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Heterogeneous Patterns of Childbirth-Related Trauma Responses in Postpartum Women: A Prospective Longitudinal Study Using Latent Profile Analysis of Traumatic Memory Organisation and Post-traumatic Stress Symptoms

Kunlian Li
Southern Medical University Shenzhen Hospital
Liqiong Liu
National Cancer Center/National Clinical Research Center for Cancer/Cancer Hospital & Shenzhen Hospital
Yani Yang
Southern Medical University Shenzhen Hospital
Yuling Zhu
National Cancer Center/National Clinical Research Center for Cancer/Cancer Hospital & Shenzhen Hospital
Xiuqi Song
Southern Medical University Shenzhen Hospital
Yiyang Zhang
Southern Medical University Shenzhen Hospital
Zixia Qiu
Southern Medical University Shenzhen Hospital
Xiaojun Tan
Southern Medical University Shenzhen Hospital
Ling Chen
dangdang601@smu.edu.cn

Southern Medical University Shenzhen Hospital

Research Article

Keywords: Childbirth, Postpartum Period, Post-Traumatic Stress Disorder, Memory, Latent Profile Analysis, Maternal Mental Health

Posted Date: August 25th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10592812/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Childbirth-related post-traumatic stress symptoms represent an important dimension of postpartum mental health. Women exposed to similar childbirth experiences may develop markedly different psychological responses; however, the heterogeneity of trauma-related memory processing and its relationship with post-traumatic stress symptoms remain insufficiently understood.

Methods

This prospective longitudinal observational study included 746 women recruited during pregnancy and followed up at 6–12 weeks postpartum. Latent profile analysis was conducted to identify distinct psychological profiles based on six dimensions of childbirth-related traumatic memory characteristics and two dimensions of childbirth-related post-traumatic stress symptoms. As a supplementary analysis, K-means clustering was performed using the same indicators to examine classification consistency. Binary logistic regression was used to identify factors associated with membership in the trauma-salient profile.

Results

Two distinct trauma-related psychological profiles were identified: an adaptive-integrated profile (72.9%) and a trauma-salient profile (27.1%). Compared with women in the adaptive-integrated profile, those in the trauma-salient profile exhibited more frequent involuntary recall, stronger sensory memory experiences, greater memory centrality, and lower memory coherence. Higher perceived childbirth trauma, greater fear of childbirth, and neonatal complications were independently associated with membership in the trauma-salient profile.

Conclusions

Childbirth-related psychological responses are heterogeneous and may be characterized by distinct patterns of trauma-related memory processing and post-traumatic stress symptoms. The trauma-salient profile was characterized by a combination of heightened trauma-related memory characteristics and greater symptom burden, rather than post-traumatic stress symptoms alone. Identifying women with trauma-salient memory profiles may facilitate early risk stratification and inform interventions targeting adaptive memory integration.

1. Background

Childbirth is widely recognized as a major life event associated with positive emotions and psychological growth. However, for a substantial proportion of women, childbirth may also be experienced as frightening, distressing, or traumatic [1]. Childbirth-related post-traumatic stress symptoms (CB-PTSS) have emerged as an important public health concern within perinatal mental health, as they may impair maternal psychological well-being and adversely affect family functioning and early child development. Childbirth-related post-traumatic stress symptoms have been associated with adverse outcomes including impaired couple relationships [2], disrupted mother–infant bonding [3], and breastfeeding difficulties [4]. Although prevalence estimates vary according to assessment methods and study populations [5, 6], clinically significant childbirth-related post-traumatic stress symptoms affect a considerable proportion of women following childbirth and have become an increasing concern in maternal mental health research [1].

The development of childbirth-related post-traumatic stress symptoms cannot be explained solely by the objective severity of childbirth events or obstetric complications. Many women experience emergency caesarean birth, instrumental delivery, severe pain, or neonatal complications without developing persistent trauma-related symptoms, whereas others report substantial psychological distress despite the absence of major obstetric adversity [1, 5–7]. This heterogeneity highlights the importance of individual differences in responses to childbirth experiences, suggesting that psychological characteristics may contribute to vulnerability beyond the objective features of childbirth events. Increasing attention has therefore been directed towards cognitive and psychological factors that may explain why women exposed to similar childbirth experiences show markedly different psychological outcomes.

Accumulating evidence suggests that subjective memory characteristics may be more predictive of subsequent psychological outcomes than objective characteristics of traumatic events alone [8, 9]. According to the cognitive model of post-traumatic stress disorder (PTSD) proposed by Ehlers and Clark [10], persistent post-traumatic stress symptoms are influenced by how traumatic experiences are encoded, interpreted, and retrieved in memory. Traumatic memories characterized by fragmentation, strong sensory representations, and limited temporal or contextual integration are more likely to contribute to intrusive recollections and a persistent sense of current threat [11, 12]. The dual representation theory further suggests that trauma memories may differ in the balance between sensory-perceptual and contextualized autobiographical representations, providing a theoretical basis for understanding variability in trauma responses [13]. Together, these theoretical models suggest that trauma-related memory characteristics may represent important indicators of psychological vulnerability following childbirth.

Women may attribute different emotional meanings to similar childbirth experiences and consequently differ in perceived threat, memory characteristics, and psychological responses [14, 15]. Although cognitive models of PTSD have emphasized the role of poorly integrated traumatic memories and maladaptive appraisals in symptom persistence [10], whether childbirth-related trauma memories naturally form distinct patterns across individuals remains unclear. Emerging evidence indicates that

trauma memories are multidimensional experiences involving emotional intensity, sensory vividness, involuntary retrieval, event centrality, and narrative coherence [16–20]. Different combinations of these characteristics may reflect distinct trauma-related memory patterns and may help explain variability in postpartum psychological outcomes.

Previous studies of childbirth-related trauma have predominantly adopted variable-centered approaches, examining associations between individual risk factors, memory characteristics, and post-traumatic stress symptoms while assuming relative homogeneity across individuals [21]. Our previous study showed that emotional memory, intrusive recollections, event centrality, and memory coherence were associated with childbirth-related post-traumatic stress symptoms [22]. However, variable-centered analyses examine associations at the population level and cannot determine whether these characteristics naturally co-occur to form distinct psychological phenotypes. A person-centered approach may therefore provide additional insight into the heterogeneity of childbirth-related trauma responses by identifying subgroups characterized by different combinations of trauma memory characteristics and symptom patterns.

Latent profile analysis (LPA) is a person-centered approach that identifies unobserved subgroups based on patterns across multiple continuous indicators [23]. Previous trauma studies have mainly applied longitudinal approaches to identify symptom trajectories, such as resilient, chronic, and delayed-onset patterns [24]. However, symptom trajectories alone may not fully capture differences in how individuals experience, remember, and integrate traumatic childbirth events. By simultaneously considering trauma-related memory characteristics and post-traumatic stress symptoms, LPA may provide a complementary framework for identifying heterogeneous psychological profiles following childbirth.

Based on this framework, we hypothesized that psychological responses following childbirth-related trauma are characterized by distinct memory–symptom configurations rather than a single continuum of symptom severity. Specifically, we expected that some women would exhibit a trauma-salient profile characterized by frequent involuntary recall, vivid sensory memories, greater event centrality, and reduced memory coherence, whereas others would demonstrate a more integrated memory profile characterized by better memory organization and lower trauma-related symptom burden.

Accordingly, this study aimed to identify latent psychological profiles based on childbirth-related trauma memory characteristics and post-traumatic stress symptoms in a prospective longitudinal sample of postpartum women. We further examined demographic, psychosocial, and obstetric factors associated with profile membership to identify women at increased risk and provide evidence to support early screening and targeted prevention strategies for postpartum mental health.

2. Methods

2.1 Study design

This study used data from the Chinese Birth Memory Research on Trauma & Healing (C-BIRTH), a prospective longitudinal observational study designed to investigate childbirth-related psychological trauma, trauma memory characteristics, and psychological adjustment among Chinese women during the perinatal period. Participant recruitment commenced in November 2024, and data collection was completed in April 2026.

The C-BIRTH study was conducted at a tertiary hospital in Shenzhen, China. Selected measures from the International Survey of Childbirth-related Trauma (INTERSECT), an international multicenter study coordinated by City St George's, University of London, were incorporated into the postpartum follow-up assessment to facilitate measurement harmonization and international comparisons.

The C-BIRTH study consisted of three assessment time points. The baseline assessment (T0) was conducted between 28 and 40 weeks of gestation by trained research nurses. Eligible women attending routine antenatal care were invited to participate and completed baseline questionnaires after providing written informed consent. Follow-up assessments were subsequently conducted within 72 hours after childbirth (T1) and again at 6–12 weeks postpartum (T2), during which participants completed the corresponding follow-up questionnaires.

