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Childbirth-related posttraumatic stress symptoms: exploring the predictive potential of intrapartum hotspots

Meike K. Blecker[a,b], Daria Daehn[c], Sinha Engel[d], Susann Steudte-Schmiedgen[e], Susan Garthus-Niegel[f,g,h], Christine Knaevelsrud[a] and Sarah Schumacher[b]

[a]Division of Clinical Psychological Intervention, Department of Education and Psychology, Freie Universität Berlin, Berlin, Germany; [b]Clinical Psychology and Psychotherapy, Institute for Mental Health and Behavioral Medicine, Health and Medical University Potsdam, Potsdam, Germany; [c]Division of Clinical Psychology and Psychotherapy, Department of Education and Psychology, Freie Universität Berlin, Berlin, Germany; [d]Department of Experimental Psychopathology, Institute for Psychology, University of Hildesheim, Hildesheim, Germany; [e]Faculty of Medicine, Department of Psychotherapy and Psychosomatic Medicine, Technische Universität Dresden, Dresden, Germany; [f]Faculty of Medicine, Institute and Policlinic of Occupational and Social Medicine, Technische Universität Dresden, Dresden, Germany; [g]Faculty of Medicine, Institute for Systems Medicine (ISM), Medical School Hamburg MSH, Hamburg, Germany; [h]Department of Childhood and Families, Norwegian Institute of Public Health, Oslo, Norway

ABSTRACT

Childbirth-related posttraumatic stress symptoms (CB-PTSS) affect around 12% of postpartum individuals. While the subjective experience of childbirth is a key predictor of CB-PTSS, the specific defining characteristics of negative birth experiences remain poorly understood. This study aims to refine our understanding of negative birth experiences by investigating intrapartum hotspots, i.e. moments of extreme distress, and their association with CB-PTSS. In a cross-sectional study of $N = 1{,}140$ individuals who had given birth eight to ten weeks before, we examined the following: the types of hotspots, differences in hotspot-related distress, interpersonal difficulties during the hotspot, and CB-PTSS between the various types of hotspots and whether hotspot-related distress and interpersonal difficulties independently predicted CB-PTSS. Participants completed several items based on previous qualitative work [1] to assess the worst hotspot, hotspot-related distress, and interpersonal difficulties during the hotspot and the City Birth Trauma Scale to measure CB-PTSS, alongside relevant pregnancy- and birth-related questions. *Medical interventions* were the most frequently experienced worst hotspot and *separation from the child* was associated with the highest levels of hotspot-related distress, interpersonal difficulties, and CB-PTSS. Hotspot-related distress and interpersonal difficulties independently predicted CB-PTSS. Examining intrapartum hotspots poses a promising approach to define highly negative birth experiences.

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Introduction

Childbirth-related posttraumatic stress symptoms (CB-PTSS) represent a frequent complication in the postpartum period, with detrimental consequences for the affected individual, their newborn and the whole family, including impaired bonding, breastfeeding and child development [2–4,5]. Around 12% of postpartum individuals suffer from some CB-PTSS, i.e. reporting clinically relevant symptoms levels but not meeting all DSM-5 criteria [6] for posttraumatic stress disorder (PTSD). Around 5% develop the full clinical condition of childbirth-related posttraumatic stress disorder (CB-PTSD; [6]). Just like PTSD in the general population, CB-PTSD is characterized by symptoms of intrusion, avoidance, negative alterations in mood and cognition, and hyperarousal [7,8].

Interestingly, research of the past decade on the etiology of CB-PTSS has identified the subjective birth experience (SBE) as the most important predictor for CB-PTSS [9–12]. In the context of childbirth, more objective factors such as mode of birth are also established as risk factors for CB-PTSS, i.e. individuals with cesarean sections are at higher risk for CB-PTSS [13]. However, some authors argue that childbirth can be *subjectively* perceived as highly threatening [14,15]

CONTACT Sarah Schumacher Sarah.schumacher@hmu-postdam.de Clinical Psychology and Psychotherapy, Institute for Mental Health and Behavioral Medicine, Health and Medical University Potsdam, Olympischer Weg 1, Potsdam 14471, Germany

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even in the absence of serious medical danger, e.g. during a spontaneous vaginal birth [16]. However, SBE is measured inconsistently – often referring to the overall appraisal of the birth experience [17], sometimes with a single item (e.g. "*What was your overall birth experience?*" [12,18,19]). Although assessing the overall birth experience poses a convenient approach for research purposes, it is less conducive to identifying specific aspects that contribute to a negative birth experience. To prevent and modify highly negative SBEs – that increase the risk for CB-PTSS – it is, however, crucial to refine our understanding of SBEs.

