Journal of Affective Disorders 292 (2021) 121–130

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research paper

Differential predictors of birth-related posttraumatic stress disorder symptoms in mothers and fathers – A longitudinal cohort study

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ARTICLE INFO

Keywords:
Birth
Labor
Postpartum disorders
PTSD
Posttraumatic stress disorder
DREAM study

ABSTRACT

Background: Evidence on risk factors of birth-related posttraumatic stress disorder (PTSD) symptoms in mothers is increasing, whereas fathers are less examined. This study aims to determine differential predictors of PTSD symptoms in mothers and fathers.

Methods: Data derive from the DREAM study, including 1,146 mothers and 828 fathers. We assessed mental health, work, and sociodemographic factors during pregnancy, pregnancy- and birth-related factors, and birth-related PTSD symptoms using the Impact of Event Scale-Revised 8 weeks postpartum. Structural equation models were estimated to examine associations between predictors and latent factors of PTSD symptoms for mothers and fathers simultaneously. Scaled chi-square difference tests were used to investigate differences between both groups in predictors.

Results: Clinically relevant birth-related PTSD symptoms were found in 2.3% of mothers and 0.7% of fathers. Depressive and anxiety symptoms, pregnancy complications, and poorer subjective birth experience predicted PTSD symptoms in both groups. Additionally, lower support during birth and an unplanned cesarean section predicted PTSD symptoms in mothers, whereas lower job satisfaction, higher job burden, being first-time father, lower education, and mothers' lower support during birth were predictors for fathers. We found significant differences between groups regarding job burden during pregnancy, support during birth, and an unplanned cesarean section.

Limitations: Generalization of findings might be limited by self-selection bias and some systematic dropout.

Conclusions: Our results suggest differential predictors of PTSD symptoms in mothers and fathers. For fathers, less examined factors such as work factors may be important. Identifying differential risk factors may lead to customized prevention and treatment offers.

1. Introduction

While childbirth represents a positive experience for most mothers and fathers, it can also potentially be traumatic when birth is experienced as threatening the health of the mother or the child. Consequently, parents can suffer from birth-related posttraumatic stress disorder (PTSD) including symptoms of intrusion, avoidance, hyperarousal, and negative alterations in cognitions and mood (American Psychiatric Association, 2013).

In their recent systematic review and meta-analysis, Yildiz et al. (2017) found that during the first year postpartum 5.9% of women met diagnostic criteria for birth-related PTSD. Being a significant public health issue (Bauer et al., 2014), maternal birth-related PTSD has negative implications for health and relations of the whole family (Cook et al., 2018; Garthus-Niegel et al., 2017; Garthus-Niegel et al., 2018a; Garthus-Niegel et al., 2018b).

Fathers have been widely neglected in this research area. However, nowadays most fathers accompany women at childbirth (Redshaw and

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https://doi.org/10.1016/j.jad.2021.05.058
Received 10 September 2020; Received in revised form 15 May 2021; Accepted 23 May 2021
Available online 27 May 2021

Henderson, 2013; Xue et al., 2018) which can be traumatic if they are perceiving that mother or child are in danger during birth (American Psychiatric Association, 2013). First studies found that 0-5% of fathers suffer from birth-related PTSD (Ayers et al., 2007; Bradley et al., 2008; Skari et al., 2002; Zerach and Magal, 2016a, 2016b). It can be assumed that fathers are affected more seldom than mothers and exhibit lower symptom levels (Bradley et al., 2008; Iles et al., 2011; Skari et al., 2002) but opposite findings exist (Ayers et al., 2007). However, comparability of estimates is limited by study heterogeneity.

The most recent etiological model of birth-related PTSD is the evidence based diathesis-stress model (Ayers, 2004; Ayers et al., 2016). The authors propose that prepartum vulnerability factors interact with risk factors during childbirth and thus affect appraisal of birth. Hence, women may perceive childbirth as traumatic and develop PTSD symptoms. Postpartum factors can lead to maintenance of symptoms (Ayers, 2004; Ayers et al., 2016). In their meta-analysis, Ayers et al. (2016) identified factors that showed the strongest associations with maternal birth-related PTSD: *vulnerability factors* include depression in pregnancy, fear of childbirth, pregnancy complications, and former PTSD or psychological problems; *risk factors during birth* refer to birth experience, operative birth, low support, and dissociation; *postpartum factors* comprise comorbid psychological symptoms, stress, and low coping. Previous research supports the notion that subjective birth factors, such as birth experience, are of greater importance than objective birth factors (Dekel et al., 2017; Garthus-Niegel et al., 2013).

The few studies on risk factors of birth-related PTSD in fathers are limited to small- to medium-sized samples and vary in time of measurement (Ayers et al., 2007; Bradley et al., 2008; Iles et al., 2011; Johnson, 2002). As in mothers, the majority of literature suggests that also in fathers the subjective birth experience is more important than objective birth factors (Bradley et al., 2008; Zerach and Magal, 2016b). Other associated factors include feeling pressured to attend childbirth and not being supportive during birth (Johnson, 2002), trait anxiety, unplanned pregnancy, feeling less prepared, more distressed and less confident (Bradley et al., 2008), being first-time father and lower age (Iles et al., 2011), lower education (Zerach and Magal, 2016b), and prior PTSD symptoms (Zerach and Magal, 2016a, 2016b). More research on fathers is needed, particularly in comparison to mothers as to our knowledge, only two studies from the UK included both mothers and fathers finding little evidence of differential effects (Ayers et al., 2007; Iles et al., 2011). However, one of this studies was limited to a rather small sample and cross-sectional design (Ayers et al., 2007), while the other study had a moderate sample size and longitudinal design, but did not investigate the role of birth-related factors (Iles et al., 2011).

Interestingly, the role of work factors for birth-related PTSD has received little consideration in studies of both mothers and fathers although work is affected by many changes in the transition to parenthood. Recent studies found that high job burden, low job satisfaction, precarious working conditions, and psychosocial work stress during pregnancy were related to maternal postpartum depression (Karl et al., 2020; Schaber et al., 2020). In terms of birth-related PTSD, an Iranian study found that working mothers were at higher risk than housekeeping mothers (Shaban et al., 2013). Another study found that maternal employment and paternal unemployment were linked to more PTSD symptoms in mothers but not in fathers (Tofighi Naeem et al., 2019). Thus, more research on the role of work factors is needed. In that regard, job satisfaction and job burden are of special interest because those factors can be considered as indicators of either positive or negative aspects of work (DIN-Normenausschuss Ergonomie [NAErg], 2016; Schnorpfeil et al., 2003) and were found to be linked to maternal peripartum mental health; for more information see Schaber et al. (2020).

Altogether, it can be concluded that a growing number of studies have provided insights into prevalence and risk factors for mothers whereas determinants in fathers are much less investigated. Moreover, group comparisons are rare and, in all studies, work factors have been considered insufficiently.

Therefore, this study aims at examining the prospective associations of prepartum (including rarely examined work factors) and peripartum factors with birth-related PTSD symptoms in mothers and fathers 8 weeks postpartum. Moreover, potential differences between maternal and paternal predictors will be identified.

2. Methods

2.1. Design

Data are drawn from the Dresden Study on Parenting, Work, and Mental Health (**DREAM**; "**DR**esdner Studie zu **E**lternschaft, **A**rbeit und **M**entaler Gesundheit"), a prospective cohort study including a community sample of $N = 3{,}865$ parents, i.e., 2,230 mothers, 1,619 male partners, and 16 female partners, expecting a child in Dresden, Germany. From June 2017 to the end of 2020, expectant mothers and their partners have been recruited during pregnancy mainly at birth information evenings in obstetrical clinics and in midwife practices. Inclusion criteria comprise a current pregnancy, being a resident in the area, and sufficient German skills. The DREAM study aims to examine the longitudinal associations between parental work participation, role distribution, stress factors, and how such factors affect perinatal outcomes and family mental and somatic health (Kress et al., 2019). Therefore, participants are asked to complete questionnaires at six time points: during late pregnancy (T1), 8 weeks after the anticipated birth date (T2), and 14 months (T3), 2 years (T4), 3 years (T5), and 4.5 years (T6) after birth. For this study, only data from T1 and T2 were used due to the study's specific focus on the associations of prepartum and peripartum factors with PTSD symptoms closely after birth. The DREAM study has been approved by the Ethics Committee of the Faculty of Medicine of the Technische Universität Dresden (No: EK 278062015). All participants provided written informed consent. For details about the study, see Kress et al. (2019).

