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RESEARCH ARTICLE

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The role of childhood trauma and attachment state of mind in mothers' birth experiences

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ABSTRACT

Negative birth experiences are common. It is yet unclear which women may be most at risk already before pregnancy. Childhood trauma and non-autonoumous/unresolved attachment state of mind may affect how women experience giving birth. This study used longitudinal data to test childhood trauma and attachment state of mind as predictors of birth experience in at-risk sample of primipara women ($N = 193$). The Adverse Childhood Experiences questionnaire and the Adult Attachment interview were administered during pregnancy, and women reported about their birth experience three months postpartum. Partial Least Square Structural Equation Modelling was applied to answer the research questions. Childhood physical neglect and parental substance abuse were predictive of a more negative birth experience, while attachment state of mind was not associated with how women experienced giving birth. Cross-validation suggests that these findings may be considered externally valid. Further research using validated measures on birth experience are needed.

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Introduction

Depending on the country, 6.8–44% of women experience their childbirth as negative or traumatic (Chabbert et al., 2021; Hosseini Tabaghdehi et al., 2020). A traumatic birth experience refers to "a woman's experience of interactions and/or events directly related to birth that caused overwhelming distressing emotions and reactions; leading to short and/or long-term

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negative impacts on a woman's health and wellbeing" (Leinweber, Fontein-Kuipers, et al., 2022, p. 687). Although there is no clear distinction as to what would differentiate a negative birth experience from a traumatic one, a concept analysis and literature review by Greenfield et al. (2016) suggests that for a birth experience to be traumatic, the distress is required to be long-lasting. A birth that causes distress for a short period of time may thus be considered a negative birth experience. A positive birth experience, in turn, can make a woman feel being supported, in control, safe, and respected, and it may result in positive feelings such as joy, confidence, and/or fulfilment (Leinweber, Fontein-Kuipers, et al., 2022). Women with negative birth experiences may miss out on these experiences. It is important to reduce the negative aspects of birth experience by tailoring antenatal care to women's needs. Therefore, this study sought a better understanding of the factors that may, already before pregnancy, put some women at a higher risk for a negative or even traumatic birth experience.

Childhood trauma

Early traumatic experiences may hamper the development of self-regulation in the face of later stressful events (e.g. Racine et al., 2021; Sachs-Ericsson et al., 2016). For instance, childhood trauma was found to be associated with the ability to cope with stress (Gruhn & Compas, 2020; Maschi et al., 2013) and later post-traumatic stress disorder (PTSD; Crede et al., 2023; Wang et al., 2018). As giving birth can be a complex and stressful process (Larkin et al., 2009), the way a mother experiences stressful situations and how well she is able to cope with stress may affect her birth experience. Birth, and especially the physical intimacy related to it, may be emotional triggers for women who have had traumatic experiences, such as sexual abuse, in their past (Ayers et al., 2016; Beck & Casavant, 2019; Berman et al., 2021; Dikmen-Yildiz et al., 2017; Grekin et al., 2020; Henriksen et al., 2017; Soet et al., 2003). In particular, traumatic experiences during childhood may be associated with how women experience giving birth (Lev-Wiesel et al., 2009), potentially due to challenges that childhood trauma may pose to the ability to seek help (Stige et al., 2013) and to enter into a trusting relationship with maternity staff (Sperlich et al., 2017).

Research on childhood trauma has often taken a broad definition, using adverse childhood experiences (ACEs) as a collection of experiences that may have been traumatic. ACEs comprise abuse, neglect, and household dysfunction (Boullier & Blair, 2018; Center for Disease Control and Prevention, 1998). Following Lacey and Minnis (2020), using ACE scores is controversial, because the use of a cumulative ACE score assumes each adversity to have the same association with the outcome variables. On the other hand, focusing on a single adversity would offer information on the specific role of a single ACE category, but it ignores the co-occurrence of other adversities. Previous research has investigated the role of childhood trauma in one's birth experience using cumulative scores (e.g. Grekin et al., 2020) and single adversity (e.g. Berman et al., 2021; Henriksen et al., 2017). Therefore, more sophisticated, empirically driven methods are needed to overcome the limitations of these methods, when investigating the association between childhood trauma and birth experience.

Attachment state of mind

Childhood trauma alone may not be enough to predict an individual's risk for later challenges (Baldwin et al., 2021), such as for a negative or traumatic birth experience. Another concept that may explain the role of childhood experiences in how one experiences giving birth, is attachment state of mind, a concept that comes from Attachment Theory (Ainsworth et al., 1978; Bowlby, 1982). This refers to the manner in which one is able to produce and reflect upon attachment-related memories (George et al., 1984; Hesse, 1999). Attachment state of mind provides insight into the mental models that one has built based on the history with attachment figures. These mental models guide our behaviour, including coping with stress (Duschinsky et al., 2023). In contrast, retrospective self-report of childhood trauma assesses whether people remember if such events happened or not and are willing to share that (Baldwin et al., 2021).

The Adult Attachment Interview (AAI) is a widely used method to assess an adult's state of mind regarding attachment (George et al., 1984). An interviewer asks the participant to describe their early experiences with parents (or other attachment figures) and evaluate the influence of these experiences on their development and current functioning (Hesse, 2008). Based on coding the narrative structure and the coherence, interviews are classified as autonomous, dismissing, preoccupied, or unresolved regarding loss and/or trauma (Main & Goldwyn, 1994). These four types of attachment state of mind are defined as follows: 1) Adults with autonomous attachment state of mind have detailed memories of their childhood, note both positive and negative aspects of their experiences with their caregivers, and value attachment relationships; 2) Adults with dismissing attachment state of mind minimize the importance of their experiences with their caregivers, have limited attachment-related memories, and idealize their childhood experiences; 3) Adults with preoccupied attachment state of mind are often focused on their dissatisfaction with their experiences with their caregiver at the expense of losing track of the interviewer's questions; and 4) Adults with unresolved attachment state of mind have experienced a significant loss or traumatic abuse experience, which they have not processed well, and which they therefore are not able to discuss in a structured and concise manner (Main & Goldwyn, 1994; Verhage et al., 2016).

