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Pregnancy stressors and postpartum symptoms of depression and anxiety: the moderating role of a cognitive–behavioural therapy (CBT) intervention

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ABSTRACT

Background Little is known about the association between stressors (especially positive stressors) during pregnancy and postpartum depression and anxiety.

Aims We investigated the association between positive and negative stress events during different stages of pregnancy and postpartum mental health outcomes among low-income pregnant women with symptoms of anxiety in Pakistan and evaluated whether an intervention based on cognitive–behavioural therapy (CBT) had a regulatory effect.

Methods Participants were 621 pregnant Pakistani women with mild anxiety. Using the Pregnancy Experience Scale-Brief Version, six scores were created to assess positive and negative stressors. We performed a multivariate linear regression to examine whether these six scores, measured both at baseline and in the third trimester, were associated with postpartum anxiety and depressive symptoms. The effect of the intervention on this relationship was examined by adding an interaction term to the regression model.

Results Hassles frequency measured in the third trimester was positively associated with depression (B=0.22, 95% confidence interval (CI): 0.09 to 0.36) and anxiety (B=0.19, 95% CI: 0.08 to 0.30). At the same timepoint, uplifts intensity was negatively associated with symptoms of depression (B=−0.82, 95% CI: −1.46 to −0.18) and anxiety (B=−0.70, 95% CI: −1.25 to −0.15), whereas hassles intensity was positively related to symptoms of depression (B=1.02, 95% CI: 0.36 to 1.67) and anxiety (B=0.90, 95% CI: 0.34 to 1.47). The intensity ratio of hassles to uplifts reported in the third trimester was positively related to both depression (B=1.40, 95% CI: 0.59 to 2.20) and anxiety (B=1.26, 95% CI: 0.57 to 1.96). The intervention strengthened the overall positive effects of uplifts and the negative effects of hassles. Pregnancy experiences at baseline during early pregnancy to mid-pregnancy were not associated with mental health outcomes.

Conclusions Stressors in the third trimester but not earlier in pregnancy were associated with postpartum symptoms of anxiety and depression. The CBT intervention modified the association between pregnancy stressors and postpartum mental health outcomes. Programmes that promote positive experiences and reduce negative experiences, especially in late pregnancy, may mitigate postpartum mental health consequences.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Postpartum depression and anxiety are major mental health concerns that affect women worldwide. The impact of positive experiences during pregnancy on the development of these disorders has been far less studied than the impact of negative experiences.

WHAT THIS STUDY ADDS

⇒ This study provides new evidence that both positive and negative stressors during the third trimester significantly impact postpartum mental health outcomes in low- to middle-income Pakistani women. This study also highlights the potential effectiveness of cognitive–behavioural therapy in mitigating postpartum mental health consequences of stress during pregnancy.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Future studies exploring the mechanisms underlying the relationship between bidirectional stressors and mental health in pregnant women are warranted.

Trial registration number NCT03880032.

INTRODUCTION

Affecting approximately 10%–20% of mothers worldwide, depression and anxiety are major threats to women's mental health in the postpartum period.[1] Compared with high-income countries, postpartum depression and anxiety are more prevalent in resource-limited countries.[2] For example, in Pakistan, the combined prevalence of postpartum depression and anxiety is estimated to be 28.8%,[3] among the highest in Asian countries.[4] While postpartum anxiety has recently gained attention, there are no accurate estimates of its prevalence in Pakistan.[5] Postpartum depression and anxiety are major causes of mortality among postpartum

women in low and middle-income countries[6 7] and are associated with breast-feeding difficulties, poor parenting behaviours and delayed child development.[8]

Negative stressors (eg, a history of depression and miscarriage) experienced during pregnancy have frequently been linked to maternal postpartum depression and anxiety.[9 10] However, limited research exists on the influence of positive experiences during pregnancy (eg, receiving assistance and compliments)[11] on the development of these disorders. As pregnancy is associated with a wide range of emotions including joy, happiness, fear, anxiety and depression, the intensity and frequency of both positive and negative experiences during pregnancy may have an impact on postpregnancy psychological well-being.

Cognitive–behavioural therapy (CBT) is a psychological treatment used to reduce the symptoms of depression and anxiety. It has been shown to effectively treat depression and anxiety.[12] However, despite its efficacy and evidence-based recommendations for its use, neither high-income nor low-income countries have fully used it for prevention.[13]

Taking advantage of a study of pregnant women with at least mild anxiety in Pakistan,[13] we were interested in learning how women's pregnancy experiences were related to mental health symptoms in the postpartum period. With information on both positive and negative stressors, such as uplifts and hassles experienced in pregnancy, we investigated whether positive or negative experiences during different stages of pregnancy were associated with postpartum symptoms of depression and anxiety. Second, we evaluated whether receiving an intervention based on CBT principles could moderate the association between stress during pregnancy and postpartum symptoms of depression and anxiety.

METHODS

Study setting and participants

The study was embedded within the *Happy Mother–Healthy Baby* (HMHB) randomised controlled trial conducted at the Holy Family Hospital, a tertiary care hospital in Rawalpindi, Pakistan (ClinicalTrials.gov identifier: (NCT03880032). The hospital has a catchment population of over 7 million people from adjoining districts.

Between April 2019 and January 2022, pregnant women were enrolled at the outpatient clinic of the Gynaecology and Obstetrics Department. Inclusion criteria were women: aged ≥18 years with a gestational age ≤22 weeks; who resided within 20 km from Holy Family Hospital; and who understood spoken Urdu. Women who met the above criteria and expressed an initial interest were asked to provide informed consent and complete a second set of screening criteria.

