



PTSD following childbirth: A prospective study of incidence and risk factors in Canadian women

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ABSTRACT

Objective: The goals of the present study were to estimate the incidence and course of full and partial Post-Traumatic Stress Disorder (PTSD) following childbirth and to prospectively identify factors associated with the development of PTSD symptoms at 1 month following childbirth.

Methods: The sample comprised 308 women, with assessments at four time points: 25–40 weeks gestation, 4–6 weeks postpartum, 3 and 6 months postpartum. Current and prior PTSD were assessed by the Structured Clinical Interview for DSM-IV (SCID-I) and the Modified PTSD Symptom Scale Self-Report (MPSS-SR).

Results: Incidence rates of PTSD varied according to time of measurement and instrument used, with higher rates of full and partial PTSD using the MPSS-SR at 1 month postpartum (7.6% and 16.6%, respectively). Multivariate logistic regression showed that higher anxiety sensitivity (OR = 1.75; 95% CI = 1.19 2.57, $p = .005$), history of sexual trauma (OR = 2.81; 95% CI = 1.07 7.37, $p = .036$), a more negative childbirth experience than expected (OR = 0.96; 95% CI = 0.94 0.98, $p = .001$), and less available social support at 1 month postpartum (OR = 0.40; 95% CI = 0.17 0.96, $p = .041$) independently predicted full or partial PTSD at 1 month following childbirth.

Conclusion: Our results indicate that a history of sexual trauma and anxiety sensitivity can increase the probability of developing PTSD after childbirth. The findings highlight the importance of screening and providing more tailored services for women at high risk.

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Introduction

Childbirth has recently been recognized as an event that could be perceived as traumatic and consequently trigger a Post-Traumatic Stress Disorder (PTSD) reaction [1]. Studies suggest that between 0 and 6.9% of women fulfill criteria for PTSD at 4 to 10 weeks post-delivery, while 1.5 to 33.1% of women may be partially symptomatic in this time period [2–5]. PTSD prevalence rates reported between 3 and 12 months post-delivery range from 0.9 to 14.9% [5,6]. The few studies that assessed the course of PTSD symptoms have shown conflicting results. Ayers and Pickering [2] reported that PTSD symptoms decrease over time, while others suggest that symptoms increase over the first postpartum year [5,7].

Partial or subthreshold PTSD refers to the presence of PTSD symptoms below the threshold for Diagnostic and Statistical Manual for

Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) [8] diagnosis. There is accumulating evidence to suggest that partial PTSD is associated with substantial functional impairment, comorbidity, higher rates of suicidal ideation, increased healthcare utilization, and more work absences [9–11]. Discounting the importance of partial PTSD may result in neglecting a subgroup who display significant distress, functional impairment and who may be at risk for developing full PTSD.

The risk factors associated with the development of PTSD symptoms post-delivery can be categorized primarily into vulnerability-related, trauma-related, and postpartum factors. Among variables present at delivery, nulliparity [12,13], low socioeconomic status [12,14], perception of poor social support during pregnancy [14], history of psychological/psychiatric problems [6,12,15], sexual trauma [16], trait anxiety or anxiety in late pregnancy [5,14], higher anxiety sensitivity [17,18], prepartum depression [3,6,19], and severe fear of childbirth [6] have all been associated with the development of PTSD.

Several obstetrical and neonatal variables have also been found to be related to symptoms of PTSD in the postpartum. For example, women reporting instrumental delivery or emergency cesarean section [20,21] and lower Apgar scores for their baby [18] were at higher

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risk of developing PTSD. With regard to the childbirth experience, having feared for one's life or for one's infant's life [12,14,15], feelings of loss of control [15,22], peripartum dissociation [19,23], rating the birth as a negative experience [23,24], and perception of inadequate intrapartum care from staff or partner [4,12,15] were associated with PTSD. Among the few studies assessing postpartum factors, most have found that postpartum depression [5,23,25] and poor social support postpartum [6,24] were associated with the development of PTSD.

