Original Research

Posttraumatic Stress Disorder Symptoms 2 Months After Vaginal Delivery

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OBJECTIVE: To assess the prevalence of posttraumatic stress disorder (PTSD) symptoms and identify characteristics associated with it 2 months after singleton vaginal delivery at or near term.

METHODS: We conducted an ancillary cohort study of the TRAAP (TRAnexamic Acid for Preventing postpartum hemorrhage after vaginal delivery) randomized controlled trial in 15 French hospitals in 2015–2016. Women who had singleton vaginal delivery after 35 weeks of gestation were enrolled. After randomization, characteristics of labor and delivery were prospectively collected and paid special attention to postpartum blood loss. Posttraumatic stress disorder profile and provisional diagnosis were assessed 2 months after childbirth by two self-administered questionnaires: the IES-R (Impact of Event Scale-Revised) and the TES (Traumatic Event Scale). Associations between potential risk factors and PTSD symptoms were analyzed by multivariable logistic or linear regression modeling, depending on the type of dependent variable.

RESULTS: Questionnaires were returned by 2,740 of 3,891 women for the IES-R and 2,785 of 3,891 women for the TES (70.4% and 71.6% response rate). The prevalence of PTSD symptoms was 4.9% (95% CI 4.1–5.8%; 137/2,785) with the TES, and the prevalence of PTSD provisional diagnosis was 1.6% (95% CI 1.2–2.1%; 44/2,740), with the IES-R and 0.4% (95% CI 0.2–0.8%; 9/2,080) with the TES. Characteristics associated with a higher risk of PTSD in multivariable analysis were vulnerability factors — notably migrant status and history of psychiatric disorder (adjusted odds ratio [aOR] 2.7 95% CI 1.4–5.2) — and obstetric factors — notably induced labor (aOR 1.5 95% CI 1.0–2.2), being labor longer than 6 hours (aOR 1.7 95% CI 1.1–2.5), postpartum hemorrhage of 1,000 mL or more (aOR 2.0 95% CI 1.0–4.2), and bad memories of delivery at day 2 postpartum (aOR 4.5 95% CI 2.4–8.3) as assessed with the IES-R. Results were similar with the TES.

CONCLUSION: Approximately 1 of 20 women with vaginal delivery have PTSD symptoms at 2 months postpartum. History of psychiatric disorder, postpartum hemorrhage, and bad memories of deliveries at day 2 were the main factors associated with a PTSD profile.

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**A list of members of the TRAAP Study Group is in Appendix 1, available online at http://links.lww.com/AOG/C507.*

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Maternal health after childbirth can be complicated by psychiatric disorders such as postpartum depression, puerperal psychosis, and anxiety disorders.[1] Among the latter, posttraumatic stress disorder (PTSD) is receiving increasing attention.[2] It is characterized by symptoms such as persistent re-experiencing of the trauma, persistent avoidance of stimuli associated with the event, and symptoms of increased arousal. Women might develop a posttraumatic stress response after the complex experience of pregnancy or childbirth and may suffer from PTSD, even after a pregnancy or delivery perceived by caregivers as uneventful and uncomplicated.[3–6] In prior publications, the prevalence and risk factors of PTSD after childbirth have been predominantly explored in subgroups of women with severe obstetric complications, such as those with a preterm or emergency cesarean delivery.[4,7,8] Posttraumatic stress disorder has been reported in 15–20% of such women.[4,5]

In a general population of parturients, reported PTSD prevalence is 1–6% within the first year postpartum.[4,5] Nonetheless, the overall quality of available studies is moderate to low, mainly because of selected study populations (single-center studies and heterogeneous populations with various levels of risk).[4,5] In addition, women's experiences of birth may be influenced by sociodemographic, medical, psychiatric, and obstetric characteristics, which are not always collected.[5,9,10] Available evidence mostly comes from qualitative studies of prepregnancy psychiatric conditions.[2,5,9,11,12] Knowledge about how obstetric events affect psychological outcomes remains limited, particularly in women with term singleton vaginal deliveries.[13–15]

We speculated that some characteristics of childbirth may constitute risk factors for PTSD outside high-risk obstetric situations. The TRAAP (TRAnexamic Acid for Preventing postpartum hemorrhage after vaginal delivery) trial collected detailed data regarding prenatal psychiatric history and labor and delivery characteristics while assessing postpartum mental health in women who delivered vaginally near or at term. We evaluated the prevalence and risk factors of maternal PTSD 2 months after a singleton vaginal delivery among women participating in the TRAAP trial.

