

Associations among postpartum posttraumatic stress disorder symptoms and COVID-19 pandemic-related stressors

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PRÉCIS

COVID-19 pandemic-related stressors are associated with experiencing postpartum PTSD symptoms, therefore screening for PTSD in perinatal clinic settings is important.

ABSTRACT

Introduction: COVID-19 pandemic-related stressors (e.g., exposure, infection worry, self-quarantining) can result in heightened levels of distress and symptoms of postpartum posttraumatic stress disorder (PTSD).

Methods: Using a cross-sectional descriptive design, we collected survey data from a convenience sample of 670 postpartum persons who delivered an infant during the first six months of the COVID-19 pandemic in the United States. Presence of PTSD symptoms were measured using the 21-item Birth Memories And Recall Questionnaire (BirthMARQ), and defined as an affirmative rating for each item (score of 5-7 on a 1-7 agreement scale). Symptoms counts were computed for each of the six BirthMARQ domains, two symptom clusters (intrusive; mood and cognition alterations), and the total number of symptoms. Symptom counts were analyzed using descriptive statistics. We explored associations among COVID-19 experiences (self-quarantine behaviors; infection worry; exposure) and counts of PTSD symptoms using negative binomial regression models while controlling for postpartum depression screening scores, neonatal intensive care unit admissions, number of weeks postpartum, race, and marital status.

Results: Almost 99% of participants reported experiencing at least one of 21 PTSD symptoms (mean, 8.32; SD, 3.63). Exposure to COVID-19 was associated with a 34% greater risk for experiencing intrusive symptoms, specifically, symptoms of reliving the birthing experience as if it were happening now (47% greater risk). Worry surrounding COVID-19 infection was associated with a 26% increased risk for experiencing intrusive recall symptoms in which birth memories came up unexpectedly. COVID-19 quarantining behaviors were not significantly related to increasing PTSD symptoms. Many of the demographic variables included were associated with increasing PTSD symptoms.

Discussion: Screening perinatal persons for PTSD is critically important, especially during public health crises like the COVID-19 pandemic. The integration of comprehensive mental health

screening, including specific screening for trauma and symptoms of PTSD, across healthcare settings can help improve delivery of quality, patient-centered care to postpartum persons.

KEY WORDS

post-traumatic stress, depression, COVID-19, pregnancy, postpartum

QUICK POINTS

- Giving birth during COVID-19 can contribute to a traumatic birth experience for postpartum persons and increase the number of PTSD symptoms experienced.
- Exposure and worry surrounding COVID-19 infection can put postpartum persons at higher risk for experiencing PTSD symptoms.
- Considering the presence of PTSD symptoms in approximately 99% of our sample, it is essential clinicians screen for postpartum PTSD in addition to depression.

INTRODUCTION

Nearly one in four postpartum persons report symptoms of posttraumatic stress disorder (PTSD) during the postpartum period.^{1,2} Postpartum PTSD symptoms often emerge following a threat to maternal or infant health (e.g., emergency cesarean birth; fetal demise; hemorrhage),^{3,4} but can also be triggered by a traumatic experience before or during pregnancy.⁵ PTSD symptoms include intrusive re-experiencing of past traumatic events including childbirth (e.g., flashbacks; nightmares) and mood and cognition alterations such as anxiety, hypervigilance, irritability, and feelings of detachment from reality.⁶ In the context of the COVID-19 pandemic, postpartum persons can experience a variety of PTSD symptoms, signaling emotional dysregulation that could negatively affect their mental health, wellbeing, and relationships with partners⁷ and their infant.⁸

Overall risk factors for postpartum PTSD include fear of childbirth, adverse childhood experiences, prenatal health concerns (e.g., pre-eclampsia; gestational diabetes; infant congenital abnormalities), and lack of social and/or emotional support.^{5,9} Pandemic sequelae, such as social distancing, stay at home orders, unemployment, and increased dependent care responsibilities, are similar to previously established perinatal risk factors for postpartum PTSD. For example, social distancing and stay at home orders can contribute to decreased social support, placing postpartum persons at increased risk for postpartum PTSD. These pandemic-related stressors, introduced early in the pandemic, could have significantly elevated maternal mental health challenges¹⁰ and resulted in heightened levels of distress¹¹ and mental illness among perinatal persons.¹²⁻¹⁷