For secondary screening, we used the validated Urdu version of the Hospital Anxiety and Depression Scale (HADS)[14 15] and the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders

(SCID).[16] To participate, women had to have at least mild anxiety on the anxiety subscale (score ≥8) of the HADS in the absence of a depression diagnosis per the SCID. The exclusion criteria were: (1) diagnosis of a major depressive episode or suicidal ideation, (2) self-reported current or past mental disorders (such as bipolar disorder or schizophrenia) and (3) self-reported current or past psychiatric care (eg, anxiety medications, psychotropic medications) and major physical health issues.

Based on these criteria, 1200 women were enrolled and randomised equally into the intervention or control groups (figure 1, please see (blinded for review)[13] for details). Women recruited to the intervention arm received HMHB, a CBT-based psychosocial intervention for prenatal anxiety.[17] HMHB has six core sessions (up to six booster sessions for women needing reinforcement) delivered one-on-one during early to late pregnancy by non-specialist providers trained and supervised by a mental health specialist. Topics of the first five sessions took place weekly, starting from early to mid-pregnancy. The sixth session was conducted in the third trimester. The first five sessions involved psychoeducation, stress management, personal well-being, social support, bonding with infants during pregnancy and staying well. The final session in the third trimester focused on preparing the baby for the early postpartum period. The HMHB sessions were designed to address the anxiety-specific factors in pregnancy identified in our formative research.[17] Sessions incorporated stress management techniques, including breathing exercises. The intervention materials relied on culturally relevant illustrations and behavioural activation to communicate key health messages.[17] Participating women completed three assessments: at baseline (≤22nd week of pregnancy), in the third trimester and at 6 weeks post partum. Of the 755 study participants who completed the postnatal assessment, 118 were not followed up within the third trimester, leaving 637 who completed both the third trimester and postpartum assessments. To explore the moderating effect of the intervention, we compared the effects in the intervention and control groups in this randomised controlled trial.

The power of this study was determined to be sufficient to detect the effects of the intervention on the combined outcomes of anxiety and depression. A second power calculation was performed for birth outcomes (please see (Surkan et al)[13] for details). It is possible that this secondary analysis, which was not planned at the time of the study protocol, was underpowered. All participants were given verbal and written information about the study before recruitment and provided written informed consent before screening and data collection. All data were collected and managed electronically using tablet devices and stored in the cloud.

Measures

Exposure: positive and negative stressors during pregnancy

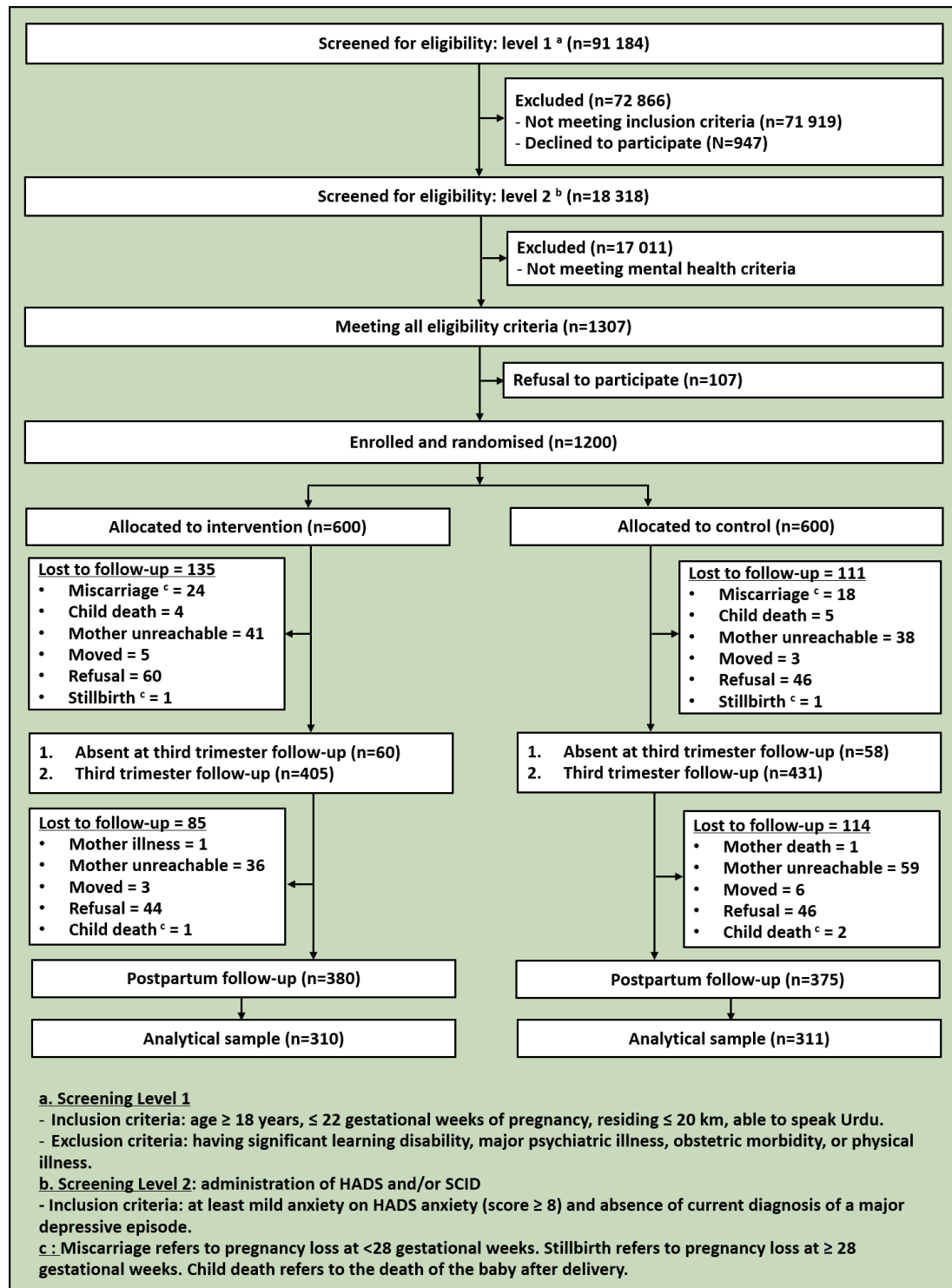This study used the Pregnancy Experience Scale-Brief Version (PES-Brief) to measure women's positive and