Even before SBEs were systematically studied, Harris and Ayers [1] proposed a promising approach to disentangle negative birth experiences that may be associated with CB-PTSS. In a study with women who self-identified a recent birth as traumatic, Harris & Ayers examined so-called *hotspots* – defined as moments of peak emotional distress during a traumatic event [20]. Of note, in contrast to more traditionally studied traumatic events such as motor vehicle crashes, childbirth as a physiological event in an individual's life is not necessarily traumatic in line with DSM-5 criterion A, i.e. a (perceived) life-threating event for the birthing parent or baby. However, negative or distressing (but not necessarily traumatic) birth experiences can increase the risk for mental health complications in the postpartum, for instance for CB-PTSS. Indeed van Heumen and colleagues [21] found clinically relevant levels of CB-PTSS even if the birth experiences had not been traumatic, i.e. criterion A was not met, thereby supporting the notion that especially the subjective appraisal of a birth experience might be predictive for CB-PTSS. Therefore, in the context of childbirth, *hotspots* could – as suggested by Harris and Ayers [1] – serve as a proxy to shed light on the subjectively most distressing moments during birth which potentially are highly associated with CB-PTSS. This notion is further supported by the finding that patients with PTSD usually reeexperience (e.g. during flashbacks) the content of hotspots [20,22]. In the study by Harris and Ayers [1], as the first and only study using hotspots to investigate birth experiences, 67.4% of the participants stated that they had experienced at least one hotspot during childbirth. Based on short descriptions of their worst hotspot, several themes were qualitatively identified. The most frequent theme of hotspots were interpersonal difficulties, specifically, being ignored, lack of support, poor communication, being abandoned and being put under pressure. The second most frequent theme were obstetric events, followed by pain, and events concerning the newborn, i.e. problems with the baby and separation from the baby. While these results indicate that the concept of hotspots is valuable to understand negative birth experiences, it remains unclear whether levels of perceived distress during a hotspot varies between the different types of hotspots. For instance, based on previous findings regarding mode of birth as a risk factor for CB-PTSS [13], individuals experiencing medical interventions as the worst hotspot are likely to report higher distress compared to other hotspots. Interestingly, independent from hotspots, previous research suggests that the acute emotional reaction to a traumatic birth [23,24] reliably predicts higher levels of CB-PTSS. Including the perceived degree of distress as one dimension of hotspots could contribute to a more nuanced understanding of which hotspots are particularly distressing and whether the degree of distress relates to higher CB-PTSS.

Of note, Harris and Ayers [1] found that in case of interpersonal difficulties, the development of CB-PTSD was four times more likely compared to hotspots concerning complications with the baby, suggesting that especially moments that involve interpersonal interactions (with the obstetric care providers) might be highly relevant to consider for preventing CB-PTSS. With the findings by Harris and Ayers [1] it remains, however, unknown whether interpersonal difficulties might be particularly relevant during a specific moment during birth. Findings on general risk factors for CB-PTSS demonstrate that interpersonal difficulties, such as lack of social support [9], are associated with higher CB-PTSS. Therefore, in a quantitative approach to intrapartum hotspots, it might be auspicious to consider interpersonal difficulties during the worst hotspot as an additional dimension (and not as a separate type of hotspot). Overall, a comprehensive understanding of negative birth experiences is essential in order to, first, prevent them and, second, to provide adequate support during and after such moments, thus reducing the risk for CB-PTSS.

With the present study, we aim to extend previous findings on intrapartum hotspots as a concept to study highly distressing birth experiences and to characterize the predictive potential of hotspots for CB-PTSS. Following the identified hotspot themes by Harris and Ayers [1], we propose a novel approach to investigate several dimensions of intrapartum hotspots, including the worst intrapartum hotspot, hotspot-related distress and interpersonal difficulties and support during the hotspots. Thus, for the first time, intrapartum hotspots are systematically and quantitatively studied. In individuals shortly after childbirth, we examine the following: first, frequency of different predefined types of hotspots, and second, mean

differences in hotspot-related distress, interpersonal difficulties, and CB-PTSS depending on the type of hotspot. Since no previous research has yet quantitatively measured intrapartum hotspots, the first two research questions are exploratory in nature and no directed hypotheses are included. Third, we aim to investigate whether higher levels of hotspot-related distress and hotspot-related interpersonal difficulties predict higher levels of CB-PTSS while controlling for known risk factors.

Methods

Participants and procedure

This study is part of a larger cross-sectional research project on predictors and mental health sequelae of stressful birth experiences. Between November 2022 and March 2023, $N = 1{,}140$ postpartum individuals were recruited online through paid social media advertisements [25,26][1]. Individuals were eligible for study participation if they had given birth eight to ten weeks prior to participation and had sufficient German language skills. Individuals were excluded if they did not meet the required timeframe, had terminated their last pregnancy by an abortion, or experienced a stillbirth. Eligible individuals were asked to complete an online survey, hosted on the platform EFS survey by Questback (unipark.de). Participants were informed that some questions might be perceived as distressing and that they could withdraw their participation at any given time. If participants felt distressed, information about several mental health services was provided. A voluntary raffle offering ten 30€ gift-vouchers was included at the end of the survey. An online consent form was obtained from all participants. The study protocol received approval from the ethics committee of the Department of Education and Psychology at Freie Universität Berlin, Berlin, Germany (reference no. 042/2022).