Postpartum PTSD can result in poor maternal infant bonding, decreased maternal self-efficacy, and strained partner relationships.¹⁸⁻²⁰ Further, postpartum PTSD can adversely affect subsequent pregnancies, including increased risk for intrauterine growth restriction, premature birth, and low birth weight.²⁰⁻²² Considering the adverse effects of PTSD on subsequent pregnancies, and since pandemic sequelae can mirror pre-established postpartum PTSD risk factors, it is critical to evaluate the association of COVID-19 pandemic experiences with PTSD symptoms. With this knowledge, midwives, perinatal nurses, obstetricians, and maternal mental health clinicians can begin to identify and/or develop clinical guidelines, resources, and supports to improve screening persons for postpartum PTSD, refer to treatment as indicated, and equip perinatal persons and their families with resources and knowledge.

Known associations among various mental health outcomes (e.g., depression; anxiety; PTSD),²³ in addition to perinatal risk factors for PTSD, suggest that pregnancy during COVID-19 can create traumatic birth memories. Understanding how traumatic birth affects postpartum mental

health is critical to providing patient-centered care that is effective and of high quality. Additionally, understanding the relationship between COVID-19 and postpartum PTSD can inform trauma-informed care approaches to minimize PTSD symptoms in subsequent pregnancies after the pandemic. Accordingly, we conducted the COVID-19 Maternal Attachment, Mood, Ability, and Support study (COVID-19 MAMAS) to explore and describe perinatal mental health during the early stages of the COVID-19 pandemic in the United States. During the first wave of COVID-19 in the US, many states began imposing temporary stay-at-home orders and mask mandates in public places, while hospitals and clinics developed and implemented strict visitation policies and other infection control measures. Using data from the COVID-19 MAMAS study, the purposes of this current study were to 1) explore the presence of PTSD symptoms among postpartum persons who delivered during the first wave of the COVID-19 pandemic in the US and 2) explore relationships among PTSD symptoms and general stressors of the COVID-19 pandemic (e.g., exposure to COVID-19 infection; worry surrounding COVID-19 infection; self-quarantining and isolation).

MATERIALS AND METHODS

Design

This study was part of the COVID-19 MAMAS (Maternal Attachment, Mood, Ability, and Support) study, which used a cross-sectional design to collect survey data from postpartum persons who delivered an infant between February 1, 2020 (after the U.S. declared COVID-19 a public health emergency)²⁴ and July 8, 2020. Data collection took place in June and early July of 2020 and included participants who birthed during the initial surge of COVID-19 cases in the United States, which peaked in April 2020.²⁵ The COVID-19 MAMAS study collected data on several selected perinatal health outcomes, including postpartum anxiety and depression, traumatic birth memories, social and emotional support, parental self-efficacy, and infant bonding. Demographic information, including COVID-19 experiences (e.g., exposure to COVID-19 infection; worry surrounding infection risk; self-quarantining behaviors), and infant information (e.g., NICU admission), were also collected. This study explores relationships among participant experiences during the COVID-19 pandemic and postpartum PTSD symptoms of emotional dysregulation including mood and cognition alternations and intrusion. The study was approved by the University of Michigan Institutional Review Board.

Sample

The COVID-19 MAMAS study recruited a convenience sample of participants across the United States via social media pages and groups targeting postpartum persons. In addition to social

media recruitment, one participating hospital in northern Ohio distributed flyers to postpartum persons discharged from the birthing center. Those interested in participating followed a link directing them to a web-based survey which screened for eligibility, provided study information, requested consent, and included all study measures. The survey was available online to any postpartum person meeting the following eligibility criteria: 1) ≥ 18 years of age; 2) lived in the United States or a U.S. territory; 3) birthed a live infant on or after February 1, 2020; and 4) could read and understand the English language.

