Comorbid anxiety and depression: A community-based study examining symptomology and correlates during the postpartum period

Sandhya Ramakrishna[1], Amanda Cooklin[2], Liana Leach[3*]

[1] The Australian National University Medical School, The Australian National University, Canberra, Australia.

[2] Judith Lumley Centre, La Trobe University, Melbourne, Australia

[3] National Centre for Epidemiology and Population Health, Research School of Population Health, The Australian National University, Canberra, Australia.

Abstract

Background: Despite indications that anxiety and depression co-occur frequently within the postpartum period, studies identifying the correlates associated with this comorbidity are rare.

Objective: This study assessed variation in social and maternal circumstances, based on comorbid anxiety and depression symptomology.

Methods: A large community-based sample of 1070 Australian postpartum women completed the Living with a Young Baby online survey. Mothers were categorised into groups: (a) comorbid anxiety and depression symptomology, (b) anxiety only, (c) depression only, or (d) neither depression nor anxiety. Multinomial Logistic Regression (MLR) investigated variation in correlates between the groups.

Results: Comorbid anxiety and depression symptomology was common (13.4%), and was associated with greater symptom severity. Women in the 'comorbid' group more often experienced financial hardship, cessation of breastfeeding, infants with difficult temperaments, inadequate social support or help, and stressful adverse life events in comparison to mothers in the 'neither symptomology' group. They were also more likely to have infants with difficult temperaments compared to the depression only group, and to receive inadequate help and support compared to the anxiety only group.

Conclusions: Comorbid anxiety and depression symptomology is common postpartum and is associated with considerable adversity across a wide range of demographic, economic and social correlates.

Introduction

The postpartum period is a time of profound social, emotional and physical change for women (Halbreich & Karkun, 2006). It is estimated that between 10-15% of mothers experience postnatal depression (Gavin et al., 2005). While prevalence estimates for postpartum anxiety vary (Leach, Poyser, & Fairweather-Schmidt, 2017), a recent meta-analysis by Goodman, Watson and Stubbs (2016) found 8.6% of women experienced one or more anxiety disorders postpartum, and a meta-analysis by Dennis, Falah-Hassani and Shiri (2017) found the figure to be similar at 9.9%. The adverse impacts of postpartum anxiety and depression can range from acute, hampering parents' ability to meet the physical and emotional needs of the newborn, to long term, potentially impacting the child's cognitive, behavioural and emotional development (Fallon, Groves, Halford, Bennett, & Harrold, 2016; Muzik & Borovska, 2010; O'Hara & Wisner, 2014).

While many studies have investigated the prevalence and risk factors for postpartum depression and anxiety as distinct mental health problems, comorbid anxiety and depression has been explored far less. Recent research suggests anxiety and depression commonly co-occur during the postpartum period (i.e. ~13% in the first 8 weeks postpartum (Falah-Hassani, Shiri, & Dennis, 2016)), and that women experiencing comorbid anxiety and depression have greater levels of symptomology and functional impairment than those experiencing either disorder alone (Farr, Dietz, O'Hara, Burley, & Ko, 2014). There are also suggestions that those who experience this comorbidity may represent a distinct clinical group from mothers who experience either postpartum anxiety or depression alone (Falah-Hassani et al., 2016; Farr et al., 2014; Giardinelli et al., 2012; Grigoriadis et al., 2011; Skipstein, Janson, Stoolmiller, & Mathiesen, 2010). Given the burden and disability likely associated with experiencing comorbid depression and anxiety in the perinatal period, early detection and intervention are critical. The current study aims

to further our understanding of the socio-demographic characteristics, and maternal and social circumstances, of mothers most likely to experience depression and anxiety concurrently within the postpartum period.

Very few studies have investigated risk factors that are specifically associated with comorbid anxiety and depression in the postpartum period. In a recent cross-sectional, population-based survey of 4451 women, Farr, Dietz, O'Hara et al. (2014) found that women with postpartum comorbid anxiety and depression symptoms had the highest prevalence of financial difficulties, partner-related stress, emotional distress and traumatic life events during pregnancy, whereas the prevalence of these risk factors in women with only anxiety symptoms was more moderate. Several studies have indicated that social and maternal risk factors associated with comorbid anxiety and depression include minimal partner support and social support, experiencing negative life events and difficulty breastfeeding (Falah-Hassani et al., 2016; Farr et al., 2014; Yelland, Sutherland, & Brown, 2010). Demographic risk factors have also been identified as contributing to comorbid symptoms of anxiety and depression, including low income, young maternal age and lower level education (Falah-Hassani et al., 2016; Farr et al., 2014; Skipstein et al., 2010). Overall, individuals with this comorbidity seem to experience both greater severity of symptoms than individuals with a single condition, and stronger associations with risk factors (Farr et al., 2014).

