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Objective. There is no evidence on the latent structure of symptoms of childbirth-related posttraumatic stress disorder (CB-PTSD) in fathers and to date, no validated French instrument exists to measure CB-PTSD in partners, although the City Birth Trauma Scale (partner version) (City BiTS (P)) was developed to measure such CB-PTSD symptoms. This study aimed to validate the French version of the City BiTS-P (City BiTS-F (P)) in partners attending childbirth and to examine its factor structure, reliability, and validity. ***Method.*** French-speaking fathers of 1-to-12-month-olds participated in this online cross-sectional survey ($n = 280$). They completed the City BiTS-F (P), the PTSD Checklist, the Edinburgh Postnatal Depression Scale, and the anxiety subscale of the Hospital Anxiety and Depression Scale, as well as sociodemographic and medical items. ***Results.*** The four-factor model did not fit well the data, contrary to the two-factor model with birth-related symptoms (BRS) and general symptoms (GS). However, the bifactor model with a general factor and the BRS and GS provided the best fit to the data. High reliability ($\alpha = .88–.89$), and good convergent and divergent validity were found. Fathers with a history of traumatic childbirth reported higher total and subscale scores. ***Discussion.*** Our findings provide evidence for the use of the City BiTS-F (P) as a reliable and validated tool to assess CB-PTSD symptoms in French-speaking partners. The use of the total score in addition to the BRS and GS subscale scores is warranted.

Clinical Impact Statement
CB-PTSD symptoms can be assessed by the City BiTS (P) according to the DSM-5-TR PTSD criteria (Ayers et al., 2018). This questionnaire's psychometric characteristics were studied within 280 French-speaking fathers of 1-to-12-month-olds. Our findings concluded that CB-PTSD is composed of two factors: *BRS* (e.g., distressing birth-related nightmares) and *GS* (e.g., anger). Fathers with a history of traumatic childbirth reported higher total and subscale scores. In sum, we recommend the use of this validated self-report questionnaire to assess CB-PTSD symptoms in French-speaking partners.

Keywords: PTSD, birth, trauma, validation, father

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Childbirth can sometimes be experienced as a traumatic stressor, according to the Diagnostic and Statistical Manual of Mental Disorders, 5th revised ed (DSM-5-TR) criteria for PTSD (American Psychiatric Association [APA], 2022). It is now well established that childbearing mothers can develop symptoms of childbirth-related PTSD (CB-PTSD) following traumatic childbirth (APA, 2022; Ayers et al., 2018; Heyne et al., 2022; Webb et al., 2021). This mental health disorder consists of four symptom clusters: intrusions, avoidance of reminders, negative cognitions and mood, and hyperarousal (APA, 2022).

Within the last couple of decades, the involvement of co-parents (i.e., non-expecting mother or father) during childbirth has increased, making them potentially vulnerable to experiencing birth trauma and to developing CB-PTSD. Recent evidence suggests that 52% and 58% of partners feared for the childbearing mother and/or their infant's life or physical integrity, respectively (Webb et al., 2021), therefore fulfilling the PTSD criterion A of the DSM-5-TR (APA, 2022). Lately, a comparative meta-analysis reported that 1.2% of fathers suffer from CB-PTSD while 1.3% show subclinical symptoms (Heyne et al., 2022). Out of the 169 studies examined in this meta-analysis on maternal and partner CB-PTSD prevalence, only five studies included exclusively fathers and 11 studies investigated both childbearing mothers and fathers (Heyne et al., 2022). Therefore, there is a need for developing research on birth trauma in partners, as well as parent-specific tools to assess partner CB-PTSD symptoms.

Given that research on CB-PTSD in partners is scarce, little is known about its consequences. In light of the well-documented consequences of maternal CB-PTSD on family outcomes (e.g., see Cook et al., 2018), it is likely that partner CB-PTSD can also influence parental and child outcomes (Horsch & Stuijfzand, 2019). Paternal CB-PTSD symptoms seem to influence the couple relationship and make a subsequent pregnancy less probable (Garthus-Niegel et al., 2018; White, 2007), while evidence on its impact on the relationship with the infant is inconsistent (Hinton et al., 2014; Stuijfzand et al., 2020). Early detection of CP-PTSD in partners appears fundamental to prevent probable consecutive consequences.

Multiple reasons can explain the lack of early detection of partner CB-PTSD. First, perinatal research and clinical practice have mainly focused on maternal CB-PTSD (Garthus-Niegel et al., 2021). Only in recent years has partner mental health following traumatic childbirth attracted attention in both research and clinical fields, even though it remains under-studied. Given that maternity services focus on childbearing mothers, partners may feel illegitimate or may avoid talking about their psychological difficulties during the postpartum period. Finally, projecting the situation for childbearing mothers on partners, CB-PTSD symptoms are often confused with postpartum depression symptoms, making CB-PTSD overlooked as a concern (Ayers et al., 2018).

The development of a validated partner-specific tool to assess CB-PTSD symptoms is therefore crucial (McKenzie-McHarg et al., 2015). Although several tools exist to measure PTSD (please see Webb et al., 2021 for more details), they were all designed for people exposed to traumatic events other than childbirth. It is only recently that a self-report questionnaire, namely the City BiTS (P), was specifically developed for partner CB-PTSD (Webb et al., 2021). The development of the City BiTS (P) was based on the DSM-5 and showed a high internal consistency, as well as good psychometric characteristics (Webb et al., 2021). The City BiTS (P) has two subscales; the birth-related symptoms (BRS) that is mainly composed of intrusions and avoidance symptoms and the general symptoms (GS) that consists of negative cognitions and mood, and hyperarousal symptoms, therefore supporting the two-factor structure (Webb et al., 2021). However, recent findings in childbearing mothers showed that a bifactor model with a general factor and two specific factors (i.e., BRS and GS) yielded a better model fit, suggesting that the use of the BRS and GS subscale scores in addition to the City BiTS total score is valuable (Nakić Radoš et al., 2020; Sandoz & Horsch, 2021). Nevertheless, according to a meta-analysis on PTSD latent factor structure following traumatic events not linked to childbirth, the two- and four-factor models fitted the data best (Yufik & Simms, 2010). In light of what has been reported above, there is thus a need to determine the latent factor structure of CB-PTSD in partners.