Attachment state of mind is hypothesised to be related to the manner of reacting to and coping with a stressful situation (Hesse, 2008; Mikulincer & Shaver, 2008). In other words, attachment state of mind may contribute to individual differences in emotion regulation. Unresolved attachment state of mind in particular has been linked to dysfunctional emotion regulation abilities (Bakkum et al., 2022; DeOliveira et al., 2005; Eilert & Buchheim, 2023). Yet, also individuals with other non-autonomous (i.e. dismissing and preoccupied) attachment state of mind may rely on less efficient coping strategies (e.g. withdrawing) when faced with relationship stressors, as compared to individuals classified with autonomous attachment state of mind (Eilert & Buchheim, 2023; Seiffge-Krenke, 2006).

Unresolved and non-autonomous attachment states of mind have found to be associated with psychological difficulties across the transition to parenthood (Schechter et al., 2008, 2010). Yet, birth experiences have thus far only been associated with self-reported romantic attachment styles (Ayers et al., 2014; Reisz et al., 2019). As narrative (e.g. AAI) and self-reported data on adult's attachment are substantially different (Crowell, 2021), there is a lack of knowledge on whether one's narratively assessed attachment state of mind is related to one's birth experience.

The current study

The current study used prospective longitudinal data from an ongoing cohort study to test whether childhood trauma and attachment state of mind predict women's birth experience. This question was explored in an "at-risk" sample (e.g. women who reported experiences with youth care, a psychiatrist, or a psychologist before the age of 18) to have sufficient variation on these variables. An analytic model, namely partial least squares structural equation modelling (PLS-SEM), was used to overcome the limitations of summary measures of ACEs and negative birth experience and to inform future theorizing on the mechanisms of association (e.g. which aspects of childhood trauma and attachment state of mind may be more predictive of the different aspects of one's birth experience). First hypothesis was that traumatic experiences in childhood (i.e. adverse childhood experiences; ACEs) are positively associated with a negative birth experience. Second hypothesis was that a) unresolved attachment state of mind is associated with more negative birth experiences in comparison to resolved attachment state of mind and that b) non-autonomous attachment state of mind is associated with more negative birth experiences in comparison to autonomous attachment state of mind. However, unresolved state of mind was expected to make a more substantial contribution to the construct of attachment state of mind than non-autonomous state of mind.

Method

Participants

This project is part of an ongoing longitudinal birth cohort study, Generations[2], that started in 2009. Women who were pregnant with their first child were recruited via the study webpage and midwifery practices, both in and around Amsterdam, The Netherlands. In addition, first-time pregnant women were approached from youth care facilities or institutions. There were two inclusion criteria for participating mothers: being pregnant with their first child and having a good enough proficiency in Dutch to fill out the questionnaires. Women with a prenatal diagnosis for a congenital abnormality of the foetus were excluded from the study. The current study focused on a subsample ($n = 193$) of (expectant) mothers at risk (e.g. women who reported experiences with youth care, a psychiatrist, or a psychologist before the age of 18), because data on childhood trauma were collected only from this subsample.

The mothers were on average 24.4 ($SD = 6.2$, range 14.9–41.3) years old during their first pregnancy. Most of them had completed secondary education, were in a relationship, and were of Dutch origin. Based on the descriptions that the mothers provided of their birth (i.e. a multiple-choice item on how the birth had proceeded), there were as many "medical" births as "non-medical" ones (details about the definitions of "medical" and "non-medical" birth can be found under "Measures"). Based on the mothers' reports, most of the births had taken place in a hospital due to medical reasons, while one-third of the women had given birth in a hospital according to their own wish. Table 1 presents the descriptive information of the sample.

Table 1. Background information of the current sample.

	N	
Age of mother in years, *M* (*SD; range*)	193	24.4 (6.2; 14.9-41.3)
Female child, *N* (%)	192	97(50)
Mother's education level	192	
Primary, *N* (%)		15 (8)
Secondary, *N* (%)		116 (60)
Tertiary[a], *N* (%)		61 (32)
Marital status, with partner *N* (%)	192	135 (70)
Country of origin[b], Dutch *N* (%)	193	157 (81)
Type of birth	169	
Non-medical, *N* (%)		75 (44)
Medical, *N* (%)		75 (44)
Unplanned caesarean, *N* (%)		19 (11)
Planned caesarean, *N* (%)		0 (0)
Place of birth	165	
Home, *N* (%)		10 (6)
Hospital by own wish, *N* (%)		50 (30)
Hospital for medical reasons, *N* (%)		105 (64)

[a]Tertiary education refers to university and university of applied sciences.
[b]Country of origin was based on the mother's parents' country of birth.