The emerging extant research indicates that comorbid anxiety and depression is common during the postpartum period, reflects greater severity of anxiety and depression symptomology, and occurs more frequently in adverse demographic, social and maternal-related circumstances. Yet, research is still sparse and further investigation is warranted. The current study investigates comorbid depression and anxiety in a large, national sample of postpartum (up to 12 months) Australian women (n=1082). The study examines the

extent to which a broad range of socio-demographic, financial, maternal, infant, and social support correlates (or contexts) are associated with experiencing comorbid anxiety and depression symptomology in comparison to experiencing low or no symptoms. The study then further explores the extent to which factors associated with comorbid anxiety and depression are similar or different to those associated with depression or anxiety symptomology alone. We use the terminology 'correlate' (rather than risk factor) to denote that this is a cross-sectional study, which primarily profiles the 'concurrent' factors (or contexts) associated with comorbid anxiety and depression during the postpartum period.

Methods

Participants and procedure

Participants were recruited from the general community to complete the Living with a Young Baby Survey (LYBS) – an online cross-sectional survey designed to assess the general health and psychological wellbeing of women during the postpartum period in Australia. Participants were recruited online via targeted Facebook advertisements and notices placed on the popular Australian pregnancy and infancy focused website 'BabyCentre'. The advertisements targeted women with a young baby aged 18 years and over who were currently residing in Australia, stating "Research: Mums Wanted! Researchers are looking for Australian women with a young baby to do a brief survey". No incentive was provided for participation, and no mention of mental health was made in order to avoid selection bias. The LYBS took approximately 15 minutes to complete, and a total of 1082 postpartum women consented to participate and met the eligibility requirements (18 years or older, female, residing in Australia, with an infant aged 0-12 months). Online recruitment is increasingly common in health research, and samples recruited using this method are typically representative (Andreeva et al., 2014; Hatch et al., 2016; Huybrechts et al., 2010; Loxton et al., 2015). However, there is some evidence that

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Facebook recruited samples over-represent those in de facto relationships, with higher levels of education, with an English speaking background, as was the case in the current LYBS sample (Leach, Butterworth, Poyser, Batterham, & Farrer, 2017). The LYBS was approved by the Australian National University Human Research Ethics Committee (Protocol #2014/646).

Measures

Postpartum depression was assessed using the Edinburgh Postnatal Depression Scale (EPDS), a widely used screening tool for depression symptoms in postpartum women. The EPDS contains 10 items that assess depressive symptoms over the preceding seven days. The total scale score ranges from 0 to 30, with a threshold of 13 indicative of a probable Major Depressive Disorder (Gibson, McKenzie-McHarg, Shakespeare, Price, & Gray, 2009). The State component of the State-Trait Anxiety Inventory (STAI) was used to assess current levels of *postpartum anxiety*. The STAI is a screening tool used to measure general anxiety. The State component contains 20 items that assess situational anxiety at the present state. The total scale score ranges from 20 to 80, and a threshold of 45 has been used as an indicator of probable Generalised Anxiety Disorder or Adjustment Disorder in perinatal samples (Dennis, Janssen, & Singer, 2004; Figueiredo & Conde, 2011; Meades & Ayers, 2011). Measures were selected for their strong psychometric properties.

An indicator variable for probable *comorbid anxiety and depression* was constructed using the cut-points for the EPDS (13) and the STAI-State component (45) outlined above. Participants above the threshold for both depression and anxiety were categorised as experiencing 'comorbid anxiety and depression symptomology', participants meeting the threshold for depression or anxiety only were categorised as 'depression symptomology only' or 'anxiety symptomology only', and participants meeting neither threshold were categorised as 'neither depressed nor anxious'.

Sociodemographic factors assessed included age of the mother and youngest child, primiparity, marital status, education level, location (remoteness), language spoken at home, annual household income, and receipt of paid maternity leave. Participants were also asked if they had experienced a range of financial hardships in the past year, and an overall measure of financial hardship was created (i.e. no financial hardships '0', or one or more hardships '1') (Butterworth, Rodgers, & Windsor, 2009).

Maternal and obstetric health and adjustment indicators included whether the pregnancy was intentional, whether the birth was perceived as difficult, current breastfeeding status and overall self-rated health. These measures were replicated or slightly modified from those used in the Longitudinal Study of Australian Children (LSAC) (Gray & Sanson, 2005).

Infant temperament was assessed using the Short Temperament Scale for Infants (STSI) (Sanson, Prior, Garino, Oberklaid, & Sewell, 1987). The STSI includes 12 items assessing infant approachability, cooperativeness and irritability. The total scale score ranges from 12 to 72, with higher scores representing a more relaxed infant temperament. Mother's perceptions of infant sleep quality was also assessed using a measure where '0' represented poor infant sleep patterns in either the day or night and '1' represented good infant sleep patterns in the day and night.