Thus, this study overall aimed to establish the latent factor structure of CB-PTSD symptoms and to validate the French version of the City BiTS (P) (City BiTS-F (P)) in partners. In particular, we aimed to (a) test the four-factor model with four correlated CB-PTSD symptom clusters (intrusions, avoidance, negative cognitions and mood, and hyperarousal), the two-factor model with two correlated dimensions of CB-PTSD symptoms (BRS and GS), and the bifactor model with the general factor and two specific factors (i.e., BRS and GS); (b) establish the reliability of the City BiTS-F (P); (c) establish the convergent validity of the City BiTS-F (P) against the PTSD Checklist for DSM-5-TR (PCL-5); (d) investigate the divergent validity of the City BiTS-F (P) via correlations with the Edinburgh Postnatal Depression Scale (EPDS) and the Hospital Anxiety and Depression Scale-anxiety subscale (HADS-A); and (e) test the discriminant validity as possible differences in the City BiTS-F (P) total and subscale scores between known-groups, concerning weeks of gestation, mode of birth, history of traumatic childbirth, and history of traumatic event.

Based on previous findings, we tested the following assumptions: The two-factor model fits better to the data than the four-factor model (H1a). Considering the inconsistent findings previously displayed, no directional assumption was expressed concerning the bifactor model (H1b). The internal consistency of the City BiTS-F (P) was assumed to be high (H2), just like its convergent validity, that is, we expected moderated correlations between the scores of the City BiTS-F (P) and the PCL-5 (H3). Furthermore, the divergent validity of the City BiTS-F (P) was assumed to be high, with low correlations between the total scores of the City BiTS (P) and the EPDS (H4a) or HADS-A (H4b). Finally, its discriminant validity was expected to be high, resulting in greater City BiTS-F (P) total and subscale scores in partners with fewer weeks of gestation, a history of traumatic childbirth, a history of another traumatic event, or an emergency cesarean section (H5).

Method

Participants

To validate the City BiTS-F (childbearing mother and partner versions), both childbearing mothers and co-parents were invited to participate in this online cross-sectional survey. The validation of the City BiTS-F (childbearing mother version) was reported previously (Sandoz, Hingray, et al., 2022). Co-parents were eligible if they attended childbirth, had an infant aged between 1 and 12 months

old, were ≥18 years old, and could understand French. A total of 282 co-parents completed the survey. However, given that they were only two female co-parents among responders, the final sample of the current study only included fathers (n = 280). Sociodemographic characteristics of the sample are displayed in Table 1.

Measures

City Birth Trauma Scale (P)

In the City BiTS, 29 items measure CB-PTSD symptoms based on the PTSD criteria of the DSM-5-TR (APA, 2022; Ayers et al., 2018; Webb et al., 2021). The PTSD criterion A (i.e., exposure to a traumatic stressor) is evaluated through two items (yes = 0, no = 1). The symptom frequency of PTSD criteria B, C, D, and E present within the last week is assessed via a Likert scale (0 = not at all, 1 = once, 2 = 2–4 times, or 3 = ≥5 times). More specifically, five items concern intrusions (criterion B), two items are related to avoidance (criterion C), seven items belong to negative cognitions and mood (criterion D), and six items report hyperarousal symptoms (criterion E). Symptoms of derealization and depersonalization, which allow establishing the PTSD dissociative subtype, are assessed by one item each. In addition, two items determine the symptom onset (criterion F; 0 = before childbirth, 1 = ≤6 months following childbirth, 2 = >6 months following childbirth, or NA = no symptoms) and duration (criterion F; 0 = <1 month, 1 = 1–3 months, or 2 = >3 months). Two items also measured the distress and interference with daily activity (criterion G; 0 = yes, 1 = no or 2 = sometimes). Finally, the presence of possible physical causes to symptoms is measured via the last item (exclusion criterion H; 0 = yes, 1 = no, or 2 = sometimes).

The sum of the criteria B–E items results in the City BiTS (P) total score ranging from 0 to 60. The BRS and GS constitute the two City BiTS (P) subscales. The BRS subscales include nine items measuring symptoms of criteria B and C, as well as those of two birth-related items of criterion D, whereas the GS subscale contains 11 items, measuring the remaining criteria D and criteria E. Higher CB-PTSD symptom severity is expressed by higher total (subscale) score(s). Finally, the original study validating the City BiTS (P) reported a high internal consistency for both the total scale and subscales (α = .78–.94), and the GS subscale (α = .92).

The French translation and cultural adaptation of the City BiTS (P) were carried out using the forward-backward method (Wild et al., 2005). As a first step, two researchers with French as their mother tongue translated the City BiTS (P) into French. As a second phase, another independent French–English bilingual researcher translated it back into English. The final stage included discussing its cultural adaption in the presence of A.H., W.E.H, V.S., as well as with a key author of the original version (Prof. Susan Ayers). No significant divergences emerged during the procedure (e.g., mistranslation of a concept or changes linked to cultural perspective). All the researchers are specialists of perinatal mental health and used to diagnostic CB-PTSD based on DSM-5-TR PTSD criteria. The City BiTS-F was piloted with a couple of mothers, who made no significant comments or suggestions for change. The original versions of the City BiTS (childbearing mother and partner versions), as well as the translated ones can be accessed online free of charge (https://blogs.city.ac.uk/citybirthtraumascale/translations).

