Original article

Coping strategies and postpartum depressive symptoms: A structural equation modelling approach

A. Gutiérrez-Zotes [a,*], J. Labad [a], R. Martín-Santos [b,c], L. García-Esteve [b],
E. Gelabert [c,d], M. Jover [e], R. Guillamat [f], F. Mayoral [g], I. Gornemann [g],
F. Canellas [h], M. Gratacós [i,j], M. Guitart [f], M. Roca [k], J. Costas [l], J. Luis Ivorra [e],
R. Navinés [b,c], Y. de Diego-Otero [g], E. Vilella [a], J. Sanjuan [e]

[a] Hospital Universitari Institut Pere Mata, IISPV, Universitat Rovira i Virgili, CIBERSAM, Reus, Spain
[b] Psychiatry Department, Neuroscience Institute, Hospital Clinic, IDIBAPS, CIBERSAM and Department of Psychiatry and Clinical Psychobiology,
University of Barcelona, Barcelona, Spain
[c] Neuroscience Program, IMIM-Parc de Salut Mar, Autonomous University of Barcelona, RTA, Barcelona, Spain
[d] Department of Clinical and Health Psychology, Autonomous University of Barcelona, Bellaterra, Barcelona, Spain
[e] Hospital Clínico, University of Valencia, CIBERSAM, Valencia, Spain
[f] Corporación Sanitaria Parc Taulí, Sabadell, Autonomous University of Barcelona, Barcelona, Spain
[g] Unidad de Gestión Clínica de Salud Mental, Instituto de Investigación Biomédica de Málaga (IBIMA),
Complejo Hospitalario de Málaga, Universidad de Málaga, Spain
[h] Hospital de Son Dureta, Palma de Mallorca, Spain
[i] Centre for Genomic Regulation (CRG) and UPF, Barcelona, Spain
[j] Centro de Investigación Biomédica en Red de Epidemiología y Salud Pública (CIBERESP), Barcelona, Spain
[k] Institut Universitari d'Investigació en Ciències de la Salut, RediAPP, Palma de Mallorca, Spain
[l] Instituto de Investigación Sanitaria de Santiago de Compostela (IDIS) Servizo Galego de Saúde (SERGAS), Complexo Hospitalario Universitario de Santiago
(CHUS), Santiago de Compostela, Spain

ARTICLE INFO

ABSTRACT

Background: Variables such as the mother's personality, social support, coping strategies and stressful events have been described as risk factors for postpartum depression. Structural Equation Modelling (SEM) analysis was used to examine whether neuroticism, perceived social support, perceived life events, and coping strategies are associated with postpartum depressive symptoms at the 8th and 32nd weeks.
Methods: A total of 1626 pregnant women participated in a longitudinal study. Different evaluations were performed 8 and 32 weeks after delivery. Several measures were used: the Edinburgh Postnatal Depression Scale (EPDS), the Diagnostic Interview for Genetic Studies (DIGS), the Eysenck Personality Questionnaire (EPQ-RS), the St. Paul Ramsey life events scale and the Duke-UNC Functional Social Support Questionnaire. The brief COPE scale was used to measure coping strategies. SEM analysis was conducted for all women and in those women with a clinical diagnosis of postpartum depression.
Results: Passive coping strategies were associated with postpartum depressive symptoms at both visits (8th and 32nd weeks). Neuroticism was associated with more passive coping strategies and less active coping strategies. Neuroticism and life stress were positively correlated, and social support was negatively correlated with life stress and neuroticism.
Conclusions: Early identification of potential risk for symptomatology of depression postpartum should include assessment of neuroticism, life events, social support and coping strategies.

© 2015 Elsevier Masson SAS. All rights reserved.

1. Introduction

Between 10% and 15% of new mothers have severe emotional distress or postpartum depression (PPD) [11,14,54]. Mothers who have had PPD are 25 to 100% more likely to suffer a recurrent depressive episode in later pregnancies [76,40]. Maternal depression may have important implications for child development [3],

contributing to emotional, behavioural and cognitive problems in later life [6,38,27] as well as childhood psychiatric disorders [60].

Several factors are thought to play a role in the risk of developing PPD: reproductive hormones [76], genetic alterations [63], obstetric complications [54], mothers' previous psychiatric history [54,40,7,39], family history of psychiatric illness [39], depressed mood during pregnancy [54,40,7,39] and prenatal anxiety [54,39], the mothers' neuroticism [45], cognitive attributional styles [4], stressful life events [54,53], perceived life stress [7], limited social support [60,44] and low self-esteem [44].