Figure 1 Study flowchart. HADS, Hospital Anxiety and Depression Scale; SCID, Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders.

negative stressors[11] at baseline and in the third trimester. The PES-Brief enables a quick and concise evaluation of stress exposure during pregnancy from the women's perspective of both hassles (negative stressors) and uplifts (positive stressors).[11] We translated and culturally adapted the PES-Brief into Urdu, following the World Health Organization guidelines.[11] We modified and validated the Urdu version of the PES-Brief.[11] It has nine items

representing 'uplifts' that make pregnant women feel happy and positive (eg, 'Discussions with spouse about baby names' and 'Making or thinking about nursery arrangements'). The remaining 11 items assess 'hassles' that make pregnant women feel negative or unhappy (eg, 'Normal discomforts of pregnancy' and 'Thinking about your labor and delivery').[11] Response options were rated on a 4-point Likert scale ranging from 0 (not at all) to

3 (a great deal). Based on Cronbach's α>0.8 indicating good internal consistency,[18] uplifts and hassles at both the baseline and the third trimester assessments also showed excellent internal consistency (Cronbach's α of uplifts at baseline=0.89; hassles at baseline α=0.89; uplifts at the third trimester α=0.93; hassles at the third trimester α=0.93).

Using PES-Brief items, we created six standard scores. '*Uplifts frequency*' and '*hassles frequency*' represented the number of items for which participants reported a value >0 (ie, the number of positive responses) on the uplifts or hassles items, respectively. '*Uplifts intensity*' and '*hassles intensity*' are calculated by dividing the sum of uplifts and hassles item scores by their respective frequency scores. High scores on the frequency and intensity variables indicated highly frequent or intense positive or negative stressors during pregnancy. The hassles : uplifts frequency ratio was created by dividing the hassles frequency by the uplifts frequency. The hassles : uplifts intensity ratio corresponds to the hassles intensity divided by uplifts intensity. For these two ratio variables, a ratio >1 indicates that the frequency or intensity of negative stressors is higher than that of positive stressors, while a ratio <1 indicates that positive stressors are more frequent or intense than negative stressors.

Outcome: symptoms of depression and anxiety

We used the HADS to measure the postpartum symptoms of depression and anxiety. The HADS comprises two subscales corresponding to symptoms of depression (seven items) and anxiety (seven items). Participants rated the frequency of their self-perceived mood and experiences related to depression and anxiety over the past few weeks using a 4-point Likert scale (0–3). Each subscale score ranges from 0 to 21 (the total score range is the sum of the two subscales, from 0 to 42), with higher scores indicating more severe symptoms. These two subscales had excellent internal consistency in our study (Cronbach's α=0.96 for depression; and α=0.92 for anxiety).

Covariates

For participant characteristics, we included age (≤25 years, >25 years), education level (≤8 years, >8 years) and gravidity (primigravida, multigravida). Women who experienced a miscarriage or stillbirth during a previous pregnancy were classified as having a history of pregnancy loss. Self-reported exposure to physical violence (not specific to intimate partner violence) was assessed at baseline and during the third trimester. Regarding household characteristics, family structure was categorised into nuclear, joint (living with parents-in-law) and extended/multiple households (living with parents-in-law, siblings and their family members). Monthly household income was dichotomised into ≤20 000 Pakistani rupees (PKR) and >PKR20 000, based on the median. In the analytical sample, 21 women (3.4%) who experienced pregnancy loss during the index pregnancy but completed

postpartum assessments were included. Child characteristics included sex (male, female or current pregnancy loss), birth weight (normal if ≥2.5 kg, low birth weight if <2.5 kg or current pregnancy loss) and preterm birth (preterm if <37 weeks, full term if ≥37 weeks or current pregnancy loss).

Comparing the PES-Brief uplifts and hassles scores for women recruited in the first and second trimesters of pregnancy, we found no significant difference in the summary statistics of any stress indicators, except for uplifts and hassles intensities (see online supplemental table 1). Therefore, we used baseline data collected during both trimesters for comparison with the third trimester assessments.

Statistical methods

After excluding women who had missing variables of interest in the analysis (ie, one participant was missing all the PES-Brief uplifts items in the third trimester and 15 participants did not report income), our analytical sample included 621 women (51.8% of the total sample; n=310 in the intervention group and n=311 in the control group). Univariate descriptive statistics were conducted to calculate the medians and range (Q1–Q3 and available range) of our exposure variables (ie, PES-Brief scores), and Wilcoxon matched-pairs signed-rank tests were conducted to compare PES-Brief scores between the baseline and the third trimester. Bivariate descriptive statistics were used to compare the differences in HADS depression and anxiety scores between participants with different sociodemographic characteristics. Because of the skewness in our outcomes, we used Wilcoxon rank-sum tests, Kruskal-Wallis equality of populations rank tests (for the family structure variable that had equal variance in the three categories) and analysis of variance tests (for other variables with three categories). Sociodemographic variables that were significantly associated with symptoms of depression or anxiety in the bivariate descriptive analyses (p<0.05) were adjusted for further regression analyses.