METHODS

This prospective study was a prespecified ancillary analysis of the TRAAP trial,[16] a double-blind randomized controlled trial (RCT) that assessed the efficacy of tranexamic acid for the prevention of postpartum hemorrhage after vaginal delivery. Women were randomized to receive 1 g of tranexamic acid or placebo after delivery. This trial found no significant difference in the primary outcome, which was defined as postpartum hemorrhage of at least 500 mL.[16] The study was conducted between January 1, 2015, and December 31, 2016, in 15 French maternity units and enrolled women in labor who were aged 18 years or older who planned vaginal delivery of a live singleton fetus at 35 weeks of gestation or later (details in Appendix 2, available online at http://links.lww.com/AOG/C507).[17] The trial protocol was approved by the Ouest II Committee for the Protection of Research Subjects and the French Health Products Safety Agency. The TRAAP trial was supported by the French Ministry of Health under the Clinical Research Hospital Program (contract no. PHRCN 1370458 N).[17]

We included all women enrolled in the modified intention-to-treat population (randomized women who had vaginal delivery) of the TRAAP trial[16] who responded to self-administered questionnaires sent 2 months after delivery.

All women received a self-administered questionnaire available in French that included the IES-R (Impact of Event Scale-Revised)[18,19] and the TES (Traumatic Event Scale) by electronic or postal mail 2 months after childbirth.[20] At 3 months postpartum, women were contacted for a telephone interview to assess the trial drug's potential adverse events as part of the TRAAP trial protocol.[17] On this occasion, women who did not respond to the psychological questionnaires were asked to complete and return them. After randomization, the characteristics of labor, delivery, and the third stage of labor were prospectively collected by the midwife or obstetrician handling the delivery, paying special attention to blood loss (main primary and secondary outcomes of the TRAAP trial), measured using a collector bag. Postpartum characteristics were prospectively collected, including neonatal status, hemoglobin level at day 2 postpartum, and experience of childbirth assessed using a self-administered questionnaire on day 2 after delivery with the question "Today, what are your memories of your childbirth?". Women answered this question using a five-point Likert-type scale (excellent, good, intermediate, bad, or very bad). Bad memories of delivery were defined by a "bad" or "very bad" response, as previously used in an ancillary prospective study of the TRACOR (TRAction of the CORd) trial.[15,21] The other characteristics of the women were retrospectively collected from a manual review of the medical records by a research assistant, independent of the local medical team. The quality of

collected data was checked in each center for a 10% random selection of the women included, and for all women with postpartum hemorrhage and found to be of high quality.

The two endpoints were PTSD provisional diagnosis (positive screening for symptoms consistent with a PTSD diagnosis) and PTSD profile (symptoms of PTSD) 2 months after vaginal delivery assessed using two self-administered scales: the IES-R[18] and the TES (detailed in Appendix 3, available online at http://links.lww.com/AOG/C507).[20,22]

The Impact of Event Scale remains the most widely used self-report scale of trauma-related symptoms, validated in French.[18] The IES-R includes 22 items assessing three symptoms of PTSD (intrusion, avoidance, and hyperarousal), generating a score ranging from 0 to 88.[19] A high score is suggestive of PTSD, but there is no consensual cutoff in previous reports. We defined PTSD profile as an IES-R score above the 95th percentile of its distribution in our study population and PTSD provisional diagnosis as an IES-R score higher than 33, the cutoff most used in the literature.[23,24]

Posttraumatic stress disorder was also assessed using the TES, not validated against clinical interviews, but specifically developed for PTSD after childbirth[20] and in accordance with the *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) (DSM-IV) criteria for PTSD.[25] The DSM-V criteria were not available at the beginning of the TRAAP trial. For criterion A (ie, the stressor for PTSD), childbirth was specified as the event of interest. Posttraumatic stress disorder profile was defined when all symptom criteria (B, C, and D) were met, but some other criteria (criterion A, E of duration, or F of impairment) were missing. Posttraumatic stress disorder provisional diagnosis was defined when all DSM-IV criteria (A, B, C, D, E, and F) were met.[15,20]

Three categories of exposure variables were studied: prepregnancy characteristics (preexisting psychiatric history [defined as history of depression, suicide attempt, other psychiatric condition, and psychotropic drug use before and during pregnancy and postpartum], sociodemographic, medical, and obstetric characteristics), detailed variables related to pregnancy and delivery, and postnatal variables (neonatal complication, immediate memories of delivery, and hemoglobin level). Bleeding complications were studied in terms of blood loss (postpartum hemorrhage of 500 mL or more, postpartum hemorrhage of 1,000 mL or more), postpartum hemorrhage requiring second-line intervention (defined as use of an intrauterine balloon, embolization, surgery, or transfer to intensive care unit), and the consequence of blood loss (postpartum anemia defined as hemoglobin level less than 9 g/dL at day 2 postpartum).

We compared the characteristics of respondents to the IES-R and TES questionnaires with those of nonrespondents. We estimated the prevalence of PTSD by the IES-R and TES scores 2 months postpartum with their binomial 95% CIs and provided the IES-R score distribution. Missing values for an item of the IES-R and of symptom criteria (B, C, or D) were replaced by the mean score of the other items of the corresponding respective category or criterion of PTSD symptoms (Appendix 3, http://links.lww.com/AOG/C507), if fewer than 50% of the items of this category were missing.[18,26] If more than 50% of the items of a category or criterion of symptoms were missing, the woman was considered nonrespondent.