Procedure

All participants had provided written informed consent and if a participating (expectant) mother was younger than 18 years, a written informed consent was also signed by her legal guardians. The Adult Attachment Interview was administered as part of a home visit during pregnancy. In addition, data were collected via questionnaires at two time-points: demographic information and adverse childhood experiences during pregnancy, and birth experience, type of birth, and sex of the child at 3 months postpartum. Participants filled out the questionnaires during a home visit. The Generations[2] study was reviewed and approved by the Medical Ethical committee of the VU Medical Centre (METc, registration number NL24319.029.08) and a preregistration of the current project can be found on the OSF (https://doi.org/10.17605/OSF.IO/BKYP3). The data that support the findings of this study are available upon reasonable request from the authors and principal investigators of the Generations[2] study, MO and CS. The data are not publicly available due to their containing information that could compromise the privacy of research participants.

Measures

Background variables included age (i.e. years), highest education (i.e. primary, secondary, tertiary/university education), country of origin (i.e. Dutch, other), relationship status (i.e. with partner, single), and sex of the child (i.e. male, female). Type of birth was adjusted to the Dutch setting (Niessink-Beckers et al., 2023) as follows: 1) "non-medical" birth (i.e. a vaginal birth that may have included incision, cutting off membranes, and/or being sutured), 2) "medical" birth (i.e. induction, augmentation, forceps and/or vacuum pump, removal of the placenta), 3) unplanned caesarean section, and 4) planned caesarean section. In the Netherlands, 14% of births take place at home (Perined, 2022). Therefore, also the place of birth was adjusted to the Dutch setting (i.e. 1. home, 2. hospital by own wish, and 3. hospital for medical reasons; Niessink-Beckers et al., 2023).

Childhood trauma was measured with the Dutch translation of the Adverse Childhood Experiences (ACE) questionnaire during the second or third trimester of pregnancy, depending on timing of enrolment (Felitti et al., 1998). The questionnaire consisted of 28 items that covered three categories of abuse (two items on psychological abuse, two items on physical abuse, and four items on sexual abuse), two categories of neglect (five items on psychological neglect and five items on physical neglect), and five categories of exposure to household dysfunction (four items on exposure to interparental violence, two items on exposure to substance abuse, two items on exposure to mental illness, one item on criminal behaviour, and one item on parental divorce). As described by Felitti et al. (1998), a positive response to at least one item within a category indicated the occurrence of that specific category.

A partial least square (PLS) model of the ten ACE categories was formed, and these categories were treated as formative constructs (i.e. the ACE categories cause the latent variable "childhood trauma" instead of depending on it). For this, each category was dichotomized into absence (i.e. 0) or occurrence (i.e. 1) of the event. Table S1 in supplementary material presents the absence and occurrence as well as the number of missing values for each ACE category. In the Supplementary material, Table S2 presents the interrelatedness of the study variables, where also the conventional ACE scoring (i.e. scores 0–3 = no risk, scores 4–10 = risk) is included. Noteworthy is, however, that using this conventional dichotomous scoring for ACE was not part of the analysis plan presented in the preregistration.

Attachment state of mind was measured with the Dutch version of the Adult Attachment Interview (AAI; George et al., 1984) during the second or third trimester of pregnancy, depending on timing of enrolment. The AAI is a semi-structured interview focusing on one's childhood experiences with one's parents including experiences of abuse and loss. The interviews were transcribed verbatim and coded according to the Main and Goldwyn (1994) coding system. The interviews coded as secure-autonomous used a definitive and singular strategy to answer the questions, while interviews coded as non-autonomous-dismissing tended to refuse to reveal or discuss distressing topics, and interviews coded as non-autonomous-preoccupied showed confused and inflexible focus on topics raised during the interview. Finally, an interview was coded as unresolved if the description of the event contained lapses in the reasoning or discourse. Describing extreme behavioural reactions regarding aforementioned events also led to an interview being coded as unresolved. The coders had completed the official training and reliability set for the AAI coding and the kappa score between the three coders was on average .72 for classifying unresolved attachment state of mind and .66 for classifying autonomous attachment state of mind. In this study, two types of AAI classifications were used: 1) the dichotomous classification of autonomous (i.e. F) versus non-autonomous (i.e. non-F) attachment state of mind, and 2) the dichotomous classification of unresolved versus not-unresolved attachment state of mind (i.e. U vs. non-U). In the current study, attachment state of mind was treated as a formative construct, because the latent variable on attachment state of mind did not fit the definition of a reflective construct (i.e. reflective indicators depend on the latent variable). Table S1 in supplementary material presents the occurrence of different classifications and the number of missing values in the two AAI variables. The Adult Attachment Interview was done during a home visit. Sometimes it was not possible to schedule the home visit, which caused the 31 missing AAI scores.

