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Depression and Anxiety Through Pregnancy and the Early Postpartum: An Examination of Prospective Relationships

Helen Skouteris[1], Eleanor H. Wertheim[2], Sofia Rallis[2], Jeannette Milgrom[3] and Susan J. Paxton[2],

[1] School of Psychology, Deakin University, Victoria, Australia

[2]School of Psychological Science, La Trobe University, Victoria, Australia

[3]School of Behavioural Science, The University of Melbourne,Victoria, Australia

Correspondence author:

Dr Helen Skouteris, School of Psychology, Deakin University, Burwood, Victoria, 3125, Australia

Email: helens@deakin.edu.au

Professor Eleanor Wertheim, School of Psychological Science, La Trobe University, Bundoora, Victoria, 3086, Australia

E-mail: e.wertheim@latrobe.edu.au

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Summary

Background: The aim of this study was to explore the prospective relationship between depressive symptoms and anxiety across pregnancy and the early postpartum.

Methods: Participants (*N*=207) completed the State-Trait Anxiety Inventory Trait subscale,Beck Depression Inventory, and social support and sleep quality measures at two time points during pregnancy and once in the early postpartum period.

Results: After accounting for the relative stability of anxiety and depression over time, depressive symptoms earlier in pregnancy predicted higher levels of anxiety in late pregnancy and anxiety in late pregnancy predicted higher depressive symptomatology in the early postpartum. A bi-directional model of depression and anxiety in pregnancy was supported.

Limitations: Data were based on self-reports and participating women were predominantly tertiary educated with high family incomes.

Conclusion: Our findings suggest depressive symptoms precede the development of higher levels of anxiety and that anxiety, even at non clinical levels, can predict higher depressive symptoms. Clinicians are advised to screen for anxiety and depression concurrently during pregnancy.

Key words: anxiety, depressive symptoms, sleep quality, social support, pregnancy

This study's aim was to explore the inter-relationship between anxiety and depressive symptoms across pregnancy to post-birth. Whilst antenatal anxiety has been shown to be a risk factor of postnatal depression, after controlling for antenatal depression (Beck, 2001, 2002; Heron et al., 2004; Liabsuetrakul et al., 2007; Matthey et al., 2003; Milgrom et al., 2008), research has not explored whether antenatal depression predicts development of anxiety. Given that depression and anxiety during pregnancy are concurrently associated moderately (Karacam and Ancel, in press) to highly (Heron et al., 2004), a bi-directional prospective test of their relationship is warranted. Further, antenatal anxiety is a risk factor not only for postnatal depression but also for poorer child development, low birth weight (Hedegaard et al., 1993) and greater fetal activity (DiPietro et al., 2002). Understanding risk factors of antenatal anxiety therefore is important clinically.

This study examined whether anxiety precedes depressive symptoms or whether depressive symptoms predict anxiety through pregnancy and the early postpartum. Anxiety and depressive symptoms were measured at two time points during pregnancy and also at early postpartum. Two models of the prospective relationship between anxiety and depressive symptoms were tested; the first, replicating Heron et al. (2004), depicted anxiety predicting depressive symptoms prospectively, and the second, new model depicted depressive symptoms predicting anxiety prospectively. Each model was also tested controlling for social support, prior depression and sleep quality, since they have been associated with depressive symptoms during pregnancy (Milgrom et al., 2008, Skouteris et al., 2008) and have predicted postpartum depression (Milgrom et al., 2008). A stability model was also hypothesised, in which anxiety and depressive symptoms at each time point would be predictive of that measure at the following time point.

Method

Participants

Pregnant women (*N*=207) 18+ years old who could complete English language questionnaires self-selected for participation in this study.

Design

Participants completed depression, anxiety, sleep quality, and social support measures at Pregnancy Time 1 (PregT1; mean gestation weeks=18.32, SD=1.61) and Time 2 (PregT2; mean weeks=34.63, SD=1.71); and depression and anxiety measures at Time 3 (Postpartum; mean weeks post birth=7.05, SD = 1.70).

Measures

Demographics questionnaire. Participants reported age, parity, education, income, marital status, nationality and pre-pregnancy depression.

