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Research paper

Elucidating posttraumatic stress symptom dimensions and health correlates among postpartum women

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ABSTRACT

Background: Posttraumatic stress disorder (PTSD) is associated with interpersonal dysfunction and adverse maternal health during the perinatal period (extending from conception through one year postpartum). However, PTSD is a heterogeneous disorder, and little is known about which aspects of this disorder may be particularly deleterious to the health of new mothers. Such data may inform more personalized approaches to PTSD prevention and treatment among postpartum women.

Methods: Using confirmatory factor analysis, we compared three models of PTSD symptom structure—the four-factor dysphoria model, four-factor emotional numbing model, and five-factor dysphoric arousal model—in 1,663 postpartum women from the Community and Child Health Network (CCHN). We examined associations between PTSD symptom dimensions of the best-fitting model with four correlates relevant to maternal health and functioning—parenting stress, partner relationship stress, relationship satisfaction, and contraceptive use.

Results: Though all models fit well, the five-factor dysphoric arousal model provided optimal fit. Symptom dimensions from this model—re-experiencing, avoidance, numbing, dysphoric arousal, and anxious arousal—evidenced differential associations with the maternal health indicators. Numbing symptoms were most strongly associated with indicators of poor interpersonal functioning, whereas dysphoric arousal symptoms were most strongly related to low-efficacy contraceptive use.

Limitations: Our cross-sectional study assessed *DSM-IV* PTSD symptoms.

Conclusions: PTSD symptoms among postpartum women are best-represented by five factors. Numbing symptoms (e.g., restricted affect, detachment) are most strongly associated with interpersonal difficulties, whereas dysphoric arousal symptoms (e.g., agitation, irritability) are linked with low-efficacy contraceptive use. Screening for these symptoms may help promote the health of new mothers.

1. Introduction

Posttraumatic stress disorder (PTSD)—the quintessential stress-related mental disorder characterized by re-experiencing of a traumatic event, avoidance of trauma reminders, negative alterations in thoughts and feelings, and hyperarousal—affects 4% of women postpartum (Yildiz et al., 2017). The postpartum period is an already stressful time, wherein women must acclimate to their role as a mother in the context of physical and psychological changes, and posttraumatic psychopathology may limit women's abilities to care for themselves and their family during this life juncture. Indeed, PTSD during the perinatal period—defined as extending throughout pregnancy and up to one year following delivery (O'Hara and Wisner, 2014)—is associated with adverse consequences for women's interpersonal functioning and behavioral health, including impaired family relationships and substance use (Seng et al., 2009). However, PTSD is a heterogeneous disorder (Forbes et al., 2010; Zoellner et al., 2014), and its diagnosis can reflect over 636,000 symptom combinations (Galatzer-Levy and Bryant,

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2013). Further, even subclinical presentations of PTSD symptoms that do not meet the threshold for a PTSD diagnosis are associated with significant distress and impairment (McLaughlin et al., 2015). Focusing on PTSD as a discrete diagnostic entity limits understanding of which aspects of posttraumatic psychopathology may be most deleterious to the health of postpartum women.

In an effort to unpack this heterogeneity, dimensional approaches to posttraumatic psychopathology have been examined that align with contemporary efforts in psychiatric nosology to examine psychopathology along a continuum rather than categorically (Insel et al., 2010; Kozak and Cuthbert, 2016). For example, a large body of confirmatory factor analytic research has investigated the latent symptom structure of PTSD, with two four-factor models—the emotional numbing (King et al., 1998) and dysphoria (Simms et al., 2002) models—receiving substantive empirical support (Armour et al., 2016; Yufik and Simms, 2010). The dysphoria model contains factors for re-experiencing, avoidance, hyperarousal, and dysphoria symptoms (Simms et al., 2002), while the emotional numbing model consists of re-experiencing, avoidance, numbing, and hyperarousal factors (King et al., 1998). The primary distinction is their categorization of three *Diagnostic and Statistical Manual for Mental Disorders,* fourth edition (*DSM-IV*) Criterion D symptoms—that is, whether sleep problems (D1), irritability (D2), and concentration difficulties (D3) are classified as indicators of dysphoria (as in the dysphoria model) or hyperarousal (as in the emotional numbing model). Despite this difference, the fits of these two four-factor models have been relatively equivocal across a number of studies (Armour et al., 2016; Yufik and Simms, 2010), and this research influenced the current edition of the *DSM* to model its PTSD symptom clusters after factors drawn from the emotional numbing model (*DSM-5*; APA, 2013). In 2011, a five-factor dysphoric arousal model categorized the D1—D3 symptoms into a separate latent factor representing dysphoric arousal and shifted other, fear-based hyperarousal symptoms into an anxious arousal factor, resulting in five dimensions: re-experiencing, avoidance, numbing, anxious arousal, and dysphoric arousal (Elhai et al., 2011). A recent review of over 100 studies in a variety of samples found that this five-factor model demonstrates superior fit over both four-factor models (Armour et al., 2016), even among studies utilizing revised *DSM-5* PTSD criteria (Gentes et al., 2014; Hafstad et al., 2014; Tsai et al., 2015).