2.2. Sample

From June 2017 to August 2019, $N = 2{,}546$ individuals, $n = 1{,}471$ mothers and $n = 1{,}075$ fathers, were enrolled in the DREAM study. For this study, parents were excluded if they had not returned any of the questionnaires, had not completed T1 or T2 in time, T2 had not been due yet, and in case of a stillborn child (for flowchart, see Fig. 1). Thus, we used data for $n = 1{,}146$ mothers and $n = 828$ fathers at T1 (i.e., 794 couples). At T2, the final sample comprised $n = 1{,}028$ mothers and $n = 698$ fathers (i.e., 650 couples). The retention rate from T1 to T2 was 88.8% for mothers and 82.7% for fathers.

2.3. Measures

Mental health, work, and sociodemographic factors were assessed during pregnancy (T1) while history of PTSD, pregnancy-related factors, birth-related factors, and birth-related PTSD symptoms were measured 8 weeks after the anticipated birth date (T2). All variables were assessed for both groups except from pregnancy complications and some birth factors, which were based on maternal report and assigned to both partners.

2.3.1. Birth-related PTSD symptoms

Birth-related PTSD symptoms were measured 8 weeks postpartum using the German version of the Impact of Event Scale-Revised (IES-R; Maercker and Schützwohl, 1998). This 22-item self-rating scale measures symptoms of intrusion (7 items, e.g., "Pictures about childbirth popped into my mind"), avoidance (8 items, e.g., "I tried to remove childbirth from my memory"), and hyperarousal (7 items, e.g., "I felt irritable and angry"). Respondents were asked to evaluate how frequently they have been distressed by difficulties in relation to childbirth during the last seven days. Higher scores indicate more

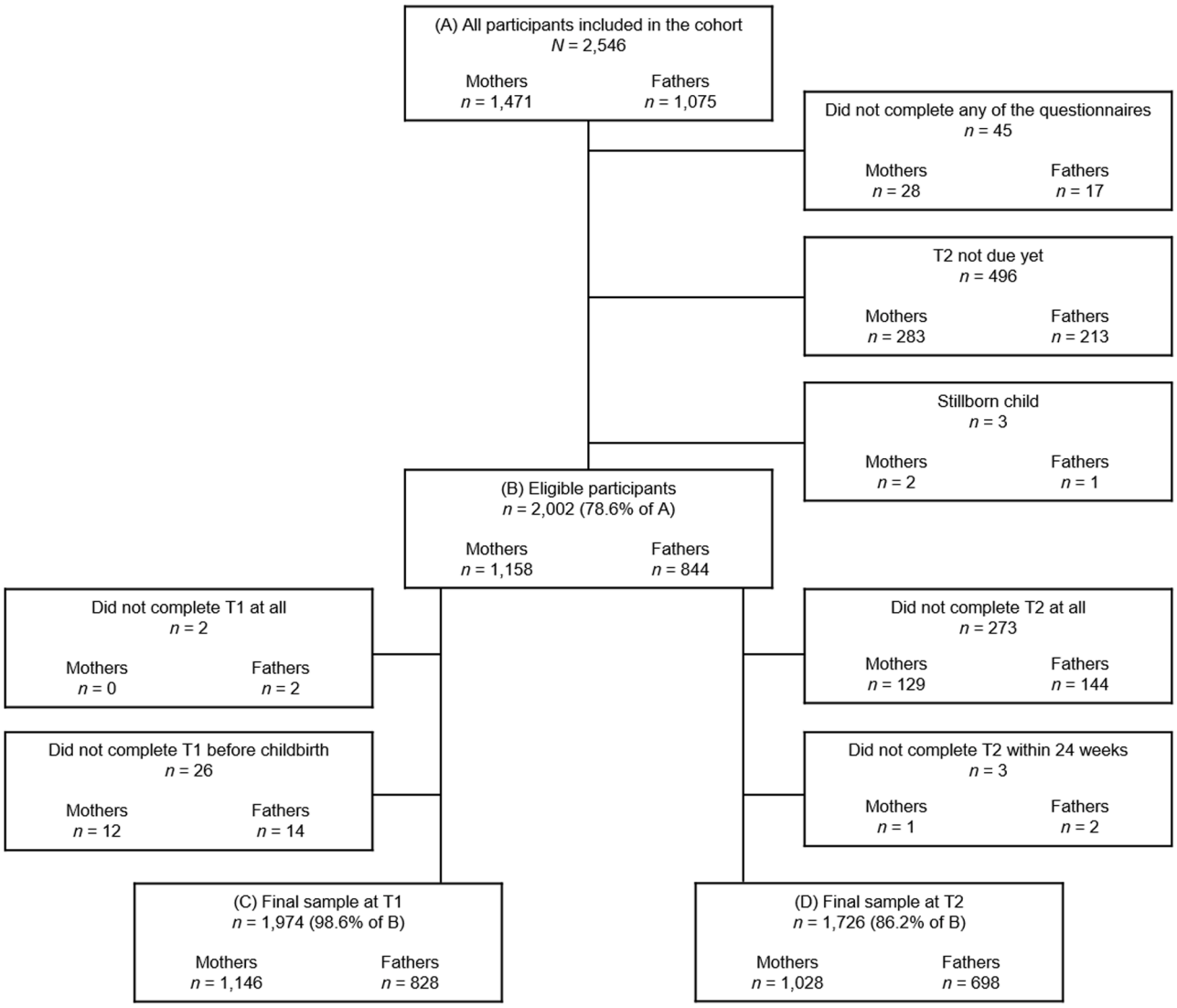

Fig. 1. Flow chart of participants. Participants were excluded from all analyses if they had not completed any of the questionnaires, T2 had not been due yet, and in case of a stillborn child. At T1 (during late pregnancy), data from participants not having completed the first questionnaire before childbirth or not at all was not used. At T2 (8 weeks after anticipated birth date), data from participants not having completed the second questionnaire within 24 weeks after childbirth or not at all was not used.

pronounced birth-related PTSD symptoms. Cutoffs for clinically relevant PTSD have been reported previously for the English version of the IES-R (Creamer et al., 2003; Morina et al., 2013; Weiss and Marmar, 1996); however, in the German version of the IES-R, the response options from the original Impact of Event Scale (IES; Horowitz et al., 1979) have been retained. Thus, it is not appropriate to use the cutoffs of the English version of the IES-R for the German version. Therefore, to report prevalence rates in this study, the widespread cutoff ≥ 35 (Neal et al., 1994) for the original IES only including symptoms of intrusion and avoidance (but not hyperarousal) was used. The subscales intrusion ($\alpha = .75$), avoidance ($\alpha = .74$), and hyperarousal ($\alpha = .66$) had all good reliabilities, albeit somewhat lower reliabilities compared to the ones reported in validation studies in other populations (Creamer et al., 2003; Maercker and Schützwohl, 1998).

2.3.2. Other mental health factors

Depressive symptoms during pregnancy were assessed by the German version of the Edinburgh Postnatal Depression Scale (EPDS; Bergant et al., 1998; Cox et al., 1987), an established 10-item self-rating scale in the peripartum period. Mothers and fathers were asked about how much they agree to statements about their well-being (e.g., "I have felt sad or miserable") during the last seven days. The total score ranges from 0 to 30 with a higher score indicating more depressive symptoms. A total score of ≥ 10 serves as a cutoff for a clinically relevant minor depression, a total score of ≥ 13 refers to a clinically relevant major depression in women (Bergant et al., 1998) and men (Matthey et al., 2001). In this study, reliability was high ($\alpha = .83$).

Anxiety symptoms during pregnancy were assessed using the German version of the 10-item subscale anxiety of the Symptom Checklist-Revised (SCL-90-R; Derogatis, 1977; Franke and Derogatis, 2002). The participants were asked how much they have been burdened by anxiety symptoms (e.g., "heart pounding or racing") during the last seven days. The total score reaches from 0 to 40 with a higher score indicating more anxiety symptoms. There is no cutoff for clinically relevant anxiety symptoms so far (Franke and Derogatis, 2002). Reliability in this sample was good ($\alpha = .75$).