Measures

We assessed four dimensions of *intrapartum hotspots* with items that were developed based on findings of previous qualitative research [1].

1. Worst hotspot: First, we provided a short definition of hotspots, i.e. moments during or shortly after childbirth that were particularly emotionally distressing or negative. We then asked participants to retrospectively indicate which of the different options would best represent their worst hotspot. Based on the hotspots identified by Harris and Ayers [1], we defined eight different types of hotspots. Examples were provided for each hotspot to clarify their meaning: physiological events during birth (e.g. rupture of the membranes), physiological events shortly after birth (e.g. birth of the placenta), medical events during birth (e.g. episiotomy), medical events shortly after birth (e.g. blood draw), labor pain, other pain, worry about the child's health (e.g. abnormal heart sounds of the unborn child), separation from the child, and "something else" was the hotspot. In the latter case, participants additionally described the type of hotspot in an open response format. Participants also had the option to indicate that they did not experience any intrapartum hotspot.
2. Hotspot-related distress: Only participants who had reported a hotspot in the first step were subsequently asked to rate the degree of distress during the hotspot with an 11-point visual analog scale ("hotspot-related distress"), ranging from 0 (no distress) to 10 (maximum distress).
3. Interpersonal difficulties: Respondents indicated whether and to which extent they experienced interpersonal difficulties during the hotspot. Based on the findings by Harris and Ayers [1], six different potential types of interpersonal difficulties (i.e, feeling of being ignored, experiencing lack of support, experiencing lack of inadequate communication, feeling left alone, feeling of being pressured, other experiences) were rated on a scale ranging from 0 (no distress) to 3 (strong distress). A sum score (range: 0-15) was calculated, excluding the item *other experiences* due to heterogeneous answers.
4. Interpersonal support: Respondents indicated whether and to which extent they experienced interpersonal support during the hotspot. Six categories (i.e. feeling of being taken seriously, experiencing adequate support, experiencing adequate communication, the feeling of not being alone, the feeling of having control, other experiences) were rated a scale from 0 (no support) to 3 (strong support).

Childbirth-related posttraumatic stress symptoms and *traumatic childbirth* exposure were assessed using the City Birth Trauma Scale (City BiTS, [8,27]), a 29-item self-report questionnaire with good to excellent reliability ($\alpha = 0.89$–0.92 [27]) based on the DSM-5 criteria for PTSD. Next to assessing trauma exposure (criterion A, i.e. "Did you believe you or your baby would be seriously injured?" and "Did you believe you or your

baby would die?"; yes/no), it measures symptom frequency (20 items) in the four DSM-5 symptom domains (i.e. intrusion, avoidance, negative mood/cognition, and hyperarousal) and symptoms of dissociation (2 items) on a 4-point Likert Scale. The remaining five items concern symptom onset, duration, distress (yes/sometimes/no), impairment (yes/sometimes/no), and the exclusion criterion (symptoms due to medication, alcohol, drugs or physical illness; yes/maybe/no). The scale offers two uses: evaluating CB-PTSD diagnostic criteria or quantifying symptom load via a sum score (range: 0–60). In this study, the sum score was used as a measure for CB-PTSS and reliability was excellent ($\alpha = 0.90$).

Demographic variables included self-reported age, relationship status, level of education, and income. In addition, participants reported if and if any which diagnoses of a mental disorder they had received before or since their last birth (in case of diagnosis, multiple answers were possible).

Pregnancy- and childbirth-related variables included information on self-reported gestational length, parity, mode of birth, and pregnancy complications. In case of pregnancy complications, participants additionally indicated the type of complications. SBE was assessed with a single item ("*How did you experience your last birth overall?"),* using a 11-point scale, ranging from 0 (very negative) to 10 (very positive) [28].

Statistical analysis

To ensure sufficiently large groups for our analysis and for easier interpretation, the hotspots physiological events during and shortly after birth were summarized as *physiological events*, medical events during and shortly after birth were summarized as *medical interventions*. Finally, labor pain and other pain were summarized as *pain*. Differences in hotspot-related distress, interpersonal difficulties, and CB-PTSS by type of hotspot were estimated with Welch analysis of variance (ANOVA) and Games-Howell post-hoc tests because the assumption of variance equality was violated.