While a fair amount of research has focused on PTSD symptom dimensions among veterans (Harpaz-Rotem et al., 2014; Pietrzak et al. 2010; Tsai et al., 2015) and civilian populations such as World Trade Center responders (Pietrzak et al., 2014) and cardiac arrest patients (Presciutti et al., 2019), minimal research has examined the dimensionality of PTSD in postpartum women. Two recent studies examined PTSD symptom structure in perinatal populations (Gelaye et al., 2017; Reichenheim et al., 2018), with mixed results. One study found the four-factor emotional numbing model to provide the best fit among a large sample of pregnant Peruvian women (Gelaye et al., 2017). The other, conducted with postpartum Brazilian women, found that a two-factor model of re-experiencing/avoidance and numbing/hyperarousal provided optimal fit over and above both of the leading four-factor models (Reichenheim et al., 2018). However, neither study considered the well-supported five-factor model.

To our knowledge, no research has examined associations between PTSD symptom dimensions and measures of psychological and physical well-being among postpartum women. Following calls from leaders in the field to validate latent PTSD factors against functional correlates (Elhai and Palmieri, 2011), research conducted with non-pregnant populations has demonstrated differential associations between symptom dimensions and health and psychosocial variables. For example, among multiple male veteran samples, dysphoria and numbing symptoms have been linked with less favorable psychosocial outcomes (Pietrzak et al., 2010; Tsai et al., 2015), including negative parent-child relationships (Ruscio et al., 2002; Samper et al., 2004) and relationship distress (Riggs et al., 1998). Dysphoric arousal symptoms were also strongly associated with parental conflict among trauma-exposed adolescents (Sumner et al., 2014). In postpartum and parenting women, total PTSD symptoms have been linked to parenting stress (Ammerman et al., 2012; Chemtob et al., 2013; Fredman et al., 2017; Samuelson et al., 2017; Wilson et al., 2017); aggression in couple relationships (Fredman et al., 2017; Marshall et al., 2019); and IPV (Sumner et al., 2012). Another relevant health correlate for new mothers is contraceptive use. Postpartum contraceptive use is a modifiable enabler of birth spacing, and birth intervals under 18 months are associated with reproductive health complications and adverse birth outcomes (Conde-Agudelo et al., 2012). Among reproductive-aged women, PTSD symptom severity is linked with sexual risk behavior (Horsey et al., 2011), although research examining postpartum contraceptive use is lacking. Elucidating the underlying dimensions of PTSD and their health correlates among postpartum women may help catalyze efforts toward identifying key dimensions of PTSD in this population that have particular relevance for postpartum health and functioning.

Toward this end, we evaluated the two leading four-factor models and the five-factor model of PTSD symptom dimensions using confirmatory factor analysis (CFA) in a large, diverse sample of postpartum women. Based on support for the five-factor dysphoric arousal model among non-pregnant populations (Armour et al., 2016), we hypothesized that this model would exhibit the best fit. We then evaluated associations between the underlying symptom dimensions of the best-fitting model and four maternal health correlates reflective of relevant concepts in the existing literature: 1) parenting stress, 2) partner relationship stress, 3) relationship satisfaction and 4) postpartum contraceptive use. Consistent with prior research in non-pregnant samples (e.g., Sumner et al., 2014, Sumner et al., 2015), we predicted that the dysphoric arousal and numbing dimensions would be most strongly associated with these measures of interpersonal functioning and behavioral health.

2. Methods

2.1. Participants and procedure

Data for this study are from the Community Child Health Network (CCHN), a community-academic network dedicated to investigating disparities in maternal and child health through community-based participatory action research methods (Ramey et al., 2015). CCHN recruited postpartum women in five U.S. cities: three urban sites (Los Angeles, CA; Baltimore, MD; Washington, DC), one suburban site (Lake County, IL) and one rural site (counties in eastern North Carolina), with an oversampling of mothers by minority race/ethnicity. Women were recruited at delivery of the index child and were interviewed about various experiences and aspects of functioning in their homes every six months for one year. Community members trained in research methods and academic staff trained in community research conducted in-home interviews in English or Spanish. The CCHN was approved by the Institional Review Boards at all partner universities, and the study was conducted in accordance with the Helsinki Declaration. All women provided informed consent. More information on the cohort and study design is described in other CCHN publications (e.g., Dunkel Schetter et al., 2013; Ramey et al., 2015). The current study used data from assessments conducted 1 month (median: 7 weeks, interquartile range: 4-12 weeks) and 6 months (median: 34 weeks, interquartile range: 29-39 weeks) postpartum.