Posttraumatic Stress Disorder Checklist for DSM-5

The severity and frequency of PTSD symptoms during the last month were assessed by the PCL-5, that is, a self-report questionnaire of 20 items with a 5-point Likert scale (0 = not at all to 4 = extremely; Blevins et al., 2015). The total score is calculated by adding the sum of the items and ranges from 0 to 80. A higher total score reflects higher PTSD symptom severity. In the current study, Cronbach's α = .89, indicating an adequate internal consistency. Excellent psychometric characteristics were observed for the French version (Ashbaugh et al., 2016).

Edinburgh Postnatal Depression Scale

Postnatal depression symptoms within the last week were measured by the EPDS (Cox et al., 1987). This 10-item self-report questionnaire uses a 4-point Likert scale. The sum of the items forms a total score (range: 0–30), with greater scores suggesting greater levels of symptom severity (Cox et al., 1987). The internal consistency of the present study was adequate (α = .89). The French version showed good psychometric characteristics (Guedeney & Fermanian, 1998).

Anxiety Subscale of the Hospital Anxiety and Depression Scale

Anxiety symptoms over the last week were evaluated by the HADS-A, which is a 7-item self-report questionnaire assessing symptom severity via a 4-point Likert scale (Zigmond & Snaith, 1983). The sum of the items results in the total score (range: 0–21) that the greater it is, the higher the symptom severity is (Zigmond & Snaith, 1983). The internal consistency of the current study was adequate (α = .78). Good psychometric properties were found for the French version (Bocerean & Dupret, 2014).

Table 1
Descriptive Characteristics of the Sample

Characteristic	M (SD)	n (%)
	Participants (n = 272)	
Age	33.81 (5.8)	
Marital status		
In a couple relationship		247 (90.8)
Single, separated, divorced, or widowed		25 (9.2)
Educational level		
Compulsory education or primary school or less		17 (6.3)
Post-compulsory education (e.g., apprenticeship)		72 (26.5)
University of Applied Science or University Diploma of Technology Degree		68 (25.0)
University		115 (42.3)
History of traumatic event		36 (13.2)
History of traumatic childbirth		46 (16.9)
Weeks of gestation	39.10 (1.93)	
Mode of delivery		
Vaginal birth		172 (63.2)
Operative vaginal birth		34 (12.5)
Emergency cesarean section		48 (17.6)
Planned cesarean section		18 (6.6)

Sociodemographic and Medical Data

Participants reported their age, marital status, educational level, their history of traumatic event and traumatic childbirth, mode of delivery, as well as the weeks of gestation of their recent baby.

Procedure

The online survey was hosted on Sphinx iQ2, while the data were stored on a secure server of a Swiss University Hospital. Different associations and institutions working in the field of parenthood in French-speaking countries, such as Switzerland, France, Belgium, and Canada, accepted to advertise for the current study. In addition, advertisements were posted on social media and via personal and professional networks. Data collection occurred between June 2020 and October 2021. Before completing the questionnaires, participants read an online information sheet and then gave their consent. This online survey had two parts: the first section was on the validation of the City BiTS-F and the second one, which was optional, examined infant sleep and temperament. Some maternal data from this survey have already been analyzed and published (i.e., maternal mental health outcomes and infant sleep data reported by mothers; Sandoz, Hingray et al., 2022; Sandoz, Lacroix et al., 2022). In the current article, only data from the partner validation substudy are reported as primary data analysis. Given participants had to finish the survey for data to be collected, no information on early dropouts is available. Data are freely available without restriction from the open-access repository Zenodo (Sandoz & Horsch, 2022). According to Swiss law, the local ethics committee categorized the current survey as anonymous, therefore not requesting a full approval process.

Statistical Analysis

The statistical analysis plan was not pre-registered. Analyses were conducted with R v4.1.0 running under RStudio v1.13.1093, with the lavaan v0.6-9 and psych v2.1.6 packages and the significance level was set at $p < .05$. Descriptive and exploratory analyses were run to check that factor analysis were appropriate. Due to technical issues, eight participants (2.9%) had missing data and were therefore excluded from the confirmatory factor analysis. Items of the City BiTS-F (P) are ordinal and their distribution was skewed. We therefore used a robust weighted least square estimator (Brown, 2015; Li, 2016).

We considered three models in the analyses: A *four-factor model* composed of the intrusions, avoidance, negative cognitions and mood, and hyperarousal factors; a *two-factor model* composed of the BRS and GS factors; and a *bifactor model* with a general factor and the BRS and GS factors. Following Kline recommendations (2010), to evaluate these models, we used the following goodness of fit indices: Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Standardized Root Mean Square Residual (SRMR). In addition, we also reported the Tucker–Lewis index (TLI) because it has a higher penalty for model complexity than CFI. RMSEA values <0.06, CFI and TLI values >0.95, and SRMR values <0.08 suggest a good fit (Hu & Bentler, 1999). A model shows a reasonable fit when the value of χ^2/df is <3.0 (Kline, 2015). According to the recommended practices in bifactor analysis (Rodriguez et al., 2016), the bifactor model was tested on several ancillary indices: the explained common variance (ECV) associated with the general and each specific factor, the individual ECVs (IECV), the omega reliability coefficient (ω), the omega hierarchical (ω_H), the measure of construct replicability (H), and the factor determinacy (FD). A value of $\omega > .70$ indicates acceptable reliability for questionnaires (Lance et al., 2006) whereas an ω_H score of the general factor >0.80 suggests that the total score can be recognized as unidimensional (Reise et al., 2013). H values >0.80 refer to well-defined latent variables (Reise et al., 2013), while factors with FD < .90 should not be used (Gorsuch, 1980).