Several conceptual and methodological limitations exist in the literature, making it difficult to accurately estimate PTSD rates in the postpartum period and the risk factors associated with PTSD following childbirth. Firstly, the wide range in the rates for PTSD following childbirth found when comparing across studies may be largely related to differences in the way the traumatic stress response has been conceptualized and measured. Several studies have focused primarily on the presence of PTSD symptoms and have not assessed for the presence of diagnostic criterion A [2,5,6,15]. Moreover, studies have differed in measures used to assess PTSD. All studies to date with the exception of Wenzel et al. [26] and Adewuya et al. [22] have relied exclusively on self-report questionnaires to assess PTSD. Many studies have assessed PTSD symptoms using a wide time span varying from 1 to 12 months following childbirth, making it difficult to distinguish between acute and chronic PTSD [12,25].

Another limitation in this area is the lack of assessment for the presence of PTSD symptoms prior to childbirth [12,25,27,28]. Some women may have PTSD during pregnancy or a trauma history, making it difficult to determine if PTSD is a direct result of birth. Furthermore, cross-sectional studies and retrospective assessment limit our ability to draw conclusions about risk factors present prior to delivery and may reflect general response biases to questionnaires. Clearly, prospective studies assessing the antecedents and risk factors present during pregnancy are necessary to identify the determinants of PTSD following childbirth.

The goals of the present study were to: (a) estimate the incidence and course of full and partial PTSD at 1, 3, and 6 months following childbirth using a semi-structured interview and a self-report questionnaire, and (b) prospectively identify factors associated with the development of PTSD symptoms at 1 month following childbirth. We hypothesized that the incidence rates assessed with self-reported questionnaire would be higher than those obtained with interview, and that the proportion of women reporting PTSD would decrease across time. We also hypothesized that psychosocial vulnerability factors, appraisal of the childbirth experience and the occurrence of labor/delivery and neonatal events would be predictive of PTSD at 1 month postpartum.

Methods

Sample recruitment and procedure

Pregnant women in the late second or third trimester of pregnancy (25–40 weeks) were recruited at the offices of obstetrician/gynecologists affiliated with the McGill University Health Centre (MUHC) or at the ultrasound department at the Jewish General Hospital (JGH) in Montreal, Canada. Women were at least 18 years of age and able to communicate in French or English. The study was approved by the McGill University Faculty of Medicine Institutional Review Board and the Research Ethics Committee of the JGH.

Data for the study were collected from December 2005 to September 2009. Consenting participants were asked to complete the questionnaire battery and return them by mail at four different time points (third trimester, 4–6 weeks [1 month], 3 months, and 6 months after childbirth). Two weeks following the women's due dates, women were contacted to ascertain date of delivery in order to accurately schedule the telephone interview at 1 month following delivery. The telephone interview inquired about the childbirth experience, drinking

behavior/substance abuse, and childbirth-related PTSD symptoms using the Structured Clinical Interview for DSM-IV (SCID-I). PTSD symptoms and health behavior information were re-assessed via telephone interview at 3 and 6 months following delivery. All clinical interviewers were trained on the administration procedures of the SCID-I. The response rates on outcome variables at each time point are shown in Fig. 1.

Measures

The PTSD Module of the Structured Clinical Interview for DSM-IV (SCID-I) [29] was used to establish the presence of current (childbirth-related) and past PTSD symptomatology. The SCID-I is a widely used semi-structured clinical interview which is considered the "gold standard" for diagnosing PTSD [30,31]. Good convergent validity with other PTSD measures such as the PTSD Symptom Scale (PSS) [32] has been reported. The diagnosis of full PTSD was made according to the DSM-IV-TR (i.e., when clusters A to F were endorsed). We utilized the definition of partial PTSD employed by Zaers et al. [5] which requires that an individual report one or more symptoms in the re-experiencing cluster and one or more symptoms in the avoidance or the arousal cluster. This definition was chosen because it uses more stringent criteria compared to the other studies on childbirth which have tended to define partial PTSD as fulfilling at least one of the symptom clusters (e.g., [14]).

The Modified PTSD Symptom Scale Self-Report (MPSS-SR) [33] is a 17-item measure that assesses the DSM-III-R [34] PTSD symptoms in the past two weeks. The items of the questionnaire were adapted to address childbirth as the traumatizing event. Internal consistency of the MPSS-SR in a clinical population and community populations has been well demonstrated (Cronbach's alpha = .92 and .97, respectively). Validation studies of this scale against the SCID-I have shown it to be highly reliable and conservative (no false positives) [35,36]. This scale, in its previous (PSS) and current version, has been the most widely used method of assessing PTSD in studies with women following childbirth, allowing us to make comparisons across studies. Furthermore, it has been widely recommended that combining several PTSD assessment methods results in greater diagnostic sensitivity and specificity [30,31]. In the present study, a symptom was rated as present if the MPSS-SR item corresponding to the symptom was scored 1 or greater (i.e., the symptom is present at least once a week).

