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Prevalence and correlates of postpartum PTSD following emergency cesarean sections: implications for perinatal mental health care: a systematic review and meta-analysis

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Abstract

Background The increasing awareness of the emotional consequences of emergency cesarean deliveries (C-sections) highlights their substantial role in fostering postpartum post-traumatic stress disorder (PTSD). This systematic review and meta-analysis aim to evaluate the prevalence and determinants of PTSD following emergency C-sections, as well as the implications of these events on maternal mental health and welfare.

Methods Undertaking extensive searches of Scopus, PubMed, PsycINFO, and Google Scholar, we have incorporated studies published from 2013 onwards that examined the occurrence of PTSD following emergency C-sections. Our primary focus was on the prevalence of PTSD at 6 weeks and up to 12 months postpartum. To evaluate the quality of these studies, we employed the Newcastle-Ottawa Scale (NOS) and the CEBM Critical Appraisal Tools.

Findings We included a total of 10 studies with 4,995 participants. The prevalence of PTSD following emergency C-sections ranged from 2.2 to 41.2%, compared to 0–20% in elective cesarean sections. A meta-analysis revealed a significant rise in the number of people with PTSD in the emergency C-section group compared to the elective C-section group six weeks after giving birth (OR = 2.74; 95% CI = 1.13 to 6.64; $p = 0.03$) and six weeks to 12 months later (OR = 3.68; 95% CI = 2.63 to 5.15; $p < 0.00001$). The emergency C-section group also had a higher PTSD prevalence compared to vaginal birth six weeks to 12 months after birth (OR 3.16; 95% CI 1.51 to 6.60; $p = 0.02$). Risk factors included poor social support, maternal and neonatal complications, and prior psychiatric history.

Conclusions Emergency C-sections are significantly associated with an increased risk of postpartum PTSD, necessitating targeted psychological support and interventions. Future research should aim for standardized diagnostic criteria and explore the long-term psychological outcomes of emergency C-sections.

Keywords Emergency cesarean section, Post-traumatic stress disorder, Postpartum mental health, Maternal well-being, psychological trauma

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Background

In recent years, researchers worldwide have increasingly focused on the experiences of birth trauma, acknowledging its potential to precipitate mental health issues in mothers [1] and significantly influence the psychosocial development of children [2–4] as well as family cohesion [5]. In 2015, Beck [6] described the "ripple effect" to characterize the adverse consequences of birth trauma on mothers and their families.

A particularly profound consequence of maternal psychological trauma during childbirth is the onset of post-traumatic stress disorder (PTSD). The symptoms of PTSD can have substantial and enduring repercussions on the mother's subsequent life. Numerous studies have demonstrated that a significant majority of mothers diagnosed with PTSD exhibit symptoms of major depressive disorder and engage in suicidal ideation at rates exceeding 90% [7–9]. Furthermore, the disruption of the mother-infant dyad often occurs [10], affecting the mother's relationship with her partner and diminishing overall family cohesion and bonding [11]. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) [12], PTSD is a mental health condition triggered by exposure to a life-threatening traumatic event. It is typically characterized by four clusters of symptoms: (a) re-experiencing the traumatic event; (b) avoidance of stimuli associated with the trauma; (c) negative alterations in cognition and mood; and (d) hyperarousal. These symptoms may manifest at any point following the traumatic event, including during childbirth, with the diagnosis of PTSD being made one month after the onset of symptoms [13].Research indicates that post-traumatic stress disorder (PTSD) has affected approximately 3.9% of the global population at some point during their lives. However, it is essential to note that not every individual who experiences a traumatic event subsequently develops this condition [14].

PTSD can affect individuals of any gender, but data indicate a significant gender disparity in its occurrence. The National Center for PTSD [15] estimates that approximately 10% of women and 4% of men will experience PTSD during their lifetime. This discrepancy is partly attributed to women being more frequently exposed to domestic violence, sexual abuse, or traumatic birth experiences. Estimates suggest that birth trauma, a particularly severe form of trauma, may cause PTSD in 1.5–6% of postpartum women [16]. Women who have undergone cesarean sections (C-sections) are at an elevated risk of developing PTSD, with reported rates ranging from 7.3 to 10.7% in this population [17, 18]. Evidence suggests that emergency C-sections, in particular, may be associated with higher levels of psychological trauma compared to vaginal deliveries [19–21].

The C-section is a critical surgical procedure that can be life-saving in cases of pregnancy or childbirth complications [22]. The World Health Organization (WHO) asserts that C-section rates exceeding 15% do not reduce maternal and neonatal mortality, yet reports indicate that of the 140.6 million live births globally, 29.7 million (21.1%) involved a C-section. This represents a 9% increase from the 12.1% of live births in 2000, with an annual growth rate of 3.7%. Projections suggest that the rate of C-sections will continue to rise, potentially reaching 29% by 2030 [23]. However, cesarean deliveries are associated with immediate maternal and neonatal complications, as well as long-term effects that are still under investigation [24]. Few studies have explored the psychological consequences of the procedure, despite extensive research on the obstetric and neonatal complications of C-Sects. [25–27]. Reports indicate that emergency C-sections, unplanned surgical procedures due to fetal or maternal conditions, differ significantly from elective C-sections scheduled in advance [28].

Given the potentially traumatic nature of emergency C-sections, it is essential to examine the prevalence of PTSD in this population. Thus, the objective of this review is to investigate the prevalence of postpartum PTSD following an emergency C-section, with the aim of developing strategies for the prevention and treatment of mental health issues during the postpartum period.

Methods

Inclusion and exclusion criteria

We conducted a systematic review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [29]. The review included prospective and cross-sectional studies published since 2013. The review excluded systematic reviews, meta-analyses, letters to the editor, and studies that did not investigate emergency C-sections as an exposure factor for women or PTSD as a postpartum outcome. Only studies written in English were considered.

Exposure and outcome

The exposure of interest was defined as C-sections performed as emergency procedures, while the outcome was the presence of post-traumatic symptoms occurring in 6 weeks and 6 weeks to 12 months after birth.

Search Strategy

We conducted a thorough literature search across Scopus, PubMed, PsycINFO, and Google Scholar. The search terms included: ("birth" [MeSH Terms]) OR ("type of delivery" [MeSH Terms]) OR ("emergency cesarean section" [MeSH Terms]) OR ("type of cesarean section" [MeSH Terms]) OR ("traumatic birth" [MeSH Terms]) OR ("PTSD" [MeSH Terms]) AND ("postpartum PTSD"

[MeSH Terms]) OR ("PTSD after birth" [MeSH Terms]) OR ("PTSD after childbirth" [MeSH Terms]) OR ("postpartum mental health" [MeSH Terms]). Following best practices for systematic reviews, the protocol for this study was prospectively registered with PROSPERO, the international prospective register of systematic reviews. Our registration number is CRD42024576248, and the registered title is 'Prevalence of Postpartum Posttraumatic Stress Disorder after Emergency Cesarean Section: A Systematic Review and Meta-Analysis.'

PRISMA process

We conducted the study selection process under the PRISMA 2020 guidelines (Fig. 1).

The initial search yielded a total of 1,913 records from four databases: PubMed ($n = 340$), Scopus ($n = 310$), PsycINFO ($n = 246$), and Google Scholar ($n = 1{,}017$).

