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Research Letter

Is neuroticism a risk factor for postpartum depression?

Introduction

Although the relationship between personality and depressive illness is complex (Shea, 2005), there is empirical evidence that some personality features such as neuroticism, harm avoidance, introversion, dependency, self-criticism or perfectionism are related to depressive illness risk (Gunderson *et al.* 1999). Moreover, personality traits, especially neuroticism, may explain the increased prevalence of depression among females (Goodwin & Gotlib, 2004).

Few studies have explored neuroticism, extraversion and psychoticism as risk factors for depression after an event as stressful as childbirth. Pitt (1968) was the first author to report high scores on neuroticism and low scores on extraversion among postpartum depressed women. Similar results were found in a comparison of mothers with and without postpartum depressive symptoms (Dudley *et al.* 2001; Podolska *et al.* 2010). A case-control study comparing women with recurrent major depression with and without a history of postpartum depression found no personality trait differences between them; however, those with a history of postpartum depression showed higher neuroticism and psychoticism and lower extraversion than controls. These results suggested that these traits did not confer a specific risk for the postnatal onset episodes (Jones *et al.* 2010). Prospective studies have also studied the link between personality and postpartum depression; however, these data are not conclusive due to methodological limitations, such as sample size (Kumar & Robson, 1984; Watson *et al.* 1984; Areias *et al.* 1991; Boyce *et al.* 1991; Matthey *et al.* 2000), selection bias (Kumar & Robson, 1984; Areias *et al.* 1991; Boyce *et al.* 1991; Matthey *et al.* 2000), or depression assessment (self-report measures *versus* clinical diagnosis: Boyce *et al.* 1991; Matthey *et al.* 2000; Dudley *et al.* 2001; Saisto *et al.* 2001; Van Bussel *et al.* 2009) or because the authors did not take into account confounding factors such as stressful life events or social support (Watson *et al.* 1984; Kumar & Robson, 1984; Boyce *et al.* 1991; Matthey *et al.* 2000; Saisto *et al.* 2001; Verkerk *et al.* 2005; Van Bussel *et al.* 2009). (See Supplementary material, Table S1.)

The aim of this paper was to extend the previous knowledge of the role of neuroticism, extroversion and psychoticism as risk factors for postpartum depression (depression symptomatology and clinical diagnosis) considering psychosocial variables in a large cohort of women from the general population.

Method

Between December 2003 and October 2004, women (second to third days postpartum) were recruited from seven acute-care teaching hospitals in Spain and invited to participate in a 32-week follow-up study (Sanjuán *et al.* 2008). All participants were Spanish, Caucasian and able to understand and answer clinical questionnaires. None of the participants had a current depression or other psychiatric illness during pregnancy. Moreover, those women whose children died after birth were excluded. The institutional review boards of the participating hospitals approved the study. All women gave written informed consent.

At baseline (second to third days postpartum) all participants completed a semi-structured interview that included sociodemographic data (i.e. age, marital status, job and economic situation), obstetric variables (parity and type of delivery) and personal and family history of psychiatric illness (any psychiatry conditions with pharmacological or psychological treatment were considered). Furthermore, all women were assessed, as follows.

(1) Validated Spanish version of the Eysenck Personality Questionnaire Revised Short Scale (EPQ-RS; Eysenck & Eysenck, 2001)

The EPQ-RS consists of 48 items from the 100-item EPQ-R and measures three dimensions of personality: extraversion (E), neuroticism (N) and psychoticism (P). We obtained gender T-scores for the Spanish population. In the present study, we also used a categorical personality classification. T-scores greater than 55 defined high extraversion, high neuroticism and high psychoticism, whereas T-scores less than or equal to 45 defined low-extraversion, low-neuroticism and low-psychoticism groups.

(2) Spanish version of the St Paul Ramsey Life Experience Scale (Baca-Garcia *et al.* 2007)

The St Paul Ramsey Life Experience Scale rated the impact of participants' stressful life events using a

Table 1. Differences in personality dimensions and other risk factors between women with and without postpartum depression