2.2. Measures

PTSD symptoms. At 6 months postpartum, PTSD symptoms were assessed using the PTSD Checklist-Civilian Version (PCL-C; Blanchard et al., 1996). Women indicated how bothered they were by each of the *DSM-IV-TR*'s 17 PTSD symptoms in the past month, with responses rated on a 5-point scale (1=Not at all, 5=Extremely). Symptoms were anchored to "general stressful experiences." The PCL is a reliable and

valid measure of PTSD symptoms (Wilkins et al., 2011) and has been used to assess PTSD symptoms in perinatal women (Gelaye et al., 2017; Levey et al., 2018; Reichenheim et al., 2018). The PCL had excellent internal consistency in our sample (Cronbach's α=0.91). For descriptive purposes, we examined PTSD as a unitary construct, using a cut-off score of ≥30 to indicate elevated PTSD symptom severity; this cut-off was developed and validated in an HMO sample of women (Walker et al., 2002). For the CFA, responses to the 17 PCL items were used as indicators of dimensional latent variables.

2.3. Maternal health correlates

Parenting stress and partner stress. Women completed a CCHN-specific adaptation of the UCLA Life Stress Interview (LSI), a semi-structured interview of chronic stress in major life domains (Hammen et al., 1987), at 6 months postpartum (see Tanner Stapleton et al., 2016, for details). Women reported on features of their neighborhood environment, family relationships, parenting, and partner relationships over the past 6 months. Trained interviewers gathered information regarding the circumstances of each domain and assigned ratings of objective stress severity for each domain using a 5-point Likert scale (1=Exceptionally positive conditions, 5=Exceptionally negative conditions). Higher scores indicate greater stress experienced in that domain. For this study, we used data from the parenting and partner domains. Women co-parenting their child with the baby's father (n=1,540) reported on *parenting stress,* and women in a committed intimate relationship (n=1,317) reported on *partner relationship stress*. Intra-class correlation coefficients for reliability analyses conducted in a subset of participants (n=272) ranged from .64 to .87 for these two domains, indicating good inter-rater reliability (Tanner Stapleton et al., 2016).

Relationship satisfaction. Women in an intimate relationship reported on their relationship satisfaction using an adapted Dyadic Adjustment Scale at the 6 month postpartum assessment (DAS; Spanier, 1976) (n=1,264). The DAS assesses couples' level of agreement about several topics (e.g., sex relations, household tasks), as well as their degree of closeness and conflict and shared activities in the relationship. The 32 items are summed to create a total score with a range of 0–151, where higher scores indicate more positive dyadic adjustment. The DAS consists of four subscales—Dyadic Consensus (13 items, Cronbach's α=.88), Dyadic Satisfaction (10 items, Cronbach's α=.86), Dyadic Cohesion (5 items, Cronbach's α=.72) and Affective Expression (4 items, Cronbach's α=.62)—and has found to be a reliable and valid measure of relationship satisfaction (Graham et al., 2006; Spanier, 1976).

Contraceptive efficacy. Women reported if they were currently using contraception at the 6 month postpartum assessment (n=1,574). If yes, they were asked to select which method(s) from a list of 20 options (e.g., abstinence, birth control pill, condom). Responses were categorized into low, moderate, or high effectiveness, based on classifications from the Centers for Disease Control (CDC, 2018). Women who reported using multiple types of contraception were categorized by their most effective method, with the exception of those who reported abstinence. Women who reported abstinence and use of an additional contraceptive method were categorized by the non-abstinent contraceptive method. Women who reported use of low effectiveness contraception methods (e.g., rhythm method, withdrawal) and no contraception (low-efficacy group) were compared to women who reported use of medium and high effectiveness contraception methods (e.g., IUD, partner vasectomy, true abstinence; high-efficacy group). Women who were pregnant at assessment were excluded.

2.4. Data analysis

First, we examined sociodemographic characteristics of our sample. We categorized women as with or without elevated PTSD symptoms and compared the groups using chi-squared ($\chi 2$) tests for categorical variables or t-tests for continuous variables in SPSS Version 26 (IBM Corp 2019).

Using Mplus Version 8 (Muthén and Muthén, 1998-2017), we evaluated structural models of PTSD symptoms using CFA (see Table 1 for item mappings). The 17 PCL items were treated as ordinal variables, and we used a robust (mean and variance-adjusted) method of weighted least squares estimation (WLSMV). We evaluated model fit using conventional fit statistics—$\chi 2$, Comparative Fit Index (CFI), Tucker Lewis Index (TLI), and root mean square error of approximation (RMSEA)—using Hu and Bentler's (1999) recommended cut-offs: CFI≥.95, TLI≥.95, and RMSEA≤.06. Additionally, we conducted $\chi 2$ difference tests using the DIFFTEST command in Mplus to compare the fits of nested models. Finally, using a latent variable framework, we examined correlations between the symptom dimensions of the best-fitting model and our four maternal health correlates, indexed by an indicator of parenting stress, an indicator of partner relationship stress, a latent factor representing relationship satisfaction (defined by the four subscale scores on the DAS), and an indicator of contraceptive efficacy. Although all women in the analytic sample had complete PTSD symptom data, some women were missing data for these correlates (as noted above). However, Mplus can produce maximum likelihood estimations under missing at random conditions. We assessed differences in the magnitudes of these correlations—and whether the difference between each pair of correlations was significantly different from zero—with Wald's $\chi 2$ tests of parameter constraints (Muthén and Muthén, 1998-2017).