The birth of a baby is a major source of stress for mothers, who require a number of adjustments to the new situation. Coping strategies, perceived stress, social support, and the dispositional or personality traits of the mother are factors that have been largely reported to determine proper adaptation to the new role.

Coping with stressful conditions to ensure proper psychological adjustment does not operate in isolation. Rather, coping mediates the relationships between certain social conditions and adjustment (e.g., depression) or between contextual and individual variables and adaptive outcomes [69]. A recent review [59] concluded that perceived stress, social support and coping strategies are variables that influence the mechanisms of adaptation to stress in mothers after childbirth. Coping strategies are thought to mediate the relationship between neuroticism and depression in subjects experiencing stress [72]. A recent study suggests that low coping efficacy partially mediates the association between negative life events and incident depression [1].

Maladaptive or passive coping strategies, including denial, distancing, self-blame and substance abuse, are associated with symptoms of antenatal depression [20], and with higher odds of developing postnatal depressive symptoms [20,23], whereas positive reappraisal strategies tend to be protective [55]. Studies that evaluate problem centered coping (a form of active coping) among pregnant women, have shown contradictory results, linking this type of coping with both lower [9,50] and higher [65] levels of postpartum depression. Mothers with depressive symptoms during pregnancy and postpartum, tend to use emotional coping strategies, (a type of avoidant coping), more frequently than mothers without such symptoms [19].

Negatively perceived stress has been found to affect the well-being of mothers [59]. Perceived postnatal stress has been associated with symptoms of postpartum depression (PPD) [36,24,71,43] and higher anxiety levels [13]. Wells et al. reported that greater stress in pregnant women was associated with depressive symptoms if the mother did not report an active coping style [74]. A recent systematic review by Guardino and Schetter on coping during pregnancy indicates that although there is evidence that avoidant coping styles are associated with postpartum depression, the evidence on the buffering effect of active coping on mental health outcomes is inconclusive [28].

Social support, which is conceptualised as a resource for coping, is defined as the perception (or experience) that one is loved and cared for by others, esteemed and valued as part of a social network of mutual assistance and obligations [75]. Coping resources such as social support in turn affect coping processes that is, specific intrapsychic and behavioural actions that people use to manage stress [69]. Social support has been associated with major PPD [21,31,33]. Perceptions that family and friends would provide effective help during times of stress (i.e., perceived support) have been consistently linked to good mental health, including low rates of major depression [41].

High scores for neuroticism have been reported in women with PPD [45,58]. Scholars have recently shown that neuroticism is an independent predictor of PPD symptomatology and major depression at 8 to 32 weeks postpartum [45]. Previous studies suggest that the link between personality and distress can be mediated by the selection of ineffective coping strategies [12]. McWilliams et al. [48] showed that having fewer adaptive coping strategies (emotion-oriented coping) is associated with neuroticism and depression, whereas an inverse association was found for task-orientated strategies.

Despite the important contribution of these variables to PPD, a joint analysis of these coping resources involved in postpartum depression has not been performed. A Structural Equation Modelling (SEM) analysis would allow the integration of variables such as stressful life events, social support, neuroticism, anxiety, coping strategies and postpartum depressive symptoms in a conceptual model of vulnerability to PPD. Fig. 1 provides a visual model of the some variables involved in the mother-stress transaction in postpartum symptomatology. We tested the hypothesis that women with a higher level of neuroticism are more sensitive to the depressogenic effects of adversity and vital stress events. Neuroticism influences the pathogenic effects of exposure to stress among other causes, having a greater tendency to use passive coping or avoidance strategies and lower perceived social support, which maintains and increases depressive symptomatology.
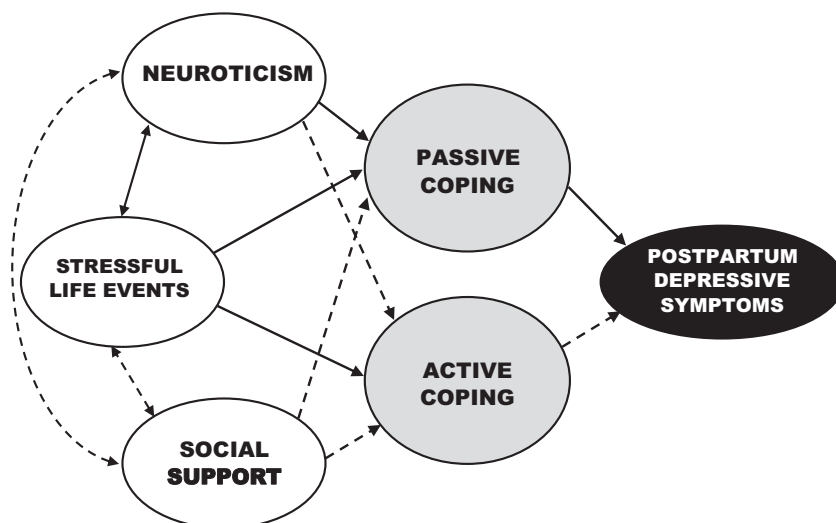