Identification We removed 880 duplicate records before screening. Additionally, we excluded 460 records due to their irrelevance based on their title and subject matter.

We then subjected the remaining 573 records to a thorough screening process. At this stage, we excluded 390 records because they were not research studies, and we excluded 99 records because they did not focus on women who had emergency cesarean sections (EMCS).

Eligibility We sought 84 reports for retrieval after the abstract review.At this stage, we further excluded reports

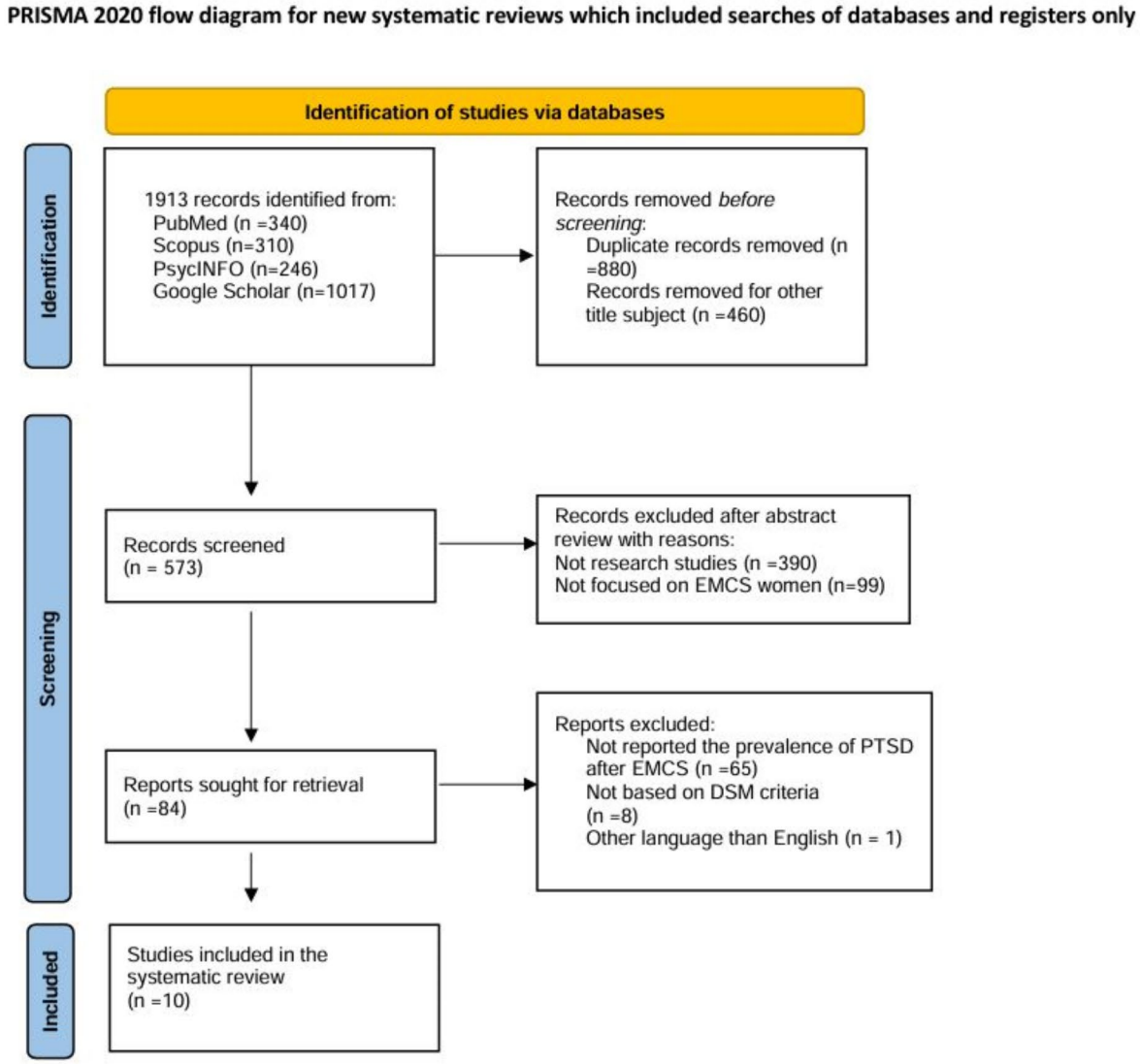

Fig. 1 Flow chart detailing the methodological approach, including the search strategy, inclusion and exclusion criteria, and the screening process. EMCS: emergency C-section; PTSD: post-traumatic stress disorder

based on the following criteria: 65 reports did not report the prevalence of post-traumatic stress disorder (PTSD) after EMCS; 8 reports were not based on DSM criteria; and 1 report was excluded because it was not written in English.

Inclusion Finally, 10 studies met the inclusion criteria and were included in the meta-analysis. These studies provided relevant data on the prevalence of PTSD among women who had undergone EMCS, adhering to the DSM criteria, and were published in English.

Methodological quality assessment

E.O. and A.S. independently assessed the quality of the included studies. No discrepancies were found between the evaluators, thus negating the need for a third-party arbitrator. The Newcastle-Ottawa Scale (NOS) [30, 31] was used for quantitative cohort studies and case-control studies. For cross-sectional studies, the Checklist for Cross-Sectional Studies of the Centre for Evidence-Based Medicine (CEBM) Critical Appraisal [32] was employed. Any differences in assessments were resolved through discussion.

Data extraction

The data extraction process involved systematically collecting and organizing relevant information from each included study (Table 1). Below is an outline of the key domains that the extracted data covered:

(a) First Author/Year/Country: We documented the principal author's name, the year when the study was conducted, and the country in which the research was carried out. This information was essential for identifying the particular study and situating the research within relevant geographical and temporal parameters. Moreover, we ensured the inclusion of the latest evidence by collecting data from studies conducted over the last decade; (b) Study Design: The documentation of each study's design included specifying whether it was a prospective, cross-sectional, cohort, case-control, or another type of study. This was crucial for understanding the methodological approach and assessing the strength of the evidence; (c) N (Sample Size): The total number of participants included in each study (N) was recorded. This provided an understanding of the study's scale and statistical power; (d) Population: Detailed information about the study population was extracted, including the demographic characteristics (age, socioeconomic status, etc.), and any specific inclusion or exclusion criteria used to select participants. This helped in assessing the generalizability of the study findings; (e) Screening diagnostic tools for PTSD: The studies utilized various screening diagnostic tools to assess PTSD in women who had undergone different types of childbirth. These tools included Post-traumatic Stress Symptom Scale (PSS), PTSD Checklist – Specific (PCLS) and Clinician-Administered PTSD Scale (CAPS), Perinatal PTSD Questionnaire (PPQ) and DMS-4 criteria and PTSD Checklist for DSM-5 (PCL-5) and The City Birth Trauma Scale for DSM-5 (CityBiTS). These tools were chosen based on the study design and population characteristics, providing a standardized approach to evaluating PTSD symptoms across various types of childbirth experiences, including emergency and elective C-sections, assisted vaginal deliveries, and normal deliveries. The use of both DSM-4 and DSM-5 criteria allowed for comprehensive assessment and comparison across studies; (f) Study group: This section included participants who underwent emergency C-sections; g); Comparators: This group included participants who underwent planned (elective) C-sections or vaginal deliveries; h) Duration of Follow-up: The length of time over which participants were followed after the exposure was recorded. This helped in understanding the timeframe for observing outcomes such as the development of PTSD symptoms; i) Prevalence of PTSD: The prevalence rate of PTSD among participants, as reported in each study, was extracted. This provided a quantitative measure of the frequency of PTSD in the studied population; j) Effects on Maternal Well-being: Information on the effects of the emergency C-section on maternal well-being was collected. This included outcomes related to mental health (e.g., depression); k) Quality Assessment: The methodological quality of each study was evaluated using established quality assessment tools, such as the Newcastle-Ottawa Scale (NOS) for cohort and case-control studies and the CEBM Checklist for cross-sectional studies. The quality rating helped in assessing the reliability and validity of the findings.