Variables and measurements

Independent Variables

Independent variables were selected based on extant research and theoretical relationships with PTSD symptoms. Demographic variables were adapted from U.S. census items and previous research on PTSD in postpartum populations and included marital status (married or not married), race (white or not white), number of weeks postpartum at time of survey, and infant admitted to a neonatal intensive care unit (NICU) (yes/no).

COVID-19 variables included 1) exposure to COVID-19; 2) worry about COVID-19 infection risk; and 3) self-quarantining behaviors. As there were no existing questions to query COVID-19 domains at the time of the study, we developed items measuring these selected COVID-19 constructs following stakeholder input from pregnant and postpartum persons not participating in the study, clinicians (e.g., labor, postpartum, and neonatal nurses; obstetricians), and researchers with expertise in perinatal research. COVID-19 exposure, worry surrounding infection risk, and self-quarantining behaviors could contribute to higher levels of PTSD symptoms. Confirmed exposure or fear of exposure to COVID-19 could have significantly altered participants' perinatal experiences and resulted in heightened PTSD symptoms of intrusion and mood and cognition alterations. Further, self-quarantining could have contributed to social isolation and lack of support during the postpartum period, resulting in alterations to pre-pandemic stress coping mechanisms (e.g., exercising, social events with friends and family), limited or altered access to clinical support and resources (e.g., in-person clinic visits; lactation support; postpartum support groups), and limited familial and community support.²⁶

COVID-19 exposure consisted of three items: 1) confirmed COVID-19 infection; 2) family member with confirmed COVID-19 infection; and 3) suspected COVID-19 infection but not tested. For COVID-19 infection worry, we included two items: 1) worry of becoming infected and 2) worry of

infant becoming infected. Two items measured self-quarantining behaviors: 1) self-quarantined during postpartum with their infant and 2) self-quarantined during postpartum without their infant. Participants selected all options applying to their perinatal experience by indicating yes or no for each item. For this study, we collapsed items by domain. For example, any positive response to COVID-19 infection worry was coded as 1 (worry present) and no positive response coded as 0 (worry not present).

Since postpartum depressive symptoms have been linked to PTSD symptoms, we measured postpartum anxiety and depression using the 10-item Edinburg Postpartum Depression Scale (EPDS).²⁷ The EPDS is a widely used and extensively validated screening measure of postpartum anxiety and depression. Participants respond to each item on a 0-3 Likert-type scale (0=yes, as much as I could; 1=yes, some of the time; 2=no, not very often; 3=no, not at all). Seven items are reversed scored. A total score, which ranges from 0-30, is calculated by summing the scores across all items. Higher scores indicate heightened depressive symptoms. A score of 10 or greater is considered a positive screen for postpartum anxiety and depression and follow-up is recommended for further clinical assessment. In our study, the EPDS demonstrated good internal consistency reliability (Cronbach's $\alpha = .88$).

Dependent Variables

We measured self-reported postpartum PTSD symptoms using the Birth Memories and Recall Questionnaire (BirthMARQ).²⁸ BirthMARQ is a postpartum PTSD screening instrument that consists of 6 domains (emotional memory, reliving, centrality of memory, sensory memory, recall, and coherence) measuring the presence of intrusion symptoms (e.g., distressing memories of childbirth; flashbacks) or symptoms of mood and cognition alterations (e.g., negative emotions; decreased self-efficacy).⁴ Participants rated their level of agreement with each item from 1 (strongly disagree) to 7 (strongly agree). Three items are reverse scored. For the purposes of this study, scores of 5-7 for each item (symptom) were coded as "symptom present" and scores of 1-4 were coded as "symptom not present." The number of symptoms were summed for the total scale, symptom cluster (mood and cognition alteration symptoms, intrusion symptoms), and each BirthMARQ domain (see Table 1). For our study, domains, symptom clusters, and total scale demonstrated acceptable to good internal consistency reliability (Cronbach's $\alpha = .75-.91$) for all but the reliving domain ($\alpha = .67$).