Baseline variables	Depressive symptoms								
	At 8 weeks postpartum			At 32 weeks postpartum			Clinical depression: 0–32 weeks postpartum		
	EPDS >9	EPDS ≤9	<i>p</i>	EPDS >9	EPDS ≤9	<i>p</i>	DIGS+	DIGS–	<i>p</i>
Mean personality traits (s.d.)									
Extraversion	49.0 (9.94)	51.3 (9.26)	0.001	49.82 (8.85)	51.19 (9.51)	0.161	48.9 (10.14)	51.2 (9.23)	0.006
Neuroticism	50.6 (10.2)	42.3 (7.24)	<0.001	46.88 (10.10)	43.13 (8.153)	<0.001	49.7 (10.52)	42.6 (7.58)	<0.001
Psychoticism	49.4 (9.6)	47.3 (8.75)	0.002	49.07 (9.66)	47.51 (8.728)	0.087	49.5 (9.36)	47.1 (8.68)	0.003
Personality profiles, <i>n</i> (%)									
Extraversion									
Low	81 (37.9)	357 (29.9)		36 (35.3)	376 (30.4)		68 (39.3)	353 (29.7)	
Medium	55 (25.7)	311 (26.1)		33 (32.4)	309 (25.5)		38 (22.0)	311 (26.2)	
High	78 (36.4)	527 (44.0)	0.048	33 (32.4)	550 (44.5)	0.052	67 (38.7)	525 (44.2)	0.037
Neuroticism									
Low	76 (35.5)	886 (74.0)		54 (52.9)	859 (69.6)		78 (45.1)	848 (71.3)	
Medium	56 (26.2)	221 (18.5)		22 (21.6)	244 (19.8)		40 (23.1)	230 (19.3)	
High	82 (38.3)	86 (7.2)	<0.001	26 (25.5)	132 (10.7)	<0.001	55 (31.8)	111 (9.3)	<0.001
Psychoticism									
Low	90 (42.1)	602 (50.5)		50 (49.0)	603 (48.8)		75 (43.4)	590 (49.6)	
Medium	64 (29.9)	362 (30.3)		25 (24.5)	386 (31.3)		47 (27.2)	370 (31.1)	
High	60 (28.0)	229 (19.2)	0.009	27 (26.5)	246 (19.9)	0.185	51 (29.5)	229 (19.3)	0.008
Other factors									
Mean age, years (s.d.)	31.8 (5.16)	32.1 (4.48)	0.541	31.6 (5.02)	32.4 (4.33)	0.134	31.7 (5.08)	32.2 (4.43)	0.005
Single, <i>n</i> (%)	12 (5.6)	31 (2.6)	0.019	5 (4.9)	34 (2.8)	0.215	30 (2.5)	11 (6.4)	0.006
Education level, <i>n</i> (%)									
Basic	74 (34.6)	326 (27.3)		25 (24.5)	335 (27.1)		59 (34.1)	306 (25.7)	
High school	77 (36.0)	504 (42.2)		51 (50)	513 (41.5)		74 (42.8)	503 (42.3)	
University	63 (29.4)	363 (30.4)	0.125	26 (25.5)	387 (31.3)	0.237	40 (23.1)	380 (32.0)	0.020
Economic situation, <i>n</i> (%)									
Good income	101 (47.2)	792 (66.4)		53 (52)	829 (67.1)		88 (50.9)	808 (68.0)	
Punctual economic difficulties	75 (35)	326 (27.3)		37 (36.3)	317 (25.7)		56 (32.4)	304 (25.6)	
Some economic problems	32 (15)	70 (5.9)		9 (8.8)	81 (6.6)		24 (13.9)	71 (6.0)	
Serious economic problems	6 (2.8)	5 (0.4)	<0.001	3 (2.9)	8 (0.6)	0.003	5 (2.9)	24 (13.9)	<0.001

Employed, <i>n</i> (%)	137 (64.0)	852 (71.4)	0.029	65 (63.7)	868 (70.3)	0.166	92 (53.2)	851 (71.6)	<0.001
Parity (primiparous), <i>n</i> (%)	91 (42.5)	551 (46.2)	0.322	45 (44.1)	587 (47.5)	0.507	74 (42.8)	568 (47.8)	0.171
Type of delivery (Caesarean), <i>n</i> (%)	42 (19.6)	236 (19.8)	0.958	22 (21.6)	244 (19.8)	0.660	41 (23.7)	229 (19.3)	0.219
Personal psychiatric history, <i>n</i> (%)	79 (36.9)	171 (14.3)	<0.001	26 (25.5)	212 (17.2)	0.035	73 (42.2)	171 (14.4)	<0.001
Family psychiatric history, <i>n</i> (%)	85 (39.7)	371 (31.1)	0.013	37 (36.3)	396 (32.1)	0.383	76 (43.9)	364 (30.6)	<0.001
Stressful life events (St Paul Ramsey), <i>n</i> (%)	163 (76.2)	736 (61.7)	<0.001	74 (72.5)	776 (62.8)	0.050	135 (78.0)	735 (61.8)	<0.001
Mean Duke-UNC score (social support) (s.d.)	47.41 (10.65)	52.60 (7.93)	<0.001	50.95 (8.33)	52.09 (9.52)	0.191	49.19 (9.20)	52.30 (8.36)	<0.001
Mean EPDS score (s.d.)	10.09 (4.91)	5.33 (3.64)	<0.001	7.23 (4.11)	5.08 (4.11)	<0.001	8.92 (4.92)	5.62 (3.98)	0.025