2.2 Setting and participants

Participants were recruited using a convenience sampling approach from pregnant women attending antenatal care and postpartum follow-up at a tertiary hospital in Shenzhen, China, between November 2024 and April 2026. The inclusion criteria were as follows: (1) aged ≥ 18 years; (2) singleton pregnancy; (3) able to understand and complete the study questionnaires; and (4) provision of written informed consent. The exclusion criteria were: (1) a history of psychiatric disorders or substance dependence, including drug or alcohol dependence; (2) physical conditions that could impede effective communication or study participation (e.g., hearing or speech impairment); (3) a diagnosis of posttraumatic stress disorder before childbirth; (4) withdrawal from the study for personal reasons; (5) medical conditions considered by the investigators to substantially interfere with completion of study procedures

2.3 Data collection

Data were collected by trained research staff using standardized procedures. Women between 28 and 40 weeks of gestation who attended routine antenatal visits were screened for eligibility and invited to participate. Before questionnaire administration, research staff explained the study objectives, procedures, and participant rights using standardized instructions. Written informed consent was obtained from all participants before data collection. Participants completed self-report questionnaires independently, and trained researchers were available to provide clarification when required without influencing responses.

Data were collected at three assessment time points: late pregnancy (T0), within 72 hours after childbirth (T1), and 6–12 weeks postpartum (T2). At T0, baseline demographic information, planned

mode of birth, planned labor analgesia, Part I of the Posttraumatic Diagnostic Scale, and fear of childbirth assessed using the Childbirth Attitudes Questionnaire (CAQ) were collected. At T1, obstetric information, including immediate skin-to-skin contact, labor analgesia, mode of birth, and childbirth satisfaction, was obtained. At T2, information on doula-assisted childbirth, perinatal complications, neonatal complications, birth trauma, the City Birth Trauma Scale, the Edinburgh Postnatal Depression Scale (EPDS), the Childbirth Memory and Recall Questionnaire, and the Pittsburgh Sleep Quality Index (PSQI) was collected.

Additional clinical and obstetric data were extracted from the hospital electronic medical record system, including scores on the Patient Health Questionnaire-9 (PHQ-9), the Generalized Anxiety Disorder-7 (GAD-7), and the Edinburgh Postnatal Depression Scale (EPDS), as well as maternal age, ethnicity, educational attainment, parity, history of adverse pregnancy outcomes, perineal laceration, mode of conception, oxytocin use, total duration of labor, infant sex, birth weight, and 1-minute and 5-minute Apgar scores.

A total of 1,123 participants completed the baseline assessment (T0), 984 completed the T1 follow-up, and 747 completed all three assessments through T2. Details of participant recruitment and retention are presented in Fig. 1. One participant was excluded from the latent profile analysis because both the City Birth Trauma Scale and Birth Memories and Recall Questionnaire data were unavailable. Therefore, the final analytical sample consisted of 746 participants. Previous methodological studies have indicated that sample sizes of approximately 500 participants are generally sufficient to obtain stable latent profile solutions under most conditions [25, 26]. Therefore, the final sample of 746 participants was considered adequate.

Figure 1. Team Formation Process Flowchart.

2.4 Measures

2.4.1 General information questionnaire

Sociodemographic information was collected using a structured questionnaire. The collected variables included age, ethnicity, educational attainment, relationship status, monthly household income per capita, place of residence, religious affiliation, only-child status, and whether participants lived apart from their husbands after marriage. These variables were selected based on previous studies examining factors associated with childbirth-related psychological distress and were considered potential demographic covariates in subsequent analyses. All information was self-reported.

2.4.2 Birth Memories and Recall Questionnaire (BirthMARQ)

The Birth Memories and Recall Questionnaire (BirthMARQ) is a 21-item self-report instrument developed to assess subjective characteristics of childbirth-related memories [15]. Because trauma-related memory characteristics may contribute to individual differences in post-traumatic stress responses after

childbirth, BirthMARQ dimensions were included as indicators in the latent profile analysis. The questionnaire consists of six dimensions: emotional memory, reliving, centrality of memory, sensory memory, recall, and coherence. Items are rated on a 7-point Likert scale ranging from 1 to 7, with items 1, 4, and 21 reverse scored. Higher scores indicate stronger emotional responses, more vivid recollection, greater memory centrality, clearer sensory experiences, more frequent recall, or greater memory coherence, depending on the corresponding subscale.

The BirthMARQ was translated into Chinese and cross-culturally adapted by our team [27]. The Chinese version demonstrated good internal consistency (Cronbach's α = 0.83; McDonald's ω = 0.81). In the present study, the Cronbach's α coefficient was 0.834 for the total scale, with subscale values ranging from 0.553 to 0.840 across the six dimensions. Because the coherence subscale contains only two items, internal consistency was additionally evaluated using the mean inter-item correlation. The observed value (0.383) was within the recommended range for acceptable reliability (0.20–0.50) [28]. Therefore, all six BirthMARQ dimensions were retained as indicators for latent profile analysis.

2.4.3 The City Birth Trauma Scale (City BiTS)

The City Birth Trauma Scale (City BiTS) was developed by Ayers et al. based on the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) criteria to assess childbirth-related post-traumatic stress symptoms and identify probable childbirth-related post-traumatic stress disorder (CB-PTSD) during the first postpartum year [29]. The original version comprised 29 items, and a subsequent Croatian validation study supported a refined 27-item version [30].

The Chinese version (City BiTS-C) was translated and culturally adapted by Nie et al. [31], demonstrating good psychometric properties (Cronbach's α = 0.889, test–retest reliability = 0.86, content validity index = 0.93). In the present study, the 20 symptom items of the City BiTS-C were used, including two dimensions reflecting childbirth-related symptoms and general post-traumatic stress symptoms. The birth-related symptoms dimension assesses symptoms specifically linked to childbirth-related trauma, including distressing memories and avoidance of childbirth-related thoughts (Items 3–12), whereas the general symptoms dimension assesses broader post-traumatic stress symptoms, including negative mood, irritability, and hyperarousal (Items 13–22). In the present study, Cronbach's α coefficients were 0.837 for the birth-related symptoms subscale and 0.847 for the general symptom subscale. Both dimensions were retained as indicators for latent profile analysis to capture different aspects of childbirth-related post-traumatic stress symptoms.

2.4.4 Childbirth Attitudes Questionnaires (CAQ)

The Childbirth Attitudes Questionnaire (CAQ) was developed by Lowe [32] and translated into Chinese by Wei et al. [33]. The Chinese version demonstrated excellent internal consistency, with a Cronbach's α of 0.924. The questionnaire consists of 16 items across four dimensions: concerns about the baby's well-being (5 items), concerns about losing control during childbirth (4 items), concerns about labor pain (4 items), and concerns about medical interventions and the hospital environment (3 items). Each item is rated on a 4-point Likert scale ranging from 1 ("none") to 4 ("severe"). Total scores range from 16 to 64,

with higher scores indicating greater fear of childbirth. In the present study, CAQ scores assessed during late pregnancy were used as a prenatal psychological factor associated with latent profile membership. The Cronbach's α coefficient of the CAQ was 0.915 in the current sample.

2.5 Data Analysis

Data management was performed using SPSS version 26.0, and statistical analyses were conducted using R version 4.4.3 and Mplus version 8.3. Missing data patterns were examined before analysis. Missingness across study variables ranged from 0% to 24.7%, with higher proportions observed for prenatal psychological measures and variables reflecting discrepancies between expected and actual childbirth experiences. Missingness among the eight latent profile indicators was below 2%. Descriptive statistics were used to summarize participant characteristics. Continuous variables are presented as mean ± standard deviation (SD) or median (interquartile range [IQR]), as appropriate, and categorical variables are presented as frequencies and percentages.

Latent profile analysis (LPA) was conducted to identify distinct psychological profiles based on childbirth-related trauma memory characteristics and post-traumatic stress symptoms. Eight continuous indicators were included: two symptom dimensions from the City Birth Trauma Scale (birth-related symptoms and general symptoms) and six memory dimensions from the Birth Memories and Recall Questionnaire (emotional memory, reliving, centrality of memory, sensory memory, recall, and coherence). One- to five-profile solutions were estimated using robust maximum likelihood estimation (MLR). Missing data within the LPA were handled using full information maximum likelihood estimation (FIML) [34].

Model selection was guided by multiple criteria, including Akaike information criterion (AIC), Bayesian information criterion (BIC), adjusted BIC (aBIC), entropy, Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMR-LRT), Lo-Mendell-Rubin likelihood ratio test (LMR-LRT), bootstrap likelihood ratio test (BLRT), profile size, and clinical interpretability. The final model was selected based on the overall balance between statistical fit, theoretical relevance, and interpretability. As a supplementary analysis, K-means clustering was performed using the same eight indicators to examine the consistency of profile classification. Agreement between LPA-derived classifications and K-means classifications was assessed using overall classification agreement and Cohen's kappa coefficient [35].