Cronbach's α and Pearson's correlation coefficients were used to test the reliability as well as the convergent and divergent validity, respectively, while the discriminant validity was checked by known group differences with a series of one-way analyses of variance (ANOVA), Kruskal–Wallis rank sum tests (when the assumptions for ANOVA were not met), and linear regressions (for continuous variables).

Results

Participants used the full range from 0 to 3 of the City BiTS-F (P) items and indices confirmed that factor analysis could be carried out.

Latent Factor Structure of CB-PTSD Symptoms

The *four-factor model* indices did not yield a good fit to the data, $\chi^2 (164) = 460.17$, $p < .001$; $\chi^2/df = 2.81$; RMSEA = 0.08; SRMS = 0.15; CFI = 0.93; TLI = 0.92. High correlations were found between the intrusions and the avoidance factors ($r = .91$, $p < .001$), and the negative cognitions and mood and the hyperarousal factors ($r = .91$, $p < .001$). According to all fit indices, the *two-factor model* provided a better fit to the data, $\chi^2 (169) = 262.15$, $p < .001$; $\chi^2/df = 1.55$; RMSEA = 0.05; SRMR = 0.09; CFI = 0.98; TLI = 0.98. Standardized factor loadings are shown in Table 2. A moderate correlation between the BRS and GS factors was observed ($r = .49$, $p < .001$) and the BRS factor was accountable for 52% of the items' variance and the GS factor for 48%. Finally, this was the *bifactor model* that produced the best fit to the data, $\chi^2 (150) = 221.45$, $p < .001$; $\chi^2/df = 1.48$; RMSEA = 0.04; SRMS = 0.07; CFI = 0.98; TLI = 0.98. Tables 3 and 4 show standardized factor loadings and ancillary indices. The *ECV* indices demonstrate that the general factor explained 56% of the common variance across the 20 items, the GS factor 30%, and the BRS factor 14%. The average IECV = 0.55 suggests that the general factor was more strongly measured by the items than the intended factors. Items 2, 7, 8, 9, and 10 loaded high on the general factor and their IECV values were >0.85, which implies these items mostly reflected the general dimension (Stucky & Edelen, 2014). Noteworthy, item 8 showed no loading on the BRS factor.

Reliability of the City BiTS-F (P)

Regarding the reliability, the internal consistency was high for the total symptoms ($\alpha = .89$), as well as for the BRS ($\alpha = .88$) and for the GS subscale ($\alpha = .89$). Inter-correlations ranged from 0.13 to 0.76 and from 0.31 to 0.77 for the BRS and GS subscales, respectively.

Validity of the City BiTS-F (P)

Concerning the convergent validity, the PCL-5 total score and the City BiTS-F (P) total score highly correlated ($r = .88$, 95% CI [0.85, 0.90]), as well as between the PCL-5 total score and

Table 2

Standardized Factor Loadings for the Two-Factor Model of the City BiTS-F (P) (n = 272)

Items	BRS	GS
Intrusions		
1. Recurrent unwanted memories of the birth.	0.86	
2. Bad dreams or nightmares about the birth.	0.82	
3. Flashbacks to the birth and/or reliving the experience.	0.70	
4. Getting upset when reminded of the birth.	0.91	
5. Feeling tense or anxious when reminded of the birth.	0.94	
Avoidance		
6. Trying to avoid thinking about the birth.	0.90	
7. Trying to avoid things that remind me of the birth.	0.97	
Negative cognitions and mood		
8. Not able to remember details of the birth.	0.56	
9. Blaming myself or others for what happened during the birth.	0.87	
10. Feeling strong negative emotions about the birth.	0.88	
11. Feeling negative about myself or thinking something awful will happen.		0.74
12. Lost interest in activities that were important to me.		0.72
13. Feeling detached from other people.		0.86
14. Not able to feel positive emotions.		0.82
Hyperarousal		
15. Feeling irritable or aggressive.		0.88
16. Feeling self-destructive or acting recklessly.		0.88
17. Feeling tense and on edge.		0.90
18. Feeling jumpy or easily startled.		0.77
19. Problems concentrating.		0.80
20. Not sleeping well … not due to the baby's sleep pattern.		0.73

Note. BRS = birth-related symptoms; City BiTS-F (P) = City Birth Trauma Scale–French Version (partner version); and GS = general symptoms.

Table 3

Standardized Factor Loadings for the Bifactor Model of the City BiTS-F (P) (n = 272)

Items	G	BSR	GS
Intrusions			
1. Recurrent unwanted memories of the birth.	0.62	0.64	
2. Bad dreams or nightmares about the birth.	0.78	0.27	
3. Flashbacks to the birth and/or reliving the experience.	0.50	0.62	
4. Getting upset when reminded of the birth.	0.68	0.63	
5. Feeling tense or anxious when reminded of the birth.	0.74	0.63	
Avoidance			
6. Trying to avoid thinking about the birth.	0.78	0.44	
7. Trying to avoid things that remind me of the birth.	1.02	0.15	
Negative cognitions and mood			
8. Not able to remember details of the birth.	0.61	0.01	
9. Blaming myself or others for what happened during the birth.	0.79	0.35	
10. Feeling strong negative emotions about the birth.	0.86	0.24	
11. Feeling negative about myself or … will happen.	0.54		0.49
12. Lost interest in activities that were important to me.	0.30		0.69
13. Feeling detached from other people.	0.49		0.71
14. Not able to feel positive emotions.	0.50		0.65
Hyperarousal			
15. Feeling irritable or aggressive.	0.40		0.82
16. Feeling self-destructive or acting recklessly.	0.49		0.74
17. Feeling tense and on edge.	0.51		0.74
18. Feeling jumpy or easily startled.	0.63		0.46
19. Problems concentrating.	0.42		0.69
20. Not sleeping well … not due to the baby's sleep pattern.	0.51		0.51

Note. BRS = birth-related symptoms; City BiTS-F (P) = City Birth Trauma Scale—French Version (partner version); G = general factor; GS = general symptoms.

