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Childhood adversity and sleep are associated with symptom severity in perinatal women presenting for psychiatric care

Rena A. Menke, PhD[a], **Leslie Swanson, PhD**[a], **Nora L. Erickson, PhD**[a], **Greta Reglan, PhD**[a], **Stephanie Thompson, LLMSW**[a], **Katherine Bullard Harris, LMSW, MPH**[a], **Katherine Rosenblum, PhD**[a,b], **Juan P. Lopez, MD**[a], **Maria Muzik, MD MS**[a,b], and **WIMH Group at University of Michigan**[c]

[a]University of Michigan, Department of Psychiatry, 4250 Plymouth Rd., Ann Arbor, MI 48105, United States of America

[b]Center for Human Growth & Development, University of Michigan, 300 N. Ingalls St, Ann Arbor, MI 48104, United States of America

[c]WIMH Group= Women and Infants Mental Health Group comprises all faculty, staff and trainees who are serving perinatal women presenting for specialized clinical care to the Women and Infants Mental Health Clinic at the Department of Psychiatry, University of Michigan.

Abstract

Purpose: This study leverages psychiatric intake data from treatment-seeking perinatal women aiming to explore the understudied associations between childhood adversity, sleep quality and severity of perinatal mental illness in this population.

Methods: The sample are 578 perinatal women presenting for initial evaluation to a university-based perinatal psychiatry clinic. At intake we collected demographics, adverse childhood experiences (ACEs), sleep quality, and diagnosis and symptom severity of depression, anxiety, and Posttraumatic Stress Disorder (PTSD).

Results: Clinician-rated diagnoses showed that 65% of women met criteria for major depression, 23% for generalized anxiety disorder, and 4% for PTSD; almost 30% of women had childhood adversity and 98.2% reported poor perinatal sleep quality. Regression analyses revealed differential associations between ACEs and sleep quality and perinatal mood symptoms; ACEs significantly associated with pregnancy and postpartum PTSD, whereas sleep quality was associated with perinatal depression and generalized anxiety.

Corresponding author: Maria Muzik, MD, MS; muzik@med.umich.edu Department of Psychiatry, University of Michigan; 4250 Plymouth Rd, Ann Arbor MI 48109.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

Conflict of Interest: None of the authors stated declare conflict of interest. WIMH Group (Women and Infants Mental Health Group) comprises all faculty, staff and trainees who are serving perinatal women presenting for specialized clinical care to the Women and Infants Mental Health Clinic at the Department of Psychiatry, University of Michigan, and these individuals declare no conflict of interest.

Conclusions: Screening for ACEs and sleep quality during perinatal intake has high clinical utility, as these two factors significantly contribute to symptom severity across peripartum.

Keywords

ACEs; sleep quality; perinatal psychopathology; perinatal psychiatric care

Perinatal mood disorders are a common (Gavin et al. 2005; Ross et al. 2005), yet often unrecognized and undertreated (Cox et al. 2016). Recent recommendations (e.g., American College of Obstetricians and Gynecologists, (2015) note that all women should be screened for perinatal mood disorders and that this must be coupled with provision of appropriate follow-up treatment. Over the past decade, many university-centers have established perinatal specialty clinics with exactly this goal: to support screening efforts in primary care and to deliver effective treatments for symptomatic women. Additional benefit of such perinatal specialty clinics is that the information collected from patients also provides the opportunity to study unique risk factors for illness severity in this population. The current manuscript leverages psychiatric intake data from treatment-seeking perinatal women presenting to a university-based perinatal psychiatry specialty clinic with the aim to examine associations between two known risk factors (i.e., childhood adversity and perinatal sleep quality) and severity of depression, anxiety, and posttraumatic stress symptoms during pregnancy and postpartum.

Childhood Adversity and Sleep as Risk Factors for Perinatal Psychopathology

A recent systematic review identified multiple risk factors for perinatal mental illness, including demographic, personal (e.g., past/current adverse life events), and biological (e.g., history of psychiatric illness, sleep disruption (Biaggi et al. 2016). Of the many risk factors identified, there is good evidence to suggest that two (i.e., childhood adversity and perinatal sleep quality) may have particular relevance to perinatal wellbeing.