We then synthesized and analyzed the extracted data to determine the overall prevalence of PTSD following emergency C-sections and its impact on maternal well-being.

PICOS design criteria for meta-analysis

If an article fulfilled the subsequent population, intervention, comparison, outcomes, and study (PICOS) design criteria, it was eligible for inclusion in the present meta-analysis: (i) Population: Women examined for PTSD after birth; (ii) Intervention: Emergency C-section vs. elective C-section or vaginal delivery (iii) Comparison: studies comparing the outcome between women who underwent emergency C-section vs. women who underwent elective C-section or vaginal delivery; (iv) Outcomes: PTSD at six weeks of follow up (emergency C-section vs. elective C-section), PTSD at 6 weeks to 12 months of follow-up (emergency C-section vs. elective C-section, emergency C-section vs. vaginal delivery); (v) Studies are already included in Table 1.

Table 1 Extracted data from the included studies

First Author/ Year/ Country	Study design	Number of total participants	Diagnostic tools for PTSD	Population of interest	Comparators	Duration of Follow-up	Prevalence of PTSD	Effects on maternal well-being	Quality Assessment
Mahmoodi 2016 [17] Iran	Prospective study	240	PSS DSM-4	154 women after EMCS	86 women after ELCS	6–8 weeks after CS	EMCS = 8.4% (*n* = 13/154) ELCS = 4.5% (*n* = 4/86)	-	NOS: Low risk
Lopez 2017 [34] Switzerland	Cohort	171	PCLS CAPS DSM-4	90 women after EMCS	81 women after ELCS	6–8 weeks after CS	EMCS = 2.2% (*n* = 2/90) ELCS = 0% (*n* = 0/81)	-	NOS: Low risk
Feeley 2017 [35] Canada	Prospective	298	PPQ DSM-4	83 women after EMCS	62 women after ELCS 94 women after VD 59 women whose neonates were in NICU	5 weeks, 8 weeks and 26 weeks after birth	**5 weeks**: NICU mothers 15.5% (*n* = 9/59) EMCS mothers 8.5% (*n* = 7/83) ELCS mothers 12.9% (*n* = 8/62) VD 9.6% (*n* = 9/94) **8 weeks** NICU mothers 14.8% (*n* = 8/59) EMCS mothers 5.2% (*n* = 4/83) ELCS mothers 5.4% (*n* = 3/62) VD mothers 9.9% (*n* = 9/94) **26 weeks** NICU = 5.9% (*n* = 3/59) EMCS = 6.0% (*n* = 4/83) ELCS = 1.9% (*n* = 1/62) VD = 9.4% (*n* = 8/94)	11% of women reported symptoms indicating possible co-morbid PTSD and depression at some point	NOS: Low risk
Dekel 2019 [36] USA	Cross-Sectional study	685	PCL-5 for DSM-5	114 women after EMCS	132 women after ELCS 49 women after AVD 238 women after VD 152 women after ND	3 months after birth	EMCS = 41.2% (*n* = 36/114) ELCS = 17.4% (*n* = 15/132) AVD = 24.5% (*n* = 12/49) VD = 14.7% (35/238) ND = 12.5% (*n* = 24/192)	Postpartum Psychopathology (BSI) EMCS = 44.7% (*n* = 51/114) ELCS = 33.3% (*n* = 44/132) AVD = 30.6%(*n* = 15/49) VD = 31.9% (*n* = 76/238) ND = 21.1%(*n* = 40/192)	CEBM: 7/12
Orovou 2020 [37] Greece	Prospective study	160	PCL-5 for DSM-5	63 women after EMCS	97 women after ELCS	6 weeks after birth	EMCS = 31.7% (*n* = 20/63) ELCS = 1% (*n* = 1/97)	-	NOS: Low risk
BayriBingol 2020 [38] Turkey	Cross-sectional study	475	The City Birth Trauma Scale for DSM-5	40 women after EMCS	140 women after ELCS 295 women after normal delivery	6 weeks after birth	CityBiTS score (Mean ± SD) EMCS = 19.27 ± 14.48 ELCS = 12.32 ± 12.02 ND = 10.11 ± 9.62	EPDS score (Mean ± SD) EMCS = 10.55 ± 7.00 ELCS = 8.54 ± 6.41 ND = 7.65 ± 5.88	CEBM: 7/12

Table 1 (continued)

First Author/ Year/ Country	Study design	Number of total participants	Diagnostic tools for PTSD	Population of interest	Comparators	Duration of Follow-up	Prevalence of PTSD	Effects on maternal well-being	Quality Assessment
Martinez-Vázquez 2021 [39] Spain	Cross-sectional study	899	PPQ DSM-4	130 women after EMCS	60 women after ELCS 170 women after AVD 539 women after VD	1–12 months after birth	EMCS = 33.1% (*n* = 43/130) ELCS = 20% (*n* = 12/60) AVD = 11.8% (*n* = 20/170) VD = 7.2% (*n* = 39/539)	-	CEBM: 8/12
Gankanda 2021 [40] Sri Lanka	Cross-sectional study	225	PSS DSM-4	10 women after EMCS	82 women after ELCS 5 women after AVD 128 women after VD	6 months after birth	EMCS = 10% (*n* = 1/10) ELCS = 4.9% (*n* = 4/82) AVD = 0% (*n* = 0/5) VD = 2.3% (*n* = 3/128)	-	CEBM: 8/12
Sten 2023 [41] Sweden	Cross-sectional study	619	The City Birth Trauma Scale for DSM-5	71 women after EMCS	42 women after ELCS 48 women after AVD 458 women after VD	6–16 weeks after birth	EMCS = 11.3%(*n* = 8/71) ELCS = 2.4% (*n* = 1/42) AVD = 16.7% (*n* = 8/48) VD = 1.3% (*n* = 6/458)	-	CEBM: 10/12
Beck-Hiestermann 2024 [42] Germany	Cross-sectional study	1223	PCL-5for DSM-5	99 women after EMCS	119 women after secondary CS 131 women after medically indicated CS 26 women after request of CS 145 women after AVD 703 women after VD	4 weeks-12 months after birth	EMCS = 29.29% (*n* = 29/99) Secondary CS = 9.92% (*n* = 13/119) Medically indicated CS = 5.04% (*n* = 6/131) Maternal request = 0% (*n* = 0/26) AVD = 13.10% (*n* = 19/145) VD = 4.27% (*n* = 30/703)	EPDS score ≥ 10 EMCS = (*n* = 54/99) Secondary CS= (*n* = 40/119) Medically indicated CS=(*n* = 43/131) Maternal request= (*n* = 8/26) AVD=(*n* = 43/145) VD=(*n* = 207/703)	CEBM: 8/12