Associations between potential risk factors and PTSD were analyzed by univariable then multivariable logistic or linear regression modeling, depending on the nature of the dependent variable for each scale: linear regression when the IER-S score was used as a continuous variable, and logistic regression when the IES-R score was dichotomized according to the 95th percentile or the cutoff value of 33 and when PTSD was assessed with the TES. Crude and adjusted odds ratios and their 95% CIs were calculated.

Variables in the multivariable analysis were included based on factors that might influence the occurrence of PTSD and the univariable analysis results. We built three multivariable models to study the association between our outcomes and postpartum blood loss characterized separately by a blood loss volume of 1,000 mL or more (model 1), postpartum hemorrhage–related invasive procedures (model 2), and a postpartum hemoglobin level less than 9 g/dL (model 3). A fourth multivariable model included the covariate "bad memories of delivery at day 2 postpartum" to assess its independent association with PTSD (model 4). The collinearity between the variables included in the multivariable models was tested. The proportion of women with missing data for any covariate included in the main multivariable model ranged from 0% to 9.9%. We performed multiple imputation chained equations according to Rubin's rules for those missing data (10 data sets imputed).[27] Differences were considered significant at $P<.05$. Stata SE 15 was used for all analyses.

RESULTS

Among the 3,981 women who participated in the TRAAP trial, 2,740 completed the IES-R (70.4% response rate), and 2,785 completed the TES (71.6%

response rate) (Fig. 1) and constituted our study populations. A total of 2,706 women responded to both scales. The median interval between delivery and completion of questionnaires was 9 weeks (interquartile range 8.3–10.4).

Nonrespondents, as compared with respondents to the IES-R and TES (Appendix 4, available online at http://links.lww.com/AOG/C507), were younger, more often born in Africa, smokers, with a history of abortion; they had a long labor, operative vaginal delivery, episiotomy, and postpartum hemorrhage less frequently and postnatal anemia more frequently. Similar proportions of nonrespondents and respondents reported bad memories of childbirth at day 2 postpartum (Appendix 4, http://links.lww.com/AOG/C507). Most IES-R respondents were younger than 35 years (81.4%), born in Europe (89.0%), and nulliparous (55.5%); 19.9% had induced labor, 18.2% had operative vaginal delivery, 9.7% had postpartum hemorrhage of 500 mL or more, and 3.1% had postpartum hemorrhage of 1,000 mL or more (Table 1). These characteristics were similar in the TES respondents (Table 1).

Two months after vaginal delivery, 1.6% of women (95% CI 1.2–2.1%; 44/2,740) had a PTSD provisional diagnosis, defined by an IES-R score of 33 or greater and 0.4% (95% CI 0.2–0.8%; 9/2,080) using TES criteria. The PTSD profile was present in 4.9% of women (95% CI 4.1–5.8%; 137/2,785) using TES criteria (Table 2).

Most associations between potential risk factors and PTSD outcomes were similar in univariable (Appendix 5, available online at http://links.lww.com/AOG/C507) and multivariable analyses (Tables 3 and 4 and Appendix 5 [Appendix 5, http://links.lww.com/AOG/C507]). Prepregnancy characteristics associated with a PTSD profile assessed using the IES-R were being born in Africa, having a history of a psychiatric disorder (adjusted odds ratio [aOR] 2.7 95% CI 1.4–5.2), being nulliparous, and a previous abortion. After adjustment for those prepregnancy factors in multivariable analysis, some characteristics of labor and delivery were also associated with a PTSD profile, notably an induced labor (aOR 1.5 95% CI 1.0–2.2), a labor longer than 6 hours (aOR 1.7 95% CI 1.1–2.5), postpartum hemorrhage of 1,000 mL or more (aOR 2.0 95% CI 1.0–4.2), and bad memories of childbirth at day 2 postpartum (aOR 4.5 95% CI 2.4–8.3) (Table 3). Among women with a PTSD profile assessed using the IES-R, 25% had bad memories of childbirth at day 2 (Appendix 5, http://links.lww.com/AOG/C507). Results were similar when the IES-R was analyzed as a continuous variable (Table 4) and according to the cutoff value of 33 (Appendix 5, http://links.lww.com/AOG/C507). Likewise, factors associated with a higher risk of PTSD profile using