Adverse Childhood Experiences (ACEs).

The Adverse Childhood Experiences (ACEs) questionnaire asks individuals to recall presence or absence of maltreatment while growing up (Felitti et al. 1998). Both within non-perinatal (Chapman et al. 2004; Dube et al. 200) and perinatal populations (Meltzer-Brody et al. 2017), greater maltreatment exposure (i.e., higher ACEs score) is linked to more psychopathology. Most research has focused on linking ACEs to perinatal depression (Barrios et al. 2015), and less is known about effects of ACEs on symptoms of perinatal anxiety and post-traumatic stress disorder (PTSD), among treatment-seeking perinatal women.

Sleep Quality.

Disturbed sleep is a common feature of the perinatal period (Gay et al. 2006), and poor sleep quality creates significant risk for perinatal depression (Dorheim et al. 2009; Okun et al. 2011). Little is known about the influence of sleep on perinatal anxiety and even less on

perinatal PTSD (Lawson et al. 2015; Swanson et al. 2011). One previous study of perinatal sleep and PTSD found that insomnia symptoms were associated with PTSD; however, this relationship was no longer significant after controlling for depression symptoms (Swanson et al. 2014).

Study Aims and Hypotheses

Given the paucity of data on associations between ACEs and sleep quality with perinatal psychopathology, especially when investigating beyond depression only and within a clinical population, the aim of this paper is to explore how ACEs and sleep quality associate with symptom severity of perinatal depression, generalized anxiety, and PTSD among treatment-seeking perinatal women presenting to specialty care. We hypothesize that ACEs and sleep quality will both contribute significantly to severity of perinatal psychopathology. Given limited prior data, we do not have a priori expectations regarding unique associations to anxiety and PTSD.

Methods

Study Design and Participants

The perinatal psychiatry specialty clinic is housed within a university-based outpatient setting in Michigan (USA) and serves women with mood and anxiety disorders. From 2010 through 2015, 661 perinatal women presented for a psychiatric evaluation and consented to participate in this study; 578 met inclusion criteria, which included English-speaking; 18 years of age or older; and pregnant (n = 250) or less than 12-months postpartum (n = 328). Women who presented to clinic for preconception counseling (n = 47), perinatal loss (n = 19), or had psychopathology related to reproductive hormonal changes more generally, (i.e., Premenstrual Dysphoric Disorder (PMDD) (n = 11)) or perimenopause (n = 6), were excluded.

Measures

All patients completed questionnaires (via clinic-based computer programs or pen and paper), without compensation, as part of standard clinical care, and data is usable in de-identified format for analyses approved by local Institutional Review Board.

Demographics include race, marital status, level of education, maternal age, and type of insurance (i.e., private or public; a proxy for income level). To examine cumulative demographic risk, variables were dichotomized (0 = no, 1 = yes) into non-White minority, single parent (i.e., unmarried or un-partnered), low education (i.e., less than a high school diploma or GED), low family income (i.e., public insurance status), and young maternal age (i.e., < 22 years old). Variables were summed (0-5) to create a demographic cumulative risk score (Sameroff et al. 1993). Additionally, we provide historical and current psychiatric information collected during intake including referral source, current treatments and post-intake disposition.

Psychopathology was assessed via self-rating scales and psychiatric diagnoses. The severity scores derived from self-rating scales were used for main analyses, whereas diagnoses were

used for sample description. The 10-item Edinburgh Postnatal Depression Scale (EPDS; (Cox et al. 1987; Gaynes et al. 2005) was used to assess depression severity (0-30; alpha = 0.87) Scores ≥13 indicate probable diagnosis of major depression. The 7-item Generalized Anxiety Disorder Scale (GAD-7) was used to assess anxiety symptom severity (Spitzer et al. 2006; Swinson 2006; Zhong et al. 2015)) and a cut-off score ≥10 indicating "moderate to severe anxiety" and possible anxiety disorder (GAD) diagnosis. Finally, the 22-item Impact of Events Scale-Revised (IES-R) was used to assess PTSD symptom severity (Sundin and Horowitz 2002; Weiss and Marmar 1997) and a cut-off score ≥33 indicating probable PTSD diagnosis (Creamer et al. 2003). We obtained DSM-IV psychiatric diagnoses for major depression, generalized anxiety disorder and PTSD (American Psychiatric Association 2000) in such that one board-certified psychiatrists obtained an initial working diagnosis by conducting the intake interview. Subsequently on same day the working diagnosis was finalized via case discussion during the team meeting with additional three board-certified psychiatrists present.