History of PTSD was assessed by asking respondents whether they had received a diagnosis of PTSD at any time but with an onset before childbirth.

2.3.3. Work factors

Working status was measured as **working full-time** and **working**

part-time prior to pregnancy (German National Cohort Consortium, 2014).

Job satisfaction and job burden during pregnancy were assessed with one five-point Likert scale item, each. Employed respondents were asked how satisfied they had been with their job (1 = *very unsatisfied* to 5 = *very satisfied*) and how heavily they had been burdened by their job (1 = *not burdened* to 5 = *very heavily burdened*). Questions were derived from the German study called Bremer Initiative zur Stärkung frühkindlicher Entwicklung.

2.3.4. Pregnancy-related factors

Pregnancy complications (ranging from 0 to 12) were reported by mothers based on the maternity records. Complications included for example bleedings or preeclampsia. An index of the number of pregnancy complications (0, 1, 2, and ≥ 3) was generated.

2.3.5. Birth-related factors

Preterm birth was defined by birth before the 37th week of gestation.

Subjective birth experience was measured by a single question derived from the Akershus Birth Cohort Study (Garthus-Niegel et al., 2013), "What was your overall experience of the birth?", ranging from 0 (*very good*) to 10 (*extremely bad*).

Perceived **support during birth** was assessed by "To what degree did you feel taken care of yourself (your needs, wishes, and well-being) around the birth?" ranging from 0 (*not at all*) to 10 (*completely*), derived from the Akershus Birth Cohort Study (Garthus-Niegel et al., 2013).

Duration of labor (time from onset of regular labor activity and opening of the cervix) was coded as usual (≤ 12 hours; 0) or long (> 12 hours; 1). Unlikely high durations of labor (≥ 72 hours; $n = 8$) were coded as missing.

Delivery mode was categorized into vaginal delivery, vaginal-assisted birth, planned cesarean section, and unplanned cesarean section. In structural equation models, delivery mode was dummy coded with a vaginal delivery as the reference group.

The occurrence of **episiotomy** was derived from maternal self-report.

Maternal birth complications (ranging from 0 to 8), for example heavy bleedings or premature detachment of the placenta, were reported by mothers. An index of the number of maternal birth complications (0, 1, 2, and ≥ 3) was generated.

Mothers were asked about **child birth complications** (ranging from 0 to 7) including, for example pathological heart sounds or transverse position. An index of the number of child birth complications (0, 1, 2, and ≥ 3) was generated.

2.3.6. Sociodemographic factors

Age, parity, and education were assessed. Regarding education, parents were categorized as having a lower (≤ 10 years; 0) or higher (> 10 years; 1) education.

2.4. Data analysis

Descriptive and attrition analyses were conducted by using IBM SPSS Statistics version 25.0.

Structural equation modeling was carried out in lavaan 0.6-4 in R 3.6.1 (Rosseel, 2012). Fit of the models was evaluated using the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), and the Tucker-Lewis Index (TLI). An RMSEA value of ≤ .06 and CFI and TLI value of ≥ 0.95 indicate a good model fit (Hu and Bentler, 1999). Maximum likelihood estimation with robust (Huber--White) standard errors was used (MLR; Rosseel, 2012). Proportion of missing data ranged from 0.0% (episiotomy and birth complications) to 7.0% (duration of labor) for mothers and from 0.5% (depressive symptoms) to 6.2% (subjective birth experience) for fathers. Missing data were handled by full information maximum likelihood estimation (FIML; Schafer and Graham, 2002).

Confirmatory factor analysis was used to build a latent factor for PTSD symptoms based on the sum scores of the subscales intrusion, avoidance, and hyperarousal for both groups. To test for measurement invariance, factor loadings were constrained to be equal between mothers and fathers. Error variances of identical subscales were allowed to correlate between mothers and fathers. Scaled chi-square difference tests were used to compare models.

Then, a set of structural models concerning predictors of birth-related PTSD symptoms were estimated simultaneously for both groups. Maternal and paternal birth-related PTSD symptoms were regressed on both maternal and paternal predictors. To examine differences in the predictors between mothers and fathers, a first model with only factor loadings constrained to be equal was compared to a second model with regression coefficients of the predictors constrained to be equal as well by using the scaled chi-square difference test.

Most of the variables included in the study were measured by self-report, and associations between these variables may have been influenced by common method biases (Podsakoff et al., 2003). We therefore conducted Harman's single factor test to examine the potential influence of such biases on estimates of associations. Results showed that 14.96% of the total variance was extracted by one factor, which is considerably lower than the often used threshold of 50% (Podsakoff et al., 2003). The test therefore indicates that common method biases may not have influenced the results to a large degree.

3. Results

3.1. Attrition analyses

Attrition analyses comparing those who dropped out at T2 with those who completed T2 were conducted for mothers and fathers separately. Regarding mothers, completers did not differ from non-completers in any study variable ($p > .05$). Regarding fathers, completers and non-completers differed only in education, with 62.5% ($n = 85$) having more than 10 years of education among those who dropped out compared to 71.2% ($n = 481$) among those who remained in the study at T2, $\chi^2(1) = 4.02$, $p = .045$.

3.2. Descriptives

Descriptive results are shown in Table 1. On average, participants completed T1 at gestational week 30.5 ($SD = 6.0$) and T2 8.9 weeks ($SD = 2.4$) postpartum. Expectant parents were mostly in a partnership, expecting their first child, had more than 10 years of education, and had been working full-time prior to pregnancy. Participants reported rather low levels of job burden and rather high levels of job satisfaction during pregnancy.

On average, levels of depressive and anxiety symptoms were low during pregnancy. Using a cutoff by ≥ 10, 17.6% of expectant mothers and 9.0% of fathers were likely affected by clinically relevant symptoms of minor or major depression. Indicating symptoms of major depression (≥ 13), 7.1% of expectant mothers and 2.8% of fathers exceeded the cutoff. Only few mothers (2.9%) and fathers (0.3%) reported to ever have suffered from PTSD before childbirth.

At T2 (see Table 1), $n = 1{,}032$ children (including 10 pairs of twins and 2 pairs of triplets) had been given birth. The vast majority of fathers had attended childbirth ($n = 676$, 97.5%). On average, mothers and fathers reported a rather positive subjective birth experience and high support during birth.

Regarding birth-related PTSD symptoms, both mothers and fathers reported rather few symptoms of intrusion, avoidance, and hyperarousal. Maternal symptom levels were statistically significantly higher than paternal levels for both overall PTSD symptoms and the three PTSD subscales ($p < .01$). More mothers (2.3%) than fathers (0.7%) showed clinically relevant PTSD symptoms, $\chi^2(1) = 6.11$, $p < .05$. All fathers

Table 1
Descriptive statistics for study variables of mothers and fathers.