Differences between latent profiles were examined using independent-samples t tests or Mann-Whitney U tests for continuous variables and χ^2 tests or Fisher's exact tests for categorical variables, as appropriate. Binary logistic regression analyses were performed to identify demographic, psychological, and obstetric factors associated with membership in the trauma-salient profile compared with the adaptive-integrated profile. Missing values among independent variables were handled using multiple imputation with predictive mean matching (five imputations) implemented in the mice package. Variables with $P < 0.10$ in univariable analyses were entered into multivariable logistic regression models. Estimates from imputed datasets were pooled according to Rubin's rules. All statistical tests were two-sided, and $P < 0.05$ was considered statistically significant.

3. Results

3.1 Model Fit and Selection for the Latent Profile Analysis

One- to five-profile solutions were estimated, and model fit indices are presented in Table 1. As the number of profiles increased, the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and sample-size adjusted Bayesian Information Criterion (aBIC) showed progressive reductions. However, both the Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMR-LRT) and the Lo-Mendell-Rubin adjusted likelihood ratio test (LMR-LRT) were non-significant for the three-profile solution ($P > 0.05$), suggesting no significant improvement compared with the two-profile solution. Although the four- and five-profile solutions demonstrated lower information criterion values, at least one profile in each solution contained fewer than 5% of participants, which reduced profile interpretability and potential clinical relevance. Considering model fit indices, classification accuracy, profile size, and theoretical interpretability, the two-profile solution was selected as the final model. The entropy value was 0.839, indicating good classification accuracy. The adaptive-integrated and trauma-salient profiles included 72.9% (n = 544) and 27.1% (n = 202) of participants, respectively.

Table 1
Fitness indicators of different latent profiles

Classes	**1**	**2**	**3**	**4**	**5**
LogLikelihood	-8390.470	-7975.651	-7686.664	-7559.476	-7448.111
AIC	16812.939	16001.302	15441.329	15204.952	15000.221
BIC	16886.775	16116.671	15598.230	15403.385	15240.187
aBIC	16835.969	16037.286	15490.267	15266.844	15075.067
Entropy	—	0.839	0.840	0.881	0.855
Minimum class proportion	746(100%)	202(27.1%)	55(7.4%)	8(1.1%)	8(1.1%)
VLMR-LRT p	—	< .001	.123	.455	.003
LMR-LRT p	—	< .001	.127	.459	.003
BLRT p	—	< .001	< .001	< .001	< .001

Note: AIC = Akaike information criterion; BIC = Bayesian information criterion; aBIC = adjusted BIC; BLRT = Bootstrap Likelihood ratio test; VLMR-LRT = Vuong-Lo-Mendell-Rubin likelihood ratio test; LMR-LRT = Lo-Mendell-Rubin likelihood ratio test.

3.2 Characteristics of the Latent Profiles

The standardized scores of the eight indicators for the two latent profiles are presented in Fig. 2 (Fig. 2). The profiles demonstrated distinct patterns across trauma-related memory characteristics and post-traumatic stress symptom dimensions. The adaptive-integrated profile was characterized by lower levels

of birth-related symptoms, general symptoms, emotional memory, recall, reliving, sensory memory, and centrality of memory, together with higher coherence scores. The trauma-salient profile showed the opposite pattern, characterized by higher trauma-related symptom levels and more prominent trauma-related memory characteristics, accompanied by lower coherence scores. Compared with women in the adaptive-integrated profile, women in the trauma-salient profile reported more frequent involuntary recall, more vivid sensory memory experiences, greater memory centrality, and lower memory coherence.

Figure 2. Standardized latent profile plot based on the City Birth Trauma Scale and the Birth Memories and Recall Questionnaire. The x-axis represents the indicators included in the latent profile analysis, and the y-axis represents the standardized mean scores of each indicator. The two lines represent the traumatic memory profiles identified by latent profile analysis.

3.3 Assessment of Latent Profile Classification Consistency

To evaluate the robustness of the latent profile solution, K-means cluster analysis was performed using the same indicators. The elbow method supported a two-cluster solution (Fig. 3a). Consistent with the latent profile analysis, K-means identified two similar patterns across the eight indicators. The clustering results (Fig. 3b) showed good separation between the two clusters, supporting the stability of the latent profile structure. The Sankey diagram (Fig. 4) showed high agreement between the latent profile analysis and K-means clustering. Most women classified into the adaptive-integrated and trauma-salient profiles were assigned to the corresponding K-means clusters, demonstrating good agreement between the two classification methods.

Figure 3. Elbow method and k-means clustering results. (a) The elbow method suggested that the optimal number of clusters was two. (b) The k-means clustering solution demonstrated high concordance with the latent profile analysis. For visualization, the eight clustering variables were projected onto two principal dimensions (Dim1 and Dim2), which summarize the greatest variation in the data.

Figure 4. Sankey diagram illustrating the agreement between the latent profile analysis (LPA) and k-means clustering solutions. Rectangles represent the profiles identified by each classification method. The colored bands represent participants assigned to each profile, and the width of each band is proportional to the number of participants shared between the corresponding profiles.

3.4 Comparison of Participant Characteristics Across Latent Profiles

Participant characteristics across the two latent profiles are presented in Table 2 (Table 2, in Supplementary file 1). Most sociodemographic and obstetric characteristics did not differ significantly between profiles, including age, educational level, household income, obstetric history, and major perinatal characteristics (all $P > 0.05$).

Women in the trauma-salient profile reported significantly higher levels of depressive symptoms during early, mid-, and late pregnancy (EPDS and PHQ-9), higher anxiety symptoms (GAD-7), greater fear of childbirth (CAQ), and more severe postpartum depressive symptoms than those in the adaptive-integrated profile (all $P < 0.05$). They also reported higher subjective birth-related trauma ($P < 0.001$) and were more likely to experience discrepancies between expected and actual childbirth ($P = 0.033$). Neonatal complications were more common in the trauma-salient profile ($P = 0.001$). Doula-assisted childbirth showed a borderline difference between profiles ($P = 0.052$).

Effect size analysis (Fig. 5a) showed the largest between-profile difference for recall (Cohen's d = 3.03), followed by sensory memory (d = 1.43), centrality of memory (d = 1.37), and reliving (d = 1.28). In contrast, effect sizes for birth-related symptoms (d = 0.76) and general symptoms (d = 0.57) were smaller.

Figure 5. (a) Cohen's d effect sizes (95% confidence intervals) for differences in BirthMARQ and City BiTS dimensions between the two latent profiles. Positive effect sizes indicate higher scores in the Trauma-salient profile. Error bars represent 95% confidence intervals. (b) Box plot of fear of childbirth (CAQ) scores among women with and without doula support. Grey dots represent individual participants. The thick horizontal line within each box indicates the median. CAQ: Childbirth Attitudes Questionnaires

3.5 Factors Associated with Latent Profile Membership

In univariable logistic regression analyses (Table 3, Supplementary File 1), several factors were associated with increased odds of membership in the trauma-salient profile, including discrepancies between expected and actual childbirth experiences (OR = 1.57, 95% CI: 1.05–2.34), doula-assisted childbirth (OR = 1.40, 95% CI: 1.01–1.94), neonatal complications (OR = 2.57, 95% CI: 1.50–4.39), higher subjective birth-related trauma scores (OR = 1.20, 95% CI: 1.13–1.28), greater fear of childbirth (OR = 1.05, 95% CI: 1.03–1.07), higher depressive and anxiety symptoms during pregnancy, and more severe postpartum depressive symptoms (OR = 1.12, 95% CI: 1.08–1.17).

After adjustment for sociodemographic, obstetric, and perinatal factors, conception through assisted reproductive technology remained associated with lower odds of membership in the trauma-salient profile (OR = 0.30, 95% CI: 0.10–0.90). Doula-assisted childbirth (OR = 1.71, 95% CI: 1.15–2.54), neonatal complications (OR = 2.03, 95% CI: 1.10–3.73), higher subjective birth-related trauma scores (OR = 1.17, 95% CI: 1.09–1.26), and greater fear of childbirth (OR = 1.03, 95% CI: 1.00-1.05) remained independently associated with higher odds of trauma-salient profile membership.

3.6 Sensitivity analysis

3.6.1 Correlation Matrix of the Study Variables

Correlations among the eight LPA indicators are presented in Table 4 (in Supplementary file 1). The strongest associations were observed among the BirthMARQ dimensions. Recall was moderately to strongly correlated with sensory memory (r = 0.511, $P < 0.001$), reliving (r = 0.485, $P < 0.001$), and

centrality of memory (r = 0.475, *P* < 0.001). Birth-related and general symptoms of the City Birth Trauma Scale (City BiTS) were moderately correlated (r = 0.395, *P* < 0.001). In contrast, coherence showed weak correlations with all other indicators (|r| < 0.15). Sampling adequacy was acceptable (Kaiser–Meyer–Olkin = 0.744), and Bartlett's test of sphericity was significant (χ^2 (28) = 1384.48, *P* < 0.001).