Adverse Childhood Experiences (ACEs) questionnaire assesses exposure to 10 aversive childhood experiences including abuse, neglect, parental mental health, and family discord (Felitti et al. 1998). Each ACE is indicated as present (1) or absent (0) and totaled (maximum score equals 10); a score ≥ 4 indicates heightened risk for subsequent health problems.

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), a 10-item scale (Buysse et al. 1989). Subscale scores for duration of sleep, sleep disturbance, sleep latency, sleep efficiency, days of dysfunction due to sleepiness, overall sleep quality, and sleep medication use are totaled (0-21) to yield a continuous global score; higher scores indicated worse sleep quality (alpha = .57; (Buysse et al. 1989). A total score of ≥ 5 indicated poor sleep quality. The measure is a reliable and valid measure of sleep quality among postpartum women (Bei et al. 2010); however, low alphas have been identified due to inclusion of medication questions, which pregnant women are prescribed less often (Skouteris et al. 2008). To remain consistent with the current published literature, these questions were included (alpha = .57). The PSQI was added after study commencement, thus, only 281 participants completed it.

Statistical Methods

Data analyses were performed using SPSS version 22 (Corp. 2013). To examine the associations between self-reported (rating scales) and clinician-based diagnoses, we ran chi-square analyses and t-tests. To test associations between risk factors (ACEs and sleep quality) and severity of psychopathology, we ran stepwise regression analyses. First, correlations between variables of interest, including covariates (demographics) were determined. Then, we performed stepwise hierarchical regression models to test proposed associations between independent (ACEs, sleep) and dependent (depression, GAD, and PTSD symptoms) variables: demographic risk was entered as a first step and ACEs as a second step. For the subsample of participants (n = 281) with complete sleep quality data, we entered sleep quality as a third step to the model. A Bonferroni correction is reported

addressing the likelihood of a Type I error (alpha = 0.008); two-tailed tests and .05 alpha were retained for comparison.

Results

Missing Data

Missing data are reported aggregately. The following variables had > 5% missing data: ACEs, anxiety severity, PTSD severity. Independent samples *t*-tests and chi-square tests determined no systematic relations between variables based on missingness (within and across the complete sample and the sleep only sample) indicating data were missing at random (MAR). Missing data were handled using SPSS version 22.0, with five sets of multiply imputed data (Graham 2009; Newman 2003).

Participant Characteristics

Participant demographics are displayed in Table 1. Primary variable means, standard deviations and correlations are listed in Table 2. Overall, the sample had relatively low demographic risk (pregnancy $M = .74$, $SD = .92$; postpartum $M = .45$, $SD = .75$), but ~30% indicated high level of childhood adversity (ACES ≥4). Clinically, pregnant and postpartum women demonstrated equal levels of psychopathology. Most women presented with depression (clinician-rated = 65.5%; self-report above cut-off = 80.8%); followed by generalized anxiety (clinician-rated = 22.5%; self-report above cut-off = 52.6%); and PTSD (clinician-rated = 3.5%; self-report above cut-off = 35.5%). There was high concordance between clinician-rated and self-rated diagnoses (Depression: χ^2 (1) = 32.87, $p = .00$; Generalized anxiety: χ^2 (1) = 24.09, $p = .00$; PTSD: χ^2 (1) = 7.48, $p = .01$). Individuals with clinician-rated diagnoses had statistically higher mean scores on self-report measures (Table 3). Most women were referred from within the medical system (75.8%). At intake, 40.8% were on psychotropic medications and only 11.6% were in psychotherapy; following intake 63.8% were prescribed medications and 73% recommended psychotherapy (see Table 1).