Associations between potential confounding variables, i.e. mental disorders before last birth, current depressive disorders, pregnancy complications, length of gestation, primiparity, operative birth, SBE, DSM-5 criterion A for PTSD [9,10,29], and the outcome variable (CB-PTSS) were tested with Spearman rank correlation for continuous and dummy-coded binary variables. Only covariates that were significantly associated with CB-PTSS, namely, mental disorder before last birth, current depressive disorder, operative birth, parity, pregnancy complications, the DSM-5 criterion A for PTSD, and SBE, were included in the regression analysis (r ranging from 0.09 to 0.55, $p < .001$–$p < .01$). Calculating the variance inflation factor (VIF) for the predictor variables, no multicollinearity was found (all VIF <5). Next, hierarchical multiple regression models were calculated to determine the unique contribution of hotspot-related distress and interpersonal difficulties during the hotspot to predict CB-PTSS. After identifying the regression models, multivariate outlier analyses (e.g. Cook's distance) revealed no values of concern. All other assumptions for regression analysis were sufficiently met. All analyses were conducted in *R*, version 4.2.1 [30]. Additional information about data preparation and statistical analysis can be found in the Supplementary Material of this article.

Results

Sample characteristics

Descriptive statistics of the sociodemographic, pregnancy- and childbirth-related variables are presented in Table 1 (for more details about current mental disorders see Table S2 of the Supplemental Material). Overall, 79.4% ($n = 908$) indicated that they had experienced a hotspot during their last birth (see Table 2 for the distribution of hotspot categories). On average, participants reported a level of hotspot-related distress of $M = 5.6$, $SD = 3.54$ (range 0–10); and interpersonal difficulties of $M = 4.4$, $SD = 4.59$ (range 0–15). For CB-PTSS, participants reported on average City BiTS sum scores of $M = 13.2$, $SD = 11.2$ (range 0–54).

A total of 25.4% ($n = 290$) of the sample experienced birth as a traumatic event according to the DSM-5 A criterion for PTSD; 5.7% ($n = 65$) fulfilled all four symptom criteria for CB-PTSD; 42 participants (3.7%) met all criteria for the full diagnosis of CB-PTSD.

Differences in hotspot-related distress, interpersonal difficulties, and CB-PTSS between the type of hotspots

A one-way Welch ANOVA including all participants who experienced a hotspot revealed that hotspot-related distress differed significantly between the types of hotspot, F_{Welch} (5, 298.23) = 9.73, $p < .001$, $\omega^2 = 0.13$, Figure 1. Individuals reporting a *physiological event* as their hotspot reported the lowest hotspot-related distress levels compared to individuals with any other type of hotspot (p from < 0.001 to < .05). Hotspot-related distress levels were the highest for *separation from child* and they differed significantly from *medical*

Table 1. Demographic, psychopathological, pregnancy- and childbirth-related sample characteristics ($N = 1140$).

	M (SD)/*n* (%)
Age	32.3 (4.24)
Relationship status	
Single	25 (2.2%)
In a relationship	299 (26.2%)
Married	806 (70.7%)
Other	8 (0.7%)
Prefer not to answer	2 (0.2%)
Level of education	
PhD	57 (5.0%)
University degree	676 (59.3%)
Vocational training	315 (27.6%)
University entrance diploma	78 (6.8%)
Lower secondary school diploma	14 (1.2%)
Monthly household income	
<1000 €	23 (2.0%)
1000–1500 €	46 (4.0%)
1500–2000 €	99 (8.7%)
2000–3000 €	225 (19.7%)
3000–5000 €	511 (44.8%)
>5000 €	206 (18.1%)
Prefer not to answer	30 (2.6%)
Mental disorder before last birth	
Yes	219 (19.2%)
No	913 (80.1%)
Prefer not to answer	8 (0.7%)
Mental disorder since last birth	
Yes	67 (5.9%)
No	1069 (93.8%)
Prefer not to answer	4 (0.4%)
Current depressive disorder	
Yes	46 (4.0%)
No	1090 (95.6%)
Prefer not to answer	4 (0.4%)
Current PTSD	
Yes	21 (1.8%)
No	1115 (97.8%)
Prefer not to answer	4 (0.4%)
Pregnancy complications	
Yes	327 (28.7%)
No	813 (71.3%)
Length of gestation (weeks)	39.6 (1.91)
Parity	
Primparous	730 (64.0%)
Multiparous	410 (36.0%)
Mode of birth	
Spontaneous vaginal birth	607 (53.2%)
Induced vaginal birth	158 (13.9%)
Instrumental vaginal birth	106 (9.3%)
Planned c-section	64 (5.6%)
Unplanned c-section	156 (13.7%)
Emergency c-section	49 (4.3%)
Subjective childbirth experience (SBE)	6.64 (2.84)

For age, data was missing for $n = 13$ participants. Relationship status: 'other' included e.g. divorced/separated, engaged, cohabiting. Instrumental vaginal birth = vacuum extraction or forceps. C-section: Cesarean section. Unplanned c-section: c-section with prior informed written consent. Emergency c-sections: c-section without prior informed written consent.