The Antenatal Questionnaire inquired about demographics, medical and obstetrical history, history of psychological difficulties, parity, current health status and current pregnancy complications, gestational length and due date.

The Trauma History Questionnaire (THQ) [37] was used at study entry to determine to what extent the participants have been exposed to potentially traumatic events in the past. It consists of 24 items addressing a range of potentially traumatizing events in three areas: crime-related, general disaster and trauma, and unwanted physical and sexual experiences. The THQ has been shown to have good stability over a 2–3 month period for reporting of most events.

The Anxiety Sensitivity Index (ASI) [38] is a 16-item questionnaire assessing fear of anxiety-related sensations. Anxiety sensitivity is viewed in itself as a distinct component of trait anxiety. Unlike trait anxiety which reflects a general tendency to respond fearfully to stressors, anxiety sensitivity is a specific tendency to respond fearfully to anxiety symptoms. Higher scores indicate greater levels of anxiety sensitivity. The scale has been shown to have good psychometric properties [39]. The ASI was completed at study entry.

The State-Trait Anxiety Inventory (STAI) [40] measures how people feel generally (trait anxiety) and how they feel presently (state anxiety), using 20 statements for each form of anxiety. Internal consistency coefficients have been shown to be .92 for the STAI-trait and .81 for the STAI-state. The STAI-trait was completed at study entry, while the STAI-state was administered at each data collection point.

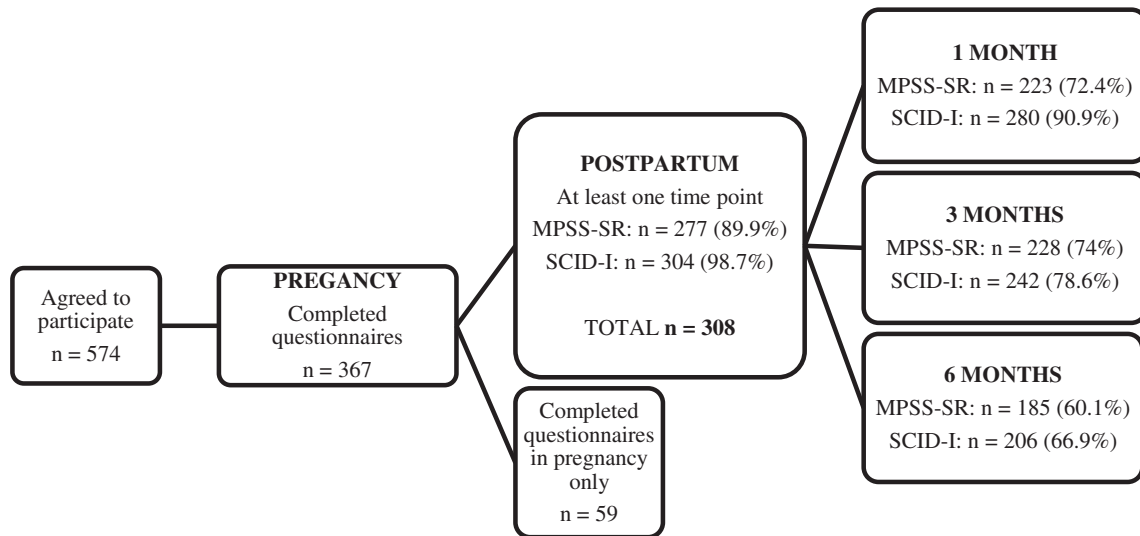


Fig. 1. Response rates at each time point on the outcome variables.

The Edinburgh Postnatal Depression Scale (EPDS) [41,42], a widely used 10-item scale developed for use in the postpartum period and validated for new mothers, was administered at each data collection point. Items inquire about the mother's mood in the past seven days. A cutoff score of 10 has been shown to have a sensitivity of 84 to 100% and a specificity of 76 to 88% when compared to a diagnosis of minor or major depression using a psychiatric interview such as the SCID-I [43–45].