Birth experience was measured by five items asking how mothers experienced their birth at 3 months postpartum. All items were dichotomized into positive-to-neutral and negative birth experience (i.e. a score of 0 and 1, respectively) to be able to combine the different rating scales. The first item asked "How do you look back on your birth experience?," and it was rated on a 5-point Likert-scale (i.e., (1) I am very happy with the way things went, (2) I am quite happy with the way things went, (3) I have no special feelings about the birth, (4) I am not quite happy with the way things went, and (5) I am very unhappy with the way things went). The answers were dichotomized to positive-to-neutral birth experience (answer options 1 to 3) and negative birth experience (answer options 4 to 5). The second item asked, "Which emotions do you have when you look back on your birth experience?," giving a list of various positive (11; e.g. proud, happy) and negative (13; upset, restless) answer options. The frequency of these emotions was rated on a 5-point Likert-scale ranging from (almost) never to very often. Positive items were recoded so that higher scores refer to more negative emotions. After calculating average sum scores, these were dichotomized to positive-to-neutral birth experience (scores below median, median = 2.1) and negative birth experience (scores above median). The third item asked, "How did you experience birth?." Answer options consisted of two emotions (i.e. fantastic and awful) that were scored on a 7-point Likert-scale: from very fantastic to not at all fantastic and from very awful to not at all awful. The former emotion (i.e. fantastic) was reversed so that higher scores refer to more negative emotions. After calculating an average sum score of these two emotions, these were dichotomized to positive-to-neutral birth experience (scores below median, median = 2.5) and negative birth experience (scores above median). The fourth item asked, "Was there a moment during birth you thought that your own life was at risk?" and the fifth "Was there a moment during birth you thought that your baby's life was at risk?." Both items were rated either "yes" (negative birth experience) or "no" (positive-to-neutral birth experience). More information on the original items can be found in a previous study that used the same items for measuring birth experience (Holopainen et al., 2020). In this study, the birth experience variable was treated as a formative construct in which the latent variable on birth experience depends on emotions that women have about their delivery, and not vice versa. Table S1 in supplementary material presents the occurrence of different answers and the number of missing values in each birth item. The number of missing data varies between the five birth experience items, which is due to participants missing or not being willing to answer some of the items.

Data analyses

Preprocessing

There are no maximum likelihood estimators in the R package "SEMinR" (Hair et al., 2021) nor multiple imputation packages that could be used with "SEMinR" models. Therefore, the R package "mice" (van Buuren et al., 2015) was used for multiple imputation to deal with missing data. Yet, as the "mice" package does not work directly with PLS-SEM models built with the "SEMinR" package, the analyses were run separately with each 20 imputed dataset and pooled the results manually. For multiple imputation, the guidelines recommended by Woods et al. (2021) were followed. Investigation of auxiliary variables showed that maternal age, education level, country of origin, and marital status were related to

missingness in at least one of the study variables. Therefore, these four descriptive variables were included in the multiple imputation model with the study variables. Table S1 in supplementary material presents the number of missing values in the ten ACE categories, two attachment state of mind classifications, and the five birth items.

Building the PLS-SEM model

For the actual analyses, partial least squares structural equation modelling (PLS-SEM) was used with the R package "SEMinR" (Hair et al., 2021). The decision to use the PLS-SEM instead of the covariance-based structural equation modelling (CB-SEM) was due to its suitability to 1) analyse complex theoretical models with many indicators, 2) exploratory research for theory testing, 3) include formatively measured constructs, 4) handling non-normal data, 5) achieving statistical power with smaller sample sizes, and 6) focusing on the model's predictive capability (Hair & Alamer, 2022; Hair et al., 2019). The path model of the entire original model can be seen in Figure 1.

Evaluating and adapting the measurement model

The measurement model (i.e. the PLS-model or the three "outer models") was evaluated based on two criteria (Hair et al., 2019). The first criterion was to assess collinearity using the variance inflation factor (VIF) and the second criterion was to assess the indicators' weights and statistical significance (Hair et al., 2019), which was done by inspecting the outer weights and bootstrapping results. As noted by Hair and colleagues, it is only seldom that an indicator from a formative model would need to be omitted. Yet, if a formative indicator weight is nonsignificant, inspection is needed of the size and significance of the indicator loading, keeping only indicators that have a loading above 0.5, even if nonsignificant (Hair et al., 2021).

Evaluating the structural model

The first step to assess the structural model ("the inner model" including the three latent variables and their relationships) was to assess collinearity using the VIF values similarly as previously when assessing the measurement model (Hair et al., 2019). The second step was to evaluate the R^2 values of the endogenous (i.e. dependent) variables, which indicates the model's explanatory power. Third, bootstrapping was used to evaluate the statistical significance and size of the path coefficients. Finally, the model's actual out-of-sample predictive power was evaluated with leave-one-out cross-validation (i.e. LOOCV) using the R package "PLSpredict" (Shmueli et al., 2019). A more detailed description of the analysis strategy is presented in supplementary material.

Explorative analyses

In addition to the analyses described above, interrelatedness of the study variables (i.e. the ten ACE categories, two attachment state of mind classifications, and five birth items) was explored to gain a more nuanced understanding of the association between childhood trauma, attachment state of mind, and birth experience. The preregistration described that in these explorative analyses the dichotomous scoring for the study variables would not be used, and that also the four-way attachment state of mind classifications would be added to the correlation matrix. Yet, some of the study variables were already originally on a dichotomous scale, and therefore it did not make sense to have some of the variables on a continuous scale and some

Figure 1. Path model of the original PLS-SEM model (i.e., 'Model 1').

on a dichotomous scale. Furthermore, the correlation matrix that could be used for dichotomous data (i.e. tetrachoric correlation) could not be used for the four-way AAI classifications. Thus, the explorative analyses were run with the 18 dichotomous items from the three study variables, namely ten ACE categories and a dichotomous ACE risk score (i.e. scores 0–3 = no risk, scores 4–10 = risk), two AAI classifications, and five birth items. Finally, post-hoc analyses were conducted to investigate the interrelatedness between the study variables and socio-demographic data (i.e. variables listed in Table 1).