2.5. Trauma exposure sensitivity analysis

Because the PTSD symptoms reported on the PCL were not anchored to a specific traumatic event and lifetime trauma exposure was not

Table 1
Item mappings of the emotional numbing, dysphoria, and dysphoric arousal models.

DSM-IV PTSD symptom	Item Mappings Emotional Numbing(4-factor)	Dysphoria(4-factor)	Dysphoric Arousal (5-factor)
B1. Intrusive thoughts	R	R	R
B2. Recurrent dreams	R	R	R
B3. Flashbacks	R	R	R
B4. Psychological reactivity to trauma cues	R	R	R
B5. Physiological reactivity to trauma cues	R	R	R
C1. Avoiding thoughts of trauma	A	A	A
C2. Avoiding reminders of trauma	A	A	A
C3. Inability to recall aspects of trauma	N	D	N
C4. Diminished interest in activities	N	D	N
C5. Detachment from others	N	D	N
C6. Restricted affect	N	D	N
C7. Sense of foreshortened future	N	D	N
D1. Sleep disturbance	H	D	DA
D2. Irritability	H	D	DA
D3. Difficulty concentrating	H	D	DA
D4. Hypervigilance	H	H	AA
D5. Exaggerated startle response	H	H	AA

Note. DSM-IV = Diagnostic and Statistical manual of Mental Disorders, 4th edition. R = re-experiencing; A = avoidance; N = numbing; H = hyperarousal; D = dysphoria; DA = dysphoric arousal; AA = anxious arousal

assessed in CCHN, we ran a sensitivity analysis examining past-year trauma exposure and how it related to total PTSD symptoms in a subset of women with information on trauma and PTSD (n=1,590). Specifically, we identified items that could indicate trauma exposure from two measures administered one-month postpartum. Women completed a Life Events Checklist, where they indicated adverse events that had occurred to them or close others in the last year (Dominguez et al., 2005). We identified eight events from the checklist as potentially traumatic, consistent with the definition of a *DSM-IV-TR* Criterion A trauma (e.g., individual experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others; APA, 2000). These events included serious injury, illness, hospitalization; mugging or assault; death; vehicular accident; threat of physical harm by another person; robbery/burglary; natural disaster; and victim of violent crime. Additionally, exposure to domestic violence in the last year was assessed using a modified HITS scale (Sherin et al., 1998). Women reported on how frequently they had experienced specific instances of physical and psychological violence in their home, with exposures coded dichotomously (0=no experience of any domestic violence events, 1=experienced at least one domestic violence event) as in previous research (O'Campo et al., 2010). Women were coded as being trauma-exposed if they reported experiencing at least one of these nine exposures in the last year; we summed the total number of traumas to calculate a trauma burden score and calculated its correlation with total PTSD symptoms.

3. Results

3.1. Descriptive statistics

Our analytic sample consisted of the 1,663 mothers for whom there was complete PTSD data. Participant characteristics are presented in Table 2. Consistent with the CCHN recruitment strategy (Ramey et al., 2015), the sample was racially and ethnically diverse, with over one-half (54.2%) of the sample Black, nearly one-quarter (22.4%) Latina, and the remaining 23.4% White. On average, women were about 26 years of age. Many (43.2%) were ≤100% below the federal poverty line. Approximately 60% of the sample reported being in a cohabitating or married relationship at six months postpartum; a little over one-half reported cohabitation with the baby's father.

The average score on the PCL was 26.6; over one-quarter of women (26.9%) had elevated PTSD symptom severity. Women with (versus without) elevated PTSD symptoms were more likely to be younger, Black, not a college graduate, not cohabiting with the baby's father, and not married or cohabiting with another partner (Table 2). Women with elevated symptoms also reported significantly greater stress in their parenting and partner roles, as well as significantly less relationship satisfaction. Contraceptive use did not differ significantly across PTSD symptom status.

3.2. Model fit comparisons

Table 3 shows fit statistics for the four-factor models and five-factor model. All three models provided excellent fit to the data. Chi-square difference tests indicated that the five-factor dysphoric arousal model fit the data significantly better than both the four-factor dysphoria model, $\chi 2(4)=124.507$, $p<.001$ and four-factor emotional numbing model, $\chi 2(4)=34.36$, $p<.001$. Intercorrelations for the five-factor model dimensions are presented in Table 4.