BSI :(somatization, obsessive compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism); **EMCS**: Emergency Cesarean Section; **ELCS**: Elective Cesarean Section; **VD**: Vaginal Delivery; **AVD**: Assisted Vaginal Delivery; **ND**: Normal Delivery; **NICU**: Neonatal Intensive Care Unit; **PSS**: Perinatal Stress Scale; **PCLS**: PTSD Checklist for DSM-5; **CAPS**: Clinician-Administered PTSD Scale; **PPQ**: Perinatal PTSD Questionnaire; **PCL-5**: PTSD Checklist for DSM-5; **BSI**: Brief Symptom Inventory; **EPDS**: Edinburgh Postnatal Depression Scale; **NOS**: Newcastle-Ottawa Scale; **CEBM**: Centre for Evidence-Based Medicine Critical Appraisal

Statistical analysis

We conducted all analyses using Review Manager Software (RevMan), version 5.4. Heterogeneity across trials was identified using I^2 statistics; considering $I^2 > 50\%$ as high heterogeneity, a meta-analysis was conducted using a random-effect model according to the Cochrane Handbook for Systematic Reviews of Interventions (version 5.1.0) [33].

We applied odds ratios (OR) with 95% CIs for the assessment of discontinuous variables. A P-value < 0.05 was considered to indicate a statistically significant difference.

Results

Among the ten studies analyzed in the review, participants were recruited from a diverse array of geographical locations, including Iran, Switzerland, Canada, the United States, Greece, Turkey, Spain, Sri Lanka, Sweden, and Germany. These studies utilized various prospective and cross-sectional designs, with participant pools ranging from 160 to 1223 individuals. The prevalence of post-traumatic stress disorder (PTSD) differed among the studies and was assessed using various methods. For example, the prevalence of PTSD in the EMCS (Emergency Cesarean Section) ranged from 2.2 to 41.2%, while in the ELCS (Elective Cesarean Section), the prevalence ranged from 0 to 20%. Moreover, the studies investigated the impact on maternal well-being, including the assessment of depression using the Edinburgh postnatal depression scale (EPDS). The quality of the studies was evaluated using the Newcastle-Ottawa Scale (NOS) and the Centre for Evidence-Based Medicine (CEBM) scale, with scores ranging from 7/12 to 10/12, indicating a low risk or moderate to high quality, respectively.

Prevalence of PTSD

The research carried out by Mahmoodi et al. [17] aimed to evaluate the relationship between the type of delivery and the incidence of post-traumatic stress disorder (PTSD) in a sample of 240 Iranian women. The study discovered that 6.2% of the participants developed PTSD following childbirth, characterized by symptoms such as re-experiencing, avoidance, and hyperarousal.Among women who underwent normal vaginal delivery, 5.1% developed PTSD, compared to 7.3% among those who had cesarean sections (C/S). Notably, PTSD was more common in women undergoing emergency cesarean Sect. (8.4%) than elective cesarean Sect. (4.5%). While the difference in PTSD prevalence between natural vaginal delivery and C-sections was not statistically significant ($P = 0.48$), emergency cesarean sections were associated with a slightly higher incidence of PTSD compared to elective cesarean sections, though this was also not statistically significant ($P = 0.37$). Poor social support was identified as a crucial factor contributing to PTSD, with women who lacked adequate support being considerably more vulnerable to developing the disorder.

A recent study by Lopez et al. [34] aimed to investigate the prevalence and risk factors associated with post-traumatic stress disorder (PTSD) in women undergoing cesarean sections. The results revealed that 2.7% of the women in the study showed full-blown PTSD, while 9.2% exhibited a PTSD profile. The researchers identified several key risk factors, including maternal and anesthetic complications and dissociative experiences during the procedure. The type of anesthesia (general or neuraxial) was not significantly associated with PTSD development. However, anesthetic complications such as pain during surgery, failed spinal anesthesia, or severe postpartum headaches were significant predictors of PTSD profile, with an adjusted odds ratio of 4.32 ($P = 0.04$).

Feeley et al. [35] examined postpartum PTSD symptoms among women who had given birth, specifically focusing on those with low birthweight infants and different modes of delivery. Women with low-birthweight infants in the NICU reported significantly more PTSD symptoms at 5 and 8 weeks postpartum than other groups. The prevalence of elevated PTSD symptoms based on self-report ranged from 8.5 to 15.5% at 5 weeks, 5.2–14.8% at 8 weeks, and 1.9–9.4% at 26 weeks. Using a structured interview, the prevalence was lower, ranging from 0 to 3.5% at 8 weeks and 1.9–3.0% at 26 weeks. At 26 weeks, women who had an emergency cesarean birth reported greater PTSD symptoms than those who had a vaginal birth without forceps or vacuum assistance. The study by Feeley et al. reported no significant difference in PTSD symptoms between women who had emergency cesarean births (mean score: 8.33, SD = 6.87 at 5 weeks postpartum) and those who had planned cesarean births (mean score: 7.40, SD = 6.89) or vaginal births (mean score: 7.96, SD = 6.75) at the same time point. Women with infants in the NICU and those who had a vaginal birth showed a significant decrease in PTSD symptoms from 8 to 26 weeks, suggesting that this period may be critical for symptom decline.

The study by Dekel et al. [36] aimed to investigate the relationship between mode of delivery and postpartum mental health, with a particular emphasis on mental health disorders such as depression, anxiety, and post-traumatic stress disorder (PTSD). The research revealed that the occurrence of probable childbirth-related PTSD was significantly higher in women who experienced unplanned cesarean sections (UPCS), with 41.2% of this group exhibiting symptoms. This subgroup of women demonstrated a 3.3 times greater risk of PTSD compared to those who underwent natural births and a 2.8 times higher risk compared to those who had vaginal deliveries.

Orovou et al. [37] investigated the relationship between different types of C-sections (emergency versus elective) and the prevalence of PTSD among Greek women. The study discovered that PTSD was significantly more prevalent in women who underwent emergency C-sections than in those who had elective C-sections. Specifically, 31.7% of women who had emergency C-sections met the criteria for PTSD, while only 1% of those who had elective C-sections did. Furthermore, 14.3% of women in the emergency C-section group had a PTSD profile, indicating significant PTSD symptoms without meeting the full diagnostic criteria, compared to 4.1% in the elective C-section group. The study also identified several risk factors associated with higher rates of PTSD among women who underwent cesarean sections, including preterm labor, inclusion in the NICU, a lack of breastfeeding, and a lack of support from a spouse.