Fig. 1. Visual model of the relationship between variables involved in the mother-stress transaction in postpartum symptomatology. Solid lines represent positive relationships whereas dashed lines represent negative associations.

The present study aimed to analyse coping strategies as risk factors for PPD, and to examine the relationship of active and passive coping strategies with neuroticism, social support, perceived stress and symptoms of PPD. We conducted a SEM analysis to explore these objectives. In the present study, we have selected only some factors related to PPD. We have omitted several other major predictors for postpartum depression described in previous studies.

2. Methods

2.1. Patients

Our study sample included 1626 women who were assessed postpartum in a study conducted at seven community urban hospitals in Spain [63] between December 2003 and October 2004. Recruitment was conducted by consecutive sampling at Obstetric Departments when all participants were admitted for the delivery of the child. The exclusion criteria included the presence of a psychiatric disorder requiring medical treatment before or during pregnancy, the death of the child following delivery, the presence of language difficulties or cultural illiteracy rendering questions unanswerable, and refusal to participate in the study or to complete the follow-up visit. All procedures are in accordance with the Declaration of Helsinki. Ethical approval was obtained from the institutional review board, and all participants provided written informed consent.

2.2. Clinical assessment

Each of the participants was assessed on three occasions (Table 1). The first assessment was at 2–3 days after birth. Two further evaluations were made at 8 and 32 weeks postpartum. The decision of scheduling these three visits was considered in order to include a time frame period that covers both early and late postpartum onsets of depressive episodes. All patients were interviewed face-to-face on three occasions. Sociodemographic characteristics (i.e., age, marital status, employment and economic status), obstetric variables, personality features and coping strategies were assessed during the first visit. Life stressors, social support and mood status were assessed during all three visits.

The Edinburgh Postnatal Depression Scale (EPDS) [25] was administered to assess depressive symptoms at 8 and 32 weeks postpartum. The EPDS is a 10-item self-report scale with four possible responses and a total score ranging from 0 to 30. Participants who scored 9 or higher on the EPDS were also assessed with the Diagnostic Interview for Genetic Studies (DIGS) for DSM-IV [52], Spanish version [61], which was adapted for PPD to obtain a clinical diagnosis of major depression. The DIGS is a structured interview for psychiatric disorders developed in 1994 by the National Institute of Mental Health (NIMH) for genetic studies. It is

an interview with a polydiagnostic capacity that allows a detailed evaluation of the course of the illness, chronology of the disorder and comorbidity.

Personality variables were evaluated using the validated Spanish version of the Eysenck Personality Questionnaire-Revised Short Scale EPQ-RS [22], a self-administered questionnaire of 48 items from the 100-item EPQ-R widely used to assess neuroticism (N), psychoticism (P) and extroversion (E). Anxiety traits were evaluated using the Anxiety Trait Inventory (STAI-R) [66], a self-administered questionnaire of 20 items.

Acute life events occurring during the early postpartum period and at weeks 8 and 32 were assessed using the St. Paul Ramsey's Life Events scale [2]. The St. Paul Ramsey's Life Events Scale rates the impact of participants' stressful life events using a seven-point scale of severity. Six different categories of events were considered: primary support, social environment, housing, work, health and economy. The Spanish version of the Duke-UNC Functional Social Support Questionnaire [8] was used to evaluate perceived functional social support.