Data Analysis

Data were analyzed in RStudio (version 1.3.1093) using R version 4.0.3. Records with missing BirthMARQ data were listwise deleted by domain. Descriptive statistics (mean, standard deviation, frequency, and percent) were calculated for the demographics and symptom counts. To examine relationships between the key independent variables and each dependent variable (symptom counts for the total scale, symptom cluster, and domain), we estimated negative binomial regression models, a conservative analytic technique for predicting count variables. We controlled for marital status, race, number of weeks postpartum, NICU admission, and EPDS screening. We calculated incidence risk ratios with 95% confidence intervals for each independent variable. Significance level was set at $\alpha < .05$ for all analyses.

RESULTS

Participant Characteristics

After listwise deletion, our sample included a total of 670 participants (approximately 92% of the total sample). No significant differences were found between the included sample and those listwise deleted. Most of the sample was white (88.8%) and married (94.1%). Approximately 68% of participants worried about their own or their infant's COVID-19 infection risk. Roughly 2% were exposed to or infected with COVID-19. Additionally, 84% of participants self-quarantined during the postpartum period. About 37% of participants scored ≥ 10 on the EPDS, which is considered a positive screen for postpartum depression. See Table 2 for full demographic information.

BirthMARQ Results

Table 3 presents participants' experiences of symptoms by individual BirthMARQ item and domain. Table 4 presents participants' experience of symptoms by total scale and symptom cluster. The average number of symptoms experienced on the total scale was approximately 8 (out of 21) and only 1.1% of participants reported experiencing no symptoms. Participants reported experiencing relatively the same proportion of mood and cognition symptoms (mean= 4.49 out of 11) and intrusion symptoms (mean= 3.83 out of 10).

Results of Regression Models by Total Scale and Symptom Cluster

COVID-19 Variables

Table 5 shows that COVID-19 exposure was associated with increased risk for experiencing more intrusion symptoms when compared to participants who were not exposed to COVID-19.

Worry about COVID-19 infection and quarantining behaviors were not found to be associated with symptoms for the composite BirthMARQ, mood and cognition alterations, or intrusion clusters.

Demographic Variables

Table 5 also shows that infant admission to a NICU and positive screens for postpartum depression were associated with increased risk for greater symptomatology in each model. For instance, NICU admission was associated with a 1.17 times greater risk of having symptoms of mood and cognition alterations. Number of weeks postpartum at time of survey completion was found to be significantly and inversely associated with intrusion symptoms. Race and marital status were not found to be significantly associated with symptoms for the composite BirthMARQ, cognition, or intrusion scales.

Results of Regression Models by Domain

COVID-19 Variables

Table 6 shows that COVID-19 exposure was significantly associated with reliving symptoms. Participants who indicated COVID-19 exposure were associated with a 1.47 times greater risk of experiencing more symptoms in this domain when compared to participants who did not indicate exposure to COVID-19. The most common reliving symptom reported was reliving visual impressions had during the birth (83.8% of sample; see Table 3). Moreover, participants who worried about COVID-19 infection were associated with a 1.26 times greater risk for increased recall symptoms when compared to participants who were not worried about COVID-19 infection, like memories of birth coming up unexpectedly (34.4% of sample). Quarantining behaviors were not found to be significantly associated with any BirthMARQ domain.

Demographic Variables

Table 6 also shows how the demographic characteristics are associated with each BirthMARQ domain. Screening positive for postpartum depression was associated with an increased risk for experience a greater number of PTSD symptoms in three of the domains (emotional memory, centrality of memory, and recall). However, a positive EPDS screen was associated with a lower risk of experiencing coherence symptoms. Infant admission to a NICU was associated with increased risk for experiencing a greater number of symptoms in three domains (emotional memory, sensory memory, and recall). Time since birth (in weeks) at survey completion was significantly associated with a lower risk of sensory memory symptoms. Participants who were of color (non-white) were

associated with a greater risk for experiencing more centrality of memory symptoms when compared to white participants. Finally, participants who were not married were associated with a greater risk for experiencing more emotional memory symptoms when compared to participants who were married.

DISCUSSION

For participants who gave birth within the context of the early stages of the COVID-19 pandemic in the US, self-reported infection worry and exposure were associated with an increased risk of experiencing a greater number of PTSD symptoms. Our findings indicate that COVID-19 experiences and associated pandemic sequelae during the early stages of the pandemic were associated with increased PTSD symptoms in postpartum persons, specifically symptoms related to reliving the birth experience such as sounds, feelings, and sights. Worry surrounding COVID-19 infection risk increased one's risk for experiencing recall symptoms, such as memories of the birth experience coming to mind unexpectedly.