EPDS, Edinburgh Postnatal Depression Scale; DIGS, Diagnostic Interview for Genetics Studies; s.d., standard deviation.

seven-point scale of severity over the pregnancy period. Six different categories of events were considered: primary support, social environment, housing, work, health and economy. The outcome variable was dichotomous: absence or presence (with at least a severity score of 2 in one or more categories) of stressful life events during pregnancy.

(3) Spanish validated version of the Duke-UNC Functional Social Support Questionnaire (Bellón *et al.* 1996)

The Duke-UNC Functional Social Support Questionnaire is an 11-item, self-administered questionnaire designed to evaluate perceived functional social support. The item response options are on a five-point scale ranging from 1 ('much less than I would like') to 5 ('as much as I would like'). Higher scores reflect higher perceived social support.

(4) Spanish validated version of the Edinburgh Postnatal Depression Scale (EPDS; Garcia-Esteve *et al.* 2003)

The EPDS was used to assess depressive symptoms at early postpartum. The EPDS is a 10-item self-report scale with four possible responses and a total score ranging from 0 to 30 and has been used as a screening tool for non-psychotic psychiatric disorders in the postpartum period (Navarro *et al.* 2007).

At 8 and 32 weeks postpartum, the presence of depressive symptoms was evaluated with the EPDS. All women who scored EPDS >9 at 8 and 32 weeks postpartum were defined as probable postpartum depression cases (Garcia-Esteve *et al.* 2003; Navarro *et al.* 2007). The Spanish version of the Diagnostic Interview for Genetics Studies (DIGS) for DSM-IV (Roca *et al.* 2007) adapted for postpartum depression evaluated all probable cases of major postpartum depression during the 32 weeks after delivery.

For the univariate analysis, we used the χ^2 test and Student's *t* test for qualitative and quantitative variables, respectively. Outcomes variables were: (1) depressive symptoms (EPDS >9) at 8 weeks postpartum; (2) depressive symptoms (EPDS >9) at 32 weeks in the case of EPDS ≤9 at 8 weeks; and (3) the presence of a major depressive episode during the 32 weeks after delivery using DIGS for DSM-IV criteria. The independent variables were neuroticism, extraversion and psychoticism, although we also considered other variables related to personality and depression, as well as sociodemographic variables.

To find an adequate logistic regression model for each of the three outcomes as a function of the independent variables of interest, we used the procedure

proposed by Hosmer & Lemeshow (2000). First, univariate logistic models for all variables of interest were fit and models with a significance level less than 0.25 were included in the multivariate model. Then, backward selection removed variables from the model if they were not significant at the 0.05 level, as long as the parameter estimates of the remaining variables did not change substantially; in this way we ruled out potential confounders from the model. Once the model included only significant variables, we checked whether previously excluded variables were now significant. We also considered possible interactions of the remaining variables. Finally, we checked the model's global goodness of fit. Model parameters were interpreted in terms of adjusted odds ratios (aORs) and 95% confidence intervals (CIs). The data analyses were carried out using SPSS 11.5 (SPSS, Inc., USA) and the R statistical software package (<http://www.r-project.org>).

Results

This study included 1974 women, 94 (5%) of whom chose not to participate and 76 (3.8%) of whom were excluded because of incomplete EPDS questionnaires; thus, the final sample comprised 1804 women. At the 8-week follow-up, 1407 (78%) women remained in the study. At 32 weeks, 1337 (74.1%) women were evaluated. Women who dropped out during the follow-up period were more likely to have a lower education level ($p < 0.001$), economic problems ($p = 0.002$), no long-term relationship ($p = 0.001$) and no psychiatric history ($p = 0.002$) than the final sample; there were no significant differences among personality variables, social support and number of stressful life events suffered during pregnancy.