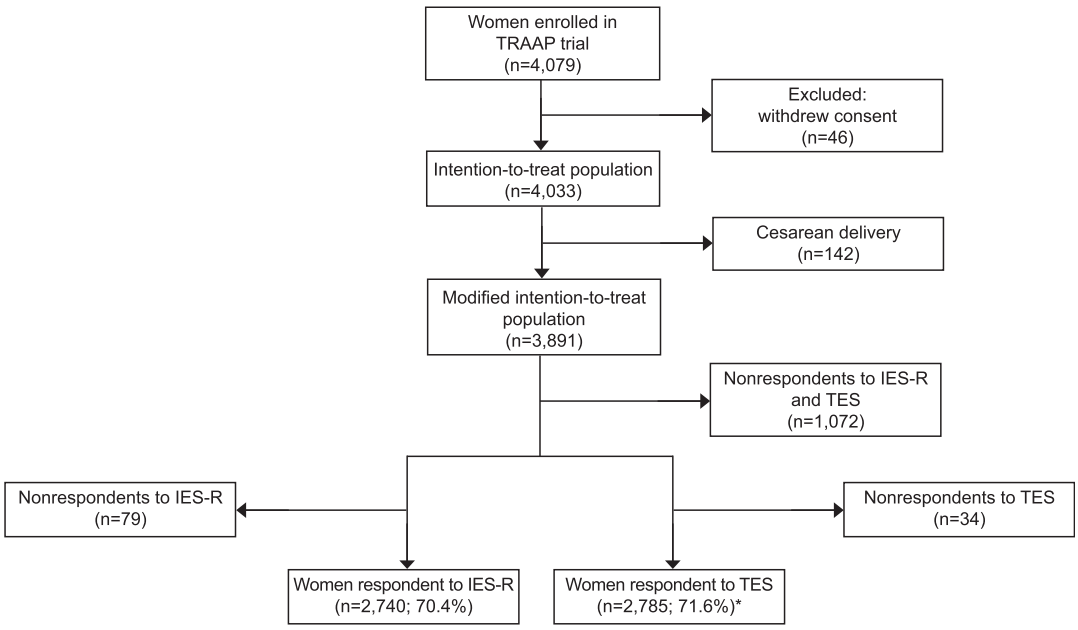

Fig. 1. Flowchart of women included in the study. *Includes 2,080 (53.5%) respondents to all criteria (A, B, C, D, E, and F). TRAAP, TRAnexamic Acid for Preventing postpartum hemorrhage after vaginal delivery. IES-R, Impact of Event Scale-Revised; TES, Traumatic Event Scale.

Froeliger. Posttraumatic Stress Disorder After Vaginal Delivery. Obstet Gynecol 2021.

Table 1. Characteristics of the Study Population

Characteristic	Respondents to IES-R (n=2,740)	Respondents to TES (n=2,785)
Demographics		
Age (y)		
Younger than 25	225 (8.2)	227 (8.2)
25–29	908 (33.1)	921 (33.1)
30–34	1,097 (40.0)	1,114 (40.0)
35 or older	510 (18.6)	523 (18.8)
BMI (kg/m^2)		
Lower than 18.5	184 (6.7)	186 (6.7)
18.5–24.9	1,842 (67.2)	1,867 (67.0)
25–29.9	471 (17.2)	488 (17.5)
30 or higher	243 (8.9)	244 (8.8)
Place of birth		
Europe	2,343 (89.0)	2,380 (89.1)
Sub-Saharan Africa	77 (2.9)	78 (2.9)
North Africa	146 (5.6)	150 (5.6)
Asia	45 (1.7)	45 (1.7)
Other	21 (0.8)	19 (0.7)
Smoking	666 (24.4)	682 (24.6)
History of psychiatric disorder	99 (3.6)	103 (3.7)
Obstetric history		
Nulliparous	1,521 (55.5)	1,552 (55.7)
Previous miscarriage	547 (20.0)	556 (20.0)
Previous abortion	349 (12.7)	344 (12.4)
Previous fetal loss*	72 (2.6)	61 (2.6)
Uterine scar	159 (5.8)	158 (5.7)
Previous PPH	135 (4.9)	131 (4.7)
Pregnancy, labor, and childbirth characteristics		
Smoking during pregnancy	305 (11.2)	314 (11.3)
Complication during pregnancy†	840 (30.7)	851 (30.6)
Hospitalization during pregnancy‡	136 (5.0)	137 (4.9)
Induction of labor	546 (19.9)	552 (19.8)
Duration of labor longer than 6 h	619 (25.0)	636 (25.3)
Social support during childbirth§	2,501 (97.6)	2,542 (97.6)
Epidural analgesia	2,688 (98.1)	2,732 (98.1)
Operative vaginal delivery	499 (18.2)	509 (19.3)
Episiotomy	688 (25.1)	701 (25.2)
3rd- or 4th-degree perineal lacerations	24 (0.9)	25 (0.9)
Manual examination of the uterine cavity	508 (18.5)	518 (18.6)
PPH		
500 mL or more	262 (9.7)	262 (9.5)
1,000 mL or more	83 (3.1)	84 (3.0)
Requiring 2nd-line intervention‖	18 (0.7)	18 (0.7)
Tranexamic acid arm¶	1,374 (50.2)	1,402 (50.3)
Neonatal complication#	134 (4.9)	136 (4.9)
Postpartum period		
Breastfeeding at day 2	1,867 (68.1)	1,900 (68.2)
Hemoglobin level less than 9 g/dL at day 2	169 (6.2)	170 (6.1)
Peripartum hemoglobin decrease of more than 2 g/dL	396 (15.3)	396 (15.1)
Bad memories of delivery at day 2**	70 (3.0)	73 (3.0)