We then performed linear regression analyses of the PES-Brief in relation to HADS depression and anxiety scores. The model was adjusted for the characteristics of the participant and her household (ie, intervention group, education level, exposure to any physical violence at baseline, exposure to any physical violence in the third trimester and monthly household income) and her child's characteristics (ie, child, birthweight and preterm birth). Finally, we created interaction terms between the six scores from the PES-Brief and group assignment (ie, being in the intervention or control group) and tested for the effect of modification of the intervention on the association between pregnancy experiences and symptoms of depression and anxiety. Models with a significant moderating effect, indicated by Wald F-tests (p<0.05), were graphically depicted to illustrate how associations varied by intervention group.

As a sensitivity analysis, we imputed the monthly household income variable that had 15 missing observations

using multiple imputations and repeated the same regression analyses, including these imputed values (n=636). All analyses were conducted using Stata V.15.1 (StataCorp, College Station, Texas, USA), and statistical tests were two-sided at p<0.05 level.

RESULTS

Online supplemental table 2 displays the summary statistics of the PES-Brief scores. Compared with the scores measured at baseline, women showed increased uplifts frequency and intensity (z=−4.39 for frequency, z=−5.30 for intensity, both p<0.001) and decreased hassles intensity (z=6.10, p<0.001) in the third trimester. There was a decrease in frequency and intensity ratios (hassles : uplifts) during the third trimester (z=3.12, p=0.002 and z=7.05, p<0.001, respectively).

The median HADS depression and anxiety scores of the postpartum women were 4 (table 1). When stratified by sociodemographic characteristics, women with lower education (≤middle school) tended to report higher HADS depression scores, compared with those with higher education (>middle school). Women who reported exposure to physical violence at baseline as well as those who reported experiencing it during the third trimester visit were more likely to have higher HADS depression and anxiety scores than those who were not exposed. Being assigned to the intervention arm and living with a monthly household income of ≤PKR20000 were associated with higher HADS depression and anxiety scores at follow-up. These depression and anxiety scores were higher among women with poor birth outcomes (ie, pregnancy loss, low birthweight or preterm birth).

When we examined the relationships between the six scores of the PES-Brief measured at baseline and the HADS scores measured at 6weeks postpartum, all associations were non-significant (table 2). However, in the third trimester, hassles frequency was positively associated with depression (B=0.22; 95% CI: 0.09 to 0.36; p=0.001) and anxiety (B=0.19; 95% CI: 0.08 to 0.30; p=0.001). Uplifts intensity was negatively associated with depression (B=−0.82, 95% CI: −1.46 to −0.18; p=0.012) and anxiety (B=−0.70, 95% CI: −1.25 to −0.15; p=0.013), whereas hassles intensity was positively related to depression (B=1.02, 95% CI: 0.36 to 1.67; p=0.002) and anxiety (B=0.90, 95% CI: 0.34 to 1.47; p=0.002). Intensity ratio (hassles : uplifts) was positively related to both depression (B=1.40, 95% CI: 0.59 to 2.20; p=0.001) and anxiety (B=1.26, 95% CI: 0.57 to 1.96; p<0.001), suggesting that higher negative stressors compared with positive stressors are associated with increased depression and anxiety scores.

Table 3 shows the moderating effects of the intervention on the associations between pregnancy stressors and symptoms of depression and anxiety, after adjusting for education level, exposure to physical violence at baseline and in the third trimester, monthly household income, child sex, child birthweight and preterm birth. The three models showed significant interactions between (1)

uplifts frequency and the intervention on depression, (2) uplifts frequency and the intervention on anxiety and (3) hassles frequency and intervention on depression. As depicted in figure 2, uplifts frequency was negatively associated with HADS depression and anxiety scores in the intervention group (B=−0.71, 95% CI: −1.33 to −0.10; p=0.023 for depression and B=−0.54, 95% CI: −1.07 to −0.01; p=0.046 for anxiety), whereas these relationships were not significant in the control group (B=0.08, 95% CI: −0.28 to 0.44; p=0.659 for depressive symptoms and B=0.13, 95% CI: −0.18 to 0.44; p=0.415 for anxiety symptoms). In contrast, hassles frequency was significantly associated with increased depressive symptoms in the control group (B=0.45, 95% CI: 0.20 to 0.69; p<0.001), while this association was not significant in the intervention group (B=0.14, 95% CI: −0.02 to 0.29; p=0.083). (For a display of other non-significant results reported in table 3, see online supplemental figure 1.) Taken together, the intervention strengthened the overall positive effects of uplifts and negative effects of hassles on mental health.

In sensitivity analyses with multiple imputations on income (n=636), the results were similar to those of the complete case analysis, although the magnitude of the effects was negligibly different (data not shown).

DISCUSSION
Main findings

The results of our study showed that in a low- to middle-income population in Pakistan, a higher frequency and intensity of hassles during the third trimester of pregnancy, as well as a higher intensity ratio of hassles to uplifts, were linked to elevated levels of postpartum symptoms of anxiety and depression. Conversely, a higher intensity of uplifts during the late stage of pregnancy was related to a decrease in symptoms of anxiety and depression. Additionally, we observed that the inverse association between uplifts frequency and postpartum anxiety and depressive symptoms was stronger among participants in the intervention arm. In other words, participation in the intervention had beneficial effects on the outcomes, that is, the intervention suppressed the positive association between depressive symptoms and hassles frequency and reinforced the negative association between depressive symptoms and hassles frequency.