Table 2. Number of participants per hotspot category ($N = 1{,}140$).

	n (%)
Physiological events	169 (14.8%)
Medical interventions	292 (25.6%)
Pain	192 (16.8%)
Worry about child's health	111 (9.7%)
Separation from child	69 (6.1%)
Something else	75 (6.6%)
No hotspot	232 (20.4%)

Examples for the category 'something else' included experiencing multiple distressing moments, being separated from the partner due to COVID regulations and negative interactions with the obstetric staff.

interventions ($p < .001$) and *worry about the child's health* ($p < .05$).

Another Welch ANOVA including all participants who experienced a hotspot revealed that interpersonal difficulties differed by the type of hotspot, F_{Welch} (5, 293.06) = 18.7, $p < .001$, $\omega^2 = 0.23$, Figure 2. Individuals reporting a *physiological event* as their hotspot reported the lowest interpersonal difficulty scores compared to individuals with *medical interventions* ($p < .001$), *separation from a child* ($p < .001$), and *something else* ($p < .001$).

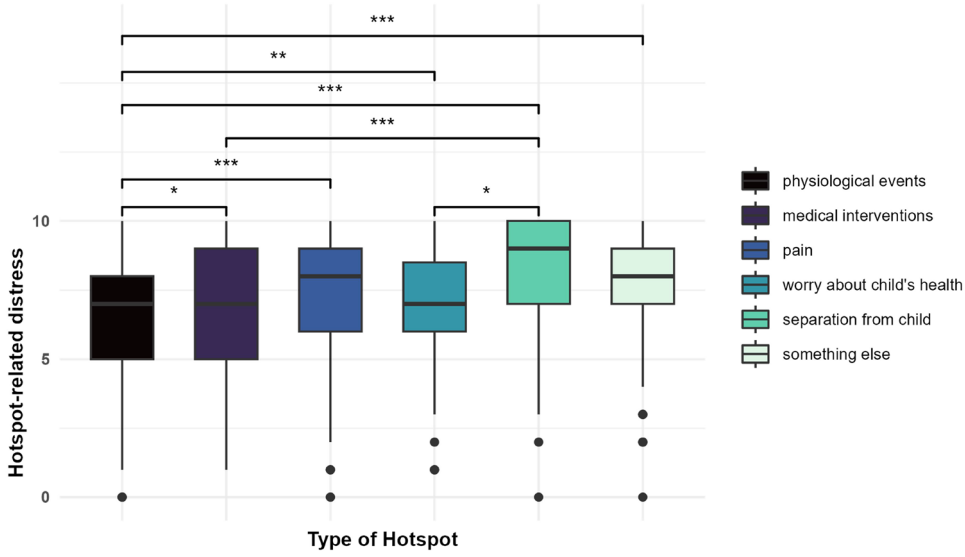

Figure 1. Differences in hotspot-related distress between the type of hotspots and results Games-Howell post-hoc test ($n = 908$). Only significant differences are displayed. *p <.05; **p <.01; ***p <.001.

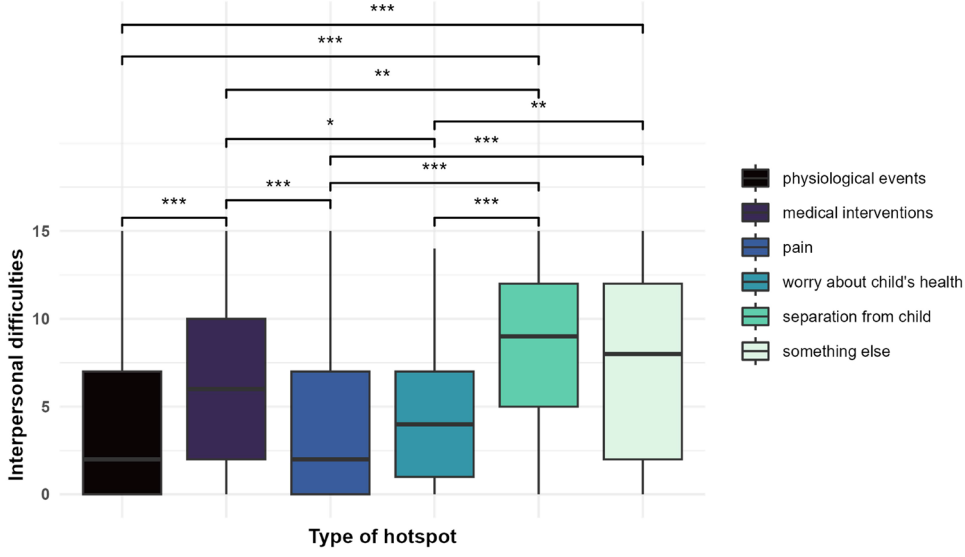

Figure 2. Differences in interpersonal difficulties between the type of hotspot and results of Games-Howell post-hoc test ($n = 903$). The sample size is slightly reduced due to $n = 5$ missing data for hotspot interpersonal difficulties. Only significant differences are displayed. *p <.05; **p <.01; ***p <.001.