Associations Between Risk Factors and Symptom Severity

Table 2 shows correlations between self-reported symptom severity and risk factors. Regression models tested for associations between ACEs and sleep quality and symptom severity of depression, anxiety, PTSD during pregnancy and postpartum when controlling for demographic risk (Table 4). Demographic cumulative risk was associated with perinatal psychopathology (mainly depression and PTSD) in pregnancy and postpartum. ACEs score significantly contributed to associations between pregnancy depression and PTSD, and postpartum PTSD, but not postpartum depression. Interestingly, ACEs risk was not significantly associated with anxiety. In the subset analyses including the sleep quality variable, we found that sleep quality was significantly associated with depression and anxiety. However, sleep quality was not associated with PTSD, in pregnancy nor postpartum.

Discussion

The current study is the first to explore concurrent associations between two established risk factors (i.e., ACEs and sleep quality) and severity of perinatal psychopathology to include

depression, generalized anxiety (GAD), and PTSD among pregnant and postpartum women presenting for psychiatric specialty care at a university-based outpatient psychiatry clinic. We found that childhood adversity and sleep quality were differentially associated with symptom severity for depression and GAD among both pregnant and postpartum patients. While sleep quality seemed to be associated more broadly with depression and GAD (not PTSD) across both pregnancy and postpartum; ACEs were more uniquely associated to PTSD across peripartum. Specifically, for pregnant women ACEs scores were associated with PTSD severity (and depression) but were not associated with GAD severity. When sleep quality was added to the model (on subsample), sleep quality was associated with depression severity and GAD severity. For postpartum women, ACEs scores again were associated with PTSD symptom severity, but not depression and GAD. In contrast, sleep quality was associated with depression and GAD in postpartum, but not PTSD.

The exact mechanistic relationship between ACEs and increased risk for perinatal PTSD is not fully known, but the perinatal period normatively triggers contemplation of childhood experiences, and women with childhood adversity may re-experience memories of trauma (Muzik et al. 2013; Oh et al. 2016) making them more vulnerable to exacerbation of possibly preexisting PTSD symptoms. Thus, trauma history may reduce the ability to cope with subsequent stressful or traumatic events such as normative stressful pregnancy or birth experiences or a traumatic birth (Dekel et al. 2017), as noted in a sensitization effect described by Naomi Breslau several decades ago (Breslau et al. 1999). Thus, women with trauma histories may exhibit PTSD symptoms induced by entry to pregnancy or after childbirth. Consistent with prior literature, we also found PTSD was associated with ACEs in pregnancy and postpartum.

Interestingly, significant associations between ACEs and depression occurred only during pregnancy, contrary to prior findings linking a history of childhood abuse to postpartum depression (Barrios et al. 2015; Meltzer-Brody et al. 2017). This may be because the current sample of treatment-seeking women had low demographic risk, whereas prior samples have included low-income populations (Mersky and Janczewski 2018; McDonnell and Valentino 2016). Differences in sampling may have therefore contributed to divergent findings and it may be that previously identified mediating mechanisms between ACEs and postpartum depression (see e.g., Mersky and Janczewski 2018) vary depending on socioeconomic and demographic factors. Additionally, it is possible that contemplation of ACEs manifests as depression in pregnancy versus PTSD in the postpartum period. Several prior studies have reported more robust effects of childhood maltreatment on prenatal depressive symptoms, as compared to postpartum symptoms (Li et al. 2017); (Robertson-Blackmore et al. 2013). Although the current study cannot address specific mechanisms, it has been posited that the hormonal and immunity changes during pregnancy, but not postpartum, may make women with a history of childhood stressors particularly vulnerable to depression during this time (Li et al. 2017). Ultimately, further research is needed to understand why ACEs would be associated with depression in pregnancy, but not in postpartum.