Future studies are needed to describe and evaluate the effect of COVID-19 experiences on postpartum PTSD symptoms. It is likely that worry over infection risk or exposure to COVID-19 can increase anxiety during the perinatal period. For example, participants who worried about their infection risk could have been intensely fearful of delivering their infant in a hospital during an infection surge and subsequently hyperaware of their birthing and postpartum experiences. Overall, the findings support the importance for midwives, perinatal nurses, obstetricians, and maternal mental health clinicians to assess for PTSD symptoms in postpartum persons and provide resources and treatment as indicated. Our study includes participants birthing during the first wave of COVID-19 in the US. PTSD symptoms and associated risk factors could be different at later stages of the pandemic. Because PTSD symptoms can reappear at a subsequent pregnancy, clinicians are strongly encouraged to consider the stage of the pandemic postpartum persons previously birthed as they assess for symptoms and develop a treatment plan. Further, our findings underscore the importance of using trauma informed care approaches when caring for perinatal persons experiencing PTSD symptoms.²⁹⁻³¹

Not surprisingly, positive screens for postpartum depression and anxiety were related to greater risk for experiencing PTSD symptoms, specifically symptoms related to mood and cognition alterations. Previous studies have also demonstrated that higher scores on many BirthMARQ domains correlate with the presence of depressive symptoms.²⁸ Similar to Foley and colleagues,²⁸ we found participants with depressive symptoms reported more mood and cognition alterations.

Many studies have found individuals with depression report more negative memories and memories central to personal identity.³²⁻³³ This is of critical concern because 1 in 3 participants in our sample screened positive for postpartum depression, which is noticeably higher than the rates reported pre-pandemic.³⁴ Other studies on postpartum depression during the COVID-19 pandemic have found similar dramatic increases.^{11, 14-15} Although our findings align with those of Foley and colleagues,²⁸ we found that a positive screen for postpartum depression was associated with reduced risk for experiencing symptoms related to coherence. It is well established that individuals with depressive symptoms can also have trouble remembering details of past events,³⁵⁻³⁶ which could explain this finding.

In our study, NICU admission was associated with a higher risk for experiencing a greater number of PTSD symptoms. We did not collect data on the reason for admission. It is possible that infants were admitted for further assessment related to COVID-19 or to prevent infection if the mother or a member of the household tested positive for COVID-19. Further, it is possible that participants with infants admitted to a NICU had more traumatic births (e.g., preterm, newborn requiring resuscitation at birth, emergency birth, genetic anomalies); unfortunately, this was not measured in our study. Parents of newborns admitted to a NICU have been known to experience depression, anxiety, and PTSD.³⁷⁻³⁸ NICU admissions can result in parental anxiety concerning infant health, decreased parental-infant bonding, and disruption of routine postpartum experiences, and these impacts can manifest during and following NICU hospitalization.³⁹ A potential pandemic-related contributor to the association of NICU admission to PTSD symptoms in our study could have been the implementation of strict hospital visitor policies in NICUs to limit infection spread and exposure among vulnerable neonates.

Increased weeks between birth and time of survey completion was associated with 3% decrease each week in the number of symptoms in the sensory memory domain. This could be due to the effect of time on the presence and magnitude of these specific symptoms. Being a person of color and unmarried were associated with increased risk for emotional memory and centrality of memory symptoms; however, this finding is not well understood and warrants further investigation.