The MOS Social Support Survey (MOS-SSS) [46] was administered at each time point. This 7-item scale measures perceived support from one's social network. This measure shows good internal consistency (Cronbach's $\alpha = .88$). In this study, the sum scores were severely negatively skewed, and no transformation resulted in a normal score distribution. The variable was thus dichotomized into two groups: a group with social support almost always available versus not.

The Perception of Care Questionnaire (PCQ) [47] assesses the woman's perception of the technical, affective and communicative aspects of the care provided to them by medical and nursing staff, as well as partner support during the delivery. Higher scores reflect higher satisfaction of the care. The internal consistency for this 22-item scale has been shown to be strong (Cronbach's $\alpha = .90$).

The Wijma Delivery Expectancy/Experience Questionnaire (W-DEQ) [48] Version A is a 33-item measure assessing a woman's fears about childbirth. Version B mirrors version A but is designed to assess the women's actual birth experience in relation to their expectations. A difference score was calculated between the two versions. Thus, negative scores represented an experience that was more negative than expectations and positive scores revealed a more positive experience. This scale has been shown to have good psychometric properties [14,48].

The Short Form Health Survey (SF-36) [49,50], a well-validated, 36-item self-administered measure of health status, assesses eight aspects of health and well-being (e.g., role limitation, general health, vitality). Higher scores reflect better health status. The subscales can be reduced to two psychometrically sound summary measures representing physical (PCS) and mental (MCS) health components [51].

Statistical analyses

Descriptive statistics (means, standard deviations, proportions, skewness, and kurtosis) were calculated for all the variables. The MPSS-SR at 1 month was used as the outcome variable as it has been most widely used in childbirth studies. The sum scores on the MPSS-SR were strongly

positively skewed, and it was not possible to normalize the variable; thus, women were classified into two diagnostic groups: full and partial PTSD versus those reporting no PTSD. Cochran's Q tests were used to measure changes in proportion of women presenting PTSD status across time. Group comparisons were performed using independent *t*-tests for continuous variables and chi-square tests for categorical variables. Multivariate logistic regression was used to examine the demographic, psychosocial, and delivery characteristics contributing to the presence of partial and full PTSD at 1 month. The pattern of correlations among the predictor variables was also examined to determine the extent of multicollinearity among predictors. The logistic regression model was constructed using the forced entry method. Statistical analyses were performed using the statistical software SPSS version 18.0.

Results

Sample characteristics

The characteristics of the 308 participants included in the study are shown in Table 1. The mean age of the sample was 32.22 years ($SD = 4.40$; range 19–44) and the mean years of school completed was 16.09 ($SD = 2.08$). Most participants were Caucasian (77.7%), and were married or living with a partner (97%). At study entry, 48.1% ($n = 148$) of the participants were primiparous and the mean number of gestational weeks was 32.67 ($SD = 3.17$). Sixteen percent ($n = 49$) of the women reported a sexual trauma history and 2.9% ($n = 9$) a past PTSD. In terms of complications, 20.5% ($n = 63$) of the women reported at least one complication during their current pregnancy (e.g., high blood pressure, gestational diabetes), 7.8% ($n = 24$) reported at least one complication during delivery (i.e., use of forceps or vacuum), and 27.7% ($n = 85$) reported having a cesarean section.

Based on the MPSS-SR, non-responders at 1 month were more likely to have given birth to twins, $\chi^2(1, N = 307) = 11.70, p = .001$, and reported higher trait anxiety, $t(306) = 2.01, p = .046$, compared to responders. At 3 months, responders were more likely to have delivered by cesarean compared to the group who did not complete the MPSS-SR, $\chi^2(1, N = 307) = 4.02, p = .045$. Women who did not complete the MPSS-SR at 6 months were more likely to be multiparous, $\chi^2(1, N = 308) = 5.54, p = .019$, and to have met criteria for a PTSD status at 1 month postpartum, $\chi^2(1, N = 223) = 5.22, p = .022$, compared to responders.

Course of postpartum symptoms

The incidence of PTSD at 3 time points postpartum using the SCID-I and the MPSS-SR is shown in Table 2. Using the MPSS-SR, the incidence ranged from 4.9 to 7.6% and 4.3 to 16.6% for full and partial PTSD, respectively. A total of 72 women (26%) met criteria for full or partial PTSD at some point postpartum. Among them, women can be categorized as follows: 31 with PTSD status at 1 month only; 12 chronic state; 3 delayed onset; 7 symptoms increased; and 4 met criteria at 1 and 6 months but not at 3 months. Among women meeting full or partial PTSD criteria on the MPSS-SR, 18 (33.3%), 13 (50%) and 6 (35.3%) also scored above 10 on the EPDS assessed at 1, 3 and 6 months postpartum, respectively.