Results

The occurrence of the different ACE categories in the current sample ranged from 19.2% to 49.7%. The least often occurring ACE categories were physical neglect (19.2%), domestic violence (20.2%), and exposure to criminal behaviour (20.2%), while the most often occurring ACE categories were parental divorce (49.7%), mental illness of a parent (36.3%), and psychological neglect (29.5%). The other four ACE categories, which are psychological abuse (21.8%), sexual abuse (22.8%), parental substance use (23.8%), and physical abuse

(26.4%) were somewhere in between. Regarding the attachment state of mind, almost half of the sample (46.1%) were classified as having a non-autonomous state of mind, while 20.7% were classified as having an unresolved state of mind. Finally, reporting a negative birth experience was most often done on the second and third birth items (i.e. "Which emotions do you have when you look back on your birth experience?" and "How did you experience birth?;" 43.5% and 39.9%, respectively), while reporting a negative birth experience was the least often on the first and fourth birth items (i.e. "How do you look back on your birth experience?" and "Was there a moment during birth you thought that your own life was at risk?;" 15.5% and 14.0%, respectively). Table S1 in supplementary material presents the absence and occurrence, as well as the number of missing values in the ten ACE categories, two attachment state of mind classifications, and the five birth items. As the sample sizes differed between study variables (see Table 1 and Table S1), a post-hoc comparison was conducted between participants who took part in the last (i.e. 3 months postpartum) measurement point and the ones who had dropped out. The samples did not differ regarding any of the sociodemographic/descriptive data (i.e. variables listed in Table 1; all p-values > .05).

Interrelatedness of the study variables

Psychological and physical abuse were strongly correlated ($r > 0.7$) with each other. Similarly, birth experience items asking, "How do you look back on your birth experience?" (item 1) and "How did you experience birth?" (item 3) were strongly correlated ($r > 0.7$) with each other. Moderate correlations ($r > 0.5$) were found between psychological abuse and violence, between psychological abuse and mental health problems, between violence and divorce, between criminality and divorce, between birth experience items 1 and 2, between birth experience items 2 and 3, as well as between birth experience items 4 and 5. Thus, interrelatedness was mainly seen between different trauma categories and between birth items, and not across the constructs, nor between the two AAI classifications (i.e. autonomous and unresolved state of mind). Also, the conventional ACE sum score (i.e. scores 0–3 = no risk, scores 4–10 = risk) was only weakly correlated with the AAI classifications and the five birth experience items. Table S2 in supplementary material presents the interrelatedness of all study variables.

Post-hoc analyses investigating the interrelatedness between the study variables and sociodemographic/descriptive data (i.e. variables listed in Table 1) showed that only maternal age was significantly associated with independent and dependent variables. Therefore, a sensitivity analysis was run including maternal age as a control variable. Maternal age was positively associated with autonomous attachment state of mind, negatively associated with ACE dimensions on physical abuse, criminal behaviour, and divorce, and positively associated with birth experience items 1 and 2 (all p-values < .05). In addition, a) mothers' country of origin was negatively related to ACE dimensions on physical abuse and violence, b) maternal education level positively related to autonomous attachment state of mind, negatively related to ACE dimensions on physical abuse, physical neglect, criminal behaviour, and divorce; c) marital status (i.e. being single) negatively related to autonomous attachment state of mind and positively related to ACE dimensions on physical abuse, sexual abuse, violence, mental illness, criminal behaviour, and divorce; d) gender of the child negatively related to Birth

experience item 5; e) birth type positively related to Birth experience items 1, 2, and 3; and f) place of birth positively related to Birth experience items 1 and 2 (all p-values < .05).

Evaluating and adapting the measurement model

After building the PLS-SEM model, "Model 1" that is presented in Figure 1, the measurement model was evaluated. All steps that are presented here were done with all 20 imputed datasets and afterwards the results were pooled. The first step was to assess collinearity using the variance inflation factor (VIF). As all VIF values were below three, there was no indication of collinearity. The second step was to assess the indicators' weights and statistical significance. In most of the imputed datasets, the indicators' weights were non-significant, and therefore indicators' loadings were assessed. When pooling the results of the indicators' loadings, the absolute average of the loadings were calculated, as also high negative values may refer to an important contribution to the construct. Of the ACE categories, only physical neglect and parental substance abuse had loadings above 0.5, of the AAI variables only the unresolved (versus resolved) AAI classification had a loading above 0.5., and of the birth items only the first four items had loadings above 0.5. Of the other ACE categories, psychological neglect had a loading of 0.48, psychological abuse a loading of 0.27, physical abuse a loading of 0.25, mental health problems a loading of 0.25, criminality a loading of 0.18, violence a loading of 0.17, sexual abuse a loading of 0.14, and divorce a loading of 0.10. Non-autonomous attachment state of mind had a loading of 0.45. Indicators were kept in the model if they had a loading equal or higher than 0.5, even if the loading was non-significant (Hair et al., 2021). Figure 2 presents indicators' loadings, and loadings that are below .5 are presented with dashed lines.

Next, this adjusted model (i.e. "Model 2") was evaluated. In comparison to the first model (i.e. "Model 1" presented in Figure 1), in this model childhood trauma consisted only of physical neglect and parental substance abuse, attachment state of mind consisted of unresolved versus resolved state of mind, and birth experience consisted of the first four birth items. This model had no collinearity issues. Next, indicators' loadings were assessed. The absolute average of the indicators' loading from the 20 imputed datasets resulted in a loading above 0.5 for all other indicators, except for the fourth birth item. Therefore, this item was removed from the model in one last adjustment (i.e. "Model 3") presented in Figure 3.

Evaluating the final model, "Model 3," there was no indication of collinearity and in half of datasets the indicators' weights were non-significant. Then, indicators' loadings were assessed. All three birth items had a loading that was above 0.5. The loading of the first birth items was 0.70, the loading of the second item was 0.81, and the loading of the third item was 0.77. More detailed description of the steps taken and the rationales behind them are presented in supplementary material. Additionally, Table S3 in supplementary material presents the results of the 20 imputed datasets.