Our findings demonstrated that both frequent and intense hassles during pregnancy were associated with elevated symptoms of anxiety and depression at 6weeks post partum. Investigating the influence of hassles as a stressor during a woman's life has been a topic of increasing interest over the last decade. A prospective cohort study conducted in the USA on health behaviours and pregnancy indicated that stress intensity during pregnancy (measured using the Prenatal Psychosocial Profile Stressor Scale[11]) was a key predictor of postpartum depression.[19] Another study conducted in India using the PES-Brief demonstrated that women experiencing psychosocial stressors during pregnancy showed

Table 1 Bivariate descriptive statistics relating sociodemographic characteristics to symptoms of depression and anxiety at 6 weeks post partum (n=621)

	n (%)	HADS depression score, median (Q1–Q3)	Statistics*	P value†	HADS anxiety score, median (Q1–Q3)	Statistics*	P value†
Median (Q1–Q3)		4 (1–10)			4 (1–9)		
Participant characteristics							
Age (years)			1.44	0.151		−0.42	0.673
≤25	360 (58.0)	5 (1–10.5)			4 (1–9)		
>25	261 (42.0)	4 (1–9)			4 (1–9)		
Education level			2.14	0.033		1.37	0.170
≤Middle school (≤8 years)	254 (40.9)	5 (1–11)			4 (1–0)		
>Middle school (>8 years)	367 (59.1)	4 (1–9)			4 (1–9)		
Gravidity			−0.86	0.393		0.62	0.538
Primigravida	166 (26.7)	5 (1–9)			4 (1–8)		
Multigravida	455 (73.3)	4 (1–10)			4 (1–9)		
Previous pregnancy loss			0.87	0.385		−0.10	0.917
Yes	274 (44.1)	4 (0–10)			4 (1–9)		
No	347 (55.9)	4 (1–10)			4 (1–9)		
Any physical violence (assessed at baseline)			−2.07	0.039		−2.53	0.012
Exposed	72 (11.6)	7 (1–11)			6 (2–12)		
Not exposed	549 (88.4)	4 (1–10)			4 (1–9)		
Any physical violence (assessed in the third trimester)			−3.79	<0.001		−4.47	<0.001
Exposed	43 (6.9)	8 (5–14)			9 (5–12)		
Not exposed	578 (93.1)	4 (1–10)			4 (1–9)		
Arm			11.60	<0.001		11.06	<0.001
Intervention	310 (49.9)	1 (0–6)			2 (0–5)		
Control	311 (50.1)	8 (4–12)			7 (3–11)		
Household characteristics							
Family structure			0.01[a]	0.994		1.07[a]	0.586
Nuclear	210 (33.8)	4 (1–10)			4 (1–9)		
Joint	199 (32.0)	4 (1–10)			4 (1–9)		
Extended/multiple households	212 (34.1)	4 (1–10)			4 (1–8.5)		
Monthly household income (Pakistani rupee, PKR)			2.54	0.011		2.31	0.021
≤20 000	398 (64.1)	5 (1–11)			4 (1–10)		
>20 000	223 (35.9)	3 (0–8)			3 (1–8)		
Child characteristics							
Sex			1.83[b]	0.161		3.67[b]	0.026
Male	290 (46.7)	4 (1–10)			4 (1–9)		
Female	310 (49.9)	4 (1–10)			4 (1–9)		
Current pregnancy loss	21 (3.4)	9 (4–11)			8 (5–12)		
Birthweight			5.39[b]	<0.001		6.49[b]	<0.001
Low birthweight (<2.5 kg)	79 (12.7)	7 (2–12)			5 (2–10)		
Normal (≥2.5 kg)	521 (83.9)	4 (1–9)			4 (1–9)		
Current pregnancy loss	21 (3.4)	9 (4–11)			8 (5–12)		

Continued

Table 1 Continued

	n (%)	HADS depression score, median (Q1–Q3)	Statistics*	P value†	HADS anxiety score, median (Q1–Q3)	Statistics*	P value†
Preterm birth			3.31[b]	0.037		4.42[b]	0.013
Preterm (<37 weeks)	126 (20.3)	3 (1–8)			4.5 (1–10)		
Full term (≥37 weeks)	474 (76.3)	4 (1–10)			4 (1–9)		
Current pregnancy loss	21 (3.4)	9 (4–11)			8 (5–12)		

*All statistics are z-scores unless otherwise stated (a: χ^2; b: F values).
†Wilcoxon rank-sum tests, Kruskal-Wallis equality of populations rank test (for family structure variables) and analysis of variance (ANOVA) tests were conducted to compare the HADS scores by covariate categories.
HADS, Hospital Anxiety and Depression Scale.

elevated hassles frequency, as well as increased intensity and frequency ratio of hassles to uplifts.[20]

Although negative stressors during pregnancy have been extensively investigated in relation to postpartum mental health, the role of positive stressors has been less explored. Among the studies based on the PES and PES-Brief to date, we found only a single study conducted in Japan that examined the relationship between uplifts and postpartum depression.

That study reported that non-depressed postpartum women exhibited significantly higher uplifts intensity during pregnancy than depressed postpartum women.[21]

Most studies focusing on positive experiences during pregnancy have examined particular types of positive experiences, such as tangible or emotional support from partners,[22] rather than comprehensively measuring pregnancy-specific positive experiences. In our study,

Table 2 Associations of positive and negative stress during pregnancy with symptoms of depression and anxiety at 6 weeks post partum