Implications for Policy and Practice

Our study results suggest the immediate need for integrating comprehensive screening processes for PTSD and depression among postpartum persons. Considering that 99% of our sample experienced at least one PTSD symptom during COVID-19, it is essential that perinatal care professionals (e.g., midwives; obstetricians) screen for PTSD. It is estimated that one in three

postpartum persons who screen positive for postpartum depression also meet criteria for PTSD.⁴⁰ Therefore, it is vital that screening for PTSD be done in addition to screening for depression.⁴¹ Although our findings are in the context of the COVID-19 pandemic, many of the relationships identified in our study have been discussed prior to the pandemic. Thus, beyond the context of the COVID-19 pandemic, it is important to consider PTSD screening for all postpartum persons while providing trauma informed care.²⁹⁻³¹ While the American College of Gynecology recommends clinicians screen postpartum persons for depression,⁴² there are currently no recommendations for screening postpartum persons for PTSD. The integration of comprehensive mental health screening across healthcare settings (e.g., hospital, primary care) is critical to providing quality, patient-centered care.

Integrating screening in routine practice can be challenging.⁴³ Clinicians who lack resources for addressing positive screens could be reluctant to screen for PTSD. Additionally, clinicians could be already significantly burdened by the number of required screenings and assessments and could be less likely to implement PTSD screening due to an overburdened workload. Considering these challenges, we recognize that integrating perinatal mental health screening tools into existing clinical guidelines and screening schedules (e.g., postpartum depression screening) could be one promising approach to encourage PTSD screening. Recently literature on postpartum PTSD has recommended using the 5-item Primary Care PTSD screening tool⁴⁴⁻⁴⁵ alongside screening tools for postpartum depression (e.g., EPDS). Additionally, increasing public awareness of perinatal mood and anxiety disorders is recognized as an important step in improving maternity mortality and morbidity outcomes in the US (see Centers for Disease Control and Prevention's HEAR Her campaign, www.cdc.gov/hearher/index.html). Therefore, we recommend providing public health education on postpartum PTSD along with currently provided education on perinatal warning signs, such as postpartum depression and anxiety.

Strengths and limitations

While our study has many strengths, we recognize several limitations. Importantly, although our sample was relatively large and collected data from participants across the US, our study sample was a convenience sample and mostly white and married. Future studies are needed to investigate PTSD among more diverse populations. Further, our findings are limited to the first six months of the COVID-19 pandemic in the US. It is important to consider differences in policy and practice during the first six months of the pandemic that could have affected participant's responses (e.g., limited information regarding COVID-19 and pregnancy; support person limitations during delivery and

hospitalization; state responses and local infection rates). Finally, our study only included live births and did not assess for additional sources of birth trauma beyond the context of the COVID-19 pandemic in the models (e.g., delivery complications; prior history of mental illness; adverse childhood experiences). Despite these limitations, our study is one of first to describe the potential links between PTSD symptoms and perinatal experiences related to the COVID-19 pandemic.

Conclusions

Giving birth during the COVID-19 pandemic was associated with increased PTSD symptomatology in postpartum persons. Screening for PTSD in perinatal clinics is critically important to identify perinatal mental illness and provide adequate resources to those affected. The integration of comprehensive mental health screening, including specific screening for trauma and symptoms of PTSD, across healthcare settings can help provide quality, patient-centered care to postpartum persons.

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Table 1. BirthMARQ Domains and Symptoms Assessed

Domain	Number of Symptoms Assessed	Examples of postpartum PTSD symptoms
Symptoms of Cognition and Mood Alterations		
Emotional Memory	5	Distorted emotions (e.g., inability to experience positive emotions)
Centrality of Memory	4	Feeling detached from others or from one's life prior to the birth
Coherence	2	Inability to remember important aspects of the birth
Intrusion Symptoms		
Reliving	4	Dissociative reactions (e.g., flashbacks) of the birth
Sensory Memory	4	Experiencing physiological reactions (e.g., sensory sensations) from the birth
Recall	2	Reoccurring, distressing memories of the birth
Symptoms are assessed using a scale from 1 (strongly disagree)-7 (strongly agree). Scores of 5-7 indicate experiencing the symptom; whereas, scores of 1-4 indicate not experiencing the symptom. Total symptoms experienced can range from 0 to 21.		