Table 4

Ancillary Indices for the Bifactor Model of the City BiTS-F (P) (n = 272)

City BiTS-F (P) dimensions	ECV	ω	ω_H	H	FD
General factor	0.56	0.97	0.70	1.10	0.99
BRS	0.14	0.97	0.22	0.76	0.95
GS	0.30	0.95	0.62	0.90	0.97

Note. BRS = birth-related symptoms; City BiTS-F (P) = City Birth Trauma Scale–French Version (partner version); ECV = Explained Common Variance; FD = Factor Determinacy; GS = general symptoms; H = Construct replicability; ω_H = Omega hierarchical; and ω = Omega.

the BRS ($r = .65$, 95% CI [0.58, 0.72]) and the GS ($r = .79$, 95% CI [0.74, 0.83]) subscales (Table 5). Regarding the divergent validity, a significant moderate correlation was found between the total scores of the City BiTS-F (P) and the HADS-A ($r = .68$, 95% CI [0.61, 0.74]). A moderate correlation was found between the BRS subscale and the HADS-A total score ($r = .33$, 95% CI [0.22, 0.43]), while the latter was highly correlated with the GS subscale ($r = .71$, 95% CI [0.65, 0.77]; Table 5). The City BiTS-F (P) total score was significantly highly correlated with the EPDS total score ($r = .76$, 95% CI [0.70, 0.81]; Table 5), which was moderately associated with the BRS subscale ($r = .37$, 95% CI [0.26, 0.47]) and highly with the GS ($r = .81$, 95% CI [0.75, 0.84]; Table 5).

Finally, regarding the discriminant validity, known group differences analyses did not show any significant associations between the obstetric variables (i.e., weeks of gestation and mode of delivery) and the City BiTS-F (P) total and subscales scores (Table 6). Regarding the psychological history variables (i.e., history of traumatic event and past traumatic childbirth), the City BiTS-F (P) total score and its BRS and GS subscales were significantly sensitive to the past traumatic childbirth only. The fathers who experienced a past traumatic childbirth reported significantly higher City BiTS-F (P) total and subscale scores compared to fathers without a past traumatic childbirth. The effect sizes were moderate for the City BiTS-F (P) total score (Cohen's $d = 0.60$) and for for the BRS subscale (Cohen's $d = 0.62$), and small for the GS subscale (Cohen's $d = 0.42$).

Discussion

The first aim of the current study was to establish the latent factor structure of CB-PTSD symptoms in partners. The bifactor model with a general factor and the BRS and GS factors provided the best fit to the data when compared to the two- and four-factor models. The second objective of this study was to validate the French version of the City BiTS in a large sample of partners who had their infant within the last year. Our findings suggest that the City BiTS-F (P) constitutes a suitable psychometric tool to measure CB-PTSD symptoms in non-expecting mothers or fathers.

According to the DSM-5-TR, (CB-)PTSD is characterized by a four-cluster structure, with symptoms of intrusions, avoidance of reminders, negative cognitions and mood, and hyperarousal (APA, 2022). However, in the current study, although the bifactor model gave the best fit to the data, both the bifactor and two-factor models

Table 5

Inter-Correlations of the City BiTS-F (P) Two-Factor Model, and Correlations with HADS-A, EPDS, and PCL-5 (n = 272)

Variables	M (SD)	1	2	3	4	5
1. City BiTS-F (P): Total score	6.79 (8.18)	—				
2. City BiTS-F (P): BRS	1.69 (3.68)	.72 [.66, .78]	—			
3. City BiTS-F (P): GS	5.10 (6.07)	.91 [.88, .93]	.37 [.26, .47]	—		
4. HADS-A	4.87 (3.62)	.68 [.61, .74]	.33 [.22, .43]	.71 [.65, .77]	—	
5. PCL-5	8.44 (9.24)	.88 [.85, .90]	.65 [.58, .72]	.79 [.74, .83]	.70 [.63, .75]	—
6. EPDS	4.95 (5.20)	.76 [.70, .81]	.37 [.26, .47]	.80 [.75, .84]	.78 [.73, .82]	.72 [.65, .77]

Note. City BiTS-F (P) = City Birth Trauma Scale—French Version (partner version); EPDS = Edinburgh Postnatal Depression Scale; HADS-A = anxiety subscale of the Hospital Anxiety and Depression Scale; and PCL-5 = PTSD Checklist for DSM-5.
All coefficients' *p*-values ≤ .001 and numbers in brackets indicate 95% confidence intervals.

yielded data better than the four-factor model. This suggests the existence of higher-order factors, with the intrusions and the avoidance factor, as well as the negative cognitions and mood and the hyperarousal factor having similar underlying constructs.

Only a few studies investigated the latent structure of CB-PTSD, mostly in childbearing mothers. The two-factor model composed of the BRS and GS factors was the most tested for CB-PTSD and provided an adequate fit to the data (Ayers et al., 2018; Bayrı Bingöl et al., 2021; Caparros-Gonzalez et al., 2021; Handelzalts et al., 2018; Nakić Radoš et al., 2020; Sandoz, Hingray, et al., 2022; Weigl et al., 2021). In addition, the original validation study on partners also validated this two-factor model (Webb et al., 2021). However, amongst the two studies that tested the bifactor model for CB-PTSD, which includes a general factor in addition to the two BRS and GS factors, the best fit was not observed in the two-factor solution but in the bifactor model (Nakić Radoš et al., 2020; Sandoz, Hingray, et al., 2022). Therefore, the use of the total score scale is justified in addition to the use of the BRS and the GS subscales (Reise et al., 2013). In the current study, the percentage of items variance explained by the general factor was 56%, suggesting the

existence of an important global dimension. Regarding the GS and BRS factors, they accounted for 30% and 14% of the items variance, respectively. Our results indicate that the City BiTS-F (P) could not be considered essentially unidimensional (Reise et al., 2013). However, caution is required when considering items 2, 7, 8, 9, and 10 in their respective subscale, since they mostly reflect a general dimension.