3.6.2 Sensitivity Analysis of Memory Profile Differences After Accounting for Symptom Severity

To assess whether profile differences in memory characteristics were explained by symptom severity, interaction analyses were performed using the total City BiTS score (Table 5, Supplementary Material 1). No significant profile-by-symptom interactions were observed for recall (*P* = 0.648), reliving (*P* = 0.340), or sensory memory (*P* = 0.097), indicating that differences in these memory dimensions were independent of symptom severity. Modest interactions were found for emotional memory (*P* = 0.002) and centrality of memory (*P* = 0.017), suggesting greater between-profile differences at higher symptom levels. Overall, the key profile differences, particularly in intrusive recall, remained robust after adjustment for symptom severity.

4. Discussion

4.1 Traumatic Memory Organization Underlies Heterogeneity in Childbirth-Related Trauma Responses

Unlike previous studies focusing primarily on symptom severity, this study incorporated childbirth-related traumatic memory characteristics into a person-centered latent profile framework to identify heterogeneous patterns of psychological responses following childbirth. Two distinct profiles were identified: an adaptive-integrated profile and a trauma-salient profile. Importantly, these profiles differed more substantially in traumatic memory characteristics than in post-traumatic stress symptom dimensions alone. Women in the trauma-salient profile reported more frequent involuntary recall, more vivid sensory memory experiences, greater memory centrality, and lower memory coherence, suggesting that childbirth-related trauma responses may represent qualitatively different patterns of memory organization rather than simply varying levels of symptom severity.

These findings are consistent with the cognitive model of PTSD proposed by Ehlers and Clark, which suggests that persistent post-traumatic distress is associated with poorly integrated trauma memories and a persistent perception of current threat [10]. Our findings extend this framework by demonstrating that differences in childbirth-related trauma responses may also be reflected in distinct configurations of traumatic memory characteristics. Specifically, the trauma-salient profile was characterized by highly vivid, intrusive, and self-relevant memories, whereas the adaptive-integrated profile showed a pattern of lower trauma-related memory salience and greater coherence. These findings support the view that psychological responses following childbirth may vary according to how traumatic experiences are

represented and integrated into autobiographical memory, rather than being determined solely by symptom severity [10, 36].

Women in the trauma-salient profile showed higher levels of reliving, sensory memory, centrality of memory, and recall, indicating that their childbirth experiences were associated with stronger emotional, perceptual, and autobiographical representations. According to the cognitive model of PTSD, trauma memories that are insufficiently integrated within their temporal and contextual framework may be more likely to be retrieved as vivid sensory fragments rather than as coherent autobiographical memories [10]. The present findings are consistent with previous evidence suggesting that childbirth can become encoded as a highly salient autobiographical memory that continues to evoke emotional responses in some women [37, 38].

Higher memory centrality in the trauma-salient profile further suggests that childbirth-related memories may occupy a more prominent role in women's self-concept. Previous research has demonstrated that traumatic events perceived as central to personal identity are associated with persistent negative emotional states and post-traumatic stress symptoms [39]. Thus, the distinction between the identified profiles may involve not only symptom expression but also differences in the role and meaning assigned to childbirth memories.

Among the eight latent profile indicators, coherence demonstrated a relatively distinct pattern, showing weak correlations with other memory dimensions ($|r| < 0.15$). Although lower coherence was observed in the trauma-salient profile, this finding should be interpreted cautiously because the coherence subscale consisted of only two items and showed relatively limited internal consistency in the present sample. Further studies using more comprehensive measures of autobiographical memory coherence are needed to clarify its contribution to childbirth-related trauma responses.

The sensitivity analyses further indicated that differences in key memory characteristics, particularly recall, reliving, and sensory memory, remained evident after accounting for overall post-traumatic stress symptom severity. This suggests that the identified profiles cannot be fully explained by differences in symptom burden alone. Rather, they may represent distinct patterns of trauma-related memory organization that contribute to heterogeneity in psychological responses following childbirth.

4.2 Prenatal Vulnerability and Subjective Appraisal in Shaping Trauma-Related Memory Organization

Women classified into the trauma-salient profile reported higher levels of depressive symptoms, anxiety symptoms, and fear of childbirth during pregnancy, suggesting that this profile may reflect psychological vulnerability that precedes childbirth rather than postpartum experiences alone. Previous studies have consistently identified prenatal anxiety, depression, and fear of childbirth as important predictors of childbirth-related post-traumatic stress symptoms [40, 41]. These findings indicate that psychological states before childbirth may influence how women perceive and process childbirth experiences.

Fear of childbirth assessed by the Childbirth Attitudes Questionnaire reflects broader anticipatory threat appraisal, including concerns regarding loss of control, maternal or neonatal safety, medical interventions, and uncertainty during childbirth, rather than fear of labor pain alone [10, 42]. Women with heightened fear of childbirth may enter labor with increased sensitivity to potential threats, which may influence the interpretation of pain, medical procedures, or unexpected events as threatening experiences. Such appraisals may subsequently be associated with more vivid sensory representations, stronger emotional responses, and more intrusive recollections of childbirth [10, 43].

Subjective birth-related trauma was the strongest independent factor associated with membership in the trauma-salient profile. This finding highlights the importance of women's subjective interpretation of childbirth experiences in shaping subsequent trauma-related memory organization. Although previous studies have traditionally focused on objective obstetric factors, such as mode of birth, labor duration, and medical complications, accumulating evidence suggests that the meaning assigned to childbirth may be more closely associated with psychological outcomes than obstetric events alone [44, 45].

Consistent with cognitive models of PTSD, persistent post-traumatic distress is thought to arise from the interaction between negative appraisals of the event and the way traumatic memories are represented and integrated [10]. The present findings extend this perspective by suggesting that subjective trauma appraisal may be associated not only with symptom severity but also with qualitatively different patterns of childbirth-related traumatic memory organization. Future longitudinal studies are needed to clarify whether prenatal psychological vulnerability and subjective trauma appraisal contribute to the development of trauma-salient memory profiles through altered memory processing.

4.3 Doula Support and Potential Indication Bias

The association between doula support and the trauma-salient profile should be interpreted cautiously. Women who received doula support were more likely to belong to the trauma-salient profile; however, this finding should not be interpreted as evidence that doula support increases the risk of maladaptive trauma responses.

Because doula support was not randomly assigned, indication bias is a possible explanation, whereby women with greater psychological vulnerability or stronger fear of childbirth may be more likely to seek or receive doula support [46]. Supporting this interpretation, women receiving doula support in our sample reported higher fear of childbirth during late pregnancy (CAQ: 29.8 ± 7.9 vs. 27.8 ± 8.0, Cohen's d = 0.25, $P < 0.001$) (Fig. 5b).

Furthermore, this study did not assess the timing, content, intensity, or quality of doula support. Therefore, whether specific models of doula care influence traumatic memory organization remain unclear. Future intervention studies are required to determine whether appropriately targeted doula support may facilitate adaptive childbirth experiences and memory integration.

4.4 Clinical Implications

The present findings suggest that heterogeneity in postpartum trauma responses extends beyond symptom severity and may involve distinct patterns of traumatic memory organization. These findings have potential implications for early identification and prevention of childbirth-related psychological difficulties. Women with greater fear of childbirth during pregnancy may represent a group with heightened vulnerability to perceiving childbirth experiences as threatening. When combined with stressful childbirth events, such as severe pain, medical interventions, or neonatal complications, heightened threat appraisal may be associated with the development of more intrusive, sensory, and emotionally salient childbirth memories.

Although the proposed pathway requires further empirical validation, our findings highlight the potential value of assessing prenatal psychological vulnerability, subjective birth-related trauma appraisal, and early memory characteristics together rather than relying solely on post-traumatic stress symptom severity. Future longitudinal studies incorporating mediation models and repeated assessments are needed to clarify the temporal relationships among prenatal psychological factors, subjective trauma appraisal, traumatic memory organization, and childbirth-related post-traumatic stress symptoms. Such evidence may support the development of targeted preventive interventions focusing on adaptive memory processing and integration after childbirth.

4.5 Strengths and Limitations

This study has several strengths. First, data were collected prospectively across multiple perinatal time points, including late pregnancy, within 72 hours after childbirth, and 6–12 weeks postpartum, allowing the examination of prenatal psychological characteristics and postpartum trauma-related outcomes within the same cohort. Second, by integrating childbirth-related traumatic memory characteristics with post-traumatic stress symptoms using a person-centered latent profile approach, this study extends previous symptom-focused research and provides a more comprehensive understanding of heterogeneity in postpartum trauma responses.

Several limitations should also be acknowledged. First, although data collection was longitudinal, the latent profile analysis was conducted using data obtained at a single postpartum assessment point (T2). Because BirthMARQ and City BiTS were assessed concurrently, the identified profiles represent co-occurring patterns of traumatic memory characteristics and post-traumatic stress symptoms at 6–12 weeks postpartum rather than temporal or causal relationships between memory organization and symptom development.