Social support was assessed using three items. Partner relationship quality was assessed using a single item which asked respondents to rate their overall happiness in their relationship ('1' extremely unhappy to '7' perfect). A single item assessed the amount of support and help received from family and friends ('1 - enough help' or '0 - not enough or no help'), and a single item also assessed the frequency with which the participant could not get the help or support they needed: '1 - often/very often (or I don't need help)' or '0 - sometimes/never' (Gray, A., 2005). Respondents were asked about a range of *negative life events* since the birth of their child. These items were adapted from Brugha and Cragg's

List of Threatening Experiences (Brugha & Cragg, 1990). An overall variable represented either: '0 – none of these events' or '1 – one or more of these negative events'.

Statistical analyses

There was little missing data for the 1082 participants who consented to participate in the study. Twelve participants had data missing on the depression and/or anxiety measure and so could not be categorised into the primary 'comorbidity' variable and were therefore excluded (remaining n=1070). For all other variables included in the analyses there was less than 1.5% missing data. Given the minimal amount of missing data no imputation procedures were conducted.

Chi-square tests and Analyses of Variance (ANOVAs) were used to identify significant univariate associations between the potential correlates and the four anxiety and depression comorbidity groups. A standard approach to model building was employed, with variables that were significant in the univariate analyses (p<.05) included in subsequent multivariate analyses. Multinomial Logistic Regression (MLR) included all correlates concurrently to test differences between the symptomology groups ('comorbid depression and anxiety', 'depression only' and 'anxiety only') and the group with no or few symptoms (i.e. the 'neither' group was the reference category). In a second MLR, the reference category was changed to the comorbid anxiety and depression group, to test whether the correlates for this group were significantly different from those relevant to experiencing anxiety only or depression only. The final models repeated the initial MLRs (including all correlates), but only included women living with a partner, as *relationship quality* was entered as an additional correlate (n=1016).

Results

Univariate analyses

The percentage of postpartum women experiencing comorbid anxiety and depression symptomology was 13.4% (n=145), depression symptomology alone was 3.3% (n=36), anxiety symptomology alone was 8.1% (n=88) and no significant symptomology (neither) was 74% (n=801). Women in the final sample were aged between 18 and 45 (with an average age of 29.7), and maternal age was not related to comorbidity status. Results for the univariate analyses are summarised in Table 1. Significant differences in the severity of depression and anxiety symptoms were found across all groups on the EPDS scale and the STAI scale. Mothers with comorbid symptomology exhibited the highest scores on the EPDS and STAI scales, compared to mothers with depression only, anxiety only and mothers without anxiety or depression. Univariate analyses also showed that mothers with comorbid anxiety and depression symptomology experienced greater adversity overall, than women in the other groups. They were significantly less likely to be living with a partner, be breastfeeding, and to have adequate social support, and more likely to be unemployed, in the lowest income bracket, to have recently experienced financial hardship, have had an unintentional pregnancy, and to have an infant with sleep and temperament difficulties. Comparably, women experiencing depression or anxiety only, showed fewer associations with adverse social and environmental contexts (see Table 1 for details).

TABLE 1 HERE

Multivariate analyses

Results for the first MLR model, investigating correlates for the 'comorbid symptomology', 'depression only' and 'anxiety only' groups in comparison to the 'neither anxiety nor depression' (reference comparison) group, can be seen in Table 2. Financial hardship was significantly associated with comorbidity status, such that mothers who experienced financial hardship were 2.45 times more likely to be in the comorbid group

and 1.94 times more likely to be in the anxiety only group, than to be in the group that experienced neither depression nor anxiety. Mothers who were not currently breastfeeding were 1.86 times more likely to be in the comorbid group. Mothers in the comorbid and anxiety only groups had infants who scored more poorly on the STSI scale (OR=0.95, 0.93 respectively) than mothers in the 'neither' group. Social support showed the greatest effects. Mothers who reported that they do not get enough help were 3.31 times more likely to be in the depression only group, 1.81 times more likely to be in the anxiety only group and 4.56 times more likely to be in the comorbid depression and anxiety group. Mothers who reported that often they did not receive enough social support were more likely to be in the comorbid group (OR=2.28), as were mothers who reported one or more negative life events (OR=1.74).

A second MLR model (not shown - results available from authors on request) investigated whether correlates were shared or unique between the different anxiety/depression symptomology groups. That is, the comorbid group were the reference group, and correlates were compared between this group and the depression only and anxiety only groups. STSI scores were significantly greater (indicating a more relaxed temperament) for infants of mothers with depression only in comparison to scores for mothers in the comorbid group. Mothers with anxiety only were less likely (OR=0.40) to receive inadequate help, and to have inadequate or no social support (OR=0.48), compared to mothers with comorbid anxiety and depression.