Consistent with the literature, the current study also supports robust associations between sleep quality and perinatal depression symptoms (Skouteris et al. 2008). The relationship observed between sleep quality and anxiety support a subset of prior research (Swanson et

al. 2011). Very few studies have examined relationships between sleep and PTSD in the perinatal population; however, our finding that sleep quality was not associated with PTSD symptom severity is consistent with previous findings (Swanson et al. 2014), and provides evidence that conditions comorbid with PTSD (e.g., depression) may be more closely associated with sleep difficulties in the perinatal population than PTSD itself. Unfortunately, many providers assume that poor sleep quality is normative in the perinatal period, which may lead to under-treatment of perinatal sleep disturbance. Our findings confirm accumulating evidence, which strongly implicates poor sleep quality and sleep disturbances as independently associated with perinatal functioning and mental health; thus, there is a critical need for sleep interventions utilizing evidence-based treatment options (e.g., Cognitive Behavioral Therapy for Insomnia [CBT-I]; (Jansson-Frojmark and Norell-Clarke 2016).

Not surprisingly, the number of women who met diagnostic cut-offs based on self-report questionnaires exceeded the number of clinician-derived diagnoses; however, there was high concordance across the two domains, supporting the validity of self-report measures as screeners. Most women received a clinical diagnosis of depression, followed by GAD and PTSD. As expected, individuals with clinician-derived diagnoses showed higher mean score levels on self-report measures compared to those without clinical diagnoses.

Finally, we were intrigued by the differential rates of pre-intake treatment in this sample. The rate of women already in psychotherapy at intake was low (11%) compared to women already on medications (40%). After disposition, the proportion of women with medication and therapy recommendations equalized, suggesting that a greater proportion of women received psychotherapy recommendations. This is consistent with the recommendation for psychotherapy as a first-line treatment for mild to moderate perinatal psychopathology (Muzik and Hamilton 2016; Yonkers et al. 2009). The low number of women presenting to the clinic with prior psychotherapy is concerning given women desire psychotherapy rather than medication during this period, and the documented efficacy of psychotherapy for perinatal depression, anxiety, and PTSD (Cristea et al. 2015; Dennis and Chung-Lee 2006; Kliem and Kröger 2013). Overall, the low pre-intake psychotherapy engagement rate may represent several reported barriers to treatment including access to psychotherapy services (Byatt et al. 2016). Further research is warranted to understand effective methods for addressing barriers.

Specialized perinatal clinics that emphasize effective interventions—both psychotherapeutic and pharmacological—may help address perinatal mental health concerns including depression, anxiety, and PTSD. Interventions connecting perinatal women with trauma-informed care are being developed in primary care (e.g., OB/GYN) and perinatal psychiatric settings (Grote et al. 2015; Muzik et al. 2015). These interventions include, for example, Circle of Security, Mom Power, and CBT-I (Huber et al. 2016; Rosenblum et al. 2017; Seeman et al. 2017). Importantly, the current study demonstrates that childhood adversity and sleep problems among treatment-seeking perinatal women is common and supports the need for increased screening and more targeted treatment referrals.

Limitations

Although novel, our findings are not without limitations. Information about non-treatment seeking women, including variables about barriers to treatment-seeking, were not collected. The studied sample is predominantly well-educated, Caucasian and partnered; therefore, the results may not generalize to high-risk and/or minority women. The primary purpose of our clinic is to provide patient care, which limits the research design and available metrics as well as the timing of data collection and follow up. Additionally, data regarding the specific types of treatments provided to the individuals in this project was not available but would be important for understanding the efficacy of outpatient services provided to perinatal women. Furthermore, findings may not generalize across populations as this is a treatment-seeking sample to a university-based clinic. It is notable that the internal consistency of the sleep quality measure was relatively low due to inclusion of questions about use of sleep medications (Skouteris et al. 2008). Despite these limitations, the current results provide perspective on characteristics of an important clinical population.