Second, subjective birth-related trauma was assessed retrospectively after childbirth and may have been influenced by participants' current psychological states. However, subjective appraisal is considered a theoretically important component of post-traumatic responses and represents an essential aspect of how individuals interpret potentially traumatic experiences.

Third, the number of participants who conceived through assisted reproductive technology was relatively small, which may have limited the precision of the corresponding estimates. Therefore, this finding

requires replication in larger samples.

Fourth, the coherence subscale of the BirthMARQ showed relatively limited internal consistency in the present sample. Given that this dimension consists of only two items, reliability estimates based on Cronbach's alpha may underestimate its measurement properties. Future studies using more comprehensive assessments of autobiographical memory coherence are needed.

Finally, participants were recruited from a single tertiary hospital, which may limit the generalizability of the findings. Future multicenter studies involving more diverse populations are required to confirm the robustness and applicability of the identified profiles.

5. Conclusion

Postpartum psychological responses following childbirth trauma are heterogeneous and cannot be fully understood through symptom severity alone. By integrating traumatic memory characteristics with post-traumatic stress symptoms, this study highlights the importance of considering how childbirth experiences are represented and organized in memory when evaluating postpartum trauma responses. The identification of a trauma-salient pattern characterized by highly intrusive, sensory, and self-relevant memories provides a potential framework for understanding individual differences in vulnerability after childbirth. These findings support the development of multidimensional screening approaches that incorporate prenatal psychological vulnerability, subjective birth-related trauma appraisal, and early trauma-related memory characteristics to facilitate personalized prevention and intervention strategies for perinatal mental health.

Abbreviations

AIC Akaike Information Criterion

aBIC adjusted Bayesian Information Criterion

BIC Bayesian Information Criterion

BirthMARQ Birth Memories and Recall Questionnaire

CAQ Childbirth Attitudes Questionnaire

CB-PTSD Childbirth-related Post-traumatic Stress Disorder

CB-PTSS Childbirth-related post-traumatic stress symptoms

City BiTS City Birth Trauma Scale

DSM-5 Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

EPDS Edinburgh Postnatal Depression Scale

FIML Full Information Maximum Likelihood

GAD-7 Generalized Anxiety Disorder-7

IQR Interquartile Range

KMO Kaiser-Meyer-Olkin measure of sampling adequacy

LPA Latent Profile Analysis

LMR-LRT Lo-Mendell-Rubin Adjusted Likelihood Ratio Test

MLR Robust Maximum Likelihood Estimation

OR Odds Ratio

PHQ-9 Patient Health Questionnaire-9

PTSD Post-traumatic Stress Disorder

PSQI Pittsburgh Sleep Quality Index

SD Standard Deviation

VLMR-LRT Vuong-Lo-Mendell-Rubin Likelihood Ratio Test

Declarations

Clinical trial number

not applicable.

Human Ethics and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki. The study protocol was approved by the Medical Ethics Committee of Shenzhen Hospital of Southern Medical University (Approval No. NYSZYYEC2024K073R005). All participants provided written informed consent before enrolment.

Consent for publication

All authors have read and approved the final manuscript for publication. Study participants provided informed consent for using the information collected in this research.

Competing interests

The authors declare that they have no competing interests

Declarations of generative AI and AI-assisted technologies in the manuscript preparation process.

Statement: During the preparation of this work the author(s) used OpenAI's ChatGPT in order to generate the R code and Mplus code used for analysis and visualization. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Funding

This work was supported by the Guangdong Basic and Applied Basic Research Foundation (grant number 2025A1515012202), Shenzhen Science and Technology Program: the 2024 Shenzhen Natural Science Foundation (grant number JCYJ20240813145217022) and the 2025 Shenzhen Natural Science Foundation (grant number JCYJ20250604183503005). The funding sources had no such involvement in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication.

Author Contribution

KLL: Conceptualization, Methodology, Formal analysis, Data analysis, Data acquisition, Writing-original draft, Writing-review & editing, Investigation, Data curation.LQL: Conceptualization, Methodology, Formal analysis, Data analysis, Data acquisition, Writing-original draft, Writing-review & editing. YNY:Data acquisition, Data curation, Methodology, Investigation. YL Z: Data acquisition, Data curation, Methodology, Investigation. XQS: Data acquisition, Data curation, Methodology, Investigation. YYZ: Data curation, Methodology, Investigation. ZXQ: Data curation, Methodology, Investigation. XJT: Data curation, Methodology, Investigation. LC: Conceptualization, Methodology, Formal analysis, Writing-original draft, Writing-review & editing, Supervision, Investigation, Data curation, Project administration.

Acknowledgement

The authors sincerely thank all the pregnant and postpartum women who generously participated in this study. Their willingness to share their personal experiences and feelings during the perinatal period made this work possible. We are deeply grateful for their trust and contribution. We also acknowledge the INTERSECT Consortium for providing the core measures and facilitating the multinational collaborative framework that supported this study.

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

References

1. Ayers S, Horsch A, Garthus-Niegel S, Nieuwenhuijze M, Bogaerts A, Hartmann K, et al. Traumatic birth and childbirth-related post-traumatic stress disorder: International expert consensus recommendations for practice, policy, and research. Women Birth. 2024;37:362–7. https://doi.org/10.1016/j.wombi.2023.11.006.
2. Delicate A, Ayers S, Easter A, McMullen S. The impact of childbirth-related post-traumatic stress on a couple's relationship: a systematic review and meta-synthesis. J Reprod Infant Psychol. 2018;36:102–15. https://doi.org/10.1080/02646838.2017.1397270.
3. Frankham LJ, Thorsteinsson EB, Bartik W. Birth related PTSD and its association with the mother-infant relationship: A meta-analysis. Sex Reprod Healthc Off J Swed Assoc Midwives. 2023;38:100920. https://doi.org/10.1016/j.srhc.2023.100920.
4. Garthus-Niegel S, Horsch A, Ayers S, Junge-Hoffmeister J, Weidner K, Eberhard-Gran M. The influence of postpartum PTSD on breastfeeding: A longitudinal population-based study. Birth. 2018;45:193–201. https://doi.org/10.1111/birt.12328.
5. Dekel S, Stuebe C, Dishy G. Childbirth Induced Posttraumatic Stress Syndrome: A Systematic Review of Prevalence and Risk Factors. Front Psychol. 2017;8. https://doi.org/10.3389/fpsyg.2017.00560.
6. Olde E, van der Hart O, Kleber R, van Son M. Posttraumatic stress following childbirth: A review. Clin Psychol Rev. 2006;26:1–16. https://doi.org/10.1016/j.cpr.2005.07.002.
7. Ayers S, Bond R, Bertullies S, Wijma K. The aetiology of post-traumatic stress following childbirth: a meta-analysis and theoretical framework. Psychol Med. 2016;46:1121–34. https://doi.org/10.1017/S0033291715002706.
8. Rubin DC, Berntsen D, Johansen MK. A Memory Based Model of Posttraumatic Stress Disorder: Evaluating Basic Assumptions Underlying the PTSD Diagnosis. Psychol Rev. 2008;115:985–1011. https://doi.org/10.1037/a0013397.
9. Rubin DC, Boals A, Berntsen D. Memory in Posttraumatic Stress Disorder: Properties of voluntary and involuntary, traumatic and non-traumatic autobiographical memories in people with and without PTSD symptoms. J Exp Psychol Gen. 2008;137:591–614. https://doi.org/10.1037/a0013165.