Table 1
Demographic, psychosocial, and delivery characteristics of the study participants (n = 308)

	Mean (SD)/%
Age (years)	32.21 (4.40)
Education (years)	16.09 (2.08)
Household income ^a	5.34 (2.00)
Married/cohabiting	97.1%
Primiparous	48.1%
History of sexual trauma (n)	15.9% (49)
Past PTSD (n)	2.9% (9)
Gestational weeks	32.67 (3.17)
Pregnancy complications (n)	20.5% (63)
ASI	13.33 (9.15)
STAI trait	36.22 (8.76)
EPDS	6.95 (4.42)
MOS-SSS	23.06 (4.89)
WDEQ	5.96 (21.51)
Cesarean (n)	27.7% (85)
Forceps or vacuum (n)	7.8% (24)
Apgar score 1 min	8.45 (1.25)

Notes. ASI = Anxiety Sensitivity Scale. STAI = State-Trait Anxiety Inventory. EPDS = Edinburgh Postnatal Depression Scale. MOS-SSS = MOS Social Support Survey. WDEQ = Delivery Expectancy/Experience Questionnaire.

^a Household income scale 1–8 e.g., 4 = \$41,000–\$60,000; 5 = \$61,000–\$80,000.

Using the SCID-I, the incidence ranged from 0 to 1.1% and 1.2 to 3.2% for full and partial PTSD, respectively. A total of 17 women (5.6%) met criteria for full or partial PTSD at some point postpartum. Among the 3 women presenting a full PTSD diagnosis at 1 month, one was classified as chronic at 3 months, one discontinued afterward, and one was not symptomatic at 3 but in the partial group at 6 months. Finally, one woman was a new full PTSD case at 3 months postpartum.

Using Cochran's Q test, we found a significant difference in the proportion of women presenting PTSD status (full or partial) across time using the MPSS-SR, $Q(2, N = 135) = 21.46, p < .001$. A pairwise comparison using McNemar's tests with Bonferroni correction ($p = .0167$) revealed that significantly more women presented PTSD at 1 month compared to 3 and 6 months postpartum ($p < .001$ and $p = .001$ respectively). There was no significant difference in the proportion of women presenting PTSD at 3 months compared to 6 months postpartum ($p = .549$). No difference was found using the SCID-I, $Q(2, N = 170) = 5.20, p = .074$.

Comparisons between women with and without PTSD status

Women who fulfilled criteria for a full or partial PTSD status (n = 54) using the MPSS-SR at 1 month postpartum were compared with those reporting no PTSD (n = 169) on various psychosocial measures. The women classified in the PTSD group reported less social support during pregnancy, $\chi^2(1, N = 223) = 8.20, p = .004$ and at 1 month postpartum, $\chi^2(1, N = 222) = 15.25, p < .001$. They also reported higher anxiety sensitivity ($p < .001$), higher trait anxiety ($p = .001$), greater depressed mood scores during pregnancy ($p < .001$), a less positive perception of the care they received during delivery ($p < .001$), a more negative childbirth experience than expected ($p < .001$), and significantly more impairment in both summary component scores (physical and mental health statuses) of the

Table 2
Rates of full and partial PTSD in women at 3 time points during the first 6 months following childbirth (n = 308)

Time point following childbirth	1 month	3 months	6 months
	No. (%)	No. (%)	No. (%)
<i>MPSS-SR</i>			
Full PTSD	17 (7.6)	14 (6.1)	9 (4.9)
Partial PTSD	37 (16.6)	12 (5.3)	8 (4.3)
Total	54 (24.2)	26 (11.4)	17 (9.2)
<i>SCID-I</i>			
Full PTSD	3 (1.1)	2 (0.8)	0 (0.0)
Partial PTSD	9 (3.2)	3 (1.2)	6 (2.9)
Total	12 (4.3)	5 (2.1)	6 (2.9)

Notes. SCID-I = Structured Clinical Interview for DSM-IV. MPSS-SR = Modified PTSD Symptom Scale Self-Report. Partial PTSD = one symptom of the re-experiencing cluster and one symptom of the avoidance or the arousal cluster exist. For the SCID-I, women had to fulfill the criteria A and E.