The study by Bayri Bingol and Demirgoz Bal [38] analyzed postpartum PTSD and depression among 481 women in Istanbul, Turkey, revealing that 8.5% of participants met the DSM-5 diagnostic criteria for PTSD. Key risk factors associated with elevated PTSD scores included a history of abuse (mean CityBiTS score 22.13 ± 16.56), unplanned pregnancies (mean score 13.12 ± 12.91), continuous urinary catheterization during labor (mean score 14.22 ± 12.54), emergency cesarean sections (mean score 19.27 ± 14.48), inability to breastfeed in the first hour postpartum (mean score 15.48 ± 13.26), and a lack of support during labor (mean score 18.21 ± 14.12). Similarly, 24.3% of women experienced depressive symptoms, with emergency cesarean sections (mean EPDS score 10.55 ± 7.00) and inadequate support during labor (mean score 11.73 ± 6.22) being significant contributors. The study also identified that women meeting PTSD criteria had a 9.7-fold higher risk of depression compared to those who did not.

Martinez-Vázquez et al. [39] aimed to investigate the association between experiencing substandard maternity care and the likelihood of developing postpartum PTSD among women in Spain. The researchers found that 12.7% of the participants were at risk for PTSD, as determined by a PPQ score of 19 or higher. Several factors were significantly associated with an increased risk of PTSD, such as not adhering to the delivery plan (adjusted odds ratio (aOR): 2.85), undergoing an elective C-section (aOR: 2.53), an emergency C-section (aOR: 3.58), admitting the newborn to an intermediate care unit (aOR: 4.95) or NICU (aOR: 2.25), formula feeding at discharge (aOR: 3.57), and experiencing verbal (aOR: 5.07) and psycho-affective (aOR: 2.61) obstetric mistreatment. On the other hand, initiating breastfeeding within the first hour postpartum (aOR: 0.48) and receiving strong support from a partner (aOR: 0.17 for a lot of support) were found to be protective against developing PTSD.

Gankanda et al. [40] focused on the prevalence and associated factors of postpartum PTSD among a cohort of mothers in Sri Lanka. Over the course of six months, the study discovered a 3.6% prevalence of postpartum PTSD. Specifically, the prevalence was 2.7% at one month postpartum, 0.9% at two months, and 0.5% at six months. The findings indicated significant connections between postpartum PTSD and two specific factors: verbal abuse during labor ($p = 0.04$) and the presence of postpartum depression ($p \leq 0.001$). No significant associations were found between postpartum PTSD and other factors such as gestational age at delivery, type and mode of delivery, labor duration, postpartum hemorrhage, manual removal of the placenta, negative birth experience, APGAR scores, neonatal and maternal intensive care, birth defects, problems with breastfeeding, or the opportunity to discuss concerns with healthcare workers.

Stén et al. [41] undertook a study to evaluate the psychometric qualities of the Swedish version of the City-BiTS, an instrument that diagnoses postpartum PTSD based on DSM-5 criteria. The study also sought to determine the prevalence of PTSD following childbirth in Sweden. A total of 619 women, who had given birth in the previous 6–16 weeks, participated by completing the City BiTS and the EPDS. Divergent validity was demonstrated through significant correlations with EPDS, and discriminant validity was established with factors such as mode of birth, parity, and history of traumatic events. The prevalence of postpartum PTSD was found to be 3.8%. Women who underwent assisted vaginal delivery had the highest prevalence, with 16.7% experiencing PTSD, potentially due to the interventions involved. Emergency C-sections also had a relatively high prevalence of 11.3%, reflecting the potentially traumatic nature of emergency procedures. In contrast, elective C-sections had a much lower prevalence of 2.4%, likely due to the planned nature of the procedure. Vaginal delivery had the lowest prevalence, at 1.3%, suggesting that less invasive, more routine deliveries are associated with a reduced risk of PTSD.

Beck-Hiestermann et al. [42] used the EPDS to assess maternal well-being, with a score of 10 or above indicating potential depressive symptoms. The findings showed that women who underwent emergency C-sections had the highest proportion of depressive symptoms (54 out of 99), followed by secondary C-Sect. (40/119), medically indicated C-Sect. (43/131), and assisted vaginal deliveries (43/145). In contrast, women who had cesarean sections upon maternal request (8/26) and vaginal deliveries (207/703) exhibited lower proportions of depressive symptoms, suggesting that the mode of delivery may influence the risk of postnatal depression.

Effects on well-being

Following Feeley et al.'s [35] research findings, approximately 11% of women have reported symptoms that could potentially indicate co-morbid PTSD and depression at some point in time, with the vast majority not experiencing these symptoms concurrently.

In the study by Dekel et al. [36], women who underwent unplanned cesarean sections (UPCS) reported the highest levels of psychiatric symptoms, including somatization (mean = 0.93, SD = 0.87), obsessive-compulsive behaviors (mean = 1.61, SD = 1.17), depression (mean = 1.61, SD = 1.21), anxiety (mean = 1.37, SD = 1.03), and hostility (mean = 1.09, SD = 0.90). These levels were significantly higher than those reported by women who experienced natural deliveries (e.g., depression mean = 0.95, SD = 0.96) or vaginal deliveries (e.g., depression mean = 1.18, SD = 1.04). Women who had planned cesarean sections (PCS) or instrumental vaginal deliveries (IVD) also reported elevated symptoms compared to natural or vaginal deliveries. Overall distress, measured by the Global Severity Index (GSI), was highest for UPCS (mean = 1.28, SD = 0.88), followed by PCS (mean = 1.03, SD = 0.78), and was lowest for natural deliveries (mean = 0.77, SD = 0.74). The study also found that women who underwent UPCS were 3.3 times more likely to experience probable childbirth-related PTSD compared to natural deliveries and 2.8 times more likely compared to vaginal deliveries.

In the research conducted by Bayri Bingol and Dernigoz Bal [38], the prevalence of depressive symptoms was found to be 24.3%. Notably, women with PTSD symptoms were at a significantly higher risk of developing depression, with those who met all PTSD criteria displaying a 9.7 times greater likelihood of experiencing depression.

Beck-Hiestermann et al. [42] used the EPDS to assess maternal well-being, with a score of 10 or above indicating potential depressive symptoms. The results revealed that women who underwent emergency C-sections, accounting for 54 out of 99, had the highest proportion of women scoring less than 10. Secondary C-Sect. (40/119), medically indicated C-Sect. (43/131), and assisted vaginal delivery (43/145) followed. Notably, women who had C-sections upon maternal request (8/26) and vaginal delivery (207/703) showed a lower proportion of depressive symptoms, suggesting that the mode of delivery may influence the likelihood of experiencing postnatal depression.

Meta-analysis results

Outcome: PTSD at six weeks after birth (emergency C-section vs. elective C-section)

In total, four articles [17, 34, 37, 41] met the eligibility criteria for this outcome. The total number of participants was 684 (378 in the emergency C-section group and 306 in the elective C-section group). There was a significant difference between the groups that had an emergency C-section and those that had an elective C-section in the number of women who had PTSD six weeks after giving birth (OR, 2.74; 95% CI, 1.13 to 6.64; $P = 0.03$), with no heterogeneity ($I^2 = 0\%$) (Fig. 2).