10. Ehlers A, Clark DM. A cognitive model of posttraumatic stress disorder. Behav Res Ther. 2000;38:319–45. https://doi.org/10.1016/S0005-7967(99)00123-0.
11. Beierl ET, Böllinghaus I, Clark DM, Glucksman E, Ehlers A. Cognitive paths from trauma to posttraumatic stress disorder: a prospective study of Ehlers and Clark's model in survivors of assaults or road traffic collisions. Psychol Med. 2020;50:2172–81. https://doi.org/10.1017/S0033291719002253.
12. Briddon E, Slade P, Isaac C, Wrench I. How do memory processes relate to the development of posttraumatic stress symptoms following childbirth? J Anxiety Disord. 2011;25:1001–7. https://doi.org/10.1016/j.janxdis.2011.06.008.
13. Brewin CR, Dalgleish T, Joseph S. A dual representation theory of posttraumatic stress disorder. Psychol Rev. 1996;103:670–86. https://doi.org/10.1037/0033-295X.103.4.670.
14. Kerr A, Warnock-Parkes E, Murray H, Wild J, Grey N, Green C, et al. Cognitive therapy for PTSD following birth trauma and baby loss: clinical considerations. Cogn Behav Ther. 2023;16:e23. https://doi.org/10.1017/S1754470X23000156.
15. Foley S, Crawley R, Wilkie S, Ayers S. The Birth Memories and Recall Questionnaire (BirthMARQ): development and evaluation. BMC Pregnancy Childbirth. 2014;14:211. https://doi.org/10.1186/1471-2393-14-211.
16. Brewin CR. Key concepts, methods, findings, and questions about traumatic memories. J Trauma Stress. 2025;38:771–80. https://doi.org/10.1002/jts.23164.
17. Holmes EA, Bourne C. Inducing and modulating intrusive emotional memories: A review of the trauma film paradigm. Acta Psychol (Amst). 2008;127:553–66. https://doi.org/10.1016/j.actpsy.2007.11.002.
18. Ehlers A, Hackmann A, Steil R, Clohessy S, Wenninger K, Winter H. The nature of intrusive memories after trauma: the warning signal hypothesis. Behav Res Ther. 2002;40:995–1002. https://doi.org/10.1016/S0005-7967(01)00077-8.
19. Blix I, Birkeland MS, Thoresen S. Vivid memories of distant trauma: Examining the characteristics of trauma memories and the relationship with the centrality of event and posttraumatic stress 26 years after trauma. Appl Cogn Psychol. 2020;34:678–84. https://doi.org/10.1002/acp.3650.
20. Giuliani A, de Haan A, Sharp T, Chideya Y, Nixon RDV, Kangaslampi S, et al. Understanding the relationship of trauma memory characteristics to symptoms of PTSD and depression in trauma-exposed children and adolescents: a comprehensive network analysis. Eur J Psychotraumatology. 2026;17:2631357. https://doi.org/10.1080/20008066.2026.2631357.
21. Galatzer-Levy IR, Bryant RA. 636,120 Ways to Have Posttraumatic Stress Disorder. Perspect Psychol Sci. 2013;8:651–62. https://doi.org/10.1177/1745691613504115.
22. Li K, Hua J, Zhou S, Huang S, Zhou Q, Cai W, et al. Interrelationships of postpartum depression and childbirth-related post-traumatic stress disorder with birth memory characteristics among postpartum women: A network perspective. Acta Psychol (Amst). 2026;262:106199. https://doi.org/10.1016/j.actpsy.2025.106199.

23. Jin M, Qian R, Wang J, Long J, Yuan Z, Zeng L, et al. Influencing factors associated with mental workload among nurses: A latent profile analysis. Int J Nurs Sci. 2024;11:330–7. https://doi.org/10.1016/j.ijnss.2024.04.002.
24. Dikmen-Yildiz P, Ayers S, Phillips L. Longitudinal trajectories of post-traumatic stress disorder (PTSD) after birth and associated risk factors. J Affect Disord. 2018;229:377–85. https://doi.org/10.1016/j.jad.2017.12.074.
25. Tein J-Y, Coxe S, Cham H. Statistical Power to Detect the Correct Number of Classes in Latent Profile Analysis. Struct Equ Model Multidiscip J. 2013;20:640–57. https://doi.org/10.1080/10705511.2013.824781.
26. Spurk D, Hirschi A, Wang M, Valero D, Kauffeld S. Latent profile analysis: A review and how to guide of its application within vocational behavior research. J Vocat Behav. 2020;120:103445. https://doi.org/10.1016/j.jvb.2020.103445.
27. Zhu Y, Hua J, Zhou S, Zhou Q, Huang S, Cai W, et al. Cross-cultural validation of the birth memories and recall questionnaire: a cross-sectional study among Chinese postpartum women. PeerJ. 2026;14:e20814. https://doi.org/10.7717/peerj.20814.
28. Briggs SR, Cheek JM. The role of factor analysis in the development and evaluation of personality scales. J Pers. 1986;54:106–48. https://doi.org/10.1111/j.1467-6494.1986.tb00391.x.
29. Ayers S, Wright DB, Thornton A. Development of a Measure of Postpartum PTSD: The City Birth Trauma Scale. Front Psychiatry. 2018;9. https://doi.org/10.3389/fpsyt.2018.00409.
30. Nakić Radoš S, Matijaš M, Kuhar L, Brekalo M, Ayers S. Measuring and Conceptualizing PTSD Following Childbirth: Validation of the City Birth Trauma Scale. Psychol Trauma Theory Res Pract Policy. 2019;12:147–55. https://doi.org/10.1037/tra0000501.
31. Nie X, Cheng L, Huang F, Zhang T, Yao Y, Tan J, et al. Construct validity and psychometric properties of the Chinese version of the City Birth Trauma Scale. J Obstet Gynaecol Res. 2022;48. https://doi.org/10.1111/jog.15391.
32. Lowe NK. Self-efficacy for labor and childbirth fears in nulliparous pregnant women. J Psychosom Obstet Gynaecol. 2000;21:219–24. https://doi.org/10.3109/01674820009085591.
33. Juan Wei J, Liu L, Zhang Y, Wu C, Fu. Reliability and validity of the Chinese version of Childbirth Attitudes Questionnaire. J Nurs Sci. 2016;31:81–3.
34. Enders CK, Bandalos DL. The Relative Performance of Full Information Maximum Likelihood Estimation for Missing Data in Structural Equation Models. Struct Equ Model Multidiscip J. 2001;8:430–57. https://doi.org/10.1207/S15328007SEM0803_5.
35. Grant R, McCloskey J, Hatfield M, Uratsu C, Ralston J, Bayliss E, et al. Use of Latent Class Analysis and k-Means Clustering to Identify Complex Patient Profiles. JAMA Netw Open. 2020;3. https://doi.org/10.1001/jamanetworkopen.2020.29068.
36. Thiel F, Berman Z, Dishy GA, Chan SJ, Seth H, Tokala M, et al. Traumatic memories of childbirth relate to maternal postpartum posttraumatic stress disorder. J Anxiety Disord. 2021;77:102342. https://doi.org/10.1016/j.janxdis.2020.102342.

37. Olde E, van der Hart O, Kleber RJ, van Son MJM, Wijnen HAA, Pop VJM. Peritraumatic dissociation and emotions as predictors of PTSD symptoms following childbirth. J Trauma Dissociation Off J Int Soc Study Dissociation. 2005;6:125–42. https://doi.org/10.1300/J229v06n03_06.
38. Haagen JFG, Moerbeek M, Olde E, van der Hart O, Kleber RJ. PTSD after childbirth: A predictive ethological model for symptom development. J Affect Disord. 2015;185:135–43. https://doi.org/10.1016/j.jad.2015.06.049.
39. Berntsen D, Rubin DC. The centrality of event scale: A measure of integrating a trauma into one's identity and its relation to post-traumatic stress disorder symptoms. Behav Res Ther. 2006;44:219–31. https://doi.org/10.1016/j.brat.2005.01.009.
40. King L, McKenzie-McHarg K, Horsch A. Testing a cognitive model to predict posttraumatic stress disorder following childbirth. BMC Pregnancy Childbirth. 2017;17:32. https://doi.org/10.1186/s12884-016-1194-3.
41. Ayers S, Bond R, Bertullies S, Wijma K. The aetiology of post-traumatic stress following childbirth: a meta-analysis and theoretical framework. Psychol Med. 2016;46:1121–34. https://doi.org/10.1017/S0033291715002706.
42. Hofberg K, Brockington I, Tokophobia. An unreasoning dread of childbirth: A series of 26 cases. Br J Psychiatry. 2000;176:83–5. https://doi.org/10.1192/bjp.176.1.83.
43. Ford E, Ayers S. Stressful events and support during birth: The effect on anxiety, mood and perceived control. J Anxiety Disord. 2009;23:260–8. https://doi.org/10.1016/j.janxdis.2008.07.009.
44. Soet JE, Brack GA, DiIorio C. Prevalence and Predictors of Women's Experience of Psychological Trauma During Childbirth. Birth. 2003;30:36–46. https://doi.org/10.1046/j.1523-536X.2003.00215.x.
45. Grekin R, O'Hara MW. Prevalence and risk factors of postpartum posttraumatic stress disorder: A meta-analysis. Clin Psychol Rev. 2014;34:389–401. https://doi.org/10.1016/j.cpr.2014.05.003.
46. Salas M, Hofman A, Stricker BH. Confounding by indication: an example of variation in the use of epidemiologic terminology. Am J Epidemiol. 1999;149:981–3. https://doi.org/10.1093/oxfordjournals.aje.a009758.