Outcome	Depressive symptoms			Anxiety symptoms		
PES-Brief	B (95% CI)*	P value	Adjusted R^2	B (95% CI)*	P value	Adjusted R^2
Baseline (gestational age ≤22 weeks)						
Uplifts frequency	−0.04 (−0.27 to 0.20)	0.756	0.232	−0.07 (−0.28 to 0.13)	0.490	0.238
Hassles frequency	0.04 (−0.12 to 0.19)	0.660	0.232	−0.05 (−0.19 to 0.08)	0.435	0.238
Uplifts intensity	−0.42 (−1.09 to 0.25)	0.217	0.234	−0.27 (−0.85 to 0.31)	0.363	0.238
Hassles intensity	−0.33 (−1.05 to 0.39)	0.367	0.233	−0.24 (−0.86 to 0.38)	0.447	0.238
Frequency ratio (hassles:uplifts)	0.11 (−0.33 to 0.55)	0.633	0.232	−0.06 (−0.31 to 0.44)	0.738	0.237
Intensity ratio (hassles:uplifts)	0.00 (−0.81 to 0.82)	0.990	0.232	−0.02 (−0.72 to 0.68)	0.949	0.237
Third trimester						
Uplifts frequency	−0.12 (−0.43 to 0.20)	0.460	0.233	−0.04 (−0.31 to 0.23)	0.778	0.237
Hassles frequency	0.22 (0.09 to 0.36)	0.001	0.246	0.19 (0.08 to 0.30)	0.001	0.250
Uplifts intensity	−0.82 (−1.46 to −0.18)	0.012	0.240	−0.70 (−1.25 to −0.15)	0.013	0.245
Hassles intensity	1.02 (0.36 to 1.67)	0.002	0.244	0.90 (0.34 to 1.47)	0.002	0.249
Frequency ratio (hassles:uplifts)	0.18 (−0.26 to 0.62)	0.433	0.233	0.24 (−0.13 to 0.62)	0.205	0.239
Intensity ratio (hassles:uplifts)	1.40 (0.59 to 2.20)	0.001	0.246	1.26 (0.57 to 1.96)	<0.001	0.235

*Linear regression models were adjusted for intervention group, education level, exposure to any physical violence at baseline and in the third trimester, monthly household income, child sex, child birth weight and preterm birth.
PES-Brief, Pregnancy Experience Scale-Brief Version.

Table 3 Moderating effects of participation in the intervention on the association between positive or negative stress during pregnancy and symptoms of depression and anxiety at 6 weeks post partum

Outcome	Depressive symptoms		Anxiety symptoms	
Interaction terms	B (95% CI)*	P value†	B (95% CI)*	P value†
Uplifts frequency×intervention	−0.80 (−1.50 to −0.09)	0.028	−0.67 (−1.28 to −0.06)	0.032
Hassles frequency×intervention	−0.31 (−0.60 to −0.02)	0.034	−0.19 (−0.44 to 0.06)	0.138
Uplifts intensity×intervention	−0.23 (−1.50 to 1.04)	0.727	−0.18 (−1.27 to 0.92)	0.754
Hassles intensity×intervention	0.47 (−0.82 to 1.77)	0.473	0.59 (−0.53 to 1.70)	0.302
Frequency ratio×intervention	0.77 (−0.15 to 1.69)	0.099	0.66 (−0.13 to 1.45)	0.101
Intensity ratio×intervention	0.76 (−0.83 to 2.36)	0.349	0.89 (−0.48 to 2.26)	0.204

*Adjusted for education level, exposure to any physical violence at baseline and in the third trimester, monthly household income, child sex, child birth weight and preterm birth.
†P values were obtained from the Wald test for the interaction.

uplifts, or positive stressors, were measured through multiple items, including social support (eg, positive comments from others about pregnancy, discussions with spouse about childbirth issues), positive emotions (eg, thinking about the baby's appearance or nursery arrangements) and receiving appropriate care (eg, antenatal care). Positive stressors during pregnancy could mitigate the risk of negative postpartum mental health outcomes.

Our study further illuminated the interaction between a culturally adapted CBT-based intervention and stressors during pregnancy in relation to postpartum mental health symptoms. The effectiveness of CBT in treating postpartum depression and anxiety has been well established.[23 24] According to the literature, tolerance towards uncertainty and the development of positive expectations can be enhanced by CBT,[23] which were also
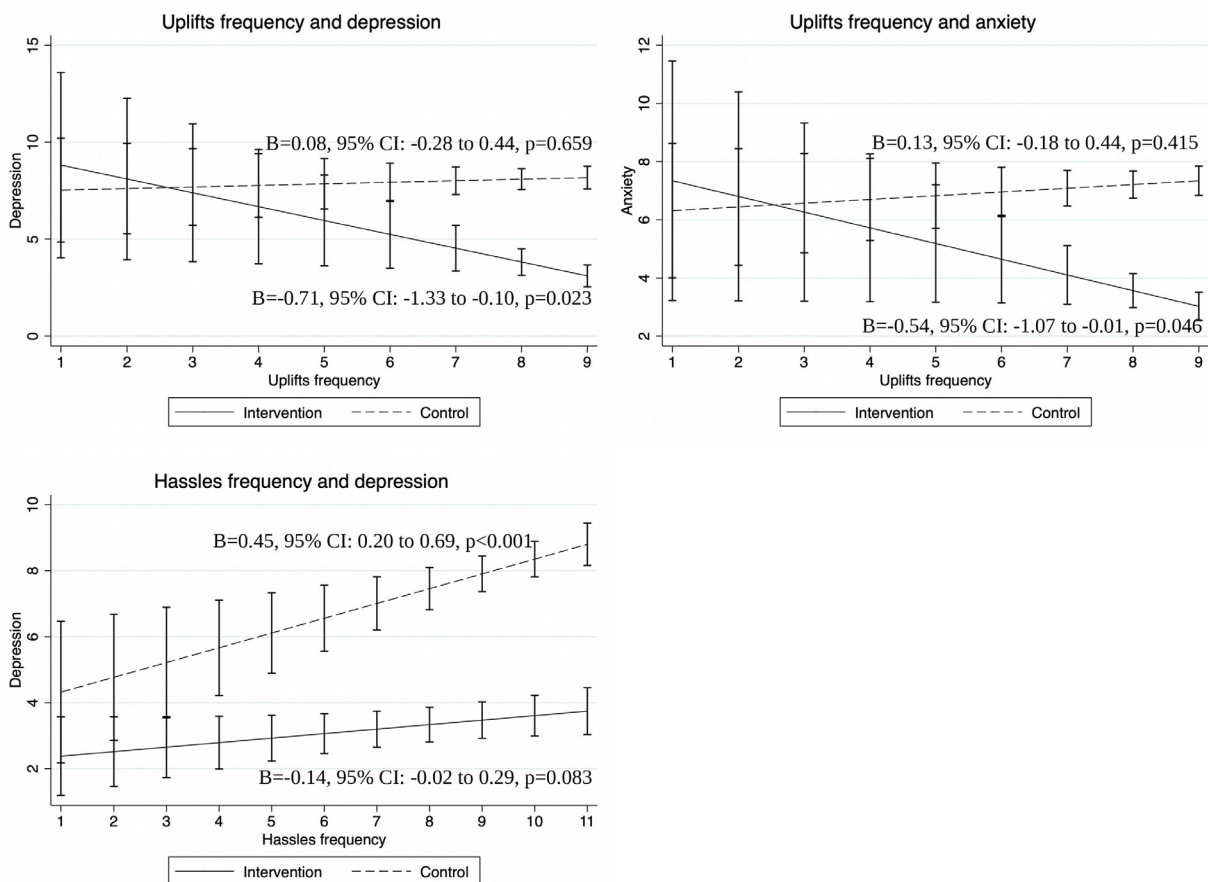
Figure 2 Moderating role of the intervention on the associations between positive and negative stressors during pregnancy with symptoms of depression and anxiety at 6 weeks post partum. Dashed lines indicate non-significant associations. Models were adjusted for education level, exposure to physical violence at baseline and in the third trimester, monthly household income, child sex, low child birth weight and preterm birth.