IES-R, Impact of Event Scale-Revised; TES, Traumatic Event Scale; BMI, body mass index; PPH, postpartum hemorrhage.
Data are n (%).
* Defined as previous stillbirth or termination of pregnancy for medical reasons.
† Defined as thrombocytopenia, gestational diabetes, preterm labor, bleeding, hypertensive disorders.
‡ Except for preterm labor.
§ Defined as presence of a partner.
‖ Defined as the use of intrauterine balloon, embolization, surgery, or transfer to intensive care unit.
¶ Randomized in the intervention arm of the TRAAP trial (injection of 1 g of tranexamic acid after delivery).
# Defined as respiratory support, transfer to neonatal intensive care unit, or neonatal death.
** Defined as "bad" or "very bad" memories of childbirth.

Table 2. Prevalence of Posttraumatic Stress Disorder Symptoms 2 Months After Vaginal Delivery

Psychological Status	n	Median (IQR)	n/N	% (95% CI)
PTSD with IES-R				
IES-R score	2,740	4 (1–8)		
Intrusion	2,740	2 (0–5)		
Avoidance	2,740	0 (0–1)		
Hyperarousal	2,740	1 (0–2)		
Score of 33 or higher	44			1.6 (1.2–2.1)
PTSD with TES				
Criterion				
A (trauma)			55/2,763	2.0 (1.5–2.6)
B (intrusion)			480/2,785	17.2 (15.8–18.7)
C (avoidance)			351/2,785	12.6 (11.4–13.9)
D (hyperarousal)			1,047/2,785	37.6 (35.8–39.4)
PTSD profile*			137/2,785	4.9 (4.1–5.8)
PTSD provisional diagnosis†			9/2,080	0.4 (0.2–0.8)

IQR, interquartile range; IES-R, Impact of Event Scale-Revised[18]; PTSD, posttraumatic stress disorder; TES, Traumatic Event Scale.[20]
* The term "PTSD profile" was used when all symptom criteria (B, C, and D) were met but some other criteria (A, E, or F) were missing.[15]
† The term "PTSD provisional diagnosis" was used when all diagnostic criteria of the *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) (A, B, C, D, E, and F) on the TES were met.[15]

the TES were similar to those identified with the IES-R (Appendix 5. http://links.lww.com/AOG/C507).

DISCUSSION

Our results suggest that, among women with vaginal delivery of a live singleton fetus at 35 weeks of gestation or later, the prevalence of PTSD profile is approximately 5% and the prevalence of PTSD provisional diagnosis ranges from 0.4% to 1.6%. We identified PTSD profile risk factors related to characteristics of prepregnancy (notably history of psychiatric disorder), of pregnancy and labor (notably induced and labor of more than 6 hours), of delivery (notably postpartum hemorrhage of 1,000 mL or more) and of postpartum, especially bad memories of delivery. These results were similar with two different PTSD scales.

Our estimated prevalence of PTSD is consistent with values reported in a general population of parturients.[4,5,15] Our results confirm that a PTSD provisional diagnosis or profile is not rare after an uneventful pregnancy and a near or at term singleton vaginal delivery. In agreement with previous reports, we found that prepregnancy vulnerability factors such as having a history of psychiatric disorder,[5,9,11] being young or nulliparous,[9,11,13,28] and having a previous abortion[15] were associated with a greater risk of PTSD profile 2 months after delivery. Migrant status was also associated with a higher risk of PTSD profile 2 months after delivery; this result is consistent with previous research describing worse perinatal mental health in women from low- and middle-income countries,[29] possibly explained by a different experience of childbirth because of migration history or cultural traditions. However, the relevance of existing PTSD measurement tools in these women, beyond language issues, is also questionable.

Some characteristics of labor were associated with a PTSD profile, notably induction. In addition to obstetric and neonatal outcomes of induced labor,[30] this result highlights the need to consider the potential psychological effect of such obstetric intervention.[31] Whether the observed association reflects trauma associated with the indications for induction (only 2% of inductions were elective in our cohort) or of the intervention itself, or both, should be investigated in future research, given the increasing prevalence of induced labor.[30]

Our study robustly demonstrates an association between postpartum hemorrhage of 1,000 mL or more and a PTSD profile after delivery. Postpartum hemorrhage was not significantly associated with PTSD profile 1 year after vaginal delivery in an ancillary study of the TRACOR trial,[21] an RCT in which blood loss was assessed with the same methodology as in the TRAAP trial.[21] However, the prior study may have lacked power to detect a significant association. Our results are consistent with other studies,[32–35] though these were limited by retrospective assessment of blood loss,[34] and the lack of information regarding the method of blood loss collection and postpartum hemorrhage assessment.[34,35] Blood loss, in terms of decreased hemoglobin level in the immediate postpartum, does not seem to be

Table 3. Factors Associated With Posttraumatic Stress Disorder Profile* (Impact of Event Scale-Revised Score Above the 95th Percentile) at 2 Months After Vaginal Delivery (n=2,740)