Outcome: PTSD at six weeks to 12 months after birth (emergency C-section vs. elective C-section)

In total, nine articles [17, 34–37, 39–42] met the eligibility criteria for this outcome. The total number of participants was 1732 (814 in the emergency C-section group and 918 in the elective C-section group). A statistically significant difference was observed in the number of cases of PTSD six weeks to 12 months after birth between the groups that had an emergency C-section and those that had an elective C-section (OR, 3.68; 95% CI, 2.63 to 5.15; $P < 0.00001$), with heterogeneity ($I^2 = 45\%$) (Fig. 3).

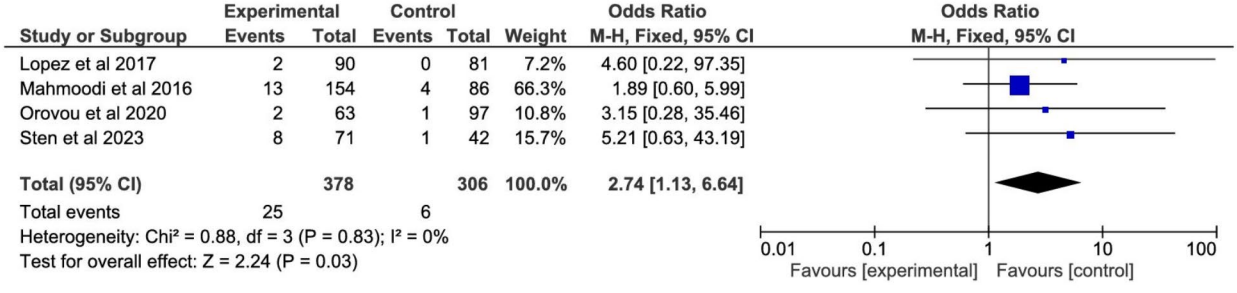

Fig. 2 Forest plot for the outcome: *PTSD at six weeks after birth (emergency C-section vs. elective C-section)*

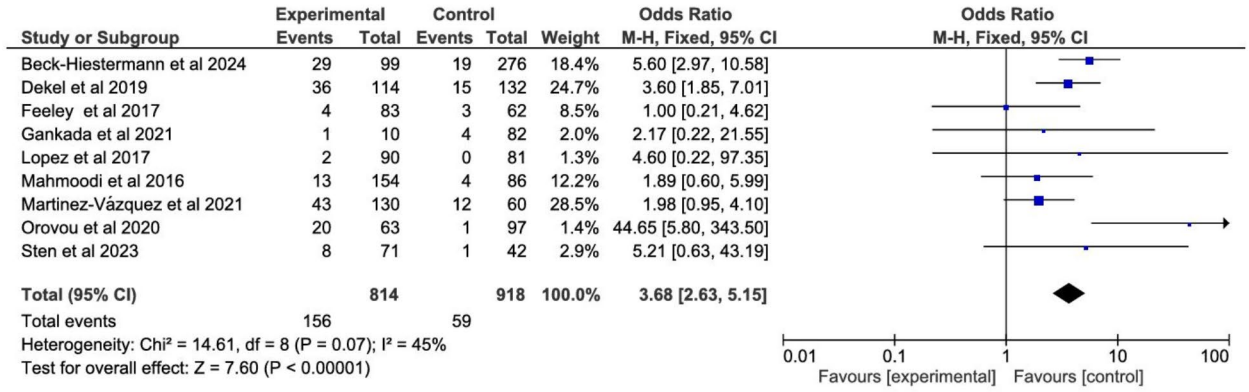

Fig. 3 Forest plot for the outcome: *PTSD at six weeks to 12 months after birth (emergency C-section vs. elective C-section)*

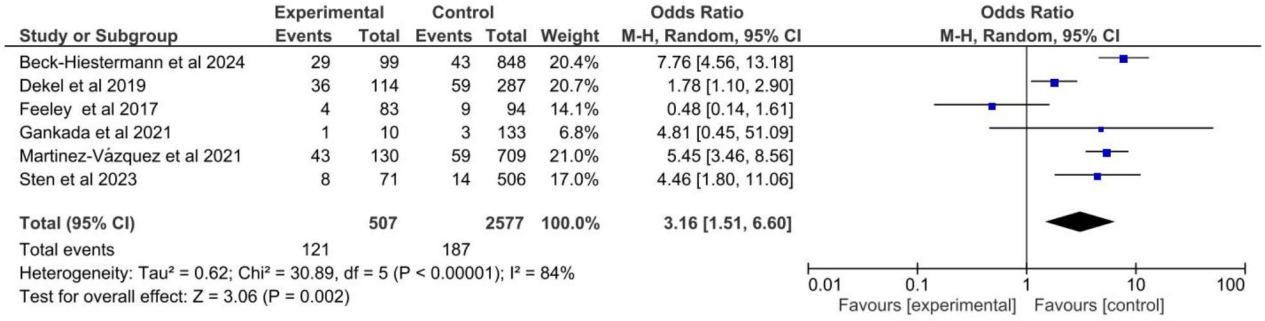

Fig. 4 Forest plot for the outcome: *PTSD at six weeks to 12 months after birth [Emergency C-section vs. Vaginal Birth (assisted or unassisted)]*

Outcome: PTSD at six weeks to 12 months after birth [Emergency C-section vs. Vaginal Birth (assisted or unassisted)]

Six articles in total were deemed suitable for this particular outcome [35, 36, 39–42].The study encompassed a total of 3084 participants, including 507 in the emergency C-section group and 2577 in the vaginal birth group. In the six weeks to 12 months after birth, there was a significant difference between the emergency C-section and vaginal groups in the number of women who had PTSD (OR, 3.16; 95% CI, 1.51 to 6.60; $P = 0.02$), with heterogeneity ($I^2 = 84\%$) (Fig. 4).

Discussion

The relationship between EMCS and postpartum PTSD is complex, with EMCS likely indicating an increased PTSD risk rather than directly causing it. High PTSD rates post-EMCS arise from factors such as the clinical context necessitating the procedure, the psychological impact of its unexpected nature, and pre-existing maternal vulnerabilities. However, the included studies notably lack data on participants' mental health history before pregnancy and childbirth. Pre-existing mental health conditions, such as anxiety, depression, or trauma, are established risk factors for postpartum PTSD and other psychological outcomes. Without comprehensive data on pre-pregnancy mental health, understanding the link between delivery mode and postpartum PTSD risk is difficult. Individuals with prior mental health issues may be predisposed to heightened stress responses, exacerbating childbirth-related trauma. This data gap introduces potential confounding, as pre-existing vulnerabilities might independently influence PTSD development regardless of delivery mode. Future research should collect detailed baseline mental health information during the antenatal period. Longitudinal designs with mental health assessments before, during, and after pregnancy would clarify the interactions between pre-existing conditions, birth experiences, and postpartum outcomes. Such approaches could help differentiate

the contributions of maternal mental health history and delivery factors to postpartum PTSD risk. Integrating baseline data would enable future studies to identify high-risk populations better and develop targeted interventions to reduce childbirth's psychological impact. Understanding pre-pregnancy mental health's role in postpartum outcomes is crucial for improving maternal well-being strategies. Therefore, this multifactorial interplay complicates attributing causation solely to EMCS. Clinical circumstances like fetal distress, maternal hemorrhage, or life-threatening complications create a high-stress environment impacting maternal mental health. These urgent, unplanned events foster feelings of fear, helplessness, and loss of control, which are precursors to PTSD. The abrupt shift from an anticipated birth to an emergency exacerbates the psychological toll, increasing PTSD vulnerability. Pre-existing maternal factors, such as anxiety, depression, or past trauma, further heighten this risk, as these conditions amplify the stress response to an emergency delivery. Procedural aspects of EMCS, such as prolonged labor, failed vaginal delivery attempts, or NICU admissions, also contribute to PTSD. Stén et al. [41] report a higher PTSD prevalence (16.7%) following assisted vaginal deliveries involving forceps or vacuum extraction compared to EMCS (11.3%), indicating that cumulative clinical complications and interventions, rather than EMCS alone, contribute to PTSD risk.