Interpersonal difficulty scores were the highest for separation from the child and differed significantly form *physiological events* ($p < .001$), *medical interventions* ($p < .01$), *pain* ($p < .001$), and *worry about the child's health* ($p < .001$).

Finally, a Welch ANOVA including all participants revealed significant differences in CB-PTSS by type of hotspot, F_{Welch} (6, 344.1) = 45.05, p < .001, ω^2 = 0.43, Figure 3. Participants without a hotspot had significantly lower CB-PTSS than women with any other hotspot type (all $p < .001$). Again, the highest CB-PTSS scores were found for *separation from a child*; they differed significantly from *physiological events* and *pain* (both $p < .01$). For means and standard deviations of hotspot-related distress, interpersonal difficulties, and CB-PTSS by type of hotspot see Table S3 of the Supplementary Material.

Hotspot-related distress and interpersonal difficulties as predictors for CB-PTSS

To explore whether hotspot-related distress and interpersonal difficulties predict CB-PTSS in participants with a hotspot above and beyond established predictors, two different regression models were calculated and compared to each other (see Table 3). In Model 1

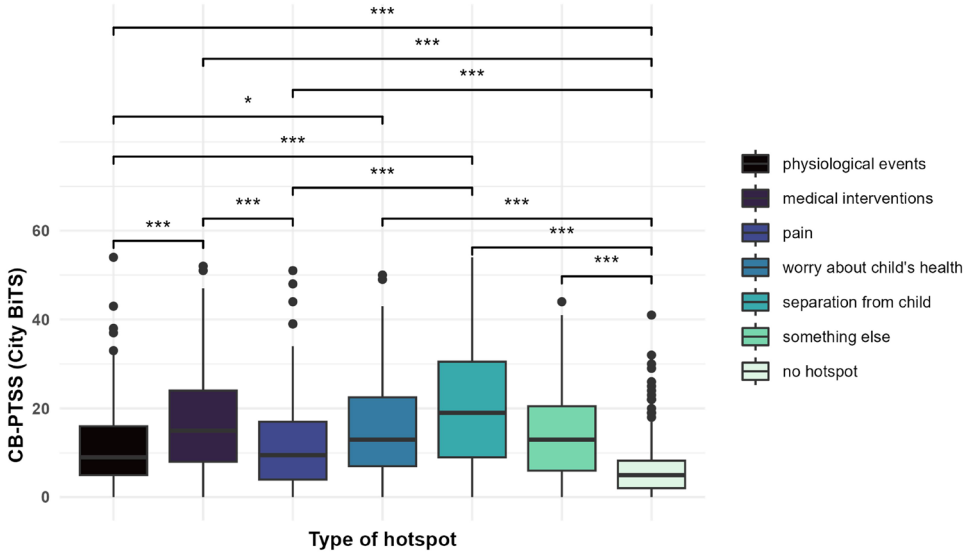

Figure 3. Differences in CB-PTSS between the type of hotspots and results Games-Howell post-hoc test ($n = 1127$). The sample size is slightly reduced due to $n = 13$ missing data for CB-PTSS. Only significant differences are displayed. *p <.05; **p <.01; ***p <.001.

Table 3. Multiple regression analysis models exploring the impact of hotspot-related distress and interpersonal difficulties on CB-PTSS ($n = 886$)[a].

	Model 1					Model 2				
	Beta	*b**	*SE*	*t*	*p*	*Beta*	*b**	*SE*	*t*	*p*
Covariates										
Mental disorder before last birth[b]	1.38	0.05	0.75	1.84	.067	1.33	0.05	0.69	1.92	.055
Current depressive disorder[b]	9.76	0.18	1.42	6.85	<.001***	9.44	0.18	1.31	7.20	<.001***
Pregnancy complications[b]	1.36	0.06	0.64	2.13	.033*	0.65	0.03	0.59	1.10	.272
Primiparity[b]	0.25	0.01	0.65	0.38	.705	−0.65	−0.03	0.60	−1.08	.278
Operative birth[b]	0.04	0.00	0.67	0.06	.953	0.18	0.01	0.62	0.29	.770
SBE	−1.96	−0.49	0.12	−16.30	<.001***	−1.35	−0.34	0.12	−10.85	<.001***
Criterion A PTSD DSM-5[b]	4.71	0.19	0.68	6.96	<.001***	3.75	0.15	0.63	5.96	<.001***
Predictors										
Hotspot-related distress						0.28	0.06	0.13	2.14	.033*
Hotspot interpersonal difficulties						0.80	0.33	0.07	12.00	<.001***
R^2 *adj.*	0.406					0.497				
R^2 change						0.092***				