	Mothers		Fathers	
Sociodemographic factors (T1)				
Age in years, *M* (*SD*)	30.1	(4.0)	32.4	(5.0)
Marital status, *n* (%)				
Married	486	(42.4)	367	(44.6)
Unmarried	626	(54.7)	427	(51.8)
Divorced	30	(2.6)	30	(3.6)
Widowed	1	(0.1)	0	(0.0)
Unknown	2	(0.2)	0	(0.0)
Partnership, *n* (%)				
Yes	1,126	(98.7)	819	(99.8)
No	15	(1.3)	2	(0.2)
Number of children[a], *n* (%)				
0	903	(79.3)	633	(78.6)
1	200	(17.6)	137	(17.0)
2	27	(2.4)	29	(3.6)
3	6	(0.5)	5	(0.6)
4	2	(0.2)	1	(0.1)
Parity[a], *n* (%)				
Primiparous	903	(79.3)	633	(78.6)
Multiparous	235	(20.7)	172	(21.4)
Education, *n* (%)				
≤ 10 years	257	(22.5)	246	(30.3)
> 10 years	887	(77.5)	566	(69.7)
Work-factors (T1)				
Working full-time prior to pregnancy, *n* (%)				
No	414	(36.5)	144	(17.6)
Yes	720	(63.5)	676	(82.4)
Working part-time prior to pregnancy, *n* (%)				
No	878	(77.4)	761	(92.8)
Yes	256	(22.6)	59	(7.2)
Job satisfaction (1-5), *M* (*SD*)	3.5	(1.1)	3.7	(1.0)
Job burden (1-5), *M* (*SD*)	2.6	(0.9)	2.7	(0.9)
Mental health factors (T1/T2)				
EPDS: Depressive symptoms (0-30)[b], *M* (*SD*)	5.7	(4.2)	4.0	(3.6)
SCL-90-R: Anxiety symptoms (0-40)[b], *M* (*SD*)	2.6	(3.1)	1.8	(2.6)
History of PTSD[c], *n* (%)				
No	971	(97.1)	682	(99.7)
Yes	29	(2.9)	2	(0.3)
Pregnancy-related factors (T2)				
Number of pregnancy complications, *n* (%)				
0	588	(57.2)		
1	302	(29.4)		
2	105	(10.2)		
≥ 3	33	(3.2)		
Birth-related factors (T2)				
Number of delivered children, *n* (%)				
One	1,006	(98.8)		
Twins	10	(1.0)		
Triplets	2	(0.2)		
Sex of child, *n* (%)				
Female	511	(50.2)		
Male	507	(49.8)		
Preterm birth, *n* (%)				
No	962	(94.6)		
Yes	55	(5.4)		
Place of birth, *n* (%)				
Obstetrical clinic	957	(94.6)		
Freestanding birth center	42	(4.1)		
Home birth	13	(1.3)		
Duration of labor, *n* (%)				
≤ 12 hours	689	(72.1)		
> 12 hours	267	(27.9)		
Mode of delivery, *n* (%)				
Vaginal birth (spontaneously or induced)	747	(74.6)		
Vaginal-assisted birth (forceps or vacuum extraction)	80	(8.0)		
Planned cesarean section	72	(7.2)		
Unplanned cesarean section	102	(10.2)		
Episiotomy, *n* (%)				
No	841	(81.8)		
Yes	187	(18.2)		
Number of maternal birth complications, *n* (%)				
0	561	(54.6)		
1	339	(33.0)		
2	104	(10.1)		
≥ 3	24	(2.3)		
Number of child birth complications, *n* (%)				
0	693	(67.5)		
1	277	(26.9)		
2	54	(5.2)		
≥ 3	4	(0.4)		
Subjective birth experience (0-10), *M* (*SD*)	2.9	(2.6)	1.6	(1.8)
Support during birth (0-10), *M* (*SD*)	8.2	(2.3)	7.2	(2.7)
Birth-related PTSD symptoms (T2)				
IES-R: Intrusion subscale (0-35), *M* (*SD*)	7.8	(5.6)	6.0	(4.7)
IES-R: Avoidance subscale (0-40), *M* (*SD*)	4.0	(5.1)	2.4	(3.7)
IES-R: Hyperarousal subscale (0-35), *M* (*SD*)	3.6	(4.5)	3.0	(3.7)
IES-R: Total score (0-75)[d], *M* (*SD*)	11.8	(8.6)	8.4	(6.6)
IES-R: Clinically relevant PTSD symptoms (≥ 35)[d], *n* (%)				
No	983	(97.7)	683	(99.3)
Yes	23	(2.3)	5	(0.7)

Note. *n* may slightly vary due to missing data. EPDS = Edinburgh Postnatal Depression Scale; SCL-90-R = Symptom Checklist-Revised; IES-R = Impact of Event Scale-Revised. T1 = during late pregnancy; T2 = 8 weeks after anticipated birth date.

[a] For fathers, number of children and parity refers to biological children.

[b] Assessed at T1.

[c] Assessed at T2.

[d] Total score of only intrusion and avoidance subscale as basis for clinical cutoff.

exceeding the cutoff had attended childbirth. There was no couple with both mother and father showing clinically relevant PTSD symptoms.

3.3. Confirmatory factor analysis

Confirmatory factor analyses were conducted with a latent birth-related PTSD symptoms factor loading on the three subscales intrusion, avoidance, and hyperarousal for both mothers and fathers in one model. Model fit was good (RMSEA = .008, 90% CI [.000, .046], CFI = 0.999, TLI = 0.998). Results showed that the standardized factor loadings of hyperarousal were similarly high in mothers (.771) and fathers (.768), whereas factor loadings of intrusion and avoidance were somewhat higher in mothers (.546 and .542, respectively) than in fathers (.472 and .477, respectively). The latent factor showed a moderate correlation between mothers and fathers ($r = .293$, $p < .01$).

Next, a new model was estimated where factor loadings were forced to be equal between mothers and fathers (see Fig. 2). The scaled chi-square difference test indicated no significant difference between the two models, $\Delta\chi^2(2) = 1.41$, $p = .496$, thereby supporting measurement invariance across mothers and fathers.

3.4. Structural models

A set of structural models was conducted for mothers and fathers simultaneously with factor loadings constrained to be equal in order to obtain measurement invariance.

In Fig. 3, two examples of models with predictors of birth-related PTSD in both mothers and fathers, i.e., depressive symptoms during pregnancy and pregnancy complications, are shown. For predictors reported by both parents separately (such as depressive symptoms), maternal and paternal birth-related PTSD were regressed on both maternal and paternal predictors (Panel a). For predictors reported by mothers only (such as pregnancy complications), both parents' PTSD were regressed on this single predictor (Panel b). Model fit of all models

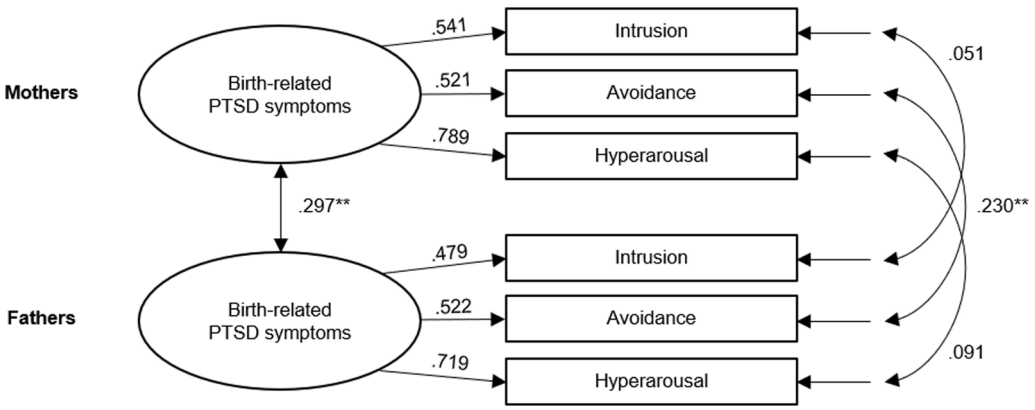

Fig. 2. Results of the confirmatory factor analysis with maternal and paternal latent factors of birth-related PTSD symptoms based on intrusion, avoidance, and hyperarousal with factor loadings constrained to be equal between mothers and fathers. Standardized coefficients are reported. $\chi^2(7) = 8.00$, RMSEA = .000, 90% CI [.000, .040], CFI = 1.000, TLI = 1.002. ** $p < .01$.