The total sample ($n = 1804$) had a mean age of 31.7 (s.d. = 4.6), and a range of 18–46 years; 32% of participants had only attended primary school, 41% finished secondary school and 27% had a college degree. Almost all were married or had a stable partner (97%) and lived with their own family (95%). Most participants (68%) were employed. Of the participants, 9% reported some economic problems, 46% were primiparous, 80% had a vaginal delivery, 31% had a family psychiatric history and 16% had a personal psychiatric history. The mean T-score for personality dimensions at baseline was 51.1 (s.d. = 9.6) for extraversion, 43.6 (s.d. = 8.5) for neuroticism and 48.0 (s.d. = 8.9) for psychoticism. The mean EPDS score was 6.1 (s.d. = 4.5). In regard to social support, the Duke-UNC score mean was 52.0 (s.d. = 8.6). Of the women, 37% reported having suffered at least one stressful life event during pregnancy.

The mean EPDS score was 5.3 (s.d. = 4.6) at 8 weeks postpartum and 4.4 (s.d. = 4.7) at 32 weeks postpartum. At 8 weeks, we identified 214 women (11.9%) with depressive symptoms (i.e. EPDS > 9). At 32 weeks postpartum, 24% women had EPDS > 9, but only 102 (7.6%) women had depressive symptomatology after 8 weeks. Overall, 173 women (12.7%) had a major depressive episode confirmed by DIGS during the first 32 weeks postpartum; 53.8% were recurrences and 46.2% were new onsets.

The results of the univariate analysis showed significant differences in personality dimensions and other potential predictors between women with or without postpartum depressive symptoms (i.e. EPDS > 9) and major postpartum depression (DSM-IV) (Table 1). With respect to personality traits, women with depressive symptoms at 8 weeks as well as women with a major postpartum depression episode during the 32 weeks postpartum obtained lower scores on extraversion and higher scores on neuroticism and psychoticism than women from healthy groups. However, when the appearance of depressive symptoms at 32 weeks postpartum was considered, differences were only found on neuroticism.

Logistic regression analyses were used to explore personality features, taking into account other risk factors that could help to predict depressive symptoms (i.e. EPDS > 9) at 8 and 32 weeks postpartum, as well as a major depressive episode using the DSM-IV criteria during 32 weeks postpartum. Neuroticism was the only personality trait which increased the risk of EPDS scores > 9 at 8 and 32 weeks postpartum as well as a major depressive episode during the 32 weeks after childbearing (aOR 1.05, 95% CI 1.02–1.07; aOR 1.04, 95% CI 1.01–1.08 and aOR 1.05, 95% CI 1.02–1.08, respectively). Other risk factors such as EPDS scores at baseline, history of depression, social support, economic situation and stressful life events during pregnancy were also identified as risk factors for postpartum depression (Table 2).

Discussion

This study confirmed in a large and representative sample of postpartum women that neuroticism is an independent predictor of major postpartum depression and depressive symptomatology at 8 and 32 weeks postpartum. Supporting research on stress vulnerability in women, our study found that high neuroticism raises the probability that a major depressive episode presents after a major biological, psychological and social life event such as giving birth. However, it is worth noting that high neuroticism showed a slightly moderate effect size, and that personal and family psychiatric histories are also

Table 2. Final logistic regression models for postpartum depression

	B (S.E.)	Wald	p	OR (95% CI)
Model 1*				
Depressive symptoms at 8 weeks (EPDS > 9)				
Constant	-4.305 (0.731)	-5.888	<0.001	
Neuroticism (T-scores)	0.047 (0.011)	4.119	<0.001	1.05 (1.02-1.07)
EPDS score	0.177 (0.022)	7.903	<0.001	1.19 (1.14-1.25)
Social support (Duke-UNC score)	-0.020 (0.009)	-2.291	0.022	0.98 (0.96-1.00)
Personal psychiatric history	0.668 (0.190)	3.515	<0.001	1.95 (1.34-2.83)
Model 2**				
Depressive symptoms at 32 weeks (EPDS > 9)				
Constant	-4.998 (0.701)	-7.130	<0.001	
Neuroticism (T-scores)	0.040 (0.017)	2.305	0.021	1.04 (1.01-1.08)
EPDS score	0.084 (0.034)	2.493	0.013	1.09 (1.02-1.16)
Economic situation (low income)	0.680 (0.244)	2.784	0.005	1.97 (1.22-3.18)
Model 3***				
Clinical diagnosis of postpartum depression (DIGS) during 32 weeks postpartum				
Constant	-5.739 (0.568)	-10.098	<0.001	
Neuroticism (T-scores)	0.048 (0.013)	3.660	<0.001	1.05 (1.02-1.08)
EPDS score	0.085 (0.026)	3.265	0.001	1.09 (1.03-1.14)
Personal psychiatric history	0.941 (0.210)	4.492	<0.001	2.56 (1.70-3.86)
Family psychiatric history	0.563 (0.195)	2.881	0.004	1.76 (1.20-2.57)
Stressful life events during pregnancy (St Paul Ramsey)	0.676 (0.237)	2.853	0.004	1.97 (1.24-3.13)