Table 2. Demographic and Health Characteristics of a Sample of Postpartum Persons Who Gave Birth During the Early Phase of the COVID-19 Pandemic (N = 670)

Characteristic	N = 670
Age in years, mean (SD)	31.8 (3.9)
Weeks postpartum, mean (SD)	7.4 (4.0)
Infant gestational age at birth, mean (SD)	38.8 (1.9)
Married, n (%)	631 (94.2)
Race, n (%)	
White	595 (88.8)
Latinx	31 (4.6)
Asian	26 (3.9)
Black	6 (0.9)
Pacific Islander	4 (0.6)
Native American	2 (0.3)
Other	6 (0.9)
Infant admitted to NICU, n (%)	68 (10.2)
Worry about COVID-19 infection, n (%)	458 (68.4)
Exposure to COVID-19, n (%)	16 (2.4)
Quarantined postpartum, n (%)	569 (84.9)
EPDS positive screen (score ≥ 10), n (%)	253 (37.8)

Table 3. BirthMARQ PTSD Symptoms Experienced by Participants

Domain	Experiencing Symptom n (%)
Symptoms of Mood and Cognition Alterations	
<i>Emotional memory (experiencing at least 1 symptom)</i>	397 (59.2)
My emotions at the time were extremely positive*	98 (14.6)
My emotions at the time were extremely negative	73 (10.8)
I experienced mixed positive and negative emotions at the time	361 (53.8)
While recalling the birth now, my emotions are extremely positive*	89 (13.2)
While recalling the birth now, I am experiencing mixed positive and negative emotions	224 (33.4)
<i>Centrality of memory (experiencing at least 1 symptom)</i>	528 (78.8)
The experience of birth has colored the way I think and feel about other experiences	331 (49.4)
The experience of birth has become central to the way I understand myself and the world	198 (29.5)
The experience of birth was a turning point in my life	422 (62.9)
I often think about the effects the experience of birth will have on my future	305 (45.5)
<i>Coherence (experiencing at least 1 symptom)</i>	481 (71.7)
My memory for the birth comes to me as a logical, coherent series of events with no major gaps	459 (68.5)
My memory for the birth is fragmented, it comes in bits and pieces with bits missing ^a	449 (67.0)

Intrusion Symptoms	
<i>Reliving (experiencing at least 1 symptom)</i>	588 (87.7)
While remembering the birth now, I relive visual impressions I had during the birth	562 (83.8)
While remembering the birth now, I relive the bodily sensations I had during the birth	296 (44.1)
While remembering the birth now, I feel as though I am reliving it and it is happening now, not in the past	52 (7.7)
While remembering the birth now, I relive the sound(s) I heard during the birth	204 (30.4)
<i>Sensory memory (experiencing at least 1 symptom)</i>	510 (76.1)
As I recall the birth, I can remember smells	94 (14.0)
As I recall the birth, I can remember tastes	86 (12.8)
As I recall the birth, I can remember sounds	402 (60.0)
As I recall the birth, I can remember touch	436 (65.0)
<i>Recall (experiencing at least 1 symptom)</i>	274 (40.8)
My memory for the birth (or parts of the memory) comes to me 'out of the blue' without me trying to think about it	205 (30.5)
Things that happen now can unexpectedly bring up memories of the birth (or parts of memories)	231 (34.4)
^a Indicates the item is reverse scored; Scores of 5-7 on the 1-7 scale were coded as symptom present.	

Table 4. BirthMARQ PTSD Symptoms Experienced by Participants by Symptom Cluster and Total Scale

	Experiencing at least one symptom	Number of symptoms experienced
	n (%)	M (SD)
All BirthMARQ symptoms (21 symptoms)	663 (98.9)	8.3 (3.6)
Mood and cognition symptoms (11 symptoms)	655 (97.7)	4.5 (2.1)
Intrusion symptoms (10 symptoms)	631 (94.1)	3.8 (2.4)

Table 5. Regression Results by BirthMARQ Symptom Cluster and Total Scale in Postpartum Persons Who Gave Birth During the Early Phase of the COVID-19 Pandemic (N = 670)