Depressive Symptoms. The short version Beck Depression Inventory (BDI; Beck and Beck, 1972) assessed depressive symptoms. All but one of the 13 items were included (number 7, about suicide); total scores of 0-3 are classified non-depressed, 4-7 mild, 8-15 moderate, and 16+ severe (Beck et al., 1974). The BDI short form has demonstrated construct (Beck et al., 1974) and concurrent validity (Storch et al., 2004). The BDI long and short versions correlate .89 to .97 (Beck et al., 1974) and the long version has been validated for use in pregnancy (Holcombe et al., 1996). The short form has advantages given fewer items influenced by pregnancy-related hormonal changes. In our sample Cronbach's α = .80-.83 across time points.

Anxiety Symptoms. The 20-item Trait subscale of the State-Trait Anxiety Inventory (STAI: Spielberg et al., 1970) assessed how women felt "generally" during the last 8 weeks; scores exceeding 44 have been categorised as high trait anxiety (Austin et al., 2007). This subscale has good construct validity and test-retest reliability (Bas et al.,

2004; Ravaldi et al., 2003; Spielberg, 1983), correlates highly with other antenatal and anxiety measures (Austin et al., 2007; Crisp et al., 1978; Gladstone et al., 2005; Heron et al., 2004) in pregnant samples, and has been used in pregnant samples (Hart & McMahon, 2006). In our study Cronbach's α range =.86-.91.

Social Support. The 12-item Multidimensional Scale of Perceived Social Support (MSPSS: Zimet et al., 1988) assessed social support from family, friends and significant others over the last 8 weeks. Test-retest reliability and construct validity have been supported (Zimet et al., 1988). PregT1 and PregT2 Cronbach's α =.90-91.

Sleep Quality. The 19-item Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989) measures subjective sleep quality, latency, duration, and disturbance; habitual sleep efficiency; sleep medication usage; and daytime dysfunction over the past month. Total PSQI has demonstrated construct validity (Jomeen and Martin, 2007) and internal consistency in pregnancy (Jomeen and Martin, 2007; Skouteris et al., 2008). Scores exceeding 4 indicate "poor" sleep (Buysse et al., 1989). Cronbach's α for PregT1 and PregT2 =.71-.72.

Procedure

This study was part of a larger project exploring women's well-being and body-related experiences during pregnancy and postpartum (Kamysheva et al., 2008; Skouteris et al., 2005). Following university ethics approval, women were recruited at 12-17 weeks gestation from baby shows, obstetrician and GP clinics, and advertisements in local papers, university newsletters, and pregnancy exercise classes. This time period enabled women to consider the pregnancy certain (threat of miscarriage having subsided) prior to volunteering. At each time point, code-numbered (for confidentiality) questionnaire packages were posted, completed at home and returned in reply-paid envelopes; women were unaware of the current study's specific aim.

Data Analysis

Square root transformations were applied for BDI and STAI, addressing skewness. After performing correlations, three prospective models of BDI and STAI were assessed. The first was a stability model, in which BDI at each time point predicted BDI at the subsequent point and STAI at each time point predicted subsequent STAI. The second model was of BDI prospectively predicting STAI: BDI at each time point was correlated with STAI at the next time point with STAI at the earlier time point partialled out. Testing Model 3 the reverse analyses were conducted: earlier STAI predicted later BDI partialling out earlier BDI. Analyses were repeated partialling out (controlling for) sleep quality at the earlier time point, social support at PregT1, and the incidence of prior depression.

Results

Mean age of participants was 31.74 (SD = 4.46; range=18-42 years) years; 84% of women reported a planned pregnancy and 45.9% were primiparous. Most women were Australia-born (83.6%) and tertiary educated (74.4%); 31.5% reported an annual household income > AUD$105,000 (USD$91,500) and 3.9% < AUD$25,000 (USD$21,700). Women were mostly married (75.88%) or in de facto relationships (18.8%). Regarding attrition, 323 women completed PregT1 questionnaires, of whom 64.3% completed all time points and were included in analyses.

Relationships Between Depression, Anxiety, Sleep Quality and Social Support

Preliminary correlations between BDI, STAI, sleep quality, self-reported prior depression (*n*=84, 41%) and social support scores across time points revealed moderate correlations, but no multicollinearity (Table 1).