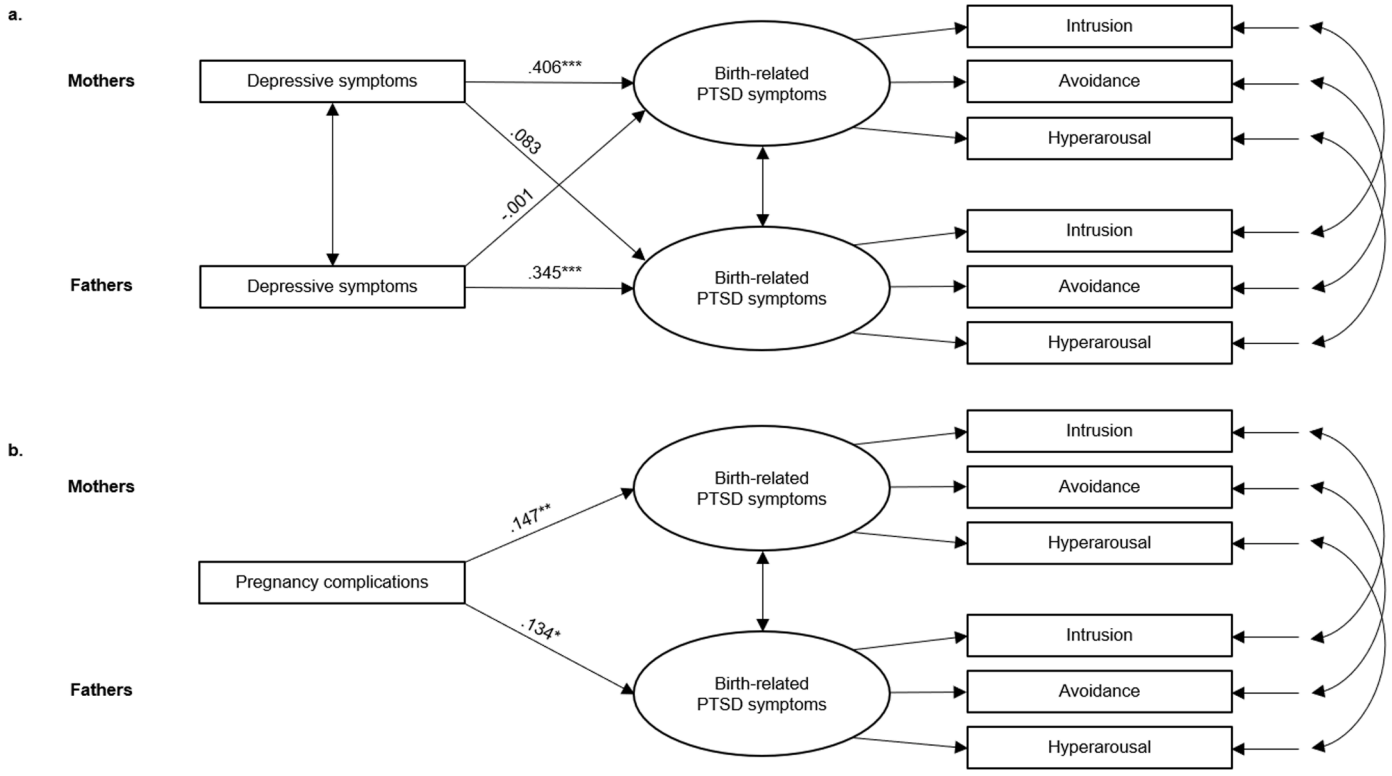

Fig. 3. Examples of structural equation models predicting maternal and paternal birth-related PTSD symptoms. Panel (a) depicts a model where both maternal and paternal predictors were included, using the example of depressive symptoms. Panel (b) depicts a model where a predictor reported by mothers was included to predict both parents' birth-related PTSD symptoms, using the example of pregnancy complications. Factor loadings for the same PTSD subscales were constrained to be equal for mothers and fathers. Standardized coefficients (β) are reported. * $p < .05$. ** $p < .01$. *** $p < .001$.

was good with the exceptions of support during birth, RMSEA = .053, 90% CI [.038, .068], CFI = 0.938, TLI = 0.898, and subjective birth experience, RMSEA = .106, 90% CI [.092, .121], CFI = 0.809, TLI = 0.686.

Detailed results are shown in Table 2. The following factors were predictors of the latent factor birth-related PTSD symptoms in both mothers and fathers: depressive and anxiety symptoms during pregnancy and poorer subjective birth experience were moderately associated with PTSD, while pregnancy complications showed smaller, but still significant associations with PTSD.

In mothers (but not in fathers), an unplanned cesarean section and lower support during birth were small to moderate predictors of PTSD symptoms. In fathers (but not in mothers), lower job satisfaction during pregnancy, being a first-time father, and lower education were small predictors of PTSD symptoms. Job burden during pregnancy was a rather moderate predictor.

No relations to both parents' PTSD were found regarding history of PTSD, working status, age, and most birth-related factors (i.e., preterm birth, duration of labor, any other delivery mode than unplanned cesarean section, episiotomy, maternal and child birth complications).

Paternal predictors did not predict maternal PTSD symptoms in any analyses when simultaneously controlling for maternal predictors (see Table 2). Concerning paternal PTSD, only lower support during birth experienced by the mother was found to be a small predictor.

Table 2
Results of structural equation models with predictors of birth-related PTSD symptoms for both mothers and fathers and results of scaled chi-square difference test conducted to compare coefficients for mothers and fathers.

Predictor	Maternal PTSD regressed on maternal predictor β	Paternal PTSD regressed on paternal predictor β	Maternal PTSD regressed on paternal predictor β	Paternal PTSD regressed on maternal predictor β	Scaled χ^2 difference test $\Delta\chi^2$	p
Mental health factors (T1/T2)						
Depressive symptoms[a]	.406***	.345***	-.001	.083	2.35	.126
Anxiety symptoms[a]	.378***	.283***	.021	.084	2.29	.130
History of PTSD[b]	.106	.053	.010	-.014	0.02	.895
Work factors (T1)						
Working full-time prior to pregnancy	.051	-.023	-.030	.031	1.46	.227
Working part-time prior to pregnancy	-.050	-.029	.006	-.018	0.05	.822
Job satisfaction	-.072	-.091*	-.079	.012	0.01	.920
Job burden	.057	.255***	.045	.047	6.46	.011
Pregnancy-related factors (T2)						
Pregnancy complications[c]	.147**	.134*			0.84	.359
Birth-related factors (T2)						
Preterm birth[c]	.052	.034			0.39	.531
Subjective birth experience	.343***	.210**	-.011	.048	1.18	.277
Support during birth	-.255***	-.060	.020	-.139*	13.26	<.001
Duration of labor[c]	.079	.026			1.48	.223
Vaginal-assisted birth[c]	.031	.002			0.29	.587
Planned cesarean section[c]	.025	.067			0.29	.590
Unplanned cesarean section[c]	.178***	.038			8.05	.005
Episiotomy[c]	-.064	.004			1.88	.170
Maternal birth complications[c]	.035	.008			0.38	.537
Child birth complications[c]	.050	-.013			1.73	.188
Socio-demographic factors (T1)						
Age	-.065	-.012	-.023	-.107	0.64	.423
Parity	.065	-.176*	-.166	.046	3.51	.061
Education	-.063	-.164**	-.096	-.071	0.63	.427

Note. T1 = during late pregnancy; T2 = 8 weeks after anticipated birth date.
[a] Assessed at T1.

[b] Assessed at T2.

[c] Factors that were based on maternal report and assigned to both partners.
* $p < .05$. ** $p < .01$. *** $p < .001$.

In a last analytic step, we examined whether the strength of the associations differed between mothers and fathers by means of scaled chi-square difference tests. For most predictors, no statistically significant differences were found (see Table 2). However, results showed significant differences in job burden during pregnancy, support during birth, and an unplanned cesarean section.

Because the IES-R does not assess criterion A of PTSD, i.e., whether childbirth was experienced as threatening the health of mother or child, we conducted supplementary analyses (results not shown) where we accounted for the lack of assessing this criterion. More specifically, we re-ran the structural equation models with only those mothers and fathers having experienced complications or unexpected operative interventions during birth (i.e., a vaginal-assisted birth, unplanned cesarean section, or episiotomy). Patterns of associations remained mainly unchanged with only slight differences in the coefficients; however, these slight changes resulted in two more significant associations among mothers (episiotomy and a birth longer than 12 hours), whereas two association among fathers (job satisfaction and being a first-time father) were slightly reduced into non-significance. Differences between mothers and fathers remained the same.

4. Discussion

This study aimed at examining the prospective associations of prepartum and peripartum factors with birth-related PTSD symptoms in mothers and fathers 8 weeks postpartum with special regard to differential effects between mothers and fathers.

First, we found that depressive and anxiety symptoms during pregnancy, pregnancy complications, and poorer subjective birth experience were predictors with small to moderately sized effects in both groups. This is in line with recent systematic reviews and meta-analyses which rated them as key factors for mothers (Andersen et al., 2012; Ayers et al., 2016; Dekel et al., 2017) and accords to the few studies that exist for fathers indicating subjective birth factors (Ayers et al., 2007; Bradley et al., 2008; Zerach and Magal, 2016b) and anxiety symptoms during pregnancy (Zerach and Magal, 2016a, 2016b) to be related to PTSD symptoms.