3.3. Associations between PTSD symptom dimensions and health correlates

As shown in Table 5, we found evidence for differential associations between distinct dimensions from the five-factor model and the four

Table 2
Participant characteristics for the full sample and by PTSD symptom status.

	Full Sample (N=1,663)	Women without Elevated PTSD Symptoms (n=1,216)	Women with Elevated PTSD Symptoms (n=447)	
	M (SD) or % (n)	M (SD) or % (n)	M (SD) or % (n)	p-value
Sociodemographics				
Age at study enrollment, years	25.8 (5.7)	26.2 (5.8)	24.5 (5.0)	<.001
Race/ethnicity				<.001
Black	54.2 (901)	51.6 (628)	61.1 (273)	
Latina	22.4 (373)	22.5 (274)	22.1 (99)	
White	23.4 (389)	25.8 (314)	16.8 (75)	
Study site				.021
Baltimore	23.0 (382)	21.3 (259)	27.5 (123)	
Chicago	25.5 (424)	26.6 (323)	22.6 (101)	
Los Angeles	11.7 (194)	12.7 (154)	8.9 (40)	
North Carolina	20.0 (332)	19.7 (240)	20.6 (92)	
WADC	19.9 (331)	19.7 (240)	20.4 (91)	
Education				<.001
< HS graduate	18.0 (300)	15.8 (192)	24.2 (108)	
HS graduate	42.3 (703)	42.1 (512)	42.7 (191)	
Some college	23.4 (389)	22.7 (276)	25.3 (113)	
College graduate or more	15.3 (255)	18.7 (227)	6.3 (28)	
Other/no information	1.0 (16)	0.7 (9)	1.6 (7)	
Poverty				<.001
≤100% FPL	43.2 (719)	37.5 (456)	58.8 (263)	
100-200% FPL	26.8 (446)	27.5 (335)	24.8 (111)	
>200% FPL	29.9 (498)	35.0 (425)	16.3 (73)	
Relationship factors				
Relationship status, 6 months postpartum				<.001
Not married orcohabitating	42.6 (708)	37.9 (461)	55.3 (247)	
Cohabitating, not married	25.2 (419)	25.7 (312)	23.9 (107)	
Married	32.2 (536)	36.4 (443)	20.8 (93)	
Cohabitation with baby's father, 6 months postpartum				<.001
Living together	54.0 (898)	61.2 (711)	43.7 (187)	
Not living together	41.6 (692)	38.8 (451)	56.3 (241)	
Maternal health correlates				
Parenting stress	2.14 (1.36)	1.98 (1.29)	2.56 (1.47)	<.001
Partner stress	1.85 (0.87)	1.70 (0.75)	2.33 (1.03)	<.001
Relationship satisfaction	119.59 (16.64)	122.31 (14.84)	110.75 (18.99)	<.001
Contraception				.160
High-efficacy	54.4 (905)	58.6 (674)	54.6 (231)	
Low-efficacy	40.2 (669)	41.4 (477)	45.4 (192)	

Note. WADC = Washington, D.C.; FPL = Federal poverty line

Table 3
Fit statistics for confirmatory factor analyses.

Model	x^2	df	CFI	TLI	RMSEA [90% CI]
Dysphoria	764.28***	113	0.968	0.962	0.059 [0.055, 0.063]
Emotional Numbing	604.82***	113	0.976	0.971	0.051 [0.047, 0.055]
Dysphoric Arousal	570.67***	109	0.977	0.972	0.050 [0.046, 0.055]

Note. df = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMSEA = root mean square error of approximation; CI = confidence interval
***$p<.001$

Table 4
Intercorrelations between five factors of the dysphoric arousal model.

	1.	2.	3.	4.	5.
1. Re-experiencing	–				
2. Avoidance	.90	–			
3. Dysphoric Arousal	.72	.64	–		
4. Numbing	.78	.76	.82	–	
5. Anxious Arousal	.67	.62	.80	.76	–

Note. All *ps* < .0001

maternal health correlates. Although greater symptom severity was significantly associated with worse interpersonal functioning for all symptom dimensions across the three measures of interpersonal functioning, numbing symptoms evidenced the largest correlations with parenting stress (r=.32), partner relationship stress (r=.36) and relationship satisfaction (r=-.44). Results of Wald tests indicated that the numbing-interpersonal functioning associations were significantly larger than the corresponding correlations for most or all of the other PTSD dimensions (Table 5). In contrast, anxious arousal symptoms evidenced some of the weakest associations with parenting stress, partner relationship stress, and relationship satisfaction. Dysphoric arousal was the only PTSD symptom dimension that was significantly associated with use of low-efficacy contraception (r=.11). Wald tests indicated that this correlation was significantly larger than the corresponding correlations with re-experiencing, avoidance, and anxious arousal symptoms.