Changes in Depressive Symptoms and Anxiety Symptoms Over Time

Differences in mean BDI and STAI scores across the three time points were examined using one-way repeated measures ANOVAs. A significant time effect was found for BDI, F (2,205) = 6.74, $p < .001$, $\eta^2 = .06$, with LSD post-hoc tests revealing

BDI scores were significantly (<.001) greater at PregT2 than at PregT1, and at Postpartum than PregT1 (Table 1 shows mean scores). The number of women in each BDI category is shown in Table 2.

A significant time effect was found for STAI, F (2,205) = 15.47, $p < .001$, $\eta^2 =$ .13 (see Table 1 for mean scores). Women reported significantly less anxiety at PregT2 than PregT1 ($p < .001$) and the Postpartum ($p < .01$), with no significant difference between PregT1 and Postpartum ($p = .24$). The STAI-Trait third trimester mean (PregT2), 34.06 (SD = 8.78) was similar to the third trimester STAI-Trait mean reported by Austin et al. (2007) of 35.1 (SD = 9.1) and by Hart and McMahon (2006) for women mean gestation of 29 weeks (SD= 3.62). At PregT1 13.5%, PregT2 15.5%, and at PP 15% of women scored above 45 on the STAI and were categorised high in trait anxiety as per Austin et al. (2007).

Prospective Relationships Between Depression and Anxiety Symptoms

Figure 1 shows results of model testing, supporting a stability model for both STAI and BDI over time points. Furthermore, higher BDI scores at PregT1 predicted increases in STAI scores at PregT2, and higher STAI scores at PregT2 predicted increases in BDI scores at Postpartum. (These findings were replicated when social support, prior depression, and sleep quality were controlled). To evaluate whether these patterns were mainly influenced by the approximately 10% of women with clinically significant levels of anxiety and depression, when data from women categorised as high in trait anxiety and those with moderate to severe BDI scores were removed from analyses; results were replicated. Other relationships were not significant and STAI PregT1 did not predict BDI PP (r =.11, p =.13) and BDI PregT1 did not predict STAI PP (r =.06, p =.44).

Discussion

Anxiety and depressive symptoms showed some (but not complete) stability across pregnancy with anxiety scores more stable than depression scores. These findings accord with findings of Heron et al.'s (2004). This study further demonstrated that depressive symptoms in middle pregnancy prospectively predicted increases in anxiety symptoms in late pregnancy. Furthermore, consistent with Heron et al., late pregnancy anxiety symptoms subsequently predicted greater depressive symptoms in the first three months post birth. Whilst anxiety means were lowest in late pregnancy (compared to middle pregnancy and the postpartum), greater anxiety during late pregnancy predicted increased postpartum depressive symptoms. This relationship remained after controlling for perceived social support, sleep quality and self-reported prior depression, supporting the proposition that it is the anxiety that contributes to later depressive symptoms.

Although much research has focussed on understanding and treating postnatal depression (Milgrom et al., 2008; O'Hara et al., 2000), treatment of anxiety during pregnancy has been largely ignored (Heron et al., 2004). Our findings revealed that when data of women categorised as high in trait anxiety were removed, low to moderate levels of anxiety still predicted higher depressive symptoms soon after birth. Anxiety symptoms late in pregnancy may be a risk factor for developing higher levels of depressive symptoms in the early postpartum even when women exhibit these anxiety symptoms at non-clinically elevated levels. Whilst around 10% of women reached clinical levels of depression postpartum (consistent with published prevalence rates), elevated levels of depressive symptoms at non-clinical levels are also relevant as depression can emerge as late as a year postpartum (see Austin and Lumley, 2003; Le et al., 2004). Thus, these increases in depressive symptoms in the first few months postpartum could potentially place women at greater risk of developing clinical depression in subsequent months.

Limitations of this study include the self-report nature of scores, participants being predominantly tertiary educated with high family incomes, and no assessment of participants' obstetric care or exposure to additional risk factors for perinatal mental health problems. These issues limit generalisability and clinical application of these data. Furthermore, methods of recruitment did not permit calculating a response rate and the possibility of selection and volunteer biases exists (Skouteris et al., 2005), with participants possibly differing from the general population.