Coping strategies were assessed with the brief COPE [15], Spanish version [18], which consists of 14 scales. We classified coping strategies as active/approach versus passive/avoidance [10,67,26]. Passive/avoidant coping involves cognitive attempts to actively avoid confronting problems and/or behaviours to indirectly reduce emotional stress through such conduct. Meanwhile, active coping refers to cognitive and behavioural attempts to directly manage problems and their effects [10]. Active coping strategies include activities, planning, positive reframing, humour, acceptance, emotional support and instrumental support. Passive/avoidant coping strategies include resignation, self-distraction, denial, religion, substance use, self-blame and emotional discharge. Those criteria were then grouped together [16]: active behavioural (active coping and planning), passive behaviour (behavioural disengagement and self-distraction), active emotional (emotional support and instrumental support), passive emotional (venting), active cognitive (positive reframing, humour and acceptance) and passive cognitive (denial, religion, substance use and self-blame). Examples of items for passive coping strategies are: "I've been saying to myself this isn't real" (denial), "I've been criticizing myself" (self-blame), "I've been using alcohol or other drugs to make myself feel better" (substance use) and "I've been saying things to let my unpleasant feelings escape" (venting). Examples of items for active coping strategies are: "I've been concentrating my efforts on doing something about the situation I'm in" (active coping), "I've been trying to come up with a strategy about what to do" (planning), "I've been trying to see it in a different light, to make it seem more positive" (positive reframing) and "I've been getting help and advice from other people" (instrumental support).

2.3. Statistical analyses

Statistical analyses were conducted using SPSS version 19.0 (SPSS Chicago) and R language (R Development Core Team [2008]. http://www.R-project.org/). We previously assessed the distribution of all variables and transformed those variables that showed skewness. Log transformation (ln) was used of EPDS and STAI-R scales, and a reflected log transformation was used for the Duke Social Support Index. Student's t-test was used to compare continuous variables between two groups (non-depression versus depression).

We conducted a SEM analysis with R using the lavaan package. We considered five latent variables that included information of different psychometric instruments: active coping (cognitive, emotional and behavioural coping strategies), passive coping (cognitive, emotional and behavioural coping strategies), social

Table 1
Evaluations in each time of study.

Scale	Baseline	8th weeks	32nd weeks
DIGS		X	X
EPDS	X	X	X
DUKE	X	X	X
COPE	X		
STAI-T	X		
RAMSEY	X	X	X
EPQ-R	X		

DIGS: Diagnostic Interview for Genetic Studies; EPDS: Edinburgh postpartum depression scale; DUKE: Functional Social Support Questionnaire; COPE: Coping strategies; STAI-T: State-Trait Anxiety Inventory – Trait scale; RAMSEY: St. Paul Ramsey's life events scale; EPQ-R: Eysenck Personality Questionnaire – Revised.

support (duke social support index), life stress (number of stressful life events close to delivery and perceived stress [Ramsey score]) and neuroticism (STAI-R and EPQ-N). All latent variables' variances were set equal to 1 in order to standardise the SEM model. We considered two dependent variables (postpartum mood symptoms at 8th week and 32nd week) based on EPDS scores at each visit. We used the Comparative Fit Index (CFI) as a measure of the fit of the model. Values greater than approximately 0.90 indicate reasonably good fit of the SEM model [34]. Root Mean Square Error of Approximation (RMSEA) was used to assess error of approximation. RMSEA ≤ 0.5 indicate close approximate fit, and values between 0.05 and 0.08 suggest reasonable error of approximation.

We first conducted an SEM analysis in the whole sample ($n = 1626$). However, as we wanted to also explore whether the theoretical model was also valid for those women who developed a PPD, we conducted another SEM analysis in a subsample of women with a PPD ($n = 161$).

3. Results

3.1. Description of the sample

In this study, 1626 women participated, 1282 women (78.84%) remained in the study at week 8, and 1231 women (75.70%) remained at week 32. We compared those women who dropped-out with those who were retained in the study, and the group that dropped-out was younger and with greater depressive symptoms (data not shown). There were no other clinical differences between groups.