Evaluating the structural model

After evaluating the measurement model, the structural model was evaluated. The structural model did not result in any collinearity issues, as both VIF values were below 3.0. Next, the model's explanatory power was assessed using the R^2 value. Values below .25 can be considered weak, and our model had an R^2 value of 0.06. Thus, the model had a low

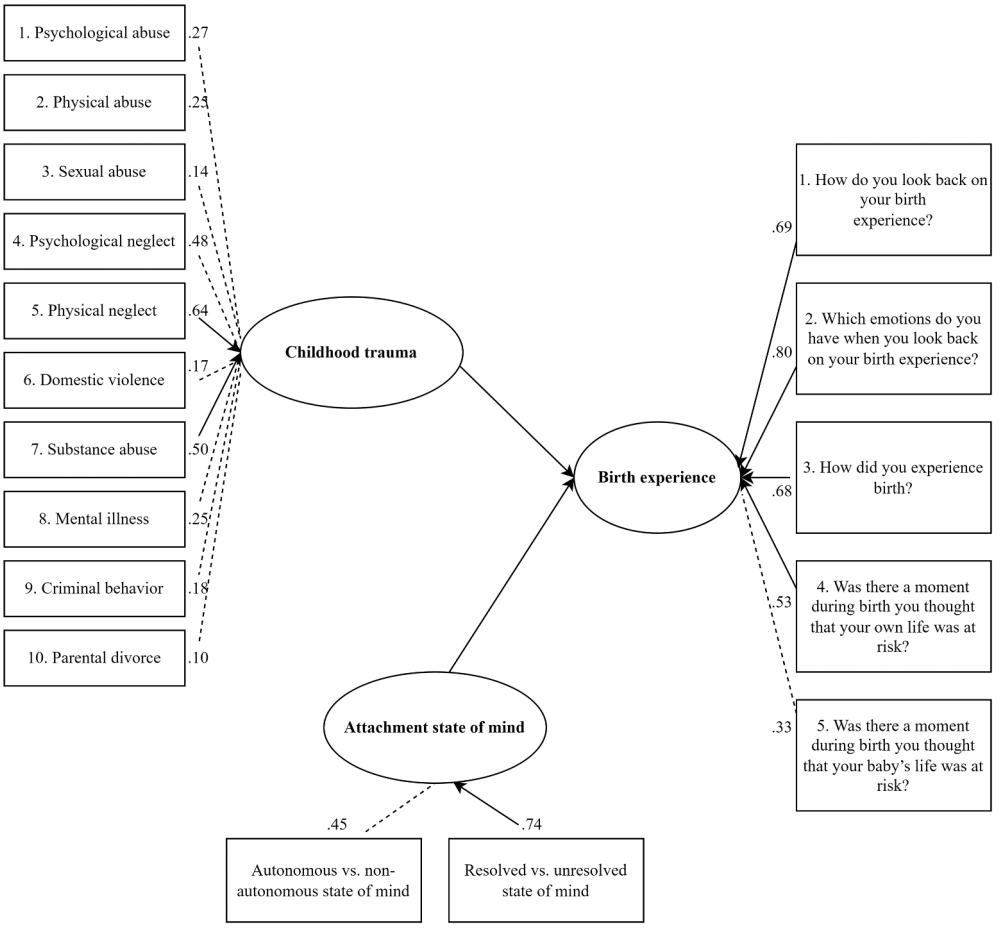

Figure 2. Path model presenting the indicator loadings of the original PLSA-SEM model (i.e., 'Model 1'). Dashed lines refer to loadings below 5.

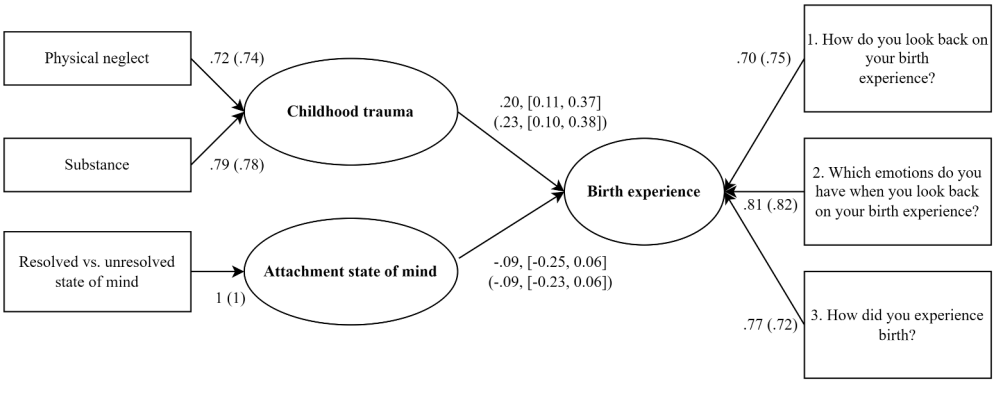

Figure 3. Path model of the final PLS-SEM model (i.e., 'Model 3'). Values in parantheses refer to results of the sensitivity analyses including maternal age as a control variable.

explanatory power, which is also understandable considering that the model included only physical neglect, parental substance abuse, and unresolved attachment state of mind as predictors of one's birth experience. Multiple other factors likely contribute to women's birth experiences.

To evaluate the statistical significance and strength of the path coefficients, the 95% confidence intervals and the beta values from the 20 imputed datasets were used. When pooling the results, childhood trauma was predictive of a more negative birth experience (b = 0.20, 95% CI [0.11, 0.37]), while attachment state of mind was not significantly associated with birth experience (b = –0.09, 95% CI [–0.25, 0.06]). Figure 3 presents the results of the final model.