In the present study a self-reported history of PTSD was not predictive of birth-related PTSD symptoms in neither parent; only a slight trend was observable in mothers. This is in contrast to evidence on trauma-related factors from systematic reviews and meta-analyses among mothers (Andersen et al., 2012; Ayers et al., 2016; Dekel et al., 2017) and one study among fathers (Zerach and Magal, 2016b), but in line with some other research among mothers (e.g., Söderquist et al., 2009). Comparability of findings is limited by heterogeneity of defining and assessing trauma or PTSD history. Thus, the potentially predictive value of related factors ought to be investigated in future studies. Most objective birth factors included in this study were not predictive of birth-related PTSD, which is in line with the emphasis in the literature on the importance of subjective factors over objective factors for both

mothers and, in a lesser degree, for fathers (Dekel et al., 2017; Garthus-Niegel et al., 2013; Zerach and Magal, 2016b). Moreover, in supplementary analyses, in a subsample of parents having experienced birth complications or unexpected operative interventions, we found similar results as in the overall sample. In line with evidence-based etiological models (Ayers et al., 2016; King et al., 2017), this highlights the essential role of cognitions and negative appraisals of the event as life-threatening even without adverse objective factors (also see Garthus-Niegel et al., 2013; Garthus-Niegel et al., 2014).

New to this study is the finding of significant differences between mothers and fathers regarding how an unplanned cesarean section, support during birth, and job burden during pregnancy are associated with PTSD symptoms. For mothers, an unplanned cesarean section was a small predictor of PTSD symptoms in this study, analogous to a number of studies (e.g., Dekel et al., 2019; Modarres et al., 2012; Stramrood et al., 2011). For fathers, evidence is sparse and inconclusive (Iles et al., 2011; Zerach and Magal, 2016a, 2016b). The present study suggests that an unplanned cesarean section might not be as detrimental for PTSD symptoms for fathers as for mothers. This is intuitive as mothers might perceive such a cesarean section as a personal failure and/or an unexpected and profound intervention in the physical integrity (especially if performed under general anesthetic), whereas fathers might perceive it as if the medical staff is taking control and often wait outside.

Further, in this study support during birth was moderately associated with PTSD symptoms in mothers, but not in fathers. Regarding mothers, this link has been stressed by several authors (Creedy et al., 2000; Czarnocka and Slade, 2000). In fathers, this has not been addressed sufficiently except from one study by Ayers et al. (2007) finding no significant association. It is conceivable that support is less important for fathers as they may have been prepared to provide support instead of receiving it. Thus, it might not be that fundamental if their needs are not paid attention to while mothers expect to be guided during birth and might have a greater need for support, especially if they experienced prior trauma or birth interventions (Ford and Ayers, 2011). Interestingly, low support during birth experienced by mothers was not only related to maternal but also weakly to paternal PTSD symptoms. This corresponds to a study by Johnson (2002) who found elevated symptom levels in fathers who felt less supportive during birth. Again, this suggests that (role) expectations may play a significant role and that more investigations on mutual effects would be relevant (Iles et al., 2011; Johnson, 2002; Zerach and Magal, 2016b).

This study extends past research by examining the role of the little examined work factors. Few studies indicate that employment is a risk factor for PTSD in mothers but not in fathers (Shaban et al., 2013; Tofighi Naeem et al., 2019). In the present study, no association was found for working status in both parents. Still, low job satisfaction and high job burden during pregnancy were linked to PTSD symptoms in fathers, but not in mothers. However, only job burden showed significant gender differences. It seems plausible that in this sensitive period, work factors are of greater importance for fathers' than mothers' birth-related PTSD symptoms because for fathers, working stress and conditions are of constant importance in the transition to parenthood whereas most of the mothers prepare themselves to pause their employment for a longer period (in Germany, maternity leave lasts about one year while fathers usually interrupt their employment for only a few months or not at all, see Kress et al., 2019). To our knowledge, this is the first study to examine this differential effect.

Finally, we found paternal but not maternal PTSD symptoms to be predicted by lower education and expecting the first child. Still, the gender difference did not become significant. For mothers, such sociodemographic factors were formerly ranked as less important (Ayers et al., 2016; Dekel et al., 2017). The few existing studies on fathers are consistent with the findings of the current study (Bradley et al., 2008; Iles et al., 2011; Zerach and Magal, 2016b). It can be assumed that younger and less educated fathers might be less prepared and have more unrealistic expectations (Iles et al., 2011) while mothers of all ages and educational levels might be equally well-informed due to an extensive routine prepartum care. Nonetheless, these factors bear further investigations.

4.1. Strengths and limitations

This study has several strengths. While there is a small body of literature on risk factors of birth-related PTSD in fathers, to our knowledge this is the first study comprising such a large sample of fathers. Including both partners of a couple, it was possible to draw comparisons and to investigate mutual effects. What is more, the prospective study design with a high retention rate and state-of-the-art handling of missing data offers novel insights into differential predictors for mothers and fathers, adding previously less examined work factors to a range of well-studied prepartum and peripartum factors.

However, some limitations should also be noted. First, a possible self-selection bias of rather highly educated and first-time parents compared to the general population must be considered (see Kress et al., 2019). Also, fathers who dropped out were characterized by a lower education. Moreover, fathers who are highly involved in family affairs might have been over-presented in the study (Costigan and Cox, 2001). Second, although we used a well-established and comprehensive instrument for measuring birth-related PTSD symptoms, at the time of assessment, no validated instrument was available assessing all diagnostic criteria, especially criterion A. As a result, some parents endorsing birth-related PTSD symptoms might have experienced a stressful, rather than traumatic birth, making a clear diagnostic classification difficult. Also, the reliabilities in our sample were somewhat lower than in other studies. Third, birth-related PTSD symptoms and pregnancy- and birth-related factors were assessed simultaneously 8 weeks postpartum. Most of these factors comprise objective information based on maternity records. Still, it is possible that the self-report measures such as subjective birth experience and support during birth were evaluated differently retrospectively. Also, common method biases may have influenced self-report variables, even though such biases may be of minor size in the present study, as shown by Harman's single factor test. Thus, conclusions about causal directions and effect sizes should be done with caution (Garthus-Niegel et al., 2013).

4.2. Implications

This study has important clinical implications. To date, even mothers are seldom screened and offered help regarding traumatic birth experiences whereas fathers are almost completely neglected. In the current study, we found that a small but not negligible number of fathers was affected by PTSD and that symptoms of both parents were linked to each other. This highlights the importance of increased efforts in involving fathers in prepartum and postpartum care. Identifying risk factors for birth-related PTSD symptoms in mothers and fathers makes it possible to derive customized prevention and treatment offers. Here, knowledge on differential risk factors derived from the present study can be put to good use. For example, as work appears particularly important for fathers, it seems promising to bring up this topic, e.g., in birth preparation courses which fathers often join nowadays. Here, awareness for long-time adverse effects of work stress beyond childbirth can be raised and professionals can help fathers, who report to be burdened by work, develop relief options even during pregnancy, e.g., reduce working hours or demands on their own performance in this challenging period. In contrast, mothers could be encouraged to speak about their needs during birth or could be better prepared that even if an unplanned cesarean section may be necessary, it should not be equated with personal failure. After childbirth, these aspects can be addressed in routine postnatal care, e.g., during home visits by midwives when both partners are at home, or in treatment. Future studies should explore the interplay of mothers' and fathers' risk factors in more detail. As this study focused on prepartum and peripartum risk factors, it could further be valuable to

extend the present study to postpartum factors such as social support that are discussed to play an important maintaining role for PTSD symptoms (e.g., Dikmen-Yildiz et al., 2017; Garthus-Niegel et al., 2015).

5. Contributors

This study was conceived, research questions developed, and the conceptual model created by VK and SGN. VK performed the literature search. VK and MK were actively involved in data collection and preparation of data for statistical analyses. VK and TvS developed the analysis plan in consultation with SGN, which VK conducted. Data were interpreted by VK, TvS, MK, PW, and SGN. VK wrote the manuscript. SGN acquired the funding, was responsible for conception and design of the DREAM study as well as the coordination and supervision of the (ongoing) data collection. All authors contributed to manuscript revision, read, and approved the submitted version.