3.4. Sensitivity analysis

In the subset of women with trauma and PTSD data, exposure to a potentially traumatic event was common: nearly 70% of women (n=1,112) had been exposed to at least one event in the past year, with the modal number of exposures being 1 (range=0-7). Furthermore, we found a small, yet significant, association between past-year trauma burden and PTSD symptoms (r=.19, p<.001). The more past-year traumas women experienced, the greater number of PTSD symptoms they reported—lending credence to the validity of our measure of PTSD symptoms.

4. Discussion

PTSD is a clinically heterogeneous disorder with demonstrated impact on maternal, as well as child, health (Cook et al., 2018; Seng et al., 2009). However, conceptualizing PTSD as a binary diagnostic entity or solely examining the total number of symptoms fails to capture which aspects of posttraumatic psychopathology may particularly impact new mothers. In this study, we examined the dimensional structure of PTSD symptoms and its association with health markers pertinent to the perinatal period—a critical window of opportunity for intervention—among a large, diverse sample of postpartum women. We found high levels of trauma exposure, with nearly 70% of women exposed to trauma in the past year alone—a rate similar to lifetime trauma exposure (Benjet et al., 2016)—and over 25% of women exceeded the cut-off indicating elevated PTSD symptom severity. Furthermore, we found that PTSD symptoms in this sample were best-represented by a model characterized by dimensions of re-experiencing, avoidance, numbing, dysphoric arousal, and anxious arousal symptoms, and that numbing and dysphoric arousal symptoms were particularly related to poor interpersonal functioning and low-efficacy contraceptive use, respectively.

Results of the current study build on a large body of confirmatory factor analytic research supporting the five-factor dysphoric arousal model of PTSD symptoms (Armour et al., 2016), and it extends it to a sample of postpartum women. Even though all three models tested fited the data well, as in other CFA studies of PTSD (e.g., Presciutti et al., 2019; Sumner et al., 2014), we found that the five-factor dysphoric arousal model provided optimal fit. Our study thus supports a more nuanced approach to the underlying structure of PTSD in postpartum women compared to the few extant studies in perinatal samples that supported either two-factor (Reichenheim et al., 2018) or four-factor (Gelaye et al., 2017) models. Of note, most research on PTSD symptom structure among perinatal populations has been conducted in circumscribed samples of South American women (Gelaye et al., 2017;

Table 5
Results of Wald tests of parameter constraints for comparisons of correlations between the factors of the dysphoric arousal model with maternal health correlates.

Correlation	*r*	Correlation	*r*	Wald test	*p*-value
Relationship satisfaction					
Re-experiencing	-.36***	Avoidance	-.37***	0.13	.717
Re-experiencing	-.36***	Numbing	-.44***	8.38	**.004**
Re-experiencing	-.36***	Dysphoric arousal	-.37***	0.22	.638
Re-experiencing	-.36***	Anxious arousal	-.25***	7.74	**.005**
Avoidance	-.37***	Numbing	-.44***	5.18	**.023**
Avoidance	-.37***	Dysphoric arousal	-.37***	0.02	.876
Avoidance	-.37***	Anxious arousal	-.25***	7.30	**.007**
Numbing	-.44***	Dysphoric arousal	-.37***	5.334	**.021**
Numbing	-.44***	Anxious arousal	-.25***	25.00	**<.001**
Dysphoric arousal	-.37***	Anxious arousal	-.25***	11.38	**.001**
Parenting stress					
Re-experiencing	.28***	Avoidance	.31***	0.58	.445
Re-experiencing	.28***	Numbing	.32***	0.93	.335
Re-experiencing	.28***	Dysphoric arousal	.18***	7.48	**.006**
Re-experiencing	.28***	Anxious arousal	.18***	4.88	**.027**
Avoidance	.31***	Numbing	.32***	0.06	.808
Avoidance	.31***	Dysphoric arousal	.18***	8.71	**.003**
Avoidance	.31***	Anxious arousal	.18***	6.02	**.014**
Numbing	.32***	Dysphoric arousal	.18***	15.98	**<.001**
Numbing	.32***	Anxious arousal	.18***	8.55	**.004**
Dysphoric arousal	.18***	Anxious arousal	.18***	0.01	.911
Partner stress					
Re-experiencing	.34***	Avoidance	.33***	0.04	.840
Re-experiencing	.34***	Numbing	.36***	0.86	.353
Re-experiencing	.34***	Dysphoric arousal	.28***	3.46	.063
Re-experiencing	.34***	Anxious arousal	.25***	5.47	**.019**
Avoidance	.33***	Numbing	.36***	1.10	.294
Avoidance	.33***	Dysphoric arousal	.28***	2.45	.118
Avoidance	.33***	Anxious arousal	.25***	4.25	**.039**
Numbing	.36***	Dysphoric arousal	.28***	9.41	**.002**
Numbing	.36***	Anxious arousal	.25***	9.26	**.002**
Dysphoric arousal	.28***	Anxious arousal	.25***	0.51	.477
Contraceptive use					
Re-experiencing	.05	Avoidance	.02	0.67	.414
Re-experiencing	.05	Numbing	.07	0.64	.423
Re-experiencing	.05	Dysphoric arousal	.11*	4.24	**.040**
Re-experiencing	.05	Anxious arousal	.03	0.20	.652
Avoidance	.02	Numbing	.07	1.87	.172
Avoidance	.02	Dysphoric arousal	.11*	5.68	**.017**
Avoidance	.02	Anxious arousal	.03	0.01	.929
Numbing	.07	Dysphoric arousal	.11*	1.87	.171
Numbing	.07	Anxious arousal	.03	1.07	.301
Dysphoric arousal	.11*	Anxious arousal	.03	4.45	**.035**