The meta-analysis further revealed that emergency C-sections are associated with a significantly higher risk of PTSD at six weeks postpartum compared to elective C-sections (OR = 2.74) and at six weeks to 12 months postpartum (OR = 3.68). Additionally, a comparison between emergency C-sections and vaginal births indicates a higher prevalence of PTSD in the former group, with an OR of 3.16.

The systematic review by Benton et al. (2019) examined psychosocial outcomes associated with emergency cesarean sections (EmCS) across 66 studies. It reported that EmCS significantly contributes to post-traumatic stress disorder (PTSD) symptoms, with PTSD rates ranging from 2 to 43% across included studies, depending on population and assessment method. However, findings regarding the relationship between EmCS and postpartum depression (PPD) were inconsistent. While some studies identified a higher prevalence of PPD among women undergoing EmCS (e.g., up to 41.3% in one study), others found no significant association compared to other modes of delivery. A majority of studies utilized the Edinburgh Postnatal Depression Scale (EPDS) for assessment, highlighting its common use in evaluating postpartum mental health [28]. However, the frequent use of the EPDS in the included studies underscores its reliability, simplicity, and ease of administration as a screening tool for postpartum depression in clinical and research contexts. Yet, its widespread use necessitates careful interpretation of this systematic review's findings. Although the EPDS is validated for postpartum depression detection, it is not designed to diagnose postpartum PTSD, potentially overlooking PTSD symptoms beyond depressive ones. Symptoms such as re-experiencing trauma, hyperarousal, and avoidance behaviors may not be identified by the EPDS, potentially causing variability in prevalence rates compared to studies using tools like the PTSD Checklist for DSM-5 (PCL-5) or the CityBiTS. Using a single screening instrument across diverse populations and healthcare settings may miss cultural and contextual nuances affecting postpartum mental health. Cultural perceptions of childbirth trauma or postpartum care practices could influence symptom reporting and interpretation with a tool validated primarily in specific contexts. The EPDS's widespread use aids comparability across studies but highlights the need for comprehensive and standardized diagnostic criteria for postpartum PTSD. Future research should develop and validate tools tailored to childbirth trauma to capture all PTSD symptoms. Including both general and childbirth-specific screening tools in research could provide a more holistic understanding of postpartum PTSD prevalence and impact across diverse settings.

The urgency and unexpected nature of emergency C-sections often result in a lack of psychological preparedness for the mother, which can exacerbate the trauma experienced during childbirth. Unpredicted complications, such as fetal distress or maternal hemorrhage, typically trigger emergency procedures, unlike planned or elective C-sections, posing immediate risks to the mother and baby. This heightened state of crisis and the accompanying medical interventions can intensify feelings of fear, helplessness, and loss of control, all of which are significant contributors to the development of PTSD. Furthermore, the abrupt shift from anticipated birth plans to emergency medical procedures can disrupt the mother's emotional and psychological equilibrium, leading to a heightened vulnerability to PTSD. The literature consistently underscores the need for specialized psychological care and support for women undergoing emergency C-sections, as these women are disproportionately affected by birth-related trauma compared to those experiencing elective C-sections or vaginal births. The higher incidence of PTSD among this group underscores the critical importance of immediate and comprehensive mental health interventions to mitigate the long-term psychological impact of such traumatic birth experiences [7].

The findings of the current systematic review and meta-analysis also underscore the need for targeted psychological support and interventions for women undergoing emergency C-sections. Prompt psychological

interventions, including cognitive-behavioral therapy (CBT) and counseling, can significantly reduce the severity of PTSD symptoms in postpartum individuals [43]. Additionally, research by Ford and Ayers suggests that providing immediate support following a traumatic birth experience can help mitigate the development of PTSD symptoms [44].

The variability in social and emotional support during labor and delivery mediates the relationship between EMCS and PTSD. Mothers perceiving inadequate communication from healthcare providers or lacking supportive care during emergency delivery often report higher psychological distress, underscoring the need to enhance perinatal support to mitigate the psychological impact of emergency childbirth. Additionally, heterogeneity in PTSD diagnostic tools and criteria across studies complicates interpretation. Some tools, like the City Birth Trauma Scale (CityBiTS), are specific to childbirth-related trauma, while others assess general PTSD symptoms [45, 46].These differences may affect reported prevalence rates, highlighting the need for standardized screening diagnostic tools tailored to childbirth experiences. EMCS should be viewed as a marker for increased PTSD risk, reflecting clinical, psychological, and social factors rather than a direct cause. Future research should disentangle these influences using robust designs, such as propensity score matching and longitudinal analyses, to identify interventions that reduce PTSD risk and improve perinatal mental health outcomes.

Healthcare providers should prioritize mental health assessments and ensure adequate support to mitigate the long-term psychological impacts on maternal well-being. The elevated prevalence of PTSD in this population highlights the need for standardized diagnostic criteria and further investigation into the long-term effects of emergency C-sections on maternal mental health. Existing diagnostic tools often fail to fully capture the unique experiences of women undergoing emergency C-sections, potentially resulting in underdiagnosis and undertreatment. Standardized criteria would enable more accurate identification and targeted treatment of PTSD in this population [45]. Additionally, Ayers et al. [46] emphasized the importance of incorporating birth-related PTSD into routine postpartum screenings, noting it as a distinct clinical condition that requires specialized attention.

Investigating the long-term effects of emergency C-sections on maternal mental health is essential for designing effective support systems. Research suggests that the incidence of postpartum PTSD following an emergency cesarean section can exceed 30% [37], a rate comparable to those observed in survivors of sexual abuse [47], natural disasters, and combat veterans [48, 49]. This highlights the profound psychological impact experienced by these mothers. However, it is important to recognize that emergency cesarean sections represent a unique form of trauma, differing in significant ways from other acute traumatic events. For example, while childbirth is a unique experience for a woman, an emergency cesarean section is an unforeseen event that occurs only when the mother or fetus is facing immediate danger. In this case, the first PTSD criterion includes direct exposure to a threatened death or threat to physical integrity, such as hemorrhages, preeclampsia, or eclampsia, as well as the mother's exposure as a witness to events concerning the fetus or newborn, such as fetal hypoxia, prematurity, or respiratory distress [50]. Besides, the inevitable symptoms of discomfort from surgery and anesthesia complications [51] contribute to the development of PTSD. Furthermore, the postpartum period shares similarities with the hyperarousal symptoms of PTSD, including emotional instability, anxiety, insomnia, and changes in circadian rhythms, resulting in irritability that characterizes this period [52].