Finally, when using cross-validation to assess the model's actual out-of-sample predictive power, the RMSE values were compared to the naive benchmark. All three RMSE values were below the naive benchmarks, suggesting the model to have high predictive out-of-sample power. As described by Hair and Alamer (2022), cross-validation evaluates the model's "external validity for similar research design contexts" (p. 8). Accordingly, high predictive out-of-sample power suggests that the results would look similar in other similar research contexts. More detailed description of the steps taken and the rationales behind them are presented under "Data analyses." Table S3 in supplementary material presents the results of the 20 imputed datasets.

Post-hoc sensitivity analysis including maternal age as a control variable

Post-hoc sensitivity analysis including maternal age as a control variable resulted in the same final model (i.e. the same variables as in Model 3). Similar to the analyses presented above, there was no indication of collinearity, and all three birth items had a loading that was above 0.5 (.75, .82, and .72, respectively, for the Birth experience items 1, 2, and 3). The structural model did neither result in any collinearity issues, as both VIF values were below 3.0. The model had an R^2 value of .09. When pooling the results, childhood trauma was predictive of a more negative birth experience (b = 0.23, 95% CI [0.10, 0.38]), while attachment state of mind was not significantly associated with birth experience (b = –0.09, 95% CI [–0.23, 0.06]). The cross-validation resulted in all three RMSE values being below the naive benchmarks, which suggests the model to have high predictive out-of-sample power. The results of the sensitivity analysis can be found in Figure 3.

Discussion

This study, based on a prospective longitudinal cohort, investigated the role of childhood trauma and attachment state of mind in mothers' birth experiences using partial least squares structural equation modelling (PLS-SEM). In the final model, childhood physical neglect and parental substance abuse were predictive of a more negative birth experience, while other types of childhood trauma or attachment state of mind were not related to how women experienced giving birth. Cross-validation suggested the model to have high external validity (i.e. the results would most likely look similar in comparable research contexts). Of the five birth experience items, only the first three items ("How do you look back on your birth experience?," "Which emotions do you have when you look back on your birth experience?," and "How did you experience birth?") offered substantial contributions to the construct of "Birth experience."

The main finding of the current study was that of the 10 different types of childhood trauma, physical neglect and parental substance abuse were the only ones that made a substantial contribution to the construct of "Childhood trauma" and were therefore included in the final model. These were also found to be predictive of a more negative birth experience. Psychological neglect was just below the threshold and was therefore not included in the final model. Interestingly, while physical neglect was especially relevant for the first birth experience item, substance abuse was most strongly correlated with the second and third birth experience items (see Table S2). These differences and reasons behind them ought to be investigated further.

Schreier et al. (2020) found that of all abuse and neglect dimensions, only physical neglect, not other forms of neglect/abuse, was related to an altered physiological stress response to initial and repeated psychosocial stressor, namely the Trier Social Stress Test. Childhood physical neglect may, thus, make an individual less able to cope in stressful situations, such as during birth. The ACE dimension of physical neglect consists of the following five items: 1) "I didn't have enough to eat," 2) "I knew there was someone to take care of me and protect me" (reversely coded), 3) "My parents were too drunk or high to take care of the family," 4) "I had to wear dirty clothes," and 5) "Someone took me to the doctor if I needed it" (reversely coded). Thus, physical neglect bears on the basic physiological human needs that ought to be tended to as the first priority (Harper et al., 2003). In the context of birth experience, a history of physical neglect in one's childhood may be related to a feeling of being alone or not being taken care of in a very vulnerable situation (i.e. during birth). Furthermore, when looking at the loadings of the different types of childhood trauma, psychological neglect was also very close to the limit of 0.5 to be included in the model, while all abuse dimensions (i.e. psychological, physical, and sexual) had much lower loadings. Neglect is often an overlooked type of maltreatment in scientific research (Stoltenborgh et al., 2013), which makes these findings even more relevant.

In addition to physical neglect, parental substance abuse was also found to potentially predict more negative birth experiences. Research on the consequences of parental substance abuse suggests various adverse effects on the next generation (e.g. ADHD, internalising and externalising problems, substance abuse; Anderson et al., 2023; Kuppens et al., 2020). Therefore, future research is needed to investigate possible mechanisms that may link specifically parental substance abuse with a more negative birth experience of the next generation.

Furthermore, the current study found that of the two AAI categories, only the unresolved attachment state of mind contributed substantially to the construct of "Attachment state of mind." Yet, similarly to most of the childhood trauma dimensions, attachment state of mind was not statistically related to how women experienced giving birth. Instead of attachment state of mind and other types of childhood trauma, there may be other factors that – already before pregnancy – put some women at a higher risk for a negative birth experience. Based on a previous systematic review, pre-birth schemas, such as inability to cooperate, commit, or meet personal goals, may put women at a higher risk for a negative birth experience (McKelvin et al., 2021). Previous mental health disorders, in turn, have been found to be potential risk factors for a traumatic birth experience (Simpson & Catling, 2016).