	Model 1†			Model 2‡		Model 3§		Model 4‖	
Characteristic	Crude OR¶	aOR (95% CI)¶	*P*	aOR (95% CI)¶	*P*	aOR (95% CI)¶	*P*	aOR (95% CI)¶	*P*
Demographics									
Age (y)			.5		.4		.5		.4
Younger than 30	1.24 (0.86–1.81)	1.21 (0.82–1.79)		1.21 (0.82–1.79)		1.25 (0.84–1.85)		1.23 (0.83–1.82)	
30–35	Ref	Ref		Ref		Ref		Ref	
35 or older	0.95 (0.57–1.57)	1.02 (0.69–1.53)		1.02 (0.69–1.53)		0.95 (0.56–1.61)		0.98 (0.58–1.65)	
Place of birth			.02		.02		.02		.02
Europe	Ref	Ref		Ref		Ref		Ref	
Sub-Saharan Africa	2.30 (1.08–4.91)	2.22 (1.00–4.90)		1.91 (0.83–4.38)		2.18 (0.99–4.79)		2.27 (1.01–5.10)	
North Africa	1.63 (0.86–3.09)	1.71 (0.88–3.32)		1.72 (0.89–3.36)		1.70 (0.88–3.30)		1.71 (0.87–3.37)	
Asia	1.91 (0.66–5.48)	1.86 (0.63–5.50)		1.86 (0.63–5.52)		1.81 (0.61–5.36)		1.87 (0.63–5.54)	
Other	4.52 (1.49–13.65)	4.03 (1.31–14.40)		4.55 (1.44–14.34)		4.02 (1.30–12.45)		4.10 (1.29–13.03)	
Smoking	1.17 (0.79–1.71)	1.02 (0.69–1.53)	0.9	1.05 (0.70–1.56)	0.8	1.02 (0.68–1.52)	0.9	1.02 (0.68–1.54)	.9
History of psychiatric disorder	2.69 (1.43–5.04)	2.71 (1.41–5.22)	<0.01	2.85 (1.48–5.50)	<0.01	2.72 (1.42–5.23)	<0.01	2.48 (1.26–4.88)	<.01
Nulliparous	1.70 (1.18–2.44)	1.32 (0.86–2.01)	0.2	1.28 (0.84–1.97)	0.2	1.31 (0.86–1.99)	0.2	1.28 (0.84–1.96)	.3
Previous abortion	2.02 (1.33–3.06)	2.04 (1.32–3.15)	<0.01	2.03 (1.31–3.14)	<0.01	2.06 (1.34–3.17)	<0.01	1.94 (1.25–3.01)	<.01
Pregnancy, labor, and childbirth characteristics									
Hospitalization during pregnancy	1.86 (1.00–3.45)	1.56 (0.81–2.98)	.2	1.67 (0.87–3.18)	0.1	1.56 (0.81–2.98)	.2	1.60 (0.83–3.10)	.2
Induction of labor	1.52 (1.03–2.23)	1.49 (1.00–2.23)	.05	1.52 (1.01–2.29)	0.05	1.50 (1.00–2.25)	.05	1.40 (0.93–2.12)	.1
Duration of labor longer than 6 hours	1.90 (1.33–2.71)	1.70 (1.14–2.54)	.01	1.76 (1.17–2.65)	0.006	1.70 (1.14–2.54)	.01	1.60 (1.03–2.47)	.04
Operative vaginal delivery	1.52 (1.02–2.26)	1.18 (0.76–1.81)	.5	1.21 (0.78–1.87)	0.4	1.18 (0.77–1.82)	.5	1.02 (0.65–1.60)	.9
3rd- or 4th-degree perineal lacerations	2.67 (0.79–9.06)	1.88 (0.52–6.76)	.3	1.86 (0.51–6.73)	0.3	1.82 (0.50–6.57)	.4	1.90 (0.49–7.33)	.4
PPH 1,000 mL or more	2.32 (1.14–4.73)	2.02 (1.00–4.24)	.05					1.60 (0.73–3.51)	
PPH requiring 2nd-line intervention#	2.33 (0.53–10.22)			2.77 (0.62–12.42)	.2				.2
Postpartum period (at day 2)									
Hemoglobin level less than 9 g/dL	1.74 (0.98–3.09)					1.25 (0.67–2.32)	.5		
Bad memories of delivery**	6.35 (3.58–11.23)							4.45 (2.38–8.33)	<.01

OR, odds ratio; aOR, adjusted odds ratio; PPH, postpartum hemorrhage.
* Posttraumatic stress disorder profile was defined as an Impact of Event Scale-Revised score above the 95th percentile.
† Model with PPH 1,000 mL or more.
‡ Model with PPH requiring second-line therapy.
§ Model with postpartum anemia.
‖ Model with bad memories of delivery.
¶ Univariate and multivariate logistic regression model.
# Defined as the use of intrauterine balloon, embolization, surgery, or transfer to intensive care unit.
** Defined as "bad" or "very bad" memories of childbirth.

associated with a higher risk of PTSD in our study, in contrast to reports that anemia is a postpartum risk factor for psychological (notably depressive) disorders,[36–40] suggesting that the stressful nature of postpartum hemorrhage and of its management may account for its relationship with adverse psychological outcomes.