Note. ***$p \leq .001$ *$p \leq .01$.

Reichenheim et al., 2018), and no study to date has considered the fit of the well-supported dysphoric arousal model. Future cross-cultural research on PTSD symptoms in perinatal populations that compares leading models of PTSD symptom structure, as we do here, is needed to confirm whether the dimensional expression of PTSD symptoms in these populations is best-represented by the five-factor dysphoric arousal model.

Although we observed that elevated PTSD symptoms based on a cut-off score were linked to adverse indices of maternal health, including poor interpersonal functioning in parent and partner roles, as in previous research (e.g., Fredman et al., 2017), a more refined understanding emerged when we considered PTSD symptom dimensions. Specifically, we found evidence for differential associations between the PTSD dimensions and our markers of maternal health and functioning, suggesting specificity of discrete dimensions even though the dimensions were positively correlated as is typical in the PTSD symptom dimensions literature (e.g., Sumner et al., 2014).

Of the five PTSD symptom clusters, numbing emerged as the symptom dimension with some of the strongest associations with maternal health correlates, whereas anxious arousal demonstrated the weakest correlations with all the maternal health markers. Numbing symptoms were most strongly associated with all three markers of interpersonal functioning, and these correlations were statistically significantly larger than the corresponding correlations with most, if not all, of the other four factors. Parenting stress, which has been linked to total PTSD symptom counts in postpartum women (Ammerman et al., 2012; Chemtob et al., 2013; Fredman et al., 2017; Samuelson et al., 2017), was associated with all five PTSD symptom dimensions; however, consistent with research examining parent-child relationships in samples of male veterans (Ruscio et al., 2002; Samper et al., 2004) and trauma-exposed women (Wilson et al., 2017), numbing was most strongly positively associated with parenting stress. Symptoms characteristic of this dimension—such as restricted affect, sense of foreshortened future, and interpersonal detachment—may inhibit new mothers' ability to effectively monitor and respond to their newborn children and contribute to elevated stress in the parenting role.

Numbing was also strongly associated with markers of functioning in intimate relationships, including partner relationship stress and relationship satisfaction. Previous research has observed unique relationships between numbing symptoms and relationship functioning among heterosexual male military samples (Cook et al., 2004; Riggs et al., 1998); we extend these results to a postpartum sample of adult women. Partnered women with greater severity of numbing symptoms may experience increased conflict with their intimate partners due to reduced capacity for emotional expression, engagement, and reciprocity. Moreover, we observed the same pattern of results across divergent assessment methods. Numbing was strongly negatively associated with relationship satisfaction—a self-report score—and strongly positively associated with partner relationship stress—an interviewer-rated measure—and at similar magnitudes. It may be that symptoms of numbing disrupt intimate relationships by restraining emotional expression and reducing connection between partners. Indeed, the restricted range of affect, detachment, and distinterest characteristic of numbing symptoms may contribute to a sense of elevated stress and dissatisfaction among women as they work to navigate their intimate relationships.

Dysphoric arousal symptoms were uniquely linked with use of low-efficacy contraception, although the effect size was small. Characterized by sleep difficulties, irritability/anger, and concentration problems, dysphoric arousal symptoms may contribute to interpersonal conflict, with spillover effects on women's health behaviors. For example, restlessness and irritability may disrupt women's assertiveness and negotiation skills with partners during intimacy, with resultant impact on the contraceptive method selected. Sleeping problems—another key symptom of this dimension—may further impair women's reasoning capacities and result in dependence on low-efficacy contraceptives. While these methods (e.g., withdrawal, spermicide, condom, no method) may be convenient and easily implemented in the moment, more reliable, higher-efficacy contraceptive methods (e.g., IUD, implant, contraceptive patch) typically require planning and preparation, which may be negatively affected by dysphoric arousal symptoms. Importantly, in modeling PTSD as a binary construct, we did not see significant differences in contraceptive use. Only in examining PTSD symptoms dimensionally did the association with this health behavior emerge, thus highlighting the added value of dimensional conceptualizations of PTSD symptoms.