To the best of our knowledge, this is the first time that the City BiTS (P) was validated in another language, although such research is ongoing in other languages, indicating a rising interest in this scale (City University of London, 2016). Similarly to the French validation of the City BiTS for childbearing mothers and the original City BiTS (P) (Sandoz, Hingray et al., 2022; Webb et al., 2021), the internal consistency for the City BiTS-F (P) total score and its BRS and GS subscales was high (Cronbach's α > .80). As recommended by the original validation (Webb et al., 2021), the current study investigated the convergent validity and found moderate to strong correlations between the City BiTS-F (P) and its subscales, and the PCL-5, another self-report questionnaire measuring PTSD symptoms. In addition, divergent validity was investigated through

Table 6

Two-Factor Model Differences in the City Bits-F (P) and its Subscales Between Known-Groups (N = 272)

Obstetric and psychological history variables	Total score β, p R²	BRS β, p R²	GS β, p R²
Weeks of gestation	β = −0.15, p = .56 R² = .001	β0 = −0.23, p = .05 R² = .01	β = 0.08, p = .68 R² = .0006
	Total score Mdn (IQR) Cohen" d	Birth-related symptoms Mdn (IQR) Cohen" d	General symptoms Mdn (IQR) Cohen" d
Mode of delivery			
Planned cesarean section (n = 18)	3 (11.5)	0 (2)	3 (8)
Emergency cesarean section (n = 48)	6.5 (11.25)	1 (4)	4 (6.25)
Vaginal operative birth (n = 34)	4 (11)	0.5 (2.75)	3 (9)
Vaginal birth (n = 172)	4 (8)	0 (2)	3 (8)
	χ²(3) = 3.71, p = .30	χ²(3) = 7.19, p = .07	χ²(3) = 1.38, p = .71
History of traumatic event			
Yes (n = 36)	7 (13.25)	1 (3)	5.5 (12.25)
No (n = 236)	4 (8)	0 (2)	3 (8)
	χ²(1) = 2.79, p = .09	χ²(1) = 3.03, p = .08	χ²(1) = 2.98, p = .08
History of traumatic childbirth			
Yes (n = 46)	8.5 (11.5)	1 (4.75)	6 (7)
No (n = 226)	4 (9)	0 (2)	3 (8)
	χ²(1) = 12.89, p < .001 d = 0.60	χ²(1) = 9.42, p < .001 d = 0.62	χ²(1) = 7.30, p = .01 d = 0.42

Note. BRS = birth-related symptoms; City Bits-F (P) = City Birth Trauma Scale–French Version (partner version); and GS = general symptoms.
Small effect size: Cohen's *d* ≥ 0.20, moderate: *d* ≥ 0.50, large: *d* ≥ 0.80.

correlations between the City BiTS-F (P) and its subscales and the EPDS (i.e., postnatal depression symptoms) and HADS-A (i.e., anxiety symptoms). Both the EPDS and the HADS-A were weakly associated with the BRS subscale of the City BiTS-F (P), implying that symptoms of intrusions and avoidance are specific to CB-PTSD. In contrast, the GS subscale and the total score of the City BiTS-f (P) were moderately to strongly correlated with the EPDS and the HADS-A, which is not surprising, given CB-PTSD, postnatal depression, and anxiety share some symptom similarities (Sandoz, Lacroix et al., 2022). These results on convergent and divergent validity aligned with the findings of previous research, including the City BiTS-F (childbearing mother version; Nakić Radoš et al., 2020; Sandoz, Hingray et al., 2022).

Regarding the discriminant validity, only the history of traumatic childbirth was discriminative, with fathers that experienced a previous traumatic childbirth having higher total scores and BRS and GS scores. The discriminant role of history of traumatic childbirth was also found in childbearing mothers (Nakić Radoš et al., 2020; Sandoz, Hingray et al., 2022). However, in our study, weeks of gestation, mode of delivery, or history of traumatic event were not discriminant, contrary to previous results with childbearing mothers (Nakić Radoš et al., 2020; Sandoz, Hingray, et al., 2022). This suggests that different factors may be involved in the CB-PTSD development in childbearing mothers and partners (Handelzalts et al., 2018; Nakić Radoš et al., 2020; Sandoz, Hingray et al., 2022).

Some limitations must be pointed out when interpreting the results of the current study. First, a selection bias cannot be excluded, given the sample was recruited online. Almost half of our participants had a university degree (42.49%) and a quarter witnessed a cesarean section of their partner (24.17%), which usually concerns one-third of the Swiss population (Federal Statistical Office, 2021). Hence, some sociodemographic characteristics of the current sample are not representative of the Swiss general population, although partner age was similar to the one of the English population of the original study (Webb et al., 2021). A second limitation refers to the use of self-report questionnaires to assess partner mental health symptoms, which does not allow the establishment of clinical diagnoses. Indeed, the nature of the study (i.e., online survey) and the sample size ($n = 280$) limited the use of clinical diagnostic interviews. Future works should determine clinical cut-offs and severity categories. Third, we were not able to investigate the symptom trajectory during the first year postpartum in partners due to the cross-sectional nature of the study. For future research, we strongly recommend the use of clinical samples with structured clinical interviews in addition to self-report measurements with longitudinal designs to provide relevant information regarding the symptom trajectory in partners. A fourth limitation relates to the fact that reliability was only calculated via internal consistency. Future validation research should also examine reliability with the test–retest method. In addition, given that the survey was anonymous, we could not collect data on the country of residence of participants. French-speaking countries have various perinatal (mental) health care provisions, which could not be taken into account in the current study and must be considered as a limitation. Finally, due to the small number of female co-parents who completed the survey ($n = 2$), the current study did not include them in the analysis. Future studies on partner CB-PTSD should include more diverse samples, including female co-parents.