Table 3
Differences between women with and without a PTSD status using the MPSS-SR at 1 month following childbirth on psychosocial measures (n = 223)

Variables	No.	Mean	SD	df	p-value	Student's t-test	d ^a
ASI	No PTSD	169	11.75	8.52	221	$p < .001$.70
	PTSD	54	18.76	9.25			
STAI trait	No PTSD	169	34.59	8.61	221	.001	.46
	PTSD	54	38.67	7.50			
EPDS	No PTSD	168	6.31	4.31	220	.001	.45
	PTSD	54	8.52	4.30			
PCQ	No PTSD	168	90.71	11.23	220	$p < .001$.52
	PTSD	54	82.94	14.86			
WDEQ	No PTSD	166	10.02	19.71	218	$p < .001$.71
	PTSD	54	-6.20	19.97			
<i>SF-36</i>							
PCS	No PTSD	169	50.88	7.81	221	$p < .001$.52
	PTSD	54	46.08	8.26			
MCS	No PTSD	169	51.16	8.68	221	$p < .001$.59
	PTSD	54	45.03	10.43			

Notes. ASI = Anxiety Sensitivity Scale. STAI = State-Trait Anxiety Inventory. EPDS = Edinburgh Postnatal Depression Scale. PCQ = Perception of Care Questionnaire. WDEQ = Delivery Expectancy/Experience Questionnaire. SF-36 = Short Form Health Survey. PCS and MCS = physical and mental health components.

^a Effect size is interpreted according to Cohen's guidelines (1988) of $d = 0.20$ (small effect size), $d = 0.50$ (medium effect size), and $d = 0.80$ (large effect size).

SF-36 at 1 month postpartum ($p < .001$ respectively). No difference was found regarding delivery mode, $\chi^2(1, N = 222) = 2.07, p = .150$. A summary of the t tests for the significant variables is shown in Table 3.

Predictors of PTSD status

Multivariate logistic regression was used to identify factors contributing to an increased likelihood of PTSD (full or partial) using the MPSS-SR at 1 month following childbirth. The 11 independent variables entered into the model are presented in Table 4. The full model containing all predictors was statistically significant, $\chi^2(11, N = 223) = 74.27, p < .001$, indicating that the model was able to distinguish between women who were classified as having PTSD and those who did not at 1 month following childbirth. The model explained between 28.3% (Cox and Snell R square) and 42.3% (Nagelkerke R square) of the variance in the presence of PTSD status, and correctly classified 78.9% of cases. Four variables (i.e., history of sexual trauma, ASI, WDEQ, and MOS-SSS 1 month) were significant predictors of PTSD. Among women who reported a history of sexual trauma, the odds of developing PTSD were almost three times greater compared to women who did not report a history of sexual abuse (OR = 2.81; 95% CI = 1.07–7.37, $p = .036$). Moreover, each increase of one point on the ASI and the WDEQ was associated with a 1.75-fold (OR = 1.75; 95% CI = 1.19–2.57, $p = .005$) increase in risk and a 0.96-fold (OR = 0.96; 95% CI = 0.94–0.98, $p = .001$) decrease in risk of developing PTSD, respectively. The odds of 0.40 (OR = 0.40; 95% CI = 0.17–0.96, $p = .041$) for the MOS-SSS at 1 month postpartum was below 1, indicating that more available social support in the postpartum was protective against the development of PTSD. When social support during pregnancy was entered into the model as a predictor instead of the values obtained at 1 month postpartum, this variable was no longer significant.