Illuminating key dimensions of PTSD among postpartum women has several clinical implications. First, shifts in psychiatric nosology can be guided by factor analytic research, as demonstrated by revisions of PTSD criteria for *DSM-5*. Establishing the fit of the five-factor model among this population builds on a large body of work supporting this model in a variety of trauma-exposed populations and may inform future iterations of the PTSD diagnostic criteria. Second, screening for symptoms of posttraumatic numbing and dysphoric arousal symptoms in postpartum samples may inform targeted allocation of resources and promote women's health. Leading organizations in obstetrics-gynecology (e.g., the American College of Obstetricians and Gynecologists) presently recommend screening for depression and anxiety during the perinatal period (American College of Obstetricians and Gynecologists (ACOG) 2018; O'Connor et al., 2016). Our findings support additional screening for numbing and dysphoric arousal symptoms, as these dimensions appear particularly deleterious for maternal health. The perinatal period is an important window for assessment and intervention, as women often have regular contact with the healthcare system during this time. Furthermore, given that many women had been exposed to a potentially traumatic event in the year prior to giving birth and over a quarter of the sample had elevated PTSD symptoms, our findings suggest that a sizeable proportion of women—particularly those of low-income—could be identified with these screening measures. Third, elucidating PTSD symptom dimensions may catalyze efforts toward more homogeneous PTSD phenotypes, which may contribute to greater understanding of how posttraumatic symptoms manifest across units of analysis (e.g., physiologically; Pietrzak et al., 2013; Watkins et al., 2016). Focusing on these more homogeneous symptom dimensions is consistent with the National Institute of Mental Health (NIMH)'s Research Domain Criteria (Insel et al., 2010; Kozak & Cuthbert, 2016)—and may shed light on underlying mechanisms of dysfunction to be targeted via clinical interventions.

5. Limitations

Several limitations need to be considered when interpreting our findings. As in some previous research (Edmondson et al., 2018), PTSD symptoms were not anchored to a specified traumatic event. We ran a sensitivity analysis to examine past-year exposure to events consistent with a Criterion A trauma and total PTSD symptom count. In line with findings indicating that greater cumulative trauma exposure (i.e., trauma burden) is associated with greater PTSD symptom severity (e.g., Mota et al., 2018; Wilker et al., 2015), we found a small, but significant, positive association between past-year trauma burden and PTSD symptoms. Second, due to the timing of the CCHN study, we assessed PTSD symptoms as defined by *DSM-IV-TR* criteria. Evidence suggests that the dysphoric arousal model is still well-representative of the disorder criteria in *DSM-5* (Gentes et al., 2014; Hafstad et al., 2014; Tsai et al., 2015), although future research on the symptom structure of *DSM-5* PTSD in postpartum women is needed. For example, a recent seven-factor hybrid model—comprised of re-experiencing, avoidance, negative affect, anhedonia, externalizing behaviors, anxious arousal, and dysphoric arousal symptom dimensions—has demonstrated superior characterization of *DSM-5* PTSD symptoms across samples (Armour et al., 2015). Studying this even more nuanced structural model in a postpartum population may elucidate different and more precise

associations between underlying PTSD symptoms and maternal health. Finally, our data are cross-sectional and preclude any conclusions around directionality of effects. Longitudinal studies are needed to disentangle the trajectories of these symptom dimensions among postpartum women, in order to better understand associations of PTSD symptoms with maternal health over time (e.g., Pietrzak et al., 2014).

Despite these limitations, this investigation is characterized by several strengths. We conducted the first examination of the dimensional structure of PTSD among postpartum women in the United States; our large, diverse sample includes Black, Latina, and White women from regions across the country. Further, we examined associations between discrete PTSD symptom dimensions with correlates relevant to maternal health and functioning during the postpartum period. Lastly, our results are convergent across distinct assessment methods—including self-report and interviewer-rated—and minimize shared method variance.

6. Conclusions

PTSD in the perinatal period is associated with adverse health and functioning, yet the phenotypic expression of this disorder is heterogeneous. Traditional conceptualizations portray PTSD as a disorder of pathological fear learning (Zoellner et al., 2014), but focusing exclusively on threat responses may overlook other aspects of posttraumatic psychopathology that have relevance for the health of new mothers. We found that numbing and dysphoric arousal symptoms are uniquely linked with interpersonal impairment and adverse health behaviors among postpartum women. The perinatal period is an important window of opportunity for prevention and intervention, and screening for these symptoms in obstetric settings may help connect women to appropriate healthcare resources. Moreover, intervening on these dimensions may ameliorate associated impairments and improve the health of impacted mothers, who may be particularly amenable to psychosocial intervention in the context of perinatal care during this transitory time.

Contributors

JLT and JAS designed the present study. JLT performed the statistical analysis, with consultation from RHP and JAS and assistance from SC. JLT wrote the first draft of the manuscript, with substantial input from JAS. As a CCHN Principal Investigator, CDS provided critical input on methodology and content. All authors contributed to and gave approval for the final version of the manuscript.

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Declaration of Competing Interest

None.

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