In sum, the City BiTS-F (P) represents a reliable and valid tool to assess CB-PTSD symptoms in French-speaking partners according to the DSM-5-TR criteria for PTSD (APA, 2022). The use of the total score in addition to the BRS and GS subscales scores is warranted. In addition, high internal consistency was found for both the total scale and the subscales of the City BiTS-F (P) (i.e., BRS and GS), while the history of traumatic childbirth was established to be a discriminant factor. We recommend the use of the City BiTS-F (P) for both, research and clinical practice, to improve the care of French-speaking partners in postpartum.

References

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.).

Ashbaugh, A. R., Houle-Johnson, S., Herbert, C., El-Hage, W., & Brunet, A. (2016). Psychometric validation of the English and French versions of the Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5). *PLoS One*, *11*(10), Article e0161645. https://doi.org/10.1371/journal.pone.0161645.

Ayers, S., Wright, D. B., & Thornton, A. (2018). Development of a measure of postpartum PTSD: The City Birth Trauma Scale. *Frontiers in Psychiatry*, *9*, Article 409. https://doi.org/10.3389/fpsyt.2018.00409

Bayrı Bingöl, F., Bal, M. D., Dişsiz, M., Sormageç, M. T., & & Yildiz, P. D. (2021). Validity and reliability of the Turkish version of the City Birth Trauma Scale (CityBiTS). *Journal of Obstetrics & Gynaecology*, *41*(7), 1023–1031. https://doi.org/10.1080/01443615.2020.1821354

Blevins, C. A., Weathers, F. W., Davis, M. T., Witte, T. K., & Domino, J. L. (2015). The Posttraumatic Stress Disorder Checklist for DSM 5 (PCL 5): Development and initial psychometric evaluation. *Journal of Traumatic Stress*, *28*(6), 489–498. https://doi.org/10.1002/jts.22059

Bocerean, C., & Dupret, E. (2014). A validation study of the Hospital Anxiety and Depression Scale (HADS) in a large sample of French employees. *BMC Psychiatry*, *14*(1), Article 354. https://doi.org/10.1186/s12888-014-0354-0

Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). Guilford Press.

Caparros-Gonzalez, R. A., Romero-Gonzalez, B., Peralta-Ramirez, M. I., Ayers, S., Galán-Paredes, A., & Caracuel-Romero, A. (2021). Assessment of posttraumatic stress disorder among women after childbirth using the City Birth Trauma Scale in Spain. *Psychological Trauma: Theory, Research, Practice, and Policy*, *13*(5), 545–554. https://doi.org/10.1037/tra0001007

City University of London. (2016). *Translated versions*. Retrieved June 2, 2022, from https://blogs.city.ac.uk/citybirthtraumascale/translations/

Cook, N., Ayers, S., & Horsch, A. (2018). Maternal posttraumatic stress disorder during the perinatal period and child outcomes: A systematic review. *Journal of Affective Disorders*, *225*, 18–31. https://doi.org/10.1016/j.jad.2017.07.045

Cox, J. L., Holden, J. M., & Sagovsky, R. (1987). Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry*, *150*(6), 782–786. https://doi.org/10.1192/bjp.150.6.782

Federal Statistical Office. (2021). *Reproductive health*. https://www.bfs.admin.ch/bfs/en/home/statistics/health/state-health/reproductive-health.html

Garthus-Niegel, S., Benyamini, Y., & Horsch, A. (2021). Perinatal mental health: Expanding the focus to the family context. *Frontiers in Psychiatry*, *12*(7), Article 719053. https://doi.org/10.3389/fpsyt.2021.719053

Garthus-Niegel, S., Horsch, A., Handtke, E., von Soest, T., Ayers, S., Weidner, K., & Eberhard-Gran, M. (2018). The impact of postpartum posttraumatic stress and depression symptoms on couples' relationship satisfaction: A population-based prospective study. *Frontiers in Psychology*, *9*, Article 1728. https://doi.org/10.3389/fpsyg.2018.01728

Gorsuch, R. L. (1980). Factor score reliabilities and domain validities. *Educational and Psychological Measurement*, *40*(4), 895–897. https://doi.org/10.1177/001316448004000412

Guedeney, N., & Fermanian, J. (1998). Validation study of the French version of the Edinburgh Postnatal Depression Scale (EPDS): New results about use and psychometric properties. *European Psychiatry*, 13(2), 83–89. https://doi.org/10.1016/s0924-9338(98)80023-0

Handelzalts, J. E., Hairston, I. S., & Matatyahu, A. (2018). Construct validity and psychometric properties of the Hebrew version of the City Birth Trauma Scale. *Frontiers in Psychology*, 9, Article 1726. https://doi.org/10.3389/fpsyg.2018.01726

Heyne, C.-S., Kazmierczak, M., Souday, R., Horesh, D., Lambregtse van den Berg, M., Weigl, T., Horsch, A., Oosterman, M., Dikmen-Yildiz, P., & Garthus-Niegel, S. (2022). Prevalence and risk factors of birth-related posttraumatic stress among parents: A comparative systematic review and meta-analysis. *Clinical Psychology Review*, 94, Article 102157. https://doi.org/10.1016/j.cpr.2022.102157

Hinton, L., Locock, L., & Knight, M. (2014). Partner experiences of "near-miss" events in pregnancy and childbirth in the UK: A qualitative study. *PLoS One*, 9(4), Article e91735. https://doi.org/10.1371/journal.pone.0091735

Horsch, A., & Stuijfzand, S. (2019). Intergenerational transfer of perinatal trauma-related consequences. *Journal of Reproductive and Infant Psychology*, 37(3), 221–223. https://doi.org/10.1080/02646838.2019.1629190

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. https://doi.org/10.1080/10705519909540118

Kline, R. B. (2015). *Principles and practice of structural equation modeling* (4th ed.). Guilford Publications.