Figures

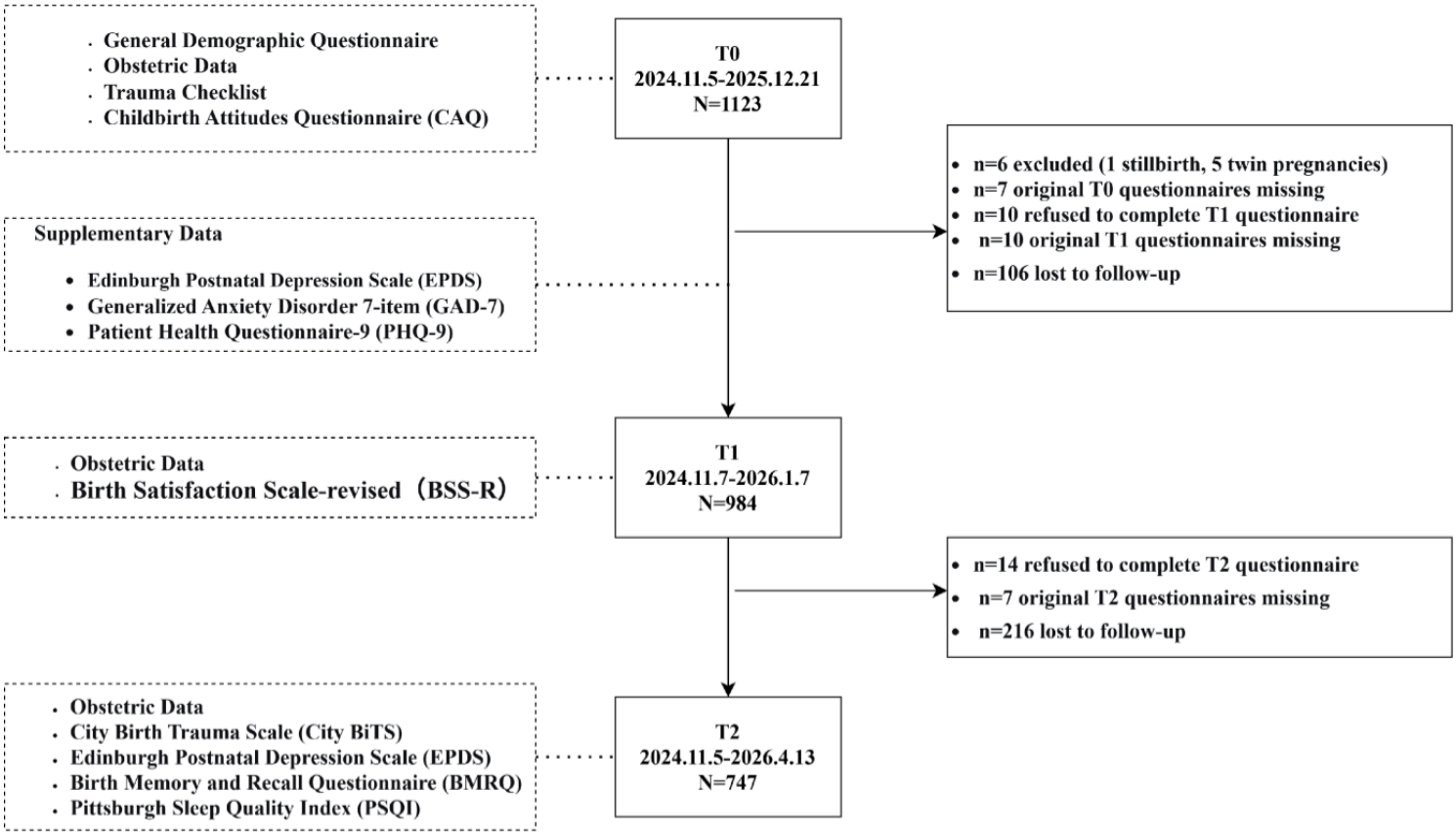


Figure 1

Team Formation Process Flowchart.

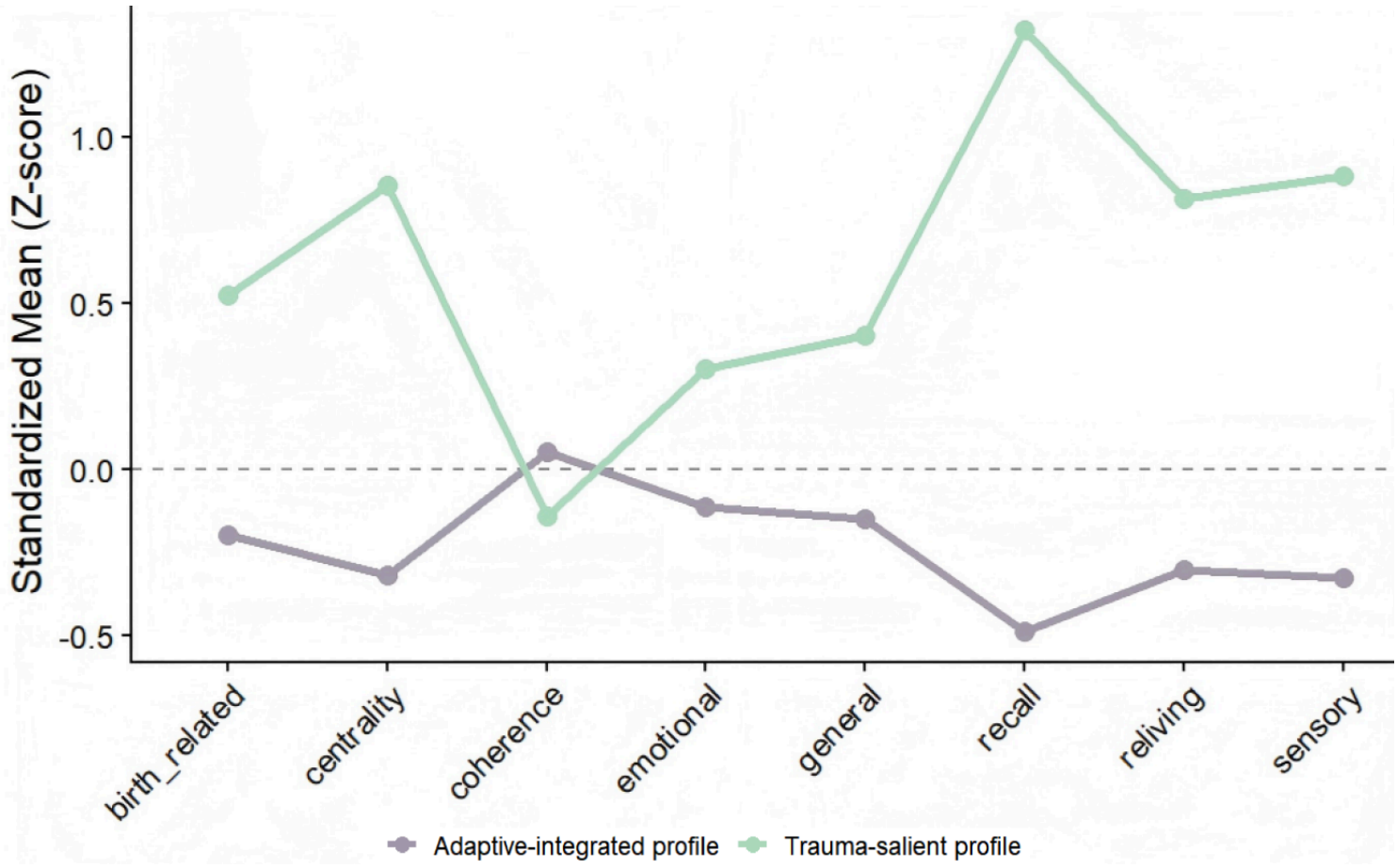


Figure 2

Standardized latent profile plot based on the City Birth Trauma Scale and the Birth Memories and Recall Questionnaire. The x-axis represents the indicators included in the latent profile analysis, and the y-axis represents the standardized mean scores of each indicator. The two lines represent the traumatic memory profiles identified by latent profile analysis.

