = 47)	3.45 (5.66)	10.11 (8.94)	13.55 (12.96)
		$F(3, 599) = 11.78; p < .0001$ [a]	$F(3, 599) = 1.78; p = .1500$	$F(3, 599) = 6.53; p < .0001$ [a]
Parity	Primiparous (*n* = 335)	5.91 (7.36)	9.10 (8.10)	15.00 (13.13)
	Multiparous (*n* = 217)	4.72 (6.66)	9.38 (8.46)	14.10 (12.88)
		$F(1, 601) = 4.00; p = .0460$	$F(1, 601) = 0.16; p = .6880$	$F(1, 601) = 0.70; p = .4050$
Birth trauma	Non-traumatic (*n* = 432)	2.74 (4.32)	8.16 (7.81)	10.90 (10.29)
	Traumatic (*n* = 171)	12.28 (8.13)	11.86 (8.70)	24.13 (14.37)
		$F(1, 601) = 346.66; p < .0001$	$F(1, 601) = 25.82; p < .0001$	$F(1, 601) = 159.79; p < .0001$
Gestational age	Pre-term delivery (*n*= 36)	5.42 (7.33)	10.81 (9.85)	16.22 (14.62)
	Term delivery (*n*= 567)	5.45 (7.33)	9.10 (8.12)	14.55 (12.93)
		$F(1, 601) = 0.00; p = .9800$	$F(1, 601) = 1.45; p = .2300$	$F(1, 601) = 0.56; p = .4560$

Note: [a] *post hoc:* vaginal = planned c.s. > instrumental vaginal = emergency c.s.

Table 4.

*PTSD and DSM-5 criteria (*N *= 603)*

|		'yes' answer *n* (%)
Criterion A	Stressor Criterion	
	Q1. Did you believe you or your baby would be seriously injured?	161 (26.70)
	Q2. Did you believe you or your baby would die?	119 (19.73)
	Q1 or Q2	188 (31.18)
Criterion B	Re-experiencing symptoms (1 needed)	346 (57.38)
Criterion C	Avoidance symptoms (1 needed)	195 (32.34)
Criterion D	Negative cognitions and mood (2 needed)	359 (59.54)
Criterion E	Hyperarousal (2 needed)	426 (70.65)
Criterion F	Duration	322 (53.40)
Criterion G	Distress and impairment	317 (52.57)
Criterion H	Exclusion criteria	31 (5.14)
	DSM-5 PTSD	77 (12.77)
	DSM-5 PTSD removing women who meet possible exclusion criteria	71 (11.77)
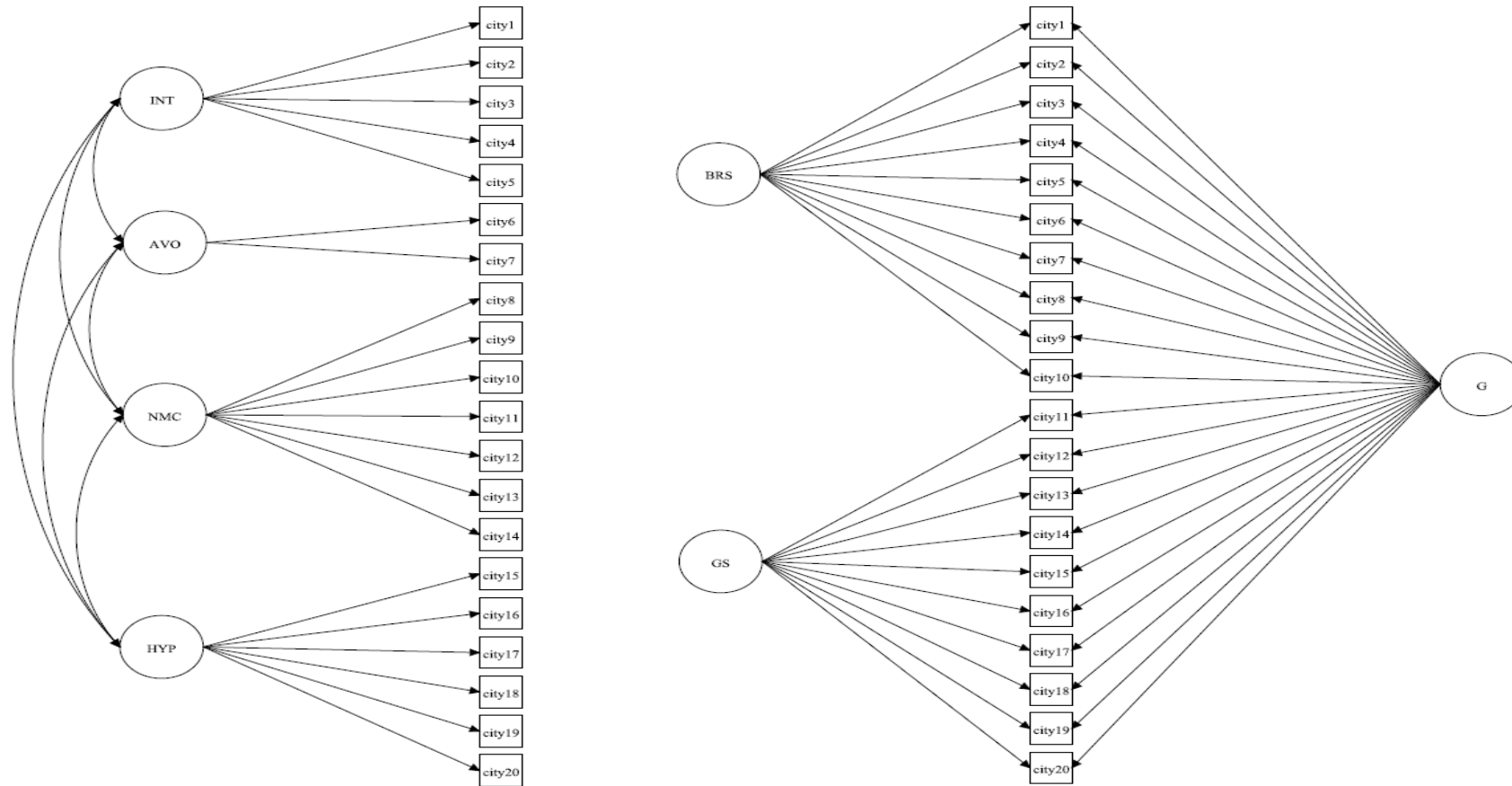
Figure 1. Four-factor correlated model (Figure 1a) with four clusters from DSM-5 including Intrusions (INT), Avoidance (AVO), Negative mood and cognitions (NMC), and Hyperarousal (HYP). Bi-factor model (Figure 1b) with the global factor (G) and specific factors of Birth-related symptoms (BRS) and General symptoms (GS).