	All BirthMARQ Symptoms	Mood and Cognition Symptoms	Intrusion Symptoms
	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)
Intercept	7.85 ^a (7.00, 8.81)	3.98 ^a (3.50, 4.52)	3.88 ^a (3.29, 4.57)
COVID-19 Variables			
COVID19 exposure	1.22 (0.99, 1.49)	1.10 (0.87, 1.37)	1.34 ^b (1.01, 1.78)
Worry about COVID19 infection	1.06 (0.98, 1.14)	1.04 (0.96, 1.13)	1.07 (0.96, 1.19)
Quarantine postpartum	0.99 (0.90, 1.09)	1.04 (0.94, 1.15)	0.94 (0.82, 1.07)

Covariates

Weeks postpartum	0.99 (0.98, 1.00)	1.00 (0.99, 1.01)	0.98 ^b (0.97, 0.99)
Infant admitted to NICU	1.18 ^c (1.06, 1.30)	1.17 ^c (1.04, 1.30)	1.19 ^b (1.02, 1.37)
Positive EPDS Screen	1.15 ^a (1.08, 1.24)	1.15 ^a (1.07, 1.24)	1.16 ^c (1.05, 1.27)
Race not white	1.02 (0.92, 1.13)	1.06 (0.95, 1.19)	0.96 (0.82, 1.11)
Not married	1.07 (0.93, 1.23)	1.08 (0.93, 1.25)	1.06 (0.86, 1.28)

Abbreviations: IRR, Incidence Risk Ratio; CI, Confidence Interval

^ap<.001

^bp<.05

^cp<.01

Table 6. Regression Model Results by BirthMARQ Domain in Postpartum Persons Who Gave Birth During the Early Phase of the COVID-19 Pandemic (N = 670)

	Emotional Memory (Reliving	Centrality of Memory	Sensory Memory	Recall	Coherence
	IRR	IRR	IRR	IRR	IRR	IRR
	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)
Intercept	0.87 (0.65, 1.17)	1.63 ^a (1.32, 2.00)	1.47 ^a (1.19, 1.79)	1.78 ^a (1.43, 2.19)	0.48 ^a (0.34, 0.67)	1.73 ^a (1.38, 2.16)
COVID-19 Variables						
COVID19 exposure	1.28 (0.76, 2.11)	1.47 ^b (1.04, 2.00)	1.17 (0.82, 1.62)	1.31 (0.89, 1.84)	1.23 (0.59, 1.92)	0.84 (0.51, 1.30)
Worry about COVID19 Infection	1.05 (0.87, 1.27)	1.08 (0.95, 1.23)	1.11 (0.98, 1.25)	1.01 (0.88, 1.15)	1.26 ^b (1.01, 1.57)	0.94 (0.82, 1.09)
Quarantine postpartum	1.02 (0.81, 1.30)	0.98 (0.84, 1.17)	1.09 (0.93, 1.29)	0.92 (0.78, 1.10)	0.84 (0.65, 1.10)	0.97 (0.81, 1.17)
Covariates						
Weeks postpartum	1.00 (0.98, 1.02)	0.99 (0.97, 1.01)	0.99 (0.98, 1.01)	0.97 ^c (0.96, 0.99)	0.99 (0.97, 1.01)	0.98 (0.97, 1.01)
Infant admitted to NICU	1.68 ^a (1.31, 2.14)	1.05 (0.86, 1.26)	1.07 (0.89, 1.28)	1.24 ^b (1.02, 1.49)	1.46 ^c (1.10, 1.89)	0.82 (0.64, 1.03)
Positive EPDS Screen	1.53 ^a (1.29, 1.81)	1.09 (0.96, 1.23)	1.22 ^a (1.08, 1.36)	1.03 (0.91, 1.18)	1.71 ^a (1.40, 2.07)	0.80 ^c (0.69, 0.92)

Race not white	1.01 (0.77, 1.31)	0.92 (0.75, 1.11)	1.18 ^b (1.01, 1.39)	0.97 (0.79, 1.17)	1.05 (0.78, 1.39)	0.94 (0.75, 1.16)
Not married	1.50 ^b (1.08, 2.05)	0.95 (0.73, 1.22)	0.92 (0.71, 1.16)	1.11 (0.85, 1.42)	1.18 (0.79, 1.69)	0.91 (0.67, 1.20)

Abbreviations: IRR, Incidence Risk Ratio; CI, Confidence Interval

^ap<.001

^bp<.05

^cp<.01