Two final MLRs (not shown - results available from authors on request) included only those mothers who were in a marital or de facto relationship (n=1016) to assess the role of relationship quality. The first model (with 'neither anxiety/depression' group as reference category) showed that as relationship quality increased, the odds of being in the comorbid group decreased (OR=0.61), as did the odds of being in the depression only

(OR=0.55) and the anxiety only groups (OR=0.55). The second model assessing

shared/unique risks across the symptom groups (with comorbidity as the reference

category) found no difference in relationship quality between the comorbid, anxiety only

and depression only groups.

TABLE 2 HERE

Discussion

This study is one of few investigating the correlates of comorbid depression and

anxiety symptomology in a large, community-based sample of Australian women. Few

studies have focussed specifically on characterising this group. The results suggest that

women with comorbid anxiety and depression symptomology experience high symptom

severity (in accordance with Farr et al. 2014), as well as considerable adversity across a

wide range of demographic, economic, and relationship correlates. Women with comorbid

symptoms not only had higher odds of experiencing each of the adverse contexts/correlates

investigated, but a greater overall burden, with a greater number of independently related

correlates (in the multivariate model) than women experiencing anxiety or depression

symptomology alone.

The strongest independent correlates of comorbidity were financial hardship,

difficult infant temperament and receiving inadequate help. Having inadequate money for

basic needs (housing, food, heating, etc.) is stressful, demoralising and often relentless

(Butterworth et al., 2009), and prior research shows a link between financial difficulties

and postpartum comorbidity as reported here (Farr et al., 2014). While previous research

has identified infant temperament as an important risk factor for postpartum anxiety

(Britton, 2011; Della Vedova, 2014) and postpartum depression separately (Bridgett et al.,

2009; Eastwood, Jalaludin, Kemp, Phung, & Barnett, 2012; Hanington, Ramchandani, &

Stein, 2010), the current study finds it is also a significant correlate for mothers with

comorbid anxiety and depression. Infants of mothers in the comorbid group demonstrated the poorest temperament, after adjusting for other correlates. Previous research suggests mothers with depression are less able to construct growth-promoting environments which can disrupt the infant's cognitive and emotional development (Bridgett et al., 2009; Cummings & Davies, 1994); but also that having an unsettled, demanding or irritable infant is a risk factor for poorer maternal mental health - worry and misery (Hiscock et al. 2014). It is likely that mothers with comorbid anxiety and depression experience these same issues – possibly intensified. Taken together, these findings confirm the need to support mothers with multiple mental health difficulties to engage with their infants and cope with the high demands of infant care (particularly the when the infant is unsettled and/or hard to soothe) during the postnatal period.

Receiving inadequate practical help was an important correlate for all three mental health conditions. Mothers with comorbid anxiety and depression symptomology were most likely to report that they did not receive enough help (4.6 times) followed by mothers with depression only (3.3 times) and mothers with anxiety only (1.8 times). In addition, the comorbid group were significantly more likely to receive insufficient help when compared to mothers with anxiety symptomology only. There is a need for further epidemiological research that considers whether postpartum mothers are receiving adequate practical help with infant care from their partner, family, friends and the broader community. Whilst it is well known that social support plays an important role in postpartum mental health (Falah-Hassani et al., 2016; Farr et al., 2014; Yelland et al., 2010), the importance of practical help has been less considered. 'Practical support' could potentially be a modifiable, discrete target for intervention. The lack of help received could also reflect a reluctance for postpartum women to seek help. Woolhouse et al. (2009) found that a large proportion of postpartum women who experience anxiety (75%), depression (54%) and comorbid anxiety and depression (36%) do not actively seek help for their emotional difficulties,

either because they are embarrassed, uncomfortable or do not recognise their emotional difficulties as poor mental health (Woolhouse, Brown, Krastev, Perlen, & Gunn, 2009).