Instrumental vaginal birth = vacuum extraction or forceps. C-section: Cesarean section. Criterion A for PTSD according to DSM-5 indicates trauma exposure. SBE: subjective birth experience, Beta: unstandardized coefficient. b* = standardized coefficient.
[a]$n = 908$ experienced a hotspot. The sample size for the regression analysis is slightly reduced due to missing data for (diagnosis of) mental disorder before last birth, current depressive disorder, hotspot interpersonal difficulties and CB-PTSS.
[b]Categorical variables were dummy coded ("*yes*" =1, "*no*" = 0). Operative birth is based on the variable mode of birth, which was dichotomized (comparing spontaneous and induced vaginal births against instrumental and cesarean sections).
*p < .05, **p < .01, ***p < .001.

current depressive disorder, the DSM-5 PTSD A criterion, pregnancy complications, and SBE predicted CB-PTSS and explained 40.6% of the variance, $F(11, 874) = 55.7$, $p < .001$. In Model 2, adding hotspot-related distress and interpersonal difficulties predicted significantly higher CB-PTSS scores, explaining an additional 9.2% of the variance, $F(13, 872) = 68.12$ $p < .001$.

Discussion

With this study, we aimed to gain insight into aspects of negative childbirth experiences that are associated with CB-PTSS by using the concept of intrapartum hotspots. Around 80% of the participants experienced a hotspot during their last birth, underscoring the relevance of the concept in the context of childbirth. The types of hotspot were differentially related to distress and interpersonal difficulties during a hotspot as well as CB-PTSS, respectively. Notably, our findings indicate that in particular separation from the child might be a highly distressing experience and might increase the risk for CB-PTSS. Our findings further revealed that hotspot-related distress and interpersonal difficulties during the hotspot predicted higher CB-PTSS, even when controlling for established risk factors such as operative birth.

In the first step, we found a similar pattern in the distribution of hotspots compared to the only previous study on intrapartum hotspots [1], with medical interventions being the most frequently reported worst

hotspot, followed by pain, worry about the child's health, and separation from the child. In contrast to Harris and Ayers [1], we included physiological events as an additional type of hotspot to account for the possibility that regular events occurring during or after birth, such as the rupture of the membranes, might still be perceived as emotionally distressing.

The second step revealed that hotspot-related distress, interpersonal difficulties and CB-PTSS differed between the types of hotspots. These findings indicate that interpersonal difficulties can occur *during* other types of hotspots such as medical interventions. This supports our decision to not include interpersonal difficulties as a distinct category of hotspots, which differs from the findings by Harris and Ayers [1]. Notably, separation from the child was associated with the highest levels of hotspot-related distress, interpersonal difficulties, and CB-PTSS, respectively. Thus, being separated from the child shortly after birth might be a particularly susceptible moment for experiencing birth as highly stressful and subsequently developing symptoms of CB-PTSS. Conversely, uninterrupted skin-to-skin contact between the mother and the newborn in the first hour after birth reduces maternal stress levels [31], promotes bonding [32], and facilitates the initiation of breastfeeding [33]. Early separation from the baby can therefore potentially also interfere with the mother-infant relationship. CB-PTSS is, in turn, also associated with impaired mother-infant bonding [3,17]. As such, the separation may initiate a vicious cycle of interrupted bonding and the development of CB-PTSS. It is therefore important to provide prompt support to all individuals experiencing separation from their child in order to avoid the consequences for the mother-child relationship and maternal CB-PTSS. In line with this, a pilot study suggests that filming the baby during separation, allowing the mother to watch it live, may improve childbirth experience and reduce the risk of CB-PTSD [34]. It must be noted, however, that in our study CB-PTSS scores did not significantly differ between separation from the child and worry about the child's health, indicating that events concerning the baby in general are associated with a high risk for CB-PTSS. Further, it is also noteworthy that separation from child did not differ significantly from "something else" in hotspot-related distress, interpersonal difficulties, and CB-PTSS. The "something else" category included heterogeneous experiences, such as experiencing multiple distressing moments. Initial studies on hotspots have similarly found that most participants reported more than one hotspot [1,20]. We did not explicitly measure the number of hotspots but focused on the worst hotspot. The moment of peak emotional distress may be linked to heightened arousal, which, in turn, impedes the emotional processing of the traumatic event [20] and potentially increases the risk for CB-PTSS. However, future studies could evaluate whether the number of hotspots reflects the perceived severity of a traumatic event and whether this predicts CB-PTSS.