Table 4
Predictors of PTSD status at 1 month following childbirth using the MPSS-SR (n = 223)

Predictor variables	Standardized B (SE)	Wald	OR	95% CI	p
Household income	0.00 (0.41)	0.00	1.00	0.45–2.24	.996
History of sexual trauma	1.03 (0.49)	4.41	2.81	1.07–7.37	.036
Past PTSD	1.66 (1.18)	1.98	5.27	0.52–53.50	.160
ASI	0.68 (0.24)	7.99	1.75	1.19–2.57	.005
STAI trait	0.20 (0.27)	0.53	1.19	0.75–1.90	.467
EPDS	0.22 (0.27)	0.68	1.26	0.73–2.19	.408
Forceps or vacuum	1.10 (0.68)	2.59	3.00	0.79–11.46	.108
Apgar score 1 min	-0.57 (0.45)	1.61	0.57	0.23–1.37	.205
MOS-SSS 1 month	-0.91 (0.45)	4.17	0.40	0.17–0.96	.041
WDEQ	-0.75 (0.22)	11.61	0.96	0.94–0.98	.001
PCQ	-0.06 (0.21)	0.09	0.95	0.68–1.33	.763

Notes. Model was significant $\chi^2(11, N = 223) = 74.27, p < .001$. ASI = Anxiety Sensitivity Scale. STAI = State-Trait Anxiety Inventory. EPDS = Edinburgh Postnatal Depression Scale. MOS-SSS = MOS Social Support Survey. PCQ = Perception of Care Questionnaire. WDEQ = Delivery Expectancy/Experience Questionnaire. The variables in bold are significant.

Discussion

In the present study, the incidence of PTSD at 1 month was 7.6% for full and 16.6% for partial. As expected, incidence rates obtained using the SCID-I were lower than those obtained using the MPSS-SR. The SCID-I is based on clinical judgment and assesses clusters A, E and F, whereas the MPSS-SR does not, hence the rates obtained using the SCID-I are considered more specific to a PTSD diagnosis [32,52]. Other studies that have measured PTSD symptoms in women at 4 to 6 weeks postpartum using self-report scales have found rates between 5.6 and 6.9% for full PTSD [2,4,5]. Using the same definition of partial PTSD, the rates obtained in the present study were lower than the 28% reported by Zaers et al. [5]. Discrepancies in the rates observed across studies may be largely related to inconsistencies in the way the traumatic stress response has been conceptualized and measured.

In terms of the progression of PTSD symptoms over time, the current study shows a decrease in the proportion of women with PTSD between 1 month and 3 months postpartum using the MPSS-SR, which is consistent with the findings observed in the study by Ayers and Pickering [2]. While our findings suggest that this decrease is maintained at 6 months postpartum, these findings should be interpreted cautiously given the attrition rate (response rates from 72.4 to 60.1%) and that non-responders at 6 months were more likely to report a PTSD status at 1 month postpartum. The present study differs from the results of other studies that report an increase in the rate of PTSD between 1 and 6 months following childbirth [5,7].

In the present study, four risk factors were predictive of a full or partial diagnosis of PTSD following childbirth. In terms of antecedent variables, a history of sexual trauma emerged as the strongest predictor of the development of PTSD. Other studies have reported similar findings showing that women with a previous sexual trauma were at higher risk of experiencing their delivery as traumatic [14], of developing PTSD [13] or an increase in the symptoms of re-experiencing or hyperarousal following childbirth [16]. It may be that for these women childbirth may provoke sensations similar to sexual abuse (e.g., feelings of lack of control, same physical location and musculature involved) and thus trigger previously repressed memories of sexual trauma [53,54].

Higher anxiety sensitivity assessed during pregnancy also emerged as a significant predictor in the development of PTSD. These results are consistent with the general literature on PTSD [55,56], as well as childbirth studies [17,18]. Although anxiety sensitivity can fluctuate with psychological treatment, it is considered a relatively stable, trait-like characteristic that can play a role in both the predisposition to, and maintenance of, symptoms of anxiety [57,58]. In this study, anxiety sensitivity had a stronger effect size compared to trait anxiety in the univariate analysis perhaps because it is more specific. Further studies are necessary to better understand the components of anxiety sensitivity and their role in the development and maintenance of PTSD following childbirth.

A more negative childbirth experience than expected was also associated with the development of PTSD. This finding is consistent with those of Soet and colleagues [14] and Söderquist et al. [6] and may be explained in terms of women's expectations and their influence on preparation for childbirth. For example, a woman who is less fearful or less aware of her fears regarding childbirth may feel less of a need to prepare for the experience. In the event that her experience of childbirth is worse than expected, she may feel helpless. Future studies should examine the influence of preparation (e.g., prenatal classes, pain-management strategies) on the development of PTSD after childbirth.