Strengths and Limitations

The current study has significant strengths (e.g. large national sample, well-validated measures, and a broad range of correlates adjusted for concurrently) and adds to the emerging literature investigating the symptom and risk profile for postpartum comorbid anxiety and depression. However, there are several limitations that must be acknowledged. Diagnostic measures of anxiety and depression were not available to categorise the depression, anxiety and comorbid groups; however the measures used were well-validated psychometric measures for both anxiety and depression. Our study intentionally adopted stringent cut-points on the measures of depression ($\geq$13 on the EPDS) and anxiety ($\geq$45 on the STAI) (previous studies have used lower thresholds (Falah-Hassani et al., 2016; Farr et al., 2014)), to assist with specifying experiences of comorbid symptomology versus experiences of postpartum anxiety only and postpartum depression only. However, it must be recognised that depression and anxiety both largely feature high levels of general psychological distress (Clark & Watson, 1991). Therefore, it is possible that the clustering of adverse social and environmental contexts experienced by the comorbid group reflects the higher levels of psychological distress (or symptomology) they experience, rather than the unique pathology of having depression and anxiety concurrently. Future research could consider matching participants based on distress or symptom scores, in an attempt to neutralise the effect of symptom severity (the sample in the current study was not sufficiently large to adopt this strategy). If severity of overall psychological distress is in fact the main determinant which aids in identifying risk factors and correlates (rather than 'comorbidity' as such), this raises important questions about the usefulness of classifying

depression, anxiety, and comorbidity as distinct in epidemiological contexts in both research and clinical practice (Falah-Hassani et al., 2016).

A further limitation is that our survey data produced cross-sectional, self-report data, and is therefore unable to address issues of causality and risk in terms of the temporal association between experiences and adversities and the onset of postpartum mental health problems. It was not possible to control/adjust for pre-conception mental health. It is likely that small numbers in the depression only group (fewer than expected) limited the power to detect significant associations, however the inclusion of this group is still informative given the small number of studies investigating correlates for postpartum comorbid mental health conditions. These findings need to be confirmed in a larger 'depression-only' sub-sample where more variation in symptom severity can be established. Finally, while we had a large nationwide sample, it was not a universal population-based sample nor random sample of new mothers, suggesting further research is needed to confirm the findings.

Conclusions

Postpartum anxiety and depression can adversely affect mothers and their families. The current study finds that mothers with comorbid anxiety and depression symptomology typically have more severe symptom levels than mothers with anxiety or depression symptomology alone, as well as a range of other indicators of disadvantage, difficulty and isolation. It is important to continue advancing research in this area to better determine the socio-demographic, maternal and infant, and social support contexts that surround mothers who concurrently experience depression and anxiety during the postpartum period, in order to provide optimal treatment and support.

Conflict of Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

Agresti, A. (1996). *An introduction to categorical data analysis* (Vol. 135): Wiley New York.

Andreeva, V. A., Galan, P., Julia, C., Castetbon, K., Kesse-Guyot, E., & Hercberg, S. (2014). Assessment of response consistency and respective participant profiles in the Internet-based NutriNet-Santé Cohort. *American journal of epidemiology, 179*(7), 910-916.

Bridgett, D. J., Gartstein, M. A., Putnam, S. P., McKay, T., Iddins, E., Robertson, C., . . . Rittmueller, A. (2009). Maternal and contextual influences and the effect of temperament development during infancy on parenting in toddlerhood. *Infant Behavior and Development, 32*(1), 103-116.

Britton, J. R. (2011). Infant temperament and maternal anxiety and depressed mood in the early postpartum period. *Women & Health, 51*(1), 55-71.

Brugha, T. S., & Cragg, D. (1990). The list of threatening experiences: the reliability and validity of a brief life events questionnaire. *Acta Psychiatr Scand, 82*(1), 77-81.

Butterworth, P., Rodgers, B., & Windsor, T. D. (2009). Financial hardship, socio-economic position and depression: Results from the PATH Through Life Survey. *Social Science & Medicine, 69*(2), 229-237.

Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications. *Journal of abnormal psychology, 100*(3), 316.

Cummings, E. M., & Davies, P. T. (1994). Maternal depression and child development. *Journal of child psychology and psychiatry, 35*(1), 73-122.

Cutrona, C. E., & Troutman, B. R. (1986). Social Support, Infant Temperament, and Parenting Self-Efficacy: A Mediational Model of Postpartum Depression. *Child Development, 57*(6), 1507. doi:10.2307/1130428

Della Vedova, A. M. (2014). Maternal psychological state and infant's temperament at three months. *Journal of Reproductive and Infant Psychology, 32*(5), 520-534.

Dennis, C.-L., Falah-Hassani, K., & Shiri, R. (2017). Prevalence of antenatal and postnatal anxiety: systematic review and meta-analysis. *The British Journal of Psychiatry*, bjp. bp. 116.187179.

Dennis, C. L., Janssen, P. A., & Singer, J. (2004). Identifying women at-risk for postpartum depression in the immediate postpartum period. *Acta Psychiatr Scand, 110*(5), 338-346.

Eastwood, J. G., Jalaludin, B. B., Kemp, L. A., Phung, H. N., & Barnett, B. E. (2012). Relationship of postnatal depressive symptoms to infant temperament, maternal expectations, social support and other potential risk factors: findings from a large Australian cross-sectional study. *BMC Pregnancy and Childbirth, 12*(1), 148.