Data statement

The dataset presented in this article is not readily available because of legal and ethical constraints. Public sharing of participant data was not included in the informed consent of the study. Requests to access the datasets should be directed to the project manager and principal investigator Susan Garthus-Niegel.

Role of the funding source

The DREAM study is funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) [grant numbers GA 2287/4-1 and GA 2287/4-2] and by the Deutsche Gesellschaft für Psychosomatische Frauenheilkunde und Geburtshilfe (DGPFG e.V., German Society of Psychosomatic Obstetrics and Gynecology). TvS was supported by a grant from the Research Council of Norway [grant number # 288083]. SGN is a management committee member of COST action CA18211.

Declaration of Competing Interest

None.

Acknowledgments

Data collection and management was facilitated using Research Electronic Data Capture (REDCap), a secure, web-based application for data capture as part of research studies, hosted at the "Koordinierungszentrum für Klinische Studien" at the Faculty of Medicine of the Technische Universität Dresden (Harris et al., 2019; Harris et al., 2009).

We want to thank all mothers and fathers for spending their time and effort in joining our study. Also, we thank all cooperating clinics, physicians, and midwives for providing access to the potential participants and all students performing the recruitment.

References

American Psychiatric Association, 2013. Diagnostic and Statistical Manual of Mental Disorders (DSM-5). American Psychiatric Association, Washington D. C.

Andersen, L.B., Melvaer, L.B., Videbech, P., Lamont, R.F., Joergensen, J.S., 2012. Risk factors for developing post-traumatic stress disorder following childbirth: a systematic review. Acta Obstet. Gynecol. Scand. 91, 1261–1272. https://doi.org/10.1111/j.1600-0412.2012.01476.x.

Ayers, S., 2004. Delivery as a traumatic event: prevalence, risk factors, and treatment for postnatal posttraumatic stress disorder. Clin. Obstet. Gynecol. 47, 552–567. https://doi.org/10.1097/01.grf.0000129919.00756.9c.

Ayers, S., Bond, R., Bertullies, S., Wijma, K., 2016. The aetiology of post-traumatic stress following childbirth: a meta-analysis and theoretical framework. Psychol. Med. 46, 1121–1134. https://doi.org/10.1017/S0033291715002706.

Ayers, S., Wright, D.B., Wells, N., 2007. Symptoms of post-traumatic stress disorder in couples after birth: association with the couple's relationship and parent–baby bond. J. Reprod. Infant Psychol. 25, 40–50. https://doi.org/10.1080/02646830601117175.

Bauer, A., Parsonage, M., Knapp, M., Iemmi, V., Adelaja, B., 2014. Costs of Perinatal Mental Health Problems. Centre for Mental Health and London School of Economics, London.

Bergant, A.M., Nguyen, T., Heim, K., Ulmer, H., Dapunt, O., 1998. Deutschsprachige Fassung und Validierung der » Edinburgh postnatal depression scale «. Dtsch. Med. Wochenschr. 123, 35–40. https://doi.org/10.1055/s-2007-1023895.

Bradley, R., Slade, P., Leviston, A., 2008. Low rates of PTSD in men attending childbirth: a preliminary study. Br. J. Clin. Psychol. 47, 295–302. https://doi.org/10.1348/014466508X279495.

Cook, N., Ayers, S., Horsch, A., 2018. Maternal posttraumatic stress disorder during the perinatal period and child outcomes: a systematic review. J. Affect. Disord. 225, 18–31. https://doi.org/10.1016/j.jad.2017.07.045.

Costigan, C.L., Cox, M.J., 2001. Fathers' participation in family research: Is there a self-selection bias? J. Fam. Psychol. 15, 706–720. https://doi.org/10.1037//0893-3200.15.4.706.

Cox, J.L., Holden, J.M., Sagovsky, R., 1987. Detection of postnatal depression: development of the 10-item Edinburgh Postnatal Depression Scale. Br. J. Psychiatry 150, 782–786. https://doi.org/10.1192/BJP.150.6.782.

Creamer, M., Bell, R., Failla, S., 2003. Psychometric properties of the impact of event scale—revised. Behav. Res. Ther. 41, 1489–1496. https://doi.org/10.1016/j.brat.2003.07.010.

Creedy, D.K., Shochet, I.M., Horsfall, J., 2000. Childbirth and the development of acute trauma symptoms: incidence and contributing factors. Birth 27, 104–111. https://doi.org/10.1046/j.1523-536x.2000.00104.x.

Czarnocka, J., Slade, P., 2000. Prevalence and predictors of post-traumatic stress symptoms following childbirth. Br. J. Clin. Psychol. 39, 35–51. https://doi.org/10.1348/014466500163095.

Dekel, S., Ein-Dor, T., Berman, Z., Barsoumian, I.S., Agarwal, S., Pitman, R.K., 2019. Delivery mode is associated with maternal mental health following childbirth. Arch. Wom. Ment. Health 22, 817–824. https://doi.org/10.1007/s00737-019-00968-2.

Dekel, S., Stuebe, C., Dishy, G., 2017. Childbirth induced posttraumatic stress syndrome: a systematic review of prevalence and risk factors. Front. Psychol. 8, 560. https://doi.org/10.3389/fpsyg.2017.00560.

Derogatis, L.R., 1977. SCL-90-R. Administration, Scoring and Procedures Manual-I for the R(evised) Version. John Hopkins University School of Medicine.

Dikmen-Yildiz, P., Ayers, S., Phillips, L., 2017. Factors associated with post-traumatic stress symptoms (PTSS) 4–6 weeks and 6 months after birth: a longitudinal population-based study. J. Affect. Disord. 221, 238–245. https://doi.org/10.1016/j.jad.2017.06.049.

DIN-Normenausschuss Ergonomie [NAErg], 2016. Grundsätze der Ergonomie für die Gestaltung von Arbeitssystemen (ISO 6385:2016); Deutsche Fassung EN ISO 6385:2016 [Principles of ergonomics for the design of work systems (ISO 6385:2016); German version EN ISO 6385:2016]. DIN Deutsches Institut für Normung e.V.

Ford, E., Ayers, S., 2011. Support during birth interacts with prior trauma and birth intervention to predict postnatal post-traumatic stress symptoms. Psychol. Health 26, 1553–1570. https://doi.org/10.1080/08870446.2010.533770.

Franke, G.H., Derogatis, L.R., 2002. SCL-90-R: Die Symptom-Checkliste von L. R. Derogatis, 2. ed. Beltz Test, Göttingen.

Garthus-Niegel, S., Ayers, S., Martini, J., von Soest, T., Eberhard-Gran, M., 2017. The impact of postpartum post-traumatic stress disorder symptoms on child development: a population-based, 2-year follow-up study. Psychol. Med. 47, 161–170. https://doi.org/10.1017/S003329171600235X.

Garthus-Niegel, S., Ayers, S., von Soest, T., Torgersen, L., Eberhard-Gran, M., 2015. Maintaining factors of posttraumatic stress symptoms following childbirth: a population-based, two-year follow-up study. J. Affect. Disord. 172, 146–152. https://doi.org/10.1016/j.jad.2014.10.003.

Garthus-Niegel, S., Horsch, A., Ayers, S., Junge-Hoffmeister, J., Weidner, K., Eberhard-Gran, M., 2018a. The influence of postpartum PTSD on breastfeeding: a longitudinal population-based study. Birth 45, 193–201. https://doi.org/10.1111/birt.12328.

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

Garthus-Niegel, S., von Soest, T., Vollrath, M.E., Eberhard-Gran, M., 2013. The impact of subjective birth experiences on post-traumatic stress symptoms: a longitudinal study. Arch. Wom. Ment. Health 16, 1–10. https://doi.org/10.1007/s00737-012-0301-3.

Garthus-Niegel, S., Knoph, C., von Soest, T., Nielsen, C.S., Eberhard-Gran, M., 2014. The role of labor pain and overall birth experience in the development of posttraumatic stress symptoms: a longitudinal cohort study. Birth 41, 108–115. https://doi.org/10.1111/birt.12093.

German National Cohort Consortium, 2014. The German National Cohort: aims, study design and organization. Eur. J. Epidemiol. 29, 371–382. https://doi.org/10.1007/s10654-014-9890-7.