In terms of postpartum factors, more available perceived social support was protective against the development of PTSD. A longitudinal study by Söderquist and colleagues [6] observed that, in women with postpartum PTSD, perceived social support decreased over time, contrary to women without PTSD. One way of interpreting these findings is that social support may be a good predictor of chronicity in this

disorder. Another interpretation is that PTSD symptoms may have a negative impact on relationships, which are consequently perceived as less supportive than before. Further longitudinal studies are needed to corroborate those hypotheses. If the second hypothesis is more valid, then additional support should be provided to women with PTSD to help them recover.

In this study, depression during pregnancy did not emerge as a significant predictor of childbirth-related PTSD, which is inconsistent with other studies [3,6,19]. A possible explanation for this inconsistency may be associated with the way the traumatic stress was measured (continuous score versus specific PTSD symptoms). Common symptoms between PTSD and depression could suggest a state of general distress post-delivery rather than a specific PTSD response. Ayers and colleagues [13] found that intrusive recollections and avoidance are predictors of PTSD, whereas emotional numbing and hyperactivity are strongly associated with depression and anxiety.

Among childbirth-related variables, perception of intrapartum care was not a significant predictor of development of PTSD, a finding which is in contrast to previous studies [4,15]. Furthermore, delivery complications and low Apgar score were found to be correlates, but not significant predictors of PTSD development in the multivariate model. These results are consistent with Söderquist et al.'s [20] hypothesis positing that the fewer the "objective" risks a delivery poses, the more important the role of pre-existing personal variables. Although obstetric events were found to be risk factors in the study by Söderquist et al. [20], those authors noted that most of the women with PTSD had in fact delivered by normal vaginal delivery.

Our study has several limitations, including its observational design, which precludes any definitive conclusions about the direction of a cause and effect relationship. Our sample was more educated [59] and had a higher household income [60] relative to the Canadian population. Therefore the sample is not representative of all women giving birth in Canada. Childbirth experiences were assessed by self-report retrospectively 1 month following the delivery, which may differ from reports obtained immediately following delivery. The logistic regression was performed using the MPSS-SR rather than the SCID. MPSS-SR does not provide a PTSD diagnosis but rather a profile indicating a high likelihood of the disorder. The predictors are thus more related to the presence of a possible diagnosis, which is consistent with most studies in this area.

Despite these limitations, this study shows that PTSD symptoms and even a diagnosis of full PTSD can occur following childbirth, which is consistent with the findings of previous studies (e.g., [7,13]). To our knowledge, this study is the first in Canada to prospectively evaluate the incidence of postpartum PTSD and assess past PTSD using a semi-structured interview over the first 6 months following childbirth. Although the incidence rates found may appear low, it demonstrates that a significant number of women may develop PTSD in the 4 to 6 weeks following childbirth. In 2008, the number of births in Canada rose to 380,660 [61], 1.1 to 7.6% of which represents 4188 to 28,931 women nationwide. This does not include those who are only partially symptomatic; for these women rates are as high as 3.2 to 16.6% at 1 month postpartum. Although the proportion of women with PTSD seems to decrease over time in this study, the impact of PTSD on both the mother and her infant can be considerable.

Our results also showed that antecedent variables including history of sexual trauma and anxiety sensitivity are risk factors for the development of PTSD following childbirth. For women with a sexual trauma history, it is important to develop interventions for preventing revictimization in traumatized women and for training staff who work with them (e.g., nurses, midwives). To this effect, several recommendations have been put forward in the scientific literature [53,62]. Screening for anxiety sensitivity and discussing childbirth fears during pregnancy may also be important preventative strategies. For women with high anxiety sensitivity, developing targeted interventions for specific pregnancy and childbirth related worries and fears and teaching stress-management techniques such as

relaxation which can be integrated into prenatal classes or internet delivered modules may help women better cope with their anxieties and feel more prepared for childbirth. Psychotherapy could also be used to help women recover from PTSD following childbirth. Although there is limited evidence concerning treatment options for women with childbirth-related PTSD [63], different kinds of psychotherapy (i.e., Cognitive-Behavioral Therapy and Eye Movement Desensitization and Reprocessing) have been reported to be effective in the general literature on PTSD [64]. Our findings also suggest that PTSD symptoms, in addition to postpartum depression, should be part of routine screening either during mothers' postpartum visits or during infant well-child visits.

Conflict of interest

All authors have completed the Unified Competing Interest form and they have no conflict of interests to report.

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