In the present study, medical interventions were linked to higher levels of interpersonal difficulties (compared to physiological events, pain, and worry about the child's health) and to higher levels of CB-PTSS (compared to physiological events and pain). Medical interventions, in contrast to physiological events, for example, inherently involve interactions with medical staff, which may increase the risk for interpersonal difficulties. Consistent with previous findings on the predictive role of lack of interpersonal support and operative births for CB-PTSS [10,12,13], our results suggest that respectful and supportive interactions during medical interventions could help mitigate this risk. We also found that physiological events were related to the lowest levels of distress, interpersonal difficulties, and CB-PTSS (with the exception of individuals without a hotspot, who had even lower CB-PTSS scores). Potentially, these individuals did not experience unexpected, sudden changes during the course of birth that in turn might require interventions. Therefore, the risk for interpersonal difficulties and thus, CB-PTSS might be low.

Lastly, our findings revealed that hotspot-related distress and interpersonal difficulties predict CB-PTSS beyond other well-established risk factors. In the literature on general PTSD, the severity of a traumatic event is a known risk factor [35]. High levels of intrapartum hotspot-related distress may equally be considered as a risk factor: hotspots are particularly present in memory in terms of intrusions [20] and can therefore potentially act as a proxy for overall severity. In our sample, interpersonal difficulties significantly predicted CB-PTSS. Together with the literature on low social support by the staff as a risk factor for CB-PTSS [10], this suggests that providing supportive, trauma-informed obstetric care might be a promising starting point for preventing CB-PTSS [36].

Taken together, our findings indicate that especially individuals who were separated from their child have a high risk for CB-PTSS and should therefore be closely monitored. Our study conclusively demonstrates that the development of CB-PTSS is not solely determined by the presence of hotspots, but also by their perceived distress and potential interpersonal difficulties. Measuring these aspects could assist identifying individuals at risk for CB-PTSS, thereby enabling the provision of preventive interventions as early as possible. Of

the few available (secondary) preventions for CB-PTSS, trauma-focused therapies such as EMDR [37] but also brief, midwife-led, supportive psychological counseling in the first days after birth pose very promising approaches ([38], Dekel et al. 2023 [39]). In light of this finding, the concept of hotspots may be a useful tool in identifying the most distressing events of birth. This may provide relevant information which need to be addressed in, for instance, a counseling session. Hence, obstetric staff could use the assessment of hotspots as a measure to determine people's risk of CB-PTSS.

Several limitations of this study should be noted. Though we aimed to recruit a non-selected sample by using social media advertisements, our sample is rather homogeneous, i.e. highly educated and with a high income, thus limiting generalizability. Because we used self-report questionnaires, clinical validity regarding information about complications during childbirth and prior and current mental disorders is limited. The retrospective cross-sectional study design hinders clear causal inferences, emphasizing the need for longitudinal studies to confirm the predictive role of hotspots CB-PTSS.

Our study is the first to quantitatively examine different dimensions of intrapartum hotspots in a large, non-clinical sample. Our findings suggest that assessing the type of hotspot that was experienced might provide insight into moments of birth that are particularly distressing and related to CB-PTSS. Overall, characterizing negative birth experiences is a crucial step in refining etiological models of CB-PTSS and developing efficacious prevention strategies.

Note

1. In research on postpartum mental health, the terms 'women' and 'mother' are commonly used. However, it is important to acknowledge that not all individuals who can carry a pregnancy to term identify as women (36). Therefore, in line with recent calls for more accurate consideration of sex and gender in reproductive psychiatry research (25,26), we aimed for a gender inclusive research approach, e.g. by avoiding the term 'women' in our recruitment materials.

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Authors contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Meike K. Blecker, Daria Dähn, and Sinha Engel. The first draft of the manuscript was written by Meike K. Blecker and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Ethical approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Freie Universität Berlin, Berlin, Germany (No. 042/2022).

Consent form

Informed consent was obtained from all individual participants included in the study.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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ORCID

Meike K. Blecker http://orcid.org/0000-0003-1378-8186
Daria Daehn http://orcid.org/0000-0001-7373-6367
Sinha Engel http://orcid.org/0000-0001-9289-7094
Susann Steudte-Schmiedgen http://orcid.org/0000-0002-1171-7133
Susan Garthus-Niegel http://orcid.org/0000-0002-7472-674X
Christine Knaevelsrud http://orcid.org/0000-0003-1342-7006
Sarah Schumacher http://orcid.org/0000-0002-6955-3493

Data availability statement

Due to the sensitive nature of the research supporting data is not publicly available. Analysis code is available at: https://osf.io/p3mcu/?view_only=06caa981c8b54fe8873513d88a60b56b

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