Finally, bad memories of delivery in the immediate postpartum were strongly associated with PTSD profile 2 months after delivery, a finding consistent with the ancillary study of the TRACOR trial, where this association was found 1 year after delivery.[15] This finding may be interpreted as either early maternal negative perception of the birth experience being a risk factor for PTSD or an early marker of psychological disorder.

Our finding that about one in 20 women has a PTSD profile 2 months after vaginal delivery alerts perinatal caregivers about the potential relationship between obstetric events and PTSD. In particular, we confirmed that severe blood loss is an independent risk factor for PTSD profile 2 months after delivery.

Knowledge of the subgroups of women and obstetric contexts that increase risk can help caregivers target women who could benefit from early screening.[2] Routine use of clinical interviews or self-administered questionnaires in all women after delivery to detect a small proportion with PTSD does not appear to be a sound strategy given the time and cost involved.[6] Although the simple question, "Today, what are your memories of your childbirth?" appears to be a quick and effective screening tool, a routine screening strategy based on this question alone may be insufficient–75% of women with a PTSD profile in our study did not report bad memories of childbirth in the immediate postpartum period. This may be explained in part by the fact that Cognitive dimension of PTSD can include distressing memories as well as difficulty remembering (ie, memory gaps of the event perceived as traumatic, in the context of related dissociation); thus, the

Table 4. Factors Associated With Posttraumatic Stress Disorder According to the Impact of Event Scale-Revised Score 2 Months After Vaginal Delivery (n=2,740)

Characteristic	Model 1*			Model 2†		Model 3‡		Model 4§	
	Crude β Coefficient‖	Adjusted β Coefficient (95% CI)‖	*P*	Adjusted β Coefficient (95% CI)‖	*P*	Adjusted β Coefficient (95% CI)‖	*P*	Adjusted β Coefficient (95% CI)‖	*P*
Demographics									
Age (y)			<.01		<.01		<.01		<.01
Younger than 30	1.12 (0.46–1.79)	0.93 (0.26–1.60)		0.93 (0.26–1.60)		0.96 (0.29–1.63)		0.98 (0.31–1.65)	
30–35	Ref	Ref		Ref		Ref		Ref	
35 or older	−0.60 (−1.44 to 0.25)	−0.59 (−1.47 to 0.25)		−0.64 (−1.48 to 0.20)		−0.56 (−1.41 to 0.28)		−0.70 (−1.53 to 0.13)	
Place of birth			<.01		<.01		<.01		<.01
Europe	Ref	Ref		Ref		Ref	Ref		
Sub-Saharan Africa	3.61 (1.76–5.46)	3.66 (1.85–5.48)		3.21 (1.40–5.02)		3.6 (1.77–5.42)		3.65 (1.87–5.43)	
North Africa	2.29 (0.96–3.62)	2.53 (1.22–3.84)		2.57 (1.26–3.88)		2.54 (1.22–3.85)		2.41 (1.11–3.70)	
Asia	0.79 (−1.64 to 3.22)	0.89 (−1.53 to 3.30)		1.02 (−1.41 to 3.44)		0.82 (−1.60 to 3.24)		0.87 (−1.49 to 3.23)	
Other	3.40 (−0.08 to 6.88)	2.82 (−0.57 to 6.20)		3.21 (−0.31 to 6.73)		2.86 (−0.55 to 6.29)		2.95 (−0.35 to 6.25)	
Smoking	0.87 (0.16–1.57)	0.68 (−0.02 to 1.38)	.06	0.76 (0.06–1.46)	.03	0.67 (−0.04 to 1.37)	.06	0.68 (−0.02 to 1.37)	.06
History of psychiatric disorder	3.27 (1.65–4.88)	3.09 (1.50–4.68)	<.01	3.23 (1.62–4.85)	<.01	3.12 (1.52–4.71)	<.01	2.88 (1.30–4.45)	<.01
Nulliparous	1.57 (0.97–2.18)	0.74 (0.05–1.42)	.04	0.73 (0.04–1.42)	.04	0.71 (0.02–1.40)	.04	0.68 (−0.01 to 1.37)	.05
Previous abortion	0.84 (−0.06 to 1.75)	0.70 (−0.20 to 1.60)	.1	0.64 (−0.25 to 1.54)	.2	0.72 (−0.18 to 1.62)	.1	0.55 (−0.34 to 1.44)	.2
Pregnancy, labor and childbirth characteristics									
Hospitalization during pregnancy	2.59 (1.20–3.98)	2.10 (0.72–4.47)	<.01	2.26 (0.89–3.63)	<.01	2.08 (0.70–3.45)	<.01	2.16 (0.80–3.52)	<.01
Induction of labor	1.38 (0.62–2.13)	1.21 (0.46–1.97)	<.01	1.18 (0.42–1.94)	<.01	1.24 (0.49–2.00)	<.01	1.07 (0.32–1.82)	<.01
Duration of labor longer than 6 h	1.54 (0.82–2.27)	1.11 (0.33–1.89)	<.01	1.13 (0.35–1.91)	<.01	1.12 (0.34–1.90)	<.01	0.94 (0.11–1.78)	.03
Operative vaginal delivery	1.56 (0.78–2.35)	0.84 (0.02–1.66)	.05	0.83 (0.01–1.65)	.05	0.86 (0.04–1.68)	.04	0.54 (−0.29 to 1.36)	.2
3rd- and 4th-degree perineal lacerations	3.55 (0.31–6.79)	2.68 (−0.50 to 5.86)	.1	2.78 (−0.37 to 5.94)	.1	2.63 (−0.56 to 5.82)	.1	2.71 (−0.46 to 5.88)	.1
PPH of 1,000 mL or more	3.45 (1.68–5.22)	3.04 (1.30–4.78)	<.01					2.48 (0.69–4.27)	<.01
PPH requiring 2nd-line intervention¶	3.58 (−0.12 to 7.28)			3.65 (0.01–7.28)	.05				
Postpartum period (at day 2)									
Hemoglobin level less than 9 g/dL	1.60 (0.34–2.85)					0.72 (−0.53 to 1.97)	.3		
Bad memories of delivery#	7.43 (5.22–9.63)							6.29 (4.08–8.50)	<.01