Falah-Hassani, K., Shiri, R., & Dennis, C. L. (2016). Prevalence and risk factors for comorbid postpartum depressive symptomatology and anxiety. *J Affect Disord, 198*, 142-147. doi:10.1016/j.jad.2016.03.010

Fallon, V., Groves, R., Halford, J. C., Bennett, K. M., & Harrold, J. A. (2016). Postpartum Anxiety and Infant-Feeding Outcomes. *J Hum Lact, 32*(4), 740-758. doi:10.1177/0890334416662241

Farr, S. L., Dietz, P. M., O'Hara, M. W., Burley, K., & Ko, J. Y. (2014). Postpartum anxiety and comorbid depression in a population-based sample of women. *Journal of Womens Health, 23*(2), 120-128. doi:10.1089/jwh.2013.4438

Figueiredo, B., & Conde, A. (2011). Anxiety and depression in women and men from early pregnancy to 3-months postpartum. *Arch Womens Ment Health, 14*(3), 247-255. doi:10.1007/s00737-011-0217-3

Gavin, N. I., Gaynes, B. N., Lohr, K. N., Meltzer-Brody, S., Gartlehner, G., & Swinson, T. (2005). Perinatal depression: a systematic review of prevalence and incidence. *Obstetrics & Gynecology, 106*(5, Part 1), 1071-1083.

Giardinelli, L., Innocenti, A., Benni, L., Stefanini, M. C., Lino, G., Lunardi, C., . . . Faravelli, C. (2012). Depression and anxiety in perinatal period: prevalence and risk factors in an Italian sample. *Archives Womens Mental Health, 15*(1), 21-30. doi:10.1007/s00737-011-0249-8

Gibson, J., McKenzie-McHarg, K., Shakespeare, J., Price, J., & Gray, R. (2009). A systematic review of studies validating the Edinburgh Postnatal Depression Scale in antepartum and postpartum women. *Acta Psychiatr Scand, 119*(5), 350-364. doi:10.1111/j.1600-0447.2009.01363.x

Goodman, J. H., Watson, G. R., & Stubbs, B. (2016). Anxiety disorders in postpartum women: A systematic review and meta-analysis. *J Affect Disord, 203*, 292-331. doi:10.1016/j.jad.2016.05.033

Goodman, S. H., & Gotlib, I. H. (1999). Risk for psychopathology in the children of depressed mothers: a developmental model for understanding mechanisms of transmission. *Psychological review, 106*(3), 458.

Gray, M., & Sanson, A. (2005). Growing Up in Australia: The Longitudinal Study of Australian Children [online]. *Family Matters, No. 72, Summer 2005: 4-9.*

Gray, M. S., A. (2005). Growing Up in Australia: The Longitudinal Study of Australian Children. *Family Matters, 72*, 4-9.

Grigoriadis, S., de Camps Meschino, D., Barrons, E., Bradley, L., Eady, A., Fishell, A., . . . Ross, L. E. (2011). Mood and anxiety disorders in a sample of Canadian perinatal women referred for psychiatric care. *Archives Womens Mental Health, 14*(4), 325-333. doi:10.1007/s00737-011-0223-5

Halbreich, U., & Karkun, S. (2006). Cross-cultural and social diversity of prevalence of postpartum depression and depressive symptoms. *Journal of Affect Disorders, 91*(2-3), 97-111. doi:10.1016/j.jad.2005.12.051

Hanington, L., Ramchandani, P., & Stein, A. (2010). Parental depression and child temperament: Assessing child to parent effects in a longitudinal population study. *Infant Behavior and Development, 33*(1), 88-95.

Hatch, E. E., Hahn, K. A., Wise, L. A., Mikkelsen, E. M., Kumar, R., Fox, M. P., . . . Rothman, K. J. (2016). Evaluation of selection bias in an internet-based study of pregnancy planners. *Epidemiology (Cambridge, Mass.), 27*(1), 98.

Hiscock, H., Cook, F., Bayer, J., Le, H. N., Mensah, F., Cann, W., ... & St James-Roberts, I. (2014). Preventing early infant sleep and crying problems and postnatal depression: a randomized trial. *Pediatrics, 133*(2), e346-e354.

Leach, L. S., Butterworth, P., Poyser, C., Batterham, P. J., & Farrer, L. M. (2017). Online Recruitment: Feasibility, Cost, and Representativeness in a Study of Postpartum Women. *Journal of medical Internet research, 19*(3).