factors mirrored in the PES-Brief used in this study (eg, negative emotions about being unwell and out of shape (hassles) and positive emotions arising from discussions of baby looks and names (uplifts)).[25 26] During our intervention, participants were encouraged to identify their fears and concerns regarding pregnancy, labour and bonding with their babies, along with any unhelpful thoughts and behaviours associated with them.[17] Pictorial illustrations were used to help them understand the likely consequences of such thoughts and behaviours for their own and their babies' well-being and to encourage them to practise thinking and acting healthy.[17] This was achieved by maintaining and monitoring mood charts and setting simple goals in collaboration with participants to engage them in healthy activities.[17] Furthermore, their problem-solving skills were strengthened by encouraging them to focus on concerns or problems that can be changed or influenced, and to make action plans to address them. Such strategies most likely enhanced the pregnant women's abilities to address pregnancy-associated hassles and concentrate on uplifts, as reflected in the interaction we observed between the frequency and intensity of these stressors and depression and anxiety. Social support during pregnancy protects against depression.[27] Our intervention aimed to promote social support by encouraging significant involvement of family members during delivery and while planning for the baby's arrival. Building social support networks may have helped participants feel supported and better prepared for childbirth, which could have contributed to the moderating effect of the intervention on their mental health.

Our study revealed that pregnancy experiences in the third trimester, but not in early gestation, were significantly associated with mental health outcomes during the postpartum period. The intervention session delivered at the later stage of pregnancy was aimed at promoting awareness of postpartum challenges (such as baby blues, postpartum depression and breastfeeding) and strategies for staying well. The psychoeducational component of the intervention likely contributed to the mitigation of postpartum mental health consequences. These findings have important implications for clinical practice.

The present study can be considered a pioneer in its approach to analysing how experiences in pregnancy are related to mental health outcomes, with respect to both early gestation to mid-gestation (≤22 weeks) versus late pregnancy (ie, the third trimester). Compared with previous studies that focused on one or a few specific events, the strength of this study is its focus on both negative (hassles) and positive (uplifts) stressors in relation to postnatal anxiety and depressive symptoms. This study used an instrument validated in Pakistan, the PES-Brief, to measure stressors during pregnancy with high internal consistency.[28] This study underscores the efficacy of CBT-based interventions in enhancing the capacity of uplifts and mitigating the adverse impact of hassles on mental health outcomes.

Limitations

A limitation of the study was the high proportion of patients lost to follow-up (approximately 37%), partly due to the coronavirus disease 2019 (COVID-19) pandemic which discouraged women from visiting the hospital and continuing antenatal care due to fear of the disease.[29] Healthcare system disruptions during the COVID-19 pandemic may have also resulted in women deciding to discontinue antenatal care. The study protocol was also changed for some of the women who received the intervention sessions and/or assessments by phone rather than in person during the pandemic. Moreover, we may have lost some women who were at risk of mental health problems, including those with a lack of autonomy and whose access to healthcare may have been restricted by their spouses. Therefore, the loss to follow-up in the study population may have been over-represented in more vulnerable subgroups.

Implications

In conclusion, our findings indicate that both positive and negative stressors experienced during the third trimester of pregnancy are associated with postpartum mental health outcomes. Furthermore, CBT-based interventions appear to help reduce the effects of hassles and increase the effects of uplifts experienced during pregnancy. Future studies exploring the potential mechanisms underlying the relationship between bidirectional stressors and mental health in pregnant women are warranted.