S.E., Standard error; OR, odds ratio; CI, confidence interval; EPDS, Edinburgh Postnatal Depression Scale; DIGS, Diagnostic Interview for Genetics Studies.

Goodness of fit: * $p=0.66$, ** $p=0.55$, *** $p=0.4$.

important risk factors in the first weeks after delivery, at 6 months and beyond. Moreover, this study highlights the role of environmental factors such as social support, economical problems and other stressful life events during pregnancy. Together, all these variables contribute to depression after delivery.

The role of other personality traits was less clear. Neither extraversion nor psychoticism was confirmed as a risk factor after controlling for EPDS scores at baseline as well as other confounding factors. Consistent with our results, extraversion has failed to predict EPDS scores (Boyce *et al.* 1991; van Bussel *et al.* 2009) and clinical major depression (Areias *et al.* 1996). In our study, low extraversion was associated with EPDS scores greater than 9 at 8 weeks and with major postpartum depression (DSM-IV), which might be explained by state effects on extraversion scores (Enns & Cox, 1997; Griens *et al.* 2002). Thus, the association between extraversion and depression would disappear after controlling for EPDS scores and other factors at baseline. In agreement with other findings in postpartum populations (Kumar & Robson, 1984; Watson *et al.* 1984), psychoticism did not predict postpartum depression; however, the results of the

univariate analysis showed that psychoticism was associated with EPDS scores at 8 weeks postpartum and with major postpartum depression (DSM-IV). These results are also consistent with a recent case-control study on women with recurrent major depression and a history of postpartum depression (Jones *et al.* 2010). Psychoticism has also been related to an excess of severe and threatening life events, depressive symptoms and suicide ideation in cross-sectional studies in non-postpartum populations (Farmer *et al.* 2001; Kumar & Pradhan, 2003; Pickering *et al.* 2003).

The results of the study cannot be generalized to the general population because we excluded women with psychiatric disorders during pregnancy, which is a risk factor for postpartum depression (Dennis & Ross, 2006). We chose this strategy to ensure that we were dealing with vulnerability to the onset of a new major postpartum depressive episode. Nevertheless, we assessed personality 2 days after delivery, and some women experience a transient affective syndrome called postpartum blues (Henshaw, 2003). For this reason, we decided to include EPDS scores at baseline in regression models. We did not exclude women with a history of major depression before pregnancy, so we

cannot determine if personality traits were a residual symptomatology of previous depressive episodes; however, our analysis controlled for personal psychiatry history. Moreover, we did not study all personality traits; so future postpartum cohort studies should include other personality traits such as perfectionism (Mazzeo *et al.* 2006; Gelabert *et al.* 2011) and coping styles (de Tychey *et al.* 2005). Recent preliminary data showed that self-criticism traits might also be an important factor in the persistence of depressive symptoms in postpartum depression (Vliegen *et al.* 2010). However, we were interested in studied personality traits and other risk factors in the postpartum period. The strengths of this study compared with previous reports in this field are: the large sample of the general population, the longitudinal design, the method of depression assessment, and the advantage of taking into account confounding factors such as stressful life events or social support during pregnancy. It would have been interesting to study stressful life events and social support also during the postpartum period.

Overall, these findings have clinical implications for women at risk of postpartum depression before leaving the obstetric ward. Understanding the effect of neuroticism, along with other biological and social variables, allows clinicians to detect subgroups of women with an increased vulnerability to postpartum depression who might receive early psychological and psychiatric care.

Supplementary material

For supplementary material accompanying this paper, visit <http://dx.doi.org/10.1017/S0033291712000712>.

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Declaration of Interest

None.

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