Research suggests that untreated PTSD can lead to chronic mental health issues, such as depression and anxiety, which may persist long after the postpartum period. Research has demonstrated that women with untreated postpartum PTSD are more susceptible to long-term depressive symptoms, which can negatively impact their overall quality of life [53]. Also, the study by Slade has shown that PTSD can negatively impact mother-infant bonding, potentially influencing child development and family dynamics [54].

The systematic review and meta-analysis exhibit several strengths and limitations.

The study's comprehensive search strategy, which included databases like Scopus, PubMed, PsycINFO, and Google Scholar, ensures a broad inclusion of relevant literature, providing a wide scope of data. The use of established quality assessment tools, such as theNOS and the CEBM Critical Appraisal Tools, adds rigor to the evaluation of the included studies, enhancing the reliability of the findings. Moreover, the inclusion criteria were clearly defined, focusing on studies that specifically addressed PTSD following emergency C-sections and excluding those that did not meet these criteria. This focus allows for a more precise understanding of the relationship between emergency C-sections and PTSD. Additionally, the meta-analysis conducted provides a quantitative synthesis of the data, offering a clearer picture of the prevalence of PTSD in this population.

Despite these strengths, the study has notable limitations. The heterogeneity of the included studies, in terms of geographic locations, study designs, and diagnostic tools for PTSD, poses a challenge for standardizing the findings and may affect the generalizability of the results. Furthermore, the variability in the follow-up periods

across studies complicates the assessment of the long-term impact of PTSD, as symptoms may vary significantly over time. Another limitation is the potential for publication bias, as the search was restricted to English-language studies, possibly excluding relevant research published in other languages. Additionally, the reliance on self-reported measures for PTSD in some studies could introduce bias, as participants may underreport or over-report symptoms.

In the context of a systematic review and meta-analysis, our principal objective is to aggregate and synthesize findings from the extant literature, rather than to impose a standardized definition that may not have been consistently applied across the studies under examination. A notable limitation of this approach is the variability in the conceptualization of key terms, such as "emergency cesarean section" and "postpartum PTSD." This lack of uniformity likely contributes to the observed heterogeneity in prevalence rates and complicates the process of drawing direct comparisons between individual studies.

While we have attempted to categorize studies based on comparable definitions and criteria, variations in study designs, diagnostic instruments, and clinical contexts inevitably influence the reported outcomes. These limitations underscore the necessity for future research to establish standardized definitions and methodologies to enhance comparability and generalizability. By acknowledging this variability, we aim to provide an objective interpretation of the findings and elucidate areas where methodological consistency could improve the quality of evidence in this field.

Controlling for confounding factors in studies on the relationship between EMCS and postpartum PTSD is challenging due to ethical and clinical constraints in childbirth research. The urgency of EMCS, often involving life-threatening conditions, prevents randomization and full control of variables such as maternal mental health history, fetal distress, and obstetric complications, leading to reliance on observational data susceptible to bias and limiting causal inferences.

This highlights the need for future prospective cohort studies designed to address these biases by collecting comprehensive data on maternal mental health, social support, and obstetric variables before and after delivery. Advanced statistical techniques, like propensity score matching and structural equation modeling, can better isolate the EMCS effect from confounders.

Incorporating qualitative methodologies could also provide deeper insights into women's subjective experiences with EMCS and their psychological outcomes. Addressing these gaps can offer a nuanced understanding of the pathways leading to PTSD after EMCS and inform targeted interventions to mitigate psychological risks, thus advancing knowledge of birth-related trauma and improving clinical practices to support maternal mental health.

One significant challenge when performing this systematic review and meta-analysis of studies assessing PTSD related to childbirth was the variability in the diagnostic tools used to measure the primary outcome. Some studies relied on generic PTSD assessment tools, such as the PTSD Checklist (PCL-5) or the Clinician-Administered PTSD Scale (CAPS), which are designed to capture symptoms of PTSD across a range of traumatic experiences. While these tools provide validated and widely accepted measures, they may underestimate the prevalence of PTSD related to childbirth. This underestimation occurs because generic tools may fail to fully capture the unique psychological and emotional dimensions of childbirth, such as the profound sense of loss, disappointment, or violation some women experience during a traumatic delivery. Conversely, studies that used childbirth-specific tools, such as the CityBiTS or the Perinatal PTSD Questionnaire (PPQ), are more tailored to the unique aspects of childbirth. These tools incorporate items specific to the birthing experience, including obstetric interventions, perceived lack of control, and inadequate support from healthcare providers. However, the heightened sensitivity of these tools may overemphasize PTSD prevalence, as they are designed specifically to capture subtle psychological impacts that generic tools might overlook. This increased sensitivity can contribute to heterogeneity in reported prevalence rates, complicating direct comparisons across studies.

This variability in measurement tools underscores the inherent challenges in synthesizing data from studies with differing methodologies. It highlights the critical need for standardized diagnostic criteria and tools tailored to the childbirth context. Standardization would not only improve the comparability of findings across studies but also ensure that the unique psychological impact of traumatic births is neither underestimated nor overstated. Until such standards are developed, it remains essential to interpret prevalence estimates with caution, acknowledging the methodological limitations inherent in this field of research.

Conclusions

This systematic review and meta-analysis revealed a strong link between emergency C-sections and an increased prevalence of PTSD. Women undergoing emergency C-sections face a higher risk of PTSD compared to those with elective C-sections or vaginal births, influenced by factors such as unexpected medical complications and inadequate social support. The study's findings emphasize the urgent need for standardized PTSD diagnostic criteria and the inclusion of mental health assessments in postpartum care, especially for

those experiencing emergency C-sections. Despite the study's strengths, including a comprehensive review and rigorous quality assessment, limitations like study heterogeneity and potential biases should be considered. Future research should continue to explore the long-term psychological impacts and refine support strategies to enhance maternal mental health outcomes.

Abbreviations

CAPS	Clinician-Administered PTSD Scale
CBT	Cognitive-Behavioral Therapy
CEBM	Centre for Evidence-Based Medicine
CityBiTS	The City Birth Trauma Scale for DSM-5
DSM	4-Diagnostic and Statistical Manual of Mental Disorders, 4th Edition
DSM	5-Diagnostic and Statistical Manual of Mental Disorders, 5th Edition
EMCS	Emergency Cesarean Section
EPDS	Edinburgh Postnatal Depression Scale
NICU	Neonatal Intensive Care Unit
NOS	Newcastle-Ottawa Scale
OR	Odds Ratio
PCL	5-PTSD Checklist for DSM-5
PCLS	PTSD Checklist-Specific
PICOS	Population, Intervention, Comparison, Outcomes, and Study Design
PPQ	Perinatal PTSD Questionnaire
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PTSD	Post-Traumatic Stress Disorder
PSS	Post-traumatic Stress Symptom Scale
RevMan	Review Manager Software
UPCS	Unplanned Cesarean Sections

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Author contributions
EO: principal investigator, study conception and design, data collection, data interpretation, drafting of the article. EA: study conception and data interpretation. IZ: data interpretation. AS: study design, data interpretation, critical writing, and revision of the article. All the authors have critically reviewed and approved the final draft and are responsible for the content of the manuscript.

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Data availability
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Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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