In addition to the factors that are present already before pregnancy and birth, there is much more evidence of the role of pregnancy- and birth-related variables in how women experience giving birth (Hosseini Tabaghdehi et al., 2020; McKelvin et al., 2021; Simpson & Catling, 2016; Watson et al., 2021). Thus, one explanation for the current findings may be

that various birth-related factors, such as "interactions and/or events directly related to birth" (Leinweber, Fontein-Kuipers, et al., 2022, p. 687), may potentially outweigh these more distal psychological factors (i.e. attachment state of mind and other types of childhood trauma). This underlines the importance of respectful and trauma-informed perinatal care to enhance birth experience and prevent adverse sequelae (Ayers et al., 2024; Sperlich et al., 2017). Measures on interactions with care providers and events related to birth (e.g. interventions) were not included in the current analyses. In addition to well-known predictors, such as the hospital care, the level of social support (e.g. from one's partner and care providers) has been suggested to potentially play a role in how women experience giving birth (McKelvin et al., 2021). In the current study, social support may have played a role (e.g. moderated) in the impact that childhood trauma and attachment state of mind may have on one's birth experience. Level of social support is, thus, one of the factors that future studies ought to consider. Furthermore, birth experience is only one facet of birth, and the current study did not investigate the potential predictive role of childhood trauma and attachment state of mind, for instance, in postpartum depression or CB-PTSD.

Another potential explanation for the surprising results especially regarding the role of childhood trauma may be linked to the study sample: all participants in the current sample reported experiences with youth care, a psychiatrist, or a psychologist before the age of 18. This selection creates a distinctive population: receiving interventions as children may have influenced the participants' emotion regulation abilities or their expectations regarding the care received from maternity staff (Leenarts et al., 2013; Vanderzee et al., 2019). This may explain why only physical neglect and parental substance abuse, and not the other types of childhood trauma, were found to be associated with one's birth experience in the current sample, although previous studies have suggested the opposite (Beck & Casavant, 2019; Berman et al., 2021; Grekin et al., 2020; Henriksen et al., 2017; Soet et al., 2003).

Of the five birth experience items, only the first three were relevant for the construct of birth experience. This is in accordance with a previous study by Holopainen et al. (2020) that used partly the same dataset. The fourth and fifth birth item (i.e. fear for own life and fear for the baby's life) were rather different from the first three items, as they focused purely on the fear of death. A recent study found that these two items were predictive of childbirth-related PTSD (CB-PTSD; Gilbert et al., 2023). These two items may, thus, be more predictive of a traumatic birth experience (or CB-PTSD) than a negative birth experience. Future studies are needed to further investigate the measure of birth experience that was used in the current study. For instance, its relation to validated measures on birth experience (e.g. CEQ-2.0; Peters et al., 2022) is still unclear.

The findings of the current study may be used to inform future research: as childhood physical neglect and parental substance abuse were found to potentially put women at a higher risk for a negative birth experience, future research may benefit from investigating the mechanisms explaining these associations (i.e. mediation). In addition, investigating further also the potential role of childhood psychological neglect in women's birth experiences may be fruitful, as psychological neglect was just below the threshold to be included in the final model. Furthermore, the current study did not find support for our hypothesis that unresolved attachment state of mind would be more predictive of birth experience than non-autonomous attachment state of mind. Future research using, for instance, validated measures on birth experience, different samples, and similar sophisticated, empirically driven analyses

are needed before any specific clinical implications can be drawn regarding the differences between various types of childhood trauma and their impact on childbirth experience. This study may thus be one of the many steps towards a better understanding of the role of childhood experiences in one's birth experience.

Strengths and limitations

This study has some strengths that should be considered. First, using the PLS-SEM enabled us to investigate the individual contribution of the different ACE categories, which would not have been possible if using, for instance, the sum score of the ACE. Second, multiple imputation and analysing the 20 imputed datasets separately, even if required to conduct it manually, enabled us to use the entire sample while dealing with missing data in the best possible way (Woods et al., 2021). Third, utilizing cross-validation (i.e. out-of-sample power) enabled us to evaluate the external validity of the findings.

This study has also some limitations that ought to be mentioned when generalizing the result to other samples. First, omitting indicators from a formative construct may decrease the measurement model's content validity (Diamantopoulos & Winklhofer, 2001). For instance, psychological neglect was just below the threshold to be included in the model. Yet, the decisions regarding the analysis strategy were based on the guidelines given by Hair et al. (2019, 2021), as an inclusion or exclusion of one category is related to the contribution of all other categories, and one may easily end up with biased results, if not following predetermined guidelines. Second, the significance of the results is somewhat constrained by the absence of a validated instrument for operationalizing birth experience. At the time of data collection for the current study in 2009, measures on birth experience were much more limited than now. For instance, on PubMed, there were no publications on validated measures on birth experience in Dutch before 2009. Comparison with previous studies is also challenging, because their focus has been on CB-PTSD instead of birth experience (Ayers et al., 2016; Dikmen-Yildiz et al., 2017), or they have investigated the role of traumatic experiences at any point of life instead of childhood trauma (e.g. Berman et al., 2021; Grekin et al., 2020; Soet et al., 2003). Therefore, future research using validated measures on birth experience is still needed to strengthen these findings.

Conclusion

This study used longitudinal data from an "at-risk" sub-sample and an empirically driven analysis method, partial least square structural equation modeling, to investigate the predictive role of childhood trauma and attachment state of mind in women's birth experiences. The current findings suggest that of childhood trauma especially physical neglect and parental substance abuse may put women at a higher risk for experiencing their childbirth negatively, while other types of childhood trauma and attachment state of mind may not be predictive of women's birth experience. Interactions and/or events directly related to birth may potentially outweigh some of the more distal psychological factors (e.g. other types of childhood trauma, attachment state of mind), which would emphasize the importance of respectful and trauma-informed perinatal care. Further research using validated measures on birth experience and including also facets of birth is needed to investigate this topic further.

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