Leach, L. S., Poyser, C., & Fairweather-Schmidt, K. (2017). Maternal perinatal anxiety: A review of prevalence and correlates. *Clinical Psychologist, 21*(1), 4-19. doi:10.1111/cp.12058

Loxton, D., Powers, J., Anderson, A. E., Townsend, N., Harris, M. L., Tuckerman, R., . . . Byles, J. (2015). Online and offline recruitment of young women for a longitudinal health survey: findings from the Australian Longitudinal Study on Women's Health 1989-95 cohort. *Journal of medical Internet research, 17*(5).

McGrath, J. M., Records, K., & Rice, M. (2008). Maternal depression and infant temperament characteristics. *Infant Behavior and Development, 31*(1), 71-80.

Meades, R., & Ayers, S. (2011). Anxiety measures validated in perinatal populations: a systematic review. *J Affect Disord, 133*(1-2), 1-15. doi:10.1016/j.jad.2010.10.009

Muzik, M., & Borovska, S. (2010). Perinatal depression: implications for child mental health. *Mental Health in Family Medicine, 7*(4), 239-247.

O'Hara, M. W., & Wisner, K. L. (2014). Perinatal mental illness: definition, description and aetiology. *Best Pract Res Clin Obstet Gynaecol, 28*(1), 3-12. doi:10.1016/j.bpobgyn.2013.09.002

Sanson, A., Prior, M., Garino, E., Oberklaid, F., & Sewell, J. (1987). The structure of infant temperament: Factor analysis of the Revised Infant Temperament Questionnaire. *Infant Behavior and Development, 10*(1), 97-104.

Skipstein, A., Janson, H., Stoolmiller, M., & Mathiesen, K. S. (2010). Trajectories of maternal symptoms of anxiety and depression. A 13-year longitudinal study of a population-based sample. *BMC Public Health, 10*.

Woolhouse, H., Brown, S., Krastev, A., Perlen, S., & Gunn, J. (2009). Seeking help for anxiety and depression after childbirth: results of the Maternal Health Study. *Arch Womens Ment Health, 12*(2), 75-83. doi:10.1007/s00737-009-0049-6

Yelland, J., Sutherland, G., & Brown, S. J. (2010). Postpartum anxiety, depression and social health: findings from a population-based survey of Australian women. . *BMC Public Health, 10*.

Tables

Table 1. Descriptive statistics for maternal characteristics each depression and anxiety comorbidity category (n=1070).

	Characteristic	Anxiety & Depression % or M (SD)	Depression only % or M (SD)	Anxiety only % or M (SD)	Neither % or M (SD)
Sociodemographic	**Age of infant (0-12 mths)**	**6.1 (3.0)**	**5.8 (3.1)**	6.0 (3.6)	**5.4 (3.1)**
	First time mother				
	Yes	53.1%	52.8%	53.4%	62.9%
	No	46.9%	47.2%	46.6%	37.1%
	Living with a partner				
	No	**10.3%**	11.1%[b]	8.0%[a]	**4.9%**
	Yes	**89.7%**	88.9%	92.0%	**95.1%**
	Education				
	Secondary incomplete	13.2%	11.1%[b]	8.0%[a]	7.6%
	Secondary completed	48.6%	58.3%	42.0%	42.4%
	Bachelor or higher	38.2%	30.6%	50.0%	49.9%
	Remoteness				
	Major city/Inner region	87.6%	91.7%	86.2%	91.2%
	Outer region/Remote	12.4%	8.3% [b]	13.8%	8.8%
	Multilingual at home				
	Yes	8.3%	11.1%[b]	14.8%	10.2%
	No	91.7%	88.9%	85.2%	89.8%
Employment and Finances	**Paid leave**				
	No	43.4%	50.0%	38.6%	43.2%
	Yes	**31.7%**	36.1%	44.3%	**44.7%**
	Unemployed	**24.8%**	13.9%[b]	17.0%	**12.1%**
	Income				
	0-30K	**40.3%**	38.9%	33.0%	**20.8%**
	30K-90K	39.6%	36.1%	50.0%	43.9%
	90K+	**20.1%**	25.0%[a]	**17.0%**	**35.2%**
	Financial hardship				
	None	**31.9%**	38.9%	**37.2%**	**61.2%**
	One or more	**68.1%**	61.1%	**62.8%**	**38.8%**
Maternal and obstetric health and adjustment	**Intentional pregnancy**				
	No	**36.1%**	38.9%	27.3%	**23.0%**
	Yes	**63.9%**	61.1%	72.7%	**77.0%**
	Difficult birth				
	No	53.1%	55.6%	55.7%	60.0%
	Yes	46.9%	44.4%	44.3%	40.0%
	Breastfeeding				
	No	**49.0%**	47.2%	38.6%	**35.0%**
	Yes	**51.0%**	52.8%	61.4%	**65.0%**
	Self-rated health				
	Excellent/very good	**17.2%**	33.3%	**25.0%**	**62.5%**
	Good	40.7%	44.4%	43.2%	30.6%
	Fair/poor	**42.1%**	22.2%	**31.8%**	**6.9%**
Infant temperament	**STSI score (12-72)**	**50.5 (8.6)**	**55.1 (8.2)**	**48.1 (9.8)**	**54.8 (8.1)**
	Infant sleep quality				
	Poor	**47.6%**	30.6%	**50.6%**	**30.0%**
	Good	**54.2%**	69.4%	**49.4%**	**70.0%**