Despite these limitations, our findings reveal that a cycle of co-morbidity may exist, whereby initial levels of depressive symptoms lead to higher levels of anxiety, which in turn may then predict higher depressive symptoms. Future research should consider exploring the prospective relationship between these two variables throughout the first year post birth to determine whether the cycle of association shown during pregnancy continues. From a practical perspective, when screening for depression, clinicians should consider assessing anxiety symptoms as well.

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Table 1

Correlations between Beck Depression Inventory, State Anxiety Inventory, Pittsburg Sleep Quality Index and Multidimensional Scale of Perceived Social Support scores (N = 207).

	1	2	3	4	5	6	7	8	9	10	11
1 DEP-Pre	-	-.28**	-.34**	-.19**	.17*	-.31**	-.27**	-.18*	.13	-.14*	-.16*
2 BDI-1[a]		-	.67**	.43**	.24**	.56**	.64**	.33**	-31**	.56**	.38**
3 STAI-1[a]			-	.39**	-.25**	.42**	.79**	.23**	-.37**	.44**	.53**
4 PSQI-1				-	-.14*	.53**	.36**	.61**	-.27**	.31**	.18**
5 MSPS-1					-	-.19**	-.32**	-.25**	.68**	-.21**	-.23**
6 BDI-2[a]						-	.52**	.49**	-.24**	.42**	.28**
7 STAI-2[a]							-	.30**	-.40**	.51**	.63**
8 PSQI-2								-	-.20**	.32**	.23**
9 MSPS-2									-	-.22**	-.29
10 BDI-3[a]										-	.61**
11 STAI-3[a]											-
M	NA	3.47	36.14	6.41	72.00	4.17	34.06	7.98	72.33	3.82	35.47
SD	NA	3.02	9.05	3.22	10.42	3.84	8.78	3.93	9.88	2.97	9.06

[a]Correlations performed on transformed variables; **p<.001; 1= PregT1; 2= PregT2; 3=Postpartum; BDI = Beck Depression Inventory (score range: 0-36) ; STAI = State-Trait Anxiety Inventory – Trait Subscale (score range: 20-80); PSQI = Pittsburgh Sleep Quality Index (score range: 0-21); MSPS = Multidimensional Scale of Perceived Support (score range: 12-84); DEP Pre = Depression Pre-pregnancy (scored as yes/no; point biserial r performed)

Table 2

Number and Percentage of Women in Each BDI Category

	Non depressed 0-3	Mild 4-7	Moderate 8-15	Severe 16+
PregT1	153 (73.9%)	31 (14.9%)	22 (10.7%)	1 (0.5%)
PregT2	146 (70.5%)	35 (16.9%)	20 (9.6%)	6 (3.0%)
Postpartum	138 (66.7%)	45 (21.7%)	22 (10.6%)	2 (1.0%)

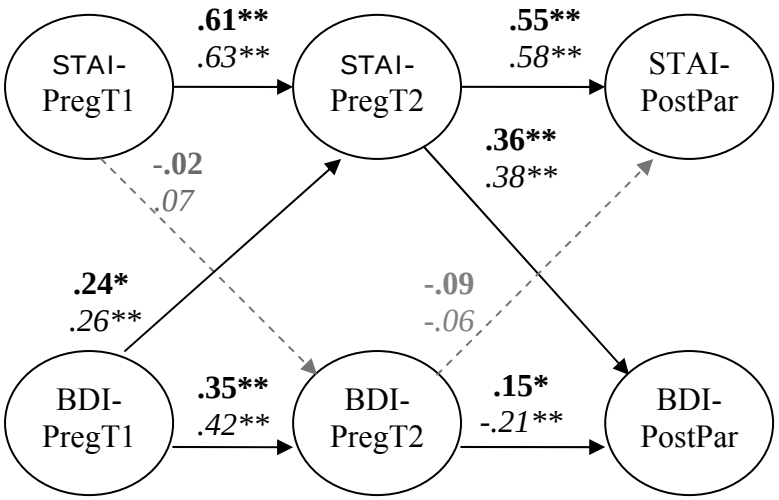

Figure 1.

Partial correlations between BDI and STAI *at PregT1 and PregT2 and between PregT2 and Postpartum, after controlling for BDI, STAI at the prior time point (in italics), and after also controlling for Prior Depression, perceived Social Support, and Sleep Quality at the prior time point (in* **bold***)*

*$p<.05$; **$p<.001$; solid paths were significant, grey dotted paths non-significant