PPH, postpartum hemorrhage.
* Model with PPH of 1,000 mL or more.
† Model with PPH requiring second-line therapy.
‡ Model with postpartum anemia.
§ Model with bad memories of delivery.
‖ Univariate and multivariate linear regression modeling.
¶ Defined as the use of intrauterine balloon, embolization, surgery, or transfer to intensive care unit.
# Defined as "bad" or "very bad" memories of childbirth.

question chosen may not detect women who display the dissociative type of memory problem.

Future research on clinical scores for predicting postpartum PTSD should help to improve detection of those at risk for PTSD. Early postpartum intervention in women reporting bad memories of delivery in the immediate postpartum may reduce PTSD symptoms, as described in other trauma contexts,[41] although this needs to be tested. Indeed, perinatal psychiatry literature shows that early identification of at-risk mothers is not enough to guarantee follow-up and treatment, and thus suggests that implementation of other interventions (such as linkage to resources or patient engagement strategies) is needed.[42]

The main strengths of our study were its prospective design and its sample size with a large cohort compared with the available literature. Prospective collection of detailed data regarding labor and delivery enabled accurate characterization of obstetric exposures, in particular blood loss (primary outcome of the TRAAP trial[16]). The quality of these data, extracted from an RCT database, has been checked.[16] Other important risk factors, such as history of psychiatric disorder, were also collected, as the present ancillary study was prespecified.[17] Moreover, although our study population came from an RCT, it had characteristics close to those of a general population of parturient women with an uneventful pregnancy and a near or at term singleton vaginal delivery.[43] The 70% response rate was higher than those previously reported using self-administered questionnaires to assess PTSD.[15,20] Although some characteristics differed between respondents and nonrespondents, no conclusion can be drawn about whether this potential selection bias leads to underestimation or overestimation of PTSD prevalence. However, because the rate of bad memories of childbirth at day 2 was similar in respondents and nonrespondents (3%), this risk of bias appears limited. Lastly, although PTSD was measured with two different scales and with various definitions, our IES-R or TES results were quite close, notably regarding risk factors, thus underlining their robustness.

Our study has some limitations. First, our study population came from participants enrolled in an RCT. Women who agreed to participate in an RCT may be different from the general population. Second, PTSD was defined according to DSM-IV criteria because DSM-V was not available at the beginning of the TRAAP trial. Nonetheless, the consequences of DSM-V changes in criteria for assessing postpartum PTSD are not clear.[44] Third, PTSD measurement was based on self-administered questionnaires that provide a screening for PTSD. A positive screening should be confirmed by a qualified health care professional through a clinical evaluation to diagnose PTSD. However, the feasibility and cost of clinical interviews limit their routine use after childbirth or in clinical research including a large sample as in the present study. Finally, although childbirth was targeted as the stressor criterion, we cannot exclude that another traumatic condition occurring after childbirth contributed to the PTSD profile emergence.

In conclusion, PTSD symptoms 2 months after vaginal delivery occurs in about 1 of 20 women with an uneventful pregnancy and a near or at-term singleton vaginal delivery. History of psychiatric disorder, postpartum hemorrhage of 1,000 mL or more, and bad memories of deliveries at day 2 were the main factors associated with a PTSD profile. Screening that targets risk factors and the use of a simple question to assess memories of delivery may help identify women at risk of PTSD who could benefit from early intervention.

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