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REFERENCES

1. Okun ML, Mancuso RA, Hobel CJ, et al. Poor sleep quality increases symptoms of depression and anxiety in postpartum women. *J Behav Med* 2018;41:703–10.
2. Yadav T, Shams R, Khan AF, et al. Postpartum depression: prevalence and associated risk factors among women in Sindh, Pakistan. *Cureus* 2020;12:e12216.
3. Ali NS, Ali BS, Azam IS. Post partum anxiety and depression in peri-urban communities of Karachi, Pakistan: a quasi-experimental study. *BMC Public Health* 2009;9:384.
4. Gulamani SS, Shaikh K, Chagani J. Postpartum depression in Pakistan. *Nursing for Women's Health* 2013;17:147–52.
5. Dosani A, Yim IS, Shaikh K, et al. Psychometric analysis of the edinburgh postnatal depression scale and pregnancy related anxiety questionnaire in Pakistani pregnant women. *Asian J Psychiatr* 2022;72:103066.
6. Hagaman AK, Bates LM, Atif N, et al. Suicide ideation within and outside the perinatal period: an exploration of interpersonal factors from a maternal cohort in rural Pakistan to improve intervention targeting. *Arch Suicide Res* 2024;28:231–49.
7. Onah MN, Field S, Bantjes J, et al. Perinatal suicidal ideation and behaviour: psychiatry and adversity. *Arch Womens Ment Health* 2017;20:321–31.
8. Ali NS, Mahmud S, Khan A, et al. Impact of postpartum anxiety and depression on child's mental development from two peri-urban communities of Karachi, Pakistan: a quasi-experimental study. *BMC Psychiatry* 2013;13:274.
9. Kornfield SL, White LK, Waller R, et al. Risk and resilience factors underlying postpartum depression and impaired mother-infant bonding during COVID-19. *Health Aff (Millwood)* 2021;40:1566–74.
10. Fellmeth G, Plugge E, Fazel M, et al. Perinatal depression in migrant and refugee women on the Thai-Myanmar border: does social support matter?. *Philos Trans R Soc Lond B Biol Sci* 2021;376:20200030.
11. DiPietro JA, Christensen AL, Costigan KA. The pregnancy experience scale – brief version. *J Psychosom Obstet Gynaecol* 2008;29:262–7.
12. Zhang A, Borhneimer LA, Weaver A, et al. Cognitive behavioral therapy for primary care depression and anxiety: a secondary meta-analytic review using robust variance estimation in meta-regression. *J Behav Med* 2019;42:1117–41.
13. Surkan PJ, Hamdani SU, Huma Z-E, et al. Cognitive-behavioral therapy-based intervention to treat symptoms of anxiety in pregnancy in a Prenatal clinic using non-specialist providers in Pakistan: design of a randomised trial. *BMJ Open* 2020;10:e037590.
14. Mumford DB, Tareen IA, Bajwa MA, et al. The translation and evaluation of an Urdu version of the hospital anxiety and depression scale. *Acta Psychiatr Scand* 1991;83:81–5.
15. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983;67:361–70.
16. First MB, Spitzer RL, Gibbon M, et al. User's guide for the structured clinical interview for DSM-IV axis I disorders SCID-I: clinician version. Available: https://onesearch.nihlibrary.ors.nih.gov/discovery/fulldisplay/alma991000219939704686/01NIH_INST:NIH [Accessed 31 Aug 2021].
17. Atif N, Nazir H, Zafar S, et al. Development of a psychological intervention to address anxiety during pregnancy in a low-income country. *Front Psychiatry* 2019;10:927.
18. George D. SPSS for windows step by step: a simple study guide and reference, 17.0 update, 10/E. Pearson Education India; 2011.
19. Katon W, Russo J, Gavin A. Predictors of postpartum depression. *J Womens Health (Larchmt)* 2014;23:753–9.
20. Dere SS, Varotariya JK, Ghildiyal RP, et al. Antenatal preparedness for motherhood and its association with antenatal anxiety and depression in first time pregnant women from India. *Ind Psychiatry J* 2019;28:255–61.
21. Ikeda M, Hayashi M, Kamibeppu K. The relationship between attachment style and postpartum depression. *Attach Hum Dev* 2014;16:557–72.
22. Della Corte L, La Rosa VL, Cassinese E, et al. Prevalence and associated psychological risk factors of postpartum depression: a cross-sectional study. *J Obstet Gynaecol* 2022;42:976–80.
23. Sockol LE. A systematic review of the efficacy of cognitive behavioral therapy for treating and preventing perinatal depression. *J Affect Disord* 2015;177:7–21.
24. Janicke DM, Fritz AM, Rozensky RH. Healthcare reform and preparing the future clinical child and adolescent psychology workforce. *J Clin Child Adolesc Psychol* 2015;44:1030–9.
25. DiPietro JA, Christensen AL, Costigan KA. The pregnancy experience scale–brief version. *J Psychosom Obstet Gynaecol* 2008;29:262–7.
26. Donegan E, Frey BN, McCabe RE, et al. Intolerance of uncertainty and perfectionistic beliefs about parenting as cognitive mechanisms of symptom change during cognitive behavior therapy for perinatal anxiety. *Behav Ther* 2022;53:738–50.
27. Bos SC, Macedo A, Marques M, et al. Is positive affect in pregnancy protective of postpartum depression? *Braz J Psychiatry* 2013;35:5–12.
28. Zaidi A, Khan A, Rowther A, et al. Cultural adaptation and psychometric validation of the pregnancy experience scale–brief version (PES-brief) in Pakistani women with antenatal anxiety symptoms. *SSM Ment Health* 2022;2:100055.
29. Rauf N, Zulfiqar S, Mumtaz S, et al. The impact of the COVID-19 pandemic on pregnant women with perinatal anxiety symptoms in Pakistan: a qualitative study. *Int J Environ Res Public Health* 2021;18:8237.
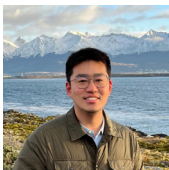
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