Social support and stress	**Amount of help received**				
	Enough/ Don't need	**36.6%**	50.0%	64.8%	**80.1%**
	Not enough/none	**63.4%**	50.0%	35.2%	**19.9%**
	Social support not received				
	Often (or don't need it)	**50.3%**	**41.7%**	22.7%	**19.4%**
	Occasionally or never	**49.7%**	**58.3%**	77.3%	**80.6%**
	Relationship quality (1-7)	**3.8 (1.6)**	**3.6 (1.5)**	**4.3 (1.3)**	**5.1 (1.2)**
	Negative life events				
	None	**28.3%**	36.1%	34.1%	**53.3%**
	1 or more	**71.7%**	63.9%	65.9%	**46.8%**
Mental health scales	**EPDS score (0-30)**	16.9 (3.1)	15.0 (1.8)	8.9 (2.7)	4.7 (3.2)
	STAI score (20-80)	55.5 (7.3)	38.9 (4.9)	49.9 (4.3)	30.3 (6.7)

Note: a) Cell sizes smaller than 10. b) Cell size smaller than 5.Bolded text indicates significant contrasts – specific significant contrasting groups are explained further in the text within the results section. Criteria for the Chi-square tests of association, included a significant overall Chi square test with a p-value of <.05 and that the standardised residuals comparing specific levels of the comorbidity variable were ≥|1.96| (Agresti, 1996). Criteria for the One-Way ANOVA was an overall p-value <.05, and the p-values of individual contrasts comparing specific levels of the comorbidity variable were <.05.

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Table 2. Adjusted odds ratios and 95% CIs for associations between maternal characteristics and depression and anxiety comorbid categories.

Characteristic	Depression only OR 95% CI	Anxiety only OR 95% CI	Anxiety & Dep OR 95% CI
Sociodemographic			
Age of youngest child	0.98 (0.87-1.10)	1.00 (0.93-1.08)	0.98 (0.92-0.97)
Living with a partner			
Yes	-	-	-
No	1.12 (0.34-3.68)	1.04 (0.39-2.79)	1.11 (0.52-2.40)
Employment and Finances			
Paid leave		-	
Yes	-		
Unemployed	0.70 (0.21-2.33)	0.86 (0.40-1.84)	1.34 (0.70-2.56)
No	0.96 (0.41-2.22)	0.61 (0.34-1.07)	0.79 (0.48-1.32)
Income			
90K+	-	-	-
0-30K	1.28 (0.40-4.08)	2.18 (0.92-5.11)	1.10 (0.54-2.25)
30K-90K	0.87 (0.34-2.26)	1.97 (0.99-3.92)	1.02 (0.58-1.80)
Financial hardship			
None	-	-	-
One or more	1.96 (0.85-4.54)	**1.94 (1.11-3.39)**	**2.45 (1.05-4.04)**
Maternal and obstetric health and adjustment			
Intentional pregnancy			-
Yes	-	-	1.00 (0.61-1.63)
No	1.31 (0.60-2.90)	0.96 (0.54-1.71)	
Breastfeeding			
Yes	-	-	-
No	1.42 (0.69-2.90)	1.34 (0.80-2.23)	**1.86 (1.20-2.87)**
Infant temperament			
STSI score	1.01 (0.96-1.05)	**0.92 (0.90-0.95)**	**0.95 (0.92-0.97)**
Baby's sleep quality			
Good	-	-	-
Poor	1.08 (0.49-2.39)	1.58 (0.96-2.61)	**1.70 (1.09-2.65)**
Social support and stress			
Help received			-
Enough/ Don't need	-	-	
Not enough/none	**3.31 (1.59-6.88)**	**1.81 (1.06-3.10)**	**4.56 (2.94-7.08)**
Support not received			
Often (or don't need it)	-	-	-
Occasionally or never	1.86 (0.88-3.91)	1.07 (0.56-1.98)	**2.28 (1.45-3.57)**
Negative life events			
None	-	-	-
1 or more	1.24 (0.58-2.66)	1.53 (0.91-2.57)	**1.74 (1.09-2.76)**

Note: Self-rated health was not included in the multinomial regressions, given the high correlation with anxiety and depression. The reference category for all comparisons was women in the **'neither anxiety nor depression'** group.