Lance, C. E., Butts, M. M., & Michels, L. C. (2006). The sources of four commonly reported cutoff criteria: What did they really say? *Organizational Research Methods*, 9(2), 202–220. https://doi.org/10.1177/1094428105284919

Li, C.-H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods*, 48(3), 936–949. https://doi.org/10.3758/s13428-015-0619-7

McKenzie-McHarg, K., Ayers, S., Ford, E., Horsch, A., Jomeen, J., Sawyer, A., Stramrood, C., Thomson, G., & Slade, P. (2015). Post-traumatic stress disorder following childbirth: An update of current issues and recommendations for future research. *Journal of Reproductive and Infant Psychology*, 33(3), 219–237. https://doi.org/10.1080/02646838.2015.1031646

Nakić Radoš, S., Matijaš, M., Kuhar, L., Anđelinović, M., & & Ayers, S. (2020). Measuring and conceptualizing PTSD following childbirth: Validation of the City Birth Trauma Scale. *Psychological Trauma: Theory, Research, Practice, and Policy*, 12(2), 147–155. https://doi.org/10.1037/tra0000501

Reise, S. P., Scheines, R., Widaman, K. F., & Haviland, M. G. (2013). Multidimensionality and structural coefficient bias in structural equation modeling: A bifactor perspective. *Educational and Psychological Measurement*, 73(1), 5–26. https://doi.org/10.1177/0013164412449831

Rodriguez, A., Reise, S. P., & Haviland, M. G. (2016). Evaluating bifactor models: Calculating and interpreting statistical indices. *Psychological Methods*, 21(2), 137–150. https://doi.org/10.1037/met0000045

Sandoz, V., Hingray, C., Stuijfzand, S., Lacroix, A., El Hage, W., & Horsch, A. (2022). Measurement and conceptualization of maternal PTSD following childbirth: Psychometric properties of the City Birth Trauma Scale—French version (City BiTS-F). *Psychological Trauma: Theory, Research, Practice, and Policy*, 14(4), 696–704. https://doi.org/10.1037/tra0001068

Sandoz, V., & Horsch, A. (2021). *Dataset of Measurement and conceptualization of maternal PTSD following childbirth: Psychometric properties of the City Birth Trauma Scale—French version (City BiTS-F) Zenodo.* https://doi.org/10.5281/zenodo.4441996

Sandoz, V., & Horsch, A. (2022). *Dataset of The latent factor structure and assessment of childbirth-related PTSD in fathers and co-parents: Psychometric characteristics of the City Birth Trauma Scale—French version (partner version) Zenodo.* https://doi.org/10.5281/zenodo.6683900

Sandoz, V., Lacroix, A., Stuijfzand, S., Bickle Graz, M., & Horsch, A. (2022). Maternal mental health symptom profiles and infant sleep: A cross-sectional survey. *Diagnostics*, 12(7), Article 1625. https://doi.org/10.3390/diagnostics12071625

Stucky, B. D., & Edelen, M. O. (2014). Using hierarchical IRT models to create unidimensional measures from multidimensional data. In S. P. Reise, & D. A. Revicki (Eds.), *Handbook of item response theory modeling: Applications to typical performance assessment* (pp. 183–206). Routledge/Taylor & Francis Group.

Stuijfzand, S., Garthus-Niegel, S., & Horsch, A. (2020). Parental birth-related PTSD symptoms and bonding in the early postpartum period: A prospective population-based cohort study. *Frontiers in Psychiatry*, 11, Article 570727. https://doi.org/10.3389/fpsyt.2020.570727

Webb, R., Smith, A. M., Ayers, S., Wright, D. B., & Thornton, A. (2021). Development and validation of a measure of birth-related PTSD for fathers and birth partners: The City Birth Trauma Scale (partner version). *Frontiers in Physiology*, 12(545), Article 596779. https://doi.org/10.3389/fpsyg.2021.596779

Weigl, T., Beck-Hiestermann, F. M. L., Stenzel, N. M., Benson, S., Schedlowski, M., & Garthus-Niegel, S. (2021). Assessment of childbirth-related PTSD: Psychometric properties of the German Version of the City Birth Trauma Scale. *Frontiers in Psychiatry*, 12, Article 731537. https://doi.org/10.3389/fpsyt.2021.731537

White, G. (2007). You cope by breaking down in private: Fathers and PTSD following childbirth. *British Journal of Midwifery*, 15(1), 39–45. https://doi.org/10.12968/bjom.2007.15.1.22679

Wild, D., Grove, A., Martin, M., Eremenco, S., McElroy, S., Verjee-Lorenz, A. & Erikson, P. (2005). Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: Report of the ISPOR Task Force for Translation and Cultural Adaptation. *Value in Health*, 8(2), 94–104. https://doi.org/10.1111/j.1524-4733.2005.04054.x

Yufik, T., & Simms, L. J. (2010). A meta-analytic investigation of the structure of posttraumatic stress disorder symptoms. *Journal of Abnormal Psychology*, 119(4), 764–776. https://doi.org/10.1037/a0020981

Zigmond, A. S., & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica*, 67(6), 361–370. https://doi.org/10.1111/j.1600-0447.1983.tb09716.x