The total sample ($n = 1626$) had a mean age of 31.8 (SD = 4.6). Clinical information and demographic data are shown in Table 2. The mean EPDS score was 5.4 (SD = 4.7) at 8 weeks postpartum and 4.4 (SD = 4.7) at 32 weeks postpartum. The prevalence of significant depressive symptoms (defined as EPDS > 9) was 15.5% at the 8th week postpartum and 12.7% at the 32nd week postpartum. The prevalence of major depression according to the DIGS interview was 6.2% at week 8 and 6.8% at week 32. Considering both visits, 9.9% of women had major depression at one of the two visits. There was an overlap of 3.1% of women who had major depression at 8 and 32 weeks.

There were significant differences between women with and without major depression according to the DIGS scores in all analysed variables (Table 3), except age and active coping. Therefore, women with depression scored significantly higher in passive coping (both cognitive and behavioural), in measurements of depressive symptoms with the EPD, anxiety trait and subjective

stress. They reported lower social support. These women also scored higher on neuroticism.

3.2. Structural Equation Modelling analysis

In the SEM analysis conducted in all women (Fig. 2), passive coping strategies were positively associated with postpartum depressive symptoms at 8th and 32nd week, and active coping strategies were negatively associated with postpartum depressive symptoms at 8th week (but not 32nd week). Increased social support and life stress were associated with both active and passive coping strategies. Neuroticism was associated with more passive coping strategies and less active coping strategies. Neuroticism and life stress were positively correlated, and social support was negatively correlated with life stress and neuroticism. All regressions shown on Fig. 2 were statistically significant with the exception of the relationship between active coping and postpartum depressive symptoms at the 32nd week.

In the SEM analysis conducted in those women with a clinical diagnosis of major PPD (Fig. 3), passive coping strategies were associated with postpartum depressive symptoms at both visits (8th and 32nd weeks) whereas active coping strategies were not significantly associated with postpartum depressive symptoms. Neuroticism was associated with more passive coping strategies and less active coping strategies. Life stress was associated with both active and passive coping strategies. Social support was not associated with active or passive coping strategies. The relationships between life stress, social support and neuroticism were comparable to those found in the previous model (in all participants). The CFI index of both SEM analyses was 0.90 and the RMSEA were 0.08.

4. Discussion

The aim of our study was to analyse together some of the coping resources implicated in PPD. Using SEM statistical approach

Table 2
Characteristics of women ($n = 1626$).

Age (mean, SD)	31.8 (4.6)
Educational level (%)	
Primary school	29.6
Secondary school	41.7
College degree	28.4
Parity (primiparous) (%)	47
Employed (%)	67.9
Marital status	
Married or paired (%)	96.2
Some medical condition during pregnancy (%)	17
Complications during pregnancy (%)	33
Hospitalisation (%)	7.2
Family history of psychiatric problems (%)	34.8

Table 3
Clinical and personality variables in women with or without postpartum depression.

	Postpartum depression[a] $n = 161$	Without postpartum depression $n = 1465$	P
Age (years)	31.65 (5.10)	31.79 (4.60)	0.726
Active coping strategies (global score)	36.59 (5.41)	36.77 (6.21)	0.743
Active behavioral coping	11.19 (2.03)	11.08 (2.30)	0.554
Active cognitive coping	14.80 (2.81)	15.06 (3.12)	0.325
Active emotional coping	10.59 (2.38)	10.61 (2.74)	0.893
Passive coping strategies (global score)	25.09 (4.57)	23.53 (4.45)	< 0.001
Passive behavioral coping	7.56 (2.03)	6.89 (1.89)	< 0.000
Passive cognitive coping	12.70 (2.86)	12.04 (2.72)	0.003
Passive emotional coping	4.82 (1.41)	4.60 (1.48)	0.071
EPDS score (8th week)	12.12 (6.13)	4.52 (3.66)	< 0.001
EPDS score (32nd week)	9.59 (6.75)	3.74 (3.85)	< 0.001
STAI-T	30.60 (8.13)	25.19 (6.93)	< 0.000
St. Paul Ramsey (baseline)	9.63 (3.13)	8.02 (2.79)	< 0.001
St. Paul Ramsey (8th week)	10.16 (2.64)	8.06 (2.17)	< 0.001
St. Paul Ramsey (32nd week)	10.25 (2.74)	7.91 (1.91)	< 0.001
Duke-UNC score social support	45.83 (7.29)	48.17 (6.47)	< 0.000
Neuroticism EPQ-R	5.60 (3.52)	3.36 (2.79)	< 0.001