Harris, P.A., Taylor, R., Minor, B.L., Elliott, V., Fernandez, M., O'Neal, L., McLeod, L., Delacqua, G., Delacqua, F., Kirby, J., Duda, S.N., 2019. The REDCap consortium: building an international community of software platform partners. J. Biomed. Inform. 95, 103208 https://doi.org/10.1016/j.jbi.2019.103208.

Harris, P.A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., Conde, J.G., 2009. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J. Biomed. Inform. 42, 377–381. https://doi.org/10.1016/j.jbi.2008.08.010.

Horowitz, M., Wilner, N., Alvarez, W., 1979. Impact of Event Scale: a measure of subjective stress. Psychosom. Med. 41, 209–218. https://doi.org/10.1097/00006842-197905000-00004.

Hu, L., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equ. Modeling 6, 1–55. https://doi.org/10.1080/10705519909540118.

Iles, J., Slade, P., Spiby, H., 2011. Posttraumatic stress symptoms and postpartum depression in couples after childbirth: the role of partner support and attachment. J. Anxiety Disord. 25, 520–530. https://doi.org/10.1016/j.janxdis.2010.12.006.

Johnson, M.P., 2002. The implications of unfulfilled expectations and perceived pressure to attend the birth on men's stress levels following birth attendance: a longitudinal study. J. Psychosom. Obstet. Gynaecol. 23, 173–182. https://doi.org/10.3109/01674820209074670.

Karl, M., Schaber, R., Kress, V., Kopp, M., Martini, J., Weidner, K., Garthus-Niegel, S., 2020. Precarious working conditions and psychosocial work stress act as a risk factor for symptoms of postpartum depression during maternity leave: results from a longitudinal cohort study. BMC Public Health 20, 1505. https://doi.org/10.1186/s12889-020-09573-w.

King, L., McKenzie-McHarg, K., Horsch, A., 2017. Testing a cognitive model to predict posttraumatic stress disorder following childbirth. BMC Pregnancy Childbirth 17, 32. https://doi.org/10.1186/s12884-016-1194-3.

Kress, V., Steudte-Schmiedgen, S., Kopp, M., Förster, A., Altus, C., Schier, C., Wimberger, P., Kirschbaum, C., Weidner, K., Junge-Hoffmeister, J., Garthus-Niegel, S., 2019. The impact of parental role distributions, work participation, and stress factors on family health-related outcomes: study protocol of the prospective multi-method cohort "Dresden Study on Parenting, Work, and Mental Health" (DREAM). Front. Psychol. 10, 1273. https://doi.org/10.3389/fpsyg.2019.01273.

Maercker, A., Schützwohl, M., 1998. Erfassung von psychischen Belastungsfolgen: die Impact of Event Skala-revidierte Version (IES-R). Diagnostica 44, 130–141. https://doi.org/10.1037/t55092-000.

Matthey, S., Barnett, B., Kavanagh, D.J., Howie, P., 2001. Validation of the Edinburgh Postnatal Depression Scale for men, and comparison of item endorsement with their partners. J. Affect. Disord. 64, 175–184. https://doi.org/10.1016/S0165-0327(00)00236-6.

Modarres, M., Afrasiabi, S., Rahnama, P., Montazeri, A., 2012. Prevalence and risk factors of childbirth-related post-traumatic stress symptoms. BMC Pregnancy Childbirth 12, 88. https://doi.org/10.1186/1471-2393-12-88.

Morina, N., Ehring, T., Priebe, S., 2013. Diagnostic utility of the impact of event scale–revised in two samples of survivors of war. PLoS One 8, e83916. https://doi.org/10.1371/journal.pone.0083916.

Neal, L.A., Busuttil, W., Rollins, J., Herepath, R., Strike, P., Turnbull, G., 1994. Convergent validity of measures of post-traumatic stress disorder in a mixed military and civilian population. J. Trauma. Stress 7, 447–455. https://doi.org/10.1007/BF02102789.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. J. Appl. Psychol. 88, 879–903. https://doi.org/10.1037/0021-9010.88.5.879.

Redshaw, M., Henderson, J., 2013. Fathers' engagement in pregnancy and childbirth: evidence from a national survey. BMC Pregnancy Childbirth 13. https://doi.org/10.1186/1471-2393-13-70.

Rosseel, Y., 2012. lavaan: An R package for structural equation modeling and more. Version 0.5–12 (BETA). J. Stat. Softw. 48, 1–36. https://doi.org/10.18637/jss.v048.i02.

Schaber, R., Karl, M., Kopp, M., Kress, V., Weidner, K., Martini, J., Garthus-Niegel, S., 2020. My job, my child, my house: the predictive value of job- and housework-related factors on depressive symptoms during the postpartum period. J. Affect. Disord. 272, 388–397. https://doi.org/10.1016/j.jad.2020.04.016.

Schafer, J.L., Graham, J.W., 2002. Missing data: our view of the state of the art. Psychol. Methods 7, 147–177. https://doi.org/10.1037/1082-989X.7.2.147.

Schnorpfeil, P., Noll, A., Schulze, R., Ehlert, U., Frey, K., Fischer, J.E., 2003. Allostatic load and work conditions. Soc. Sci. Med. 57, 647–656. https://doi.org/10.1016/s0277-9536(02)00407-0.

Shaban, Z., Dolatian, M., Shams, J., Alavi-Majd, H., Mahmoodi, Z., Sajjadi, H., 2013. Post-traumatic stress disorder (PTSD) following childbirth: prevalence and contributing factors. Iran. Red Crescent Med. J. 15, 177–182. https://doi.org/10.5812/ircmj.2312.

Skari, H., Skreden, M., Malt, U.F., Dalholt, M., Ostensen, A.B., Egeland, T., Emblem, R., 2002. Comparative levels of psychological distress, stress symptoms, depression and anxiety after childbirth—a prospective population-based study of mothers and fathers. BJOG 109, 1154–1163. https://doi.org/10.1016/S1470-0328(02)00968-0.

Söderquist, J., Wijma, B., Thorbert, G., Wijma, K., 2009. Risk factors in pregnancy for post-traumatic stress and depression after childbirth. BJOG 116, 672–680. https://doi.org/10.1111/j.1471-0528.2008.02083.x.

Stramrood, C.A.I., Paarlberg, K.M., Huis In't Veld, E.M.J., Berger, L.W.A.R., Vingerhoets, A.J.J.M., Weijmar Schultz, W.C.M., Van Pampus, M.G., 2011. Posttraumatic stress following childbirth in homelike- and hospital settings. J. Psychosom. Obstet. Gynaecol. 32, 88–97. https://doi.org/10.3109/0167482X.2011.569801.

Tofighi Naeem, A., Shariat, M., Zarkesh, M.R., Abedinia, N., Nayeri, F., 2019. The incidence and risk factors associated with posttraumatic stress disorders among parents of NICU hospitalized preterm neonates. Iranian J. Neonatol. 10, 76–82. https://doi.org/10.22038/ijn.2019.38135.1597.

Weiss, D.S., Marmar, C.R., 1996. The impact of event scale - revised. In: Wilson, J.P., Keane, T.M. (Eds.), Assessing Psychological Trauma and PTSD: A Handbook for Practitioners. Guilford Press, New York, pp. 399–411.

Xue, W.L., Shorey, S., Wang, W., He, H.-G., 2018. Fathers' involvement during pregnancy and childbirth: an integrative literature review. Midwifery 62, 135–145. https://doi.org/10.1016/j.midw.2018.04.013.

Yildiz, P.D., Ayers, S., Phillips, L., 2017. The prevalence of posttraumatic stress disorder in pregnancy and after birth: a systematic review and meta-analysis. J. Affect. Disord. 208, 634–645. https://doi.org/10.1016/j.jad.2016.10.009.

Zerach, G., Magal, O., 2016a. Anxiety sensitivity among first-time fathers moderates the relationship between exposure to stress during birth and posttraumatic stress symptoms. J. Nerv. Ment. Dis. 204, 381–387. https://doi.org/10.1097/NMD.0000000000000482.

Zerach, G., Magal, O., 2016b. Exposure to stress during childbirth, dyadic adjustment, partner's resilience, and psychological distress among first-time fathers. Psychol. Men Masc. 18, 123–133. https://doi.org/10.1037/men0000048.