Conclusions

The current study identified significant, yet modifiable, risk factors for the severity of mental health problems among women seeking treatment. Although ACEs are not directly modifiable, the mental health consequences of ACEs may be addressed via trauma-informed treatments (Resick et al. 2008). As sleep problems often persist despite successful treatment of comorbid conditions such as depression (Carney et al. 2007) and PTSD (Zayfert and DeViva 2004), clinics serving perinatal populations should consider routine sleep assessments and interventions. The results also provide an understanding of current treatment recommendations for perinatal women. The discrepancy between women receiving first-line services highlights the need for specialized perinatal mental health services that can fulfill the call for state-of-the-art screening and interventions. By providing specialized perinatal mental health care and addressing important distal and proximal risk factors, we may be able to detect and treat perinatal mental illness more effectively and ameliorate negative outcomes to mothers and their children.

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Table 1.

Sample Characteristics.

		Total Sample (n=578)		Pregnant (n=250)		Postpartum (n=328)	
		n	**Percent**	***n***	**Percent**	***n***	**Percent**
Age	> 22 years old	540	93.43	232	92.80	308	93.90
	<22 years old *	28	4.84	16	6.40	12	3.66
Partnered	Partnered	462	79.90	195	78.00	267	81.40
	Not Partnered *	66	11.40	37	14.80	29	8.80
Racial	Caucasian	453	78.40	195	78.00	258	78.70
	Minority *	114	19.70	51	20.40	63	19.20
Education	Less than High School *	22	3.80	16	6.40	6	1.80
	High School or GED	74	12.80	39	15.60	35	10.70
	Some College	89	15.40	45	18.00	44	13.40
	Bachelor's Degree	157	27.20	54	21.60	103	31.40
	Graduate Degree	147	25.40	62	24.80	85	25.90
Insurance (proxy for income risk)							
	Public *	101	17.47	64	25.80	37	11.30
	Private	465	80.45	182	72.80	283	86.30
	Other	2	0.35	2	0.80	0	0.00
Total Demographic Risk							
	0	355	61.42	131	52.40	224	68.29
	1	137	23.70	68	27.20	69	21.04
	2+	86	14.88	51	20.40	35	10.67
ACE Risk	<4	342	70.20	140	66.00	202	73.50
	≥ 4	145	29.80	72	34.00	73	26.50
Sleep Quality ^	Good Quality	5	1.8	2	1.7	3	1.9
	Poor Quality (≥ 5)	276	98.2	119	98.30	157	98.1
Diagnosis by Psychiatrist							
Depression		372	65.60	155	62.00	217	66.20
GAD		130	22.50	59	23.60	71	21.70
PTSD		20	3.50	10	4.00	10	3.00
Diagnosis by Self-Report							
Depression		467	80.8	201	80.4	266	81.1
GAD		304	52.6	138	55.2	166	50.6
PTSD		205	35.5	96	38.4	109	33.2
Referral Source							
In system (e.g., OB/GYN, inpatient, etc.)		326	75.80	140	76.50	186	75.30
Out of system		40	9.30	21	11.50	19	7.70
Self-referral		64	14.90	22	12.00	42	17.00

	Total Sample (n=578)		Pregnant (n=250)		Postpartum (n=328)	
	n	**Percent**	***n***	**Percent**	***n***	**Percent**
At Intake						
On Medication	236	40.8	101	40.4	136	41.5
In Therapy	67	11.6	29	11.6	38	11.6
Recommendations						
Therapy	422	73.00	175	70.00	247	75.30
Medication	369	63.80	147	58.80	222	67.70
Medication Change	189	32.7	79	31.6	110	33.5

Note: n's may not total 578 due to missing information.

* Risk variable.

^ Sleep Quality variable only available for subset n=281

Table 2.

Descriptive Statistics and Correlations Between Main Study Variables in Pregnancy and Postpartum.