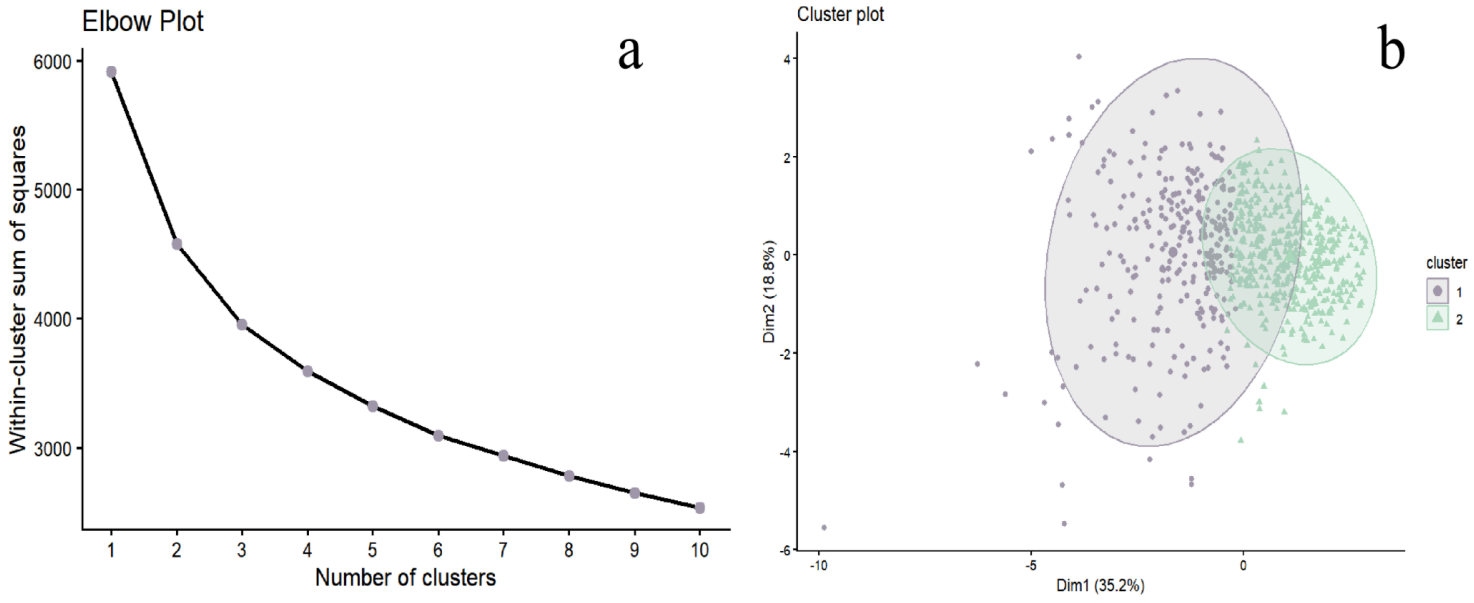


Figure 3

Elbow method and k-means clustering results. (a) The elbow method suggested that the optimal number of clusters was two. (b) The k-means clustering solution demonstrated high concordance with the latent profile analysis. For visualization, the eight clustering variables were projected onto two principal dimensions (Dim1 and Dim2), which summarize the greatest variation in the data.

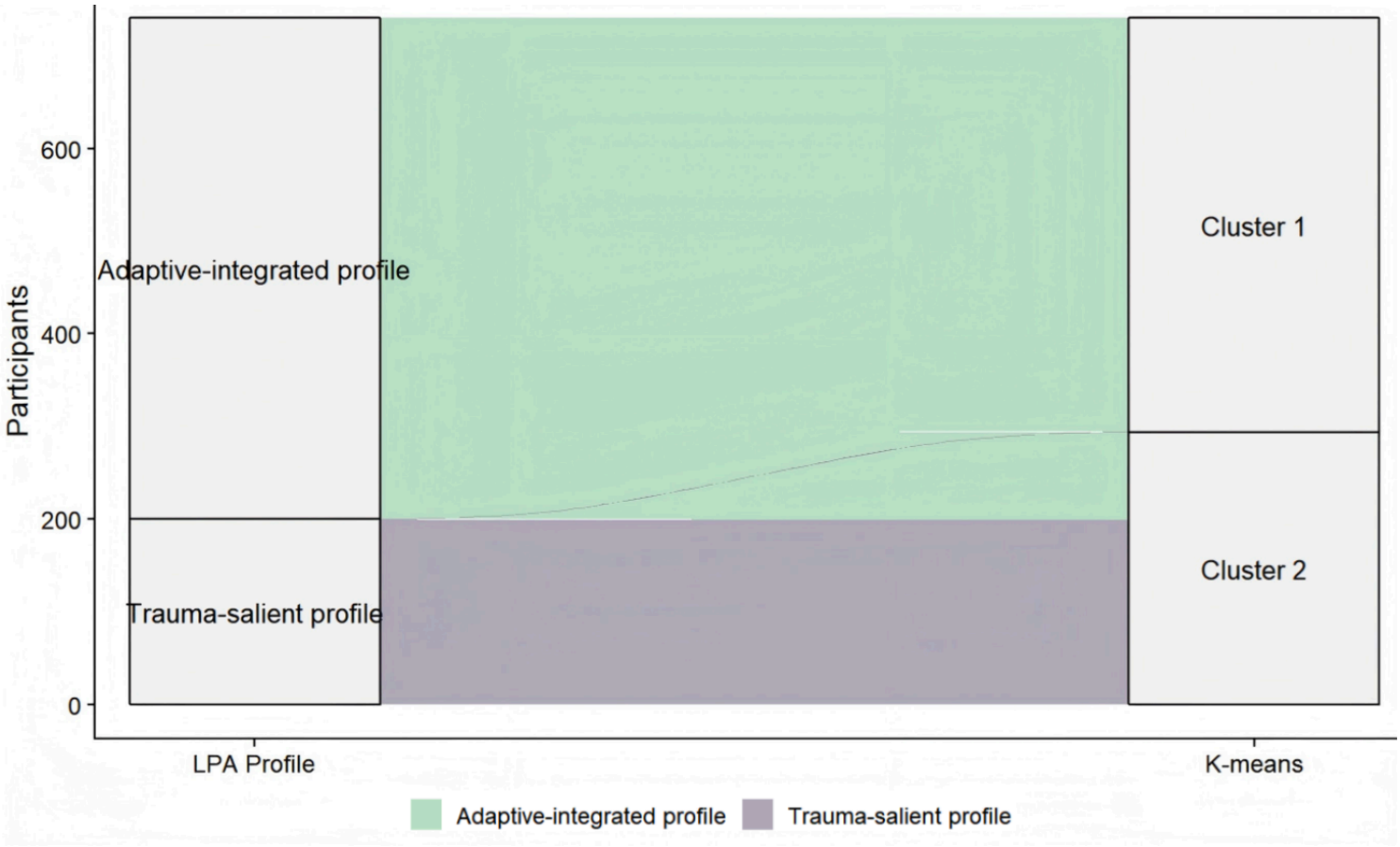


Figure 4

Sankey diagram illustrating the agreement between the latent profile analysis (LPA) and k-means clustering solutions. Rectangles represent the profiles identified by each classification method. The colored bands represent participants assigned to each profile, and the width of each band is proportional to the number of participants shared between the corresponding profiles.

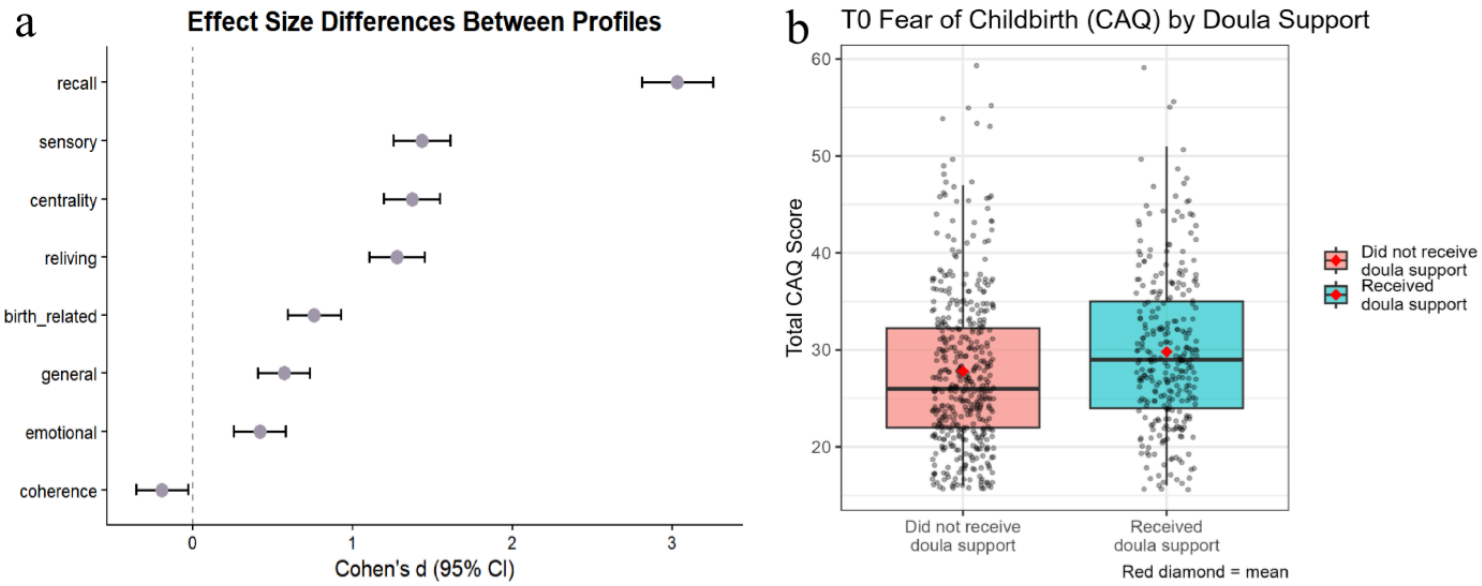


Figure 5

(a) Cohen's d effect sizes (95% confidence intervals) for differences in BirthMARQ and City BiTS dimensions between the two latent profiles. Positive effect sizes indicate higher scores in the Trauma-salient profile. Error bars represent 95% confidence intervals. (b) Box plot of fear of childbirth (CAQ) scores among women with and without doula support. Grey dots represent individual participants. The thick horizontal line within each box indicates the median. CAQ: Childbirth Attitudes Questionnaires

Supplementary Files

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- SupplementaryMaterial1Table25.docx