	1	2	3	4	5
1. Demographic Risk	**0.45 (0.75)** 0.74 (.92)	***.32*** **	***.28*** **	***.23*** **	***.28*** **
2. Sleep Quality	0.06	**11.79 (3.27)** 11.74 (3.38)	***.37*** **	***.29*** **	***.38*** **
3. Depression Severity	.23 **	.33 **	**16.45 (5.42)** 16.45 (6.29)	***.63*** **	***.54*** **
4. Anxiety Severity	0.03	.31 **	.70 **	**12.06 (5.61)** 12.77 (5.77)	***.41*** **
5. PTSD Severity	.35 **	0.17	.51 **	.49 **	**31.96 (19.99)** 32.80 (21.38)

* Note. p<.05

** Bonferroni Corrected: p<.008; Means (Standard Deviations) are on the diagonal. Postpartum values are **bold** and correlation coefficients are above the diagonal; Pregnancy values are non-bold and correlation coefficients are below the diagonal. Demographic risk is the total of variables dichotomized (0 = no, 1 = yes) into non-White minority, single parent (i.e., unmarried or un-partnered), low education (i.e., less than a high school diploma or GED), low family income (i.e., public insurance status), and young maternal age (i.e., < 22 years old). Variables were summed (0-5) to create a risk index (Sameroff et al. 1993). Depression Severity was measured by the Edinburgh Postnatal Depression Scale; Anxiety was measured by the Generalized Anxiety Disorder Scale; and PTSD was measured by the Impact of Events Scale-Revised.

Table 3.

T-tests comparing scores on self-report measures among women with and without clinician-rated diagnosis

	Clinician-Rated Diagnosis		No Diagnosis			
COMBINED	**M**	**SD**	**M**	**SD**	***t*-test**	**df**
PTSD	56.12	19.68	31.26	20.04	5.02***	407
Depression	17.63	5.38	14.30	5.98	6.59***	535
Anxiety	14.98	4.73	11.54	5.70	5.80***	465
PREGNANT						
PTSD	59.89	17.35	31.41	20.67	4.06***	182
Depression	17.90	5.70	13.99	6.50	4.85***	236
Anxiety	15.84	4.58	11.79	5.77	4.55***	200
POSTPARTUM						
PTSD	51.88	22.42	31.13	19.56	2.93***	223
Depression	17.42	5.13	14.56	5.51	4.44***	297
Anxiety	14.27	4.78	11.35	5.66	3.68***	263

*** Note. p<.00. Depression Severity was measured by the Edinburgh Postnatal Depression Scale; Anxiety was measured by the Generalized Anxiety Disorder Scale; PTSD was measured by the Impact of Events Scale-Revised.

Table 4.

Relationships between Risk Factors and Psychopathology Severity in Pregnancy and Postpartum

	Step 1: SES Risk	Step 2: Childhood Risk Factors	Step 3: Sleep Risk				
	Cumulative Demographic Risk	ACE Group	Sleep Quality	Total R^2	Last Step: Δ R^2	f (pooled analyses)	df
PREGNANCY WITHOUT SLEEP							
Depression	1.35**	2.96**		0.13	.08***	15.74***	2, 205
Anxiety		1.91		0.05	.05**	10.76**	1,201
PTSD	5.98*	9.14*		0.17	.06***	15.78***	2, 154
POSTPARTUM WITHOUT SLEEP							
Depression	1.69***	1.67		.13	.03**	19.59***	2, 259
Anxiety	0.92	1.4		0.07	.02*	10.36***	2, 260
PTSD	4.44**	9.49*		0.17	.05***	18.75***	2, 189
PREGNANCY WITH SLEEP							
Depression	1.36*	2.20*	.50***	0.18	.08***	8.57***	3, 117
Anxiety		1.47	.48**	0.11	.08**	7.15**	2, 118
PTSD	4.23	9.26*		0.15	.05*	6.71**	2, 79
POSTPARTUM WITH SLEEP							
Depression	2.18**	2.74*	.51***	0.27	0.09***	18.58***	3, 154
Anxiety	1.81**	2.88**	.35**	0.19	.04**	12.30***	3, 155
PTSD	3.80	11.02	1.27	0.22	.10***	9.50***	3, 100

*Note. p<.05

**p<.01

***Bonferroni Corrected: p<.008. Unstandardized Betas are reported. Black boxes in the Pregnancy without Sleep and Postpartum without sleep section indicate the risk factor was not related to the outcome variable in correlations. Sleep quality that it was not included in the analyses for this step. Black boxes in the Pregnancy with Sleep and Postpartum with sleep section indicate the risk factor was not related to the outcome variable in correlations.