EPDS: Edinburgh Postnatal Depression Scale; STAI-T: State-Trait Anxiety Inventory – Trait scale; DIGS: Diagnostic Interview for Genetic Studies; EPQ-R: Eysenck Personality Questionnaire – Revised.
Data are means (SD).
[a] Clinical postpartum depression during the first 32 weeks postpartum was assessed with the DIGS.
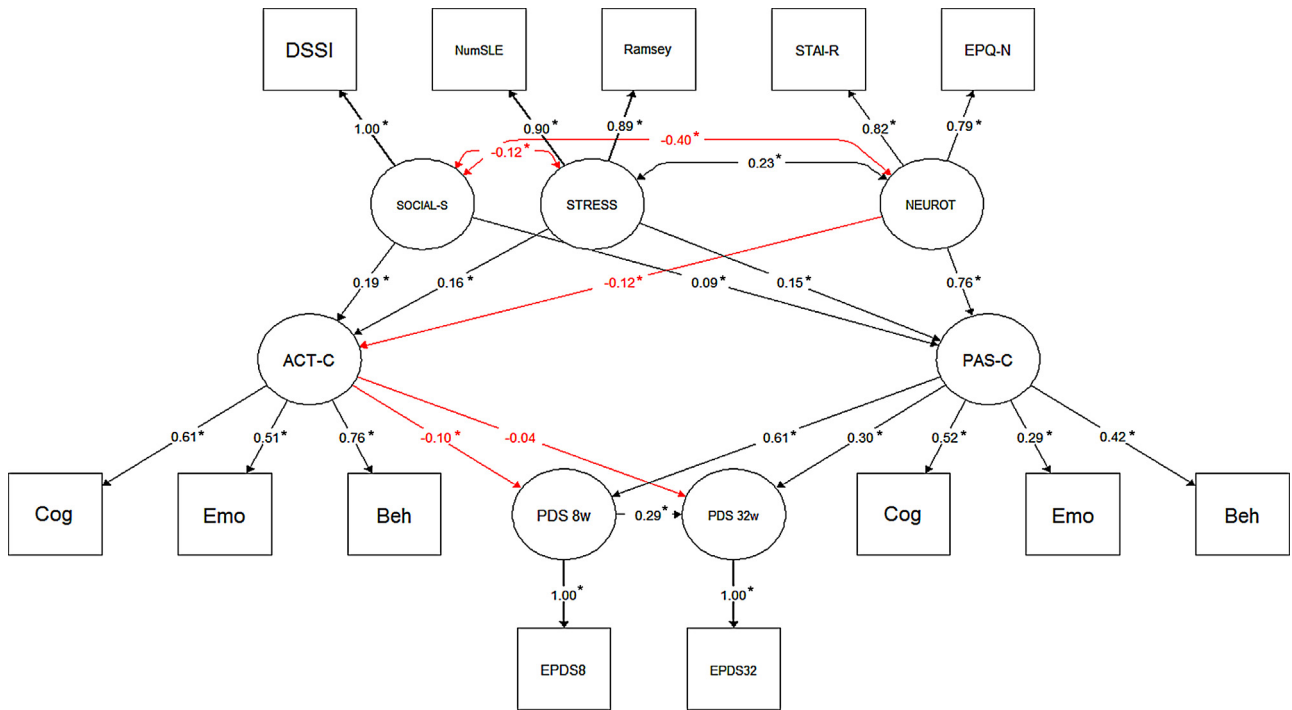
Fig. 2. Structural equation modelling analysis of the relationship between coping strategies and postpartum depressive symptoms in all women (*n* = 1465). DSSI: Duke Social Support Index; NumSLE: number of stressful life events; Ramsey: St. Paul Ramsey's life events perceived stress score; STAI-T: State-Trait Anxiety Inventory – Trait scale; EPQ-N: Eysenck Personality Questionnaire – Neuroticism; SOCIAL-S: Social support; STRESS: stressful life events; NEUROT: neuroticism; ACT-C: active coping; PAS-C: passive coping; Cog: cognitive; Emo: emotional; Beh: behavioural; PDS 8w: postpartum depressive symptoms (8 weeks); PDS 32w: postpartum depressive symptoms (32 weeks); EPDS8: Edinburgh postpartum depression scale (8 weeks); EPDS32: Edinburgh postpartum depression scale (32 weeks). Black lines represent positive associations and red lines represent negative associations. Significant associations (*P* < 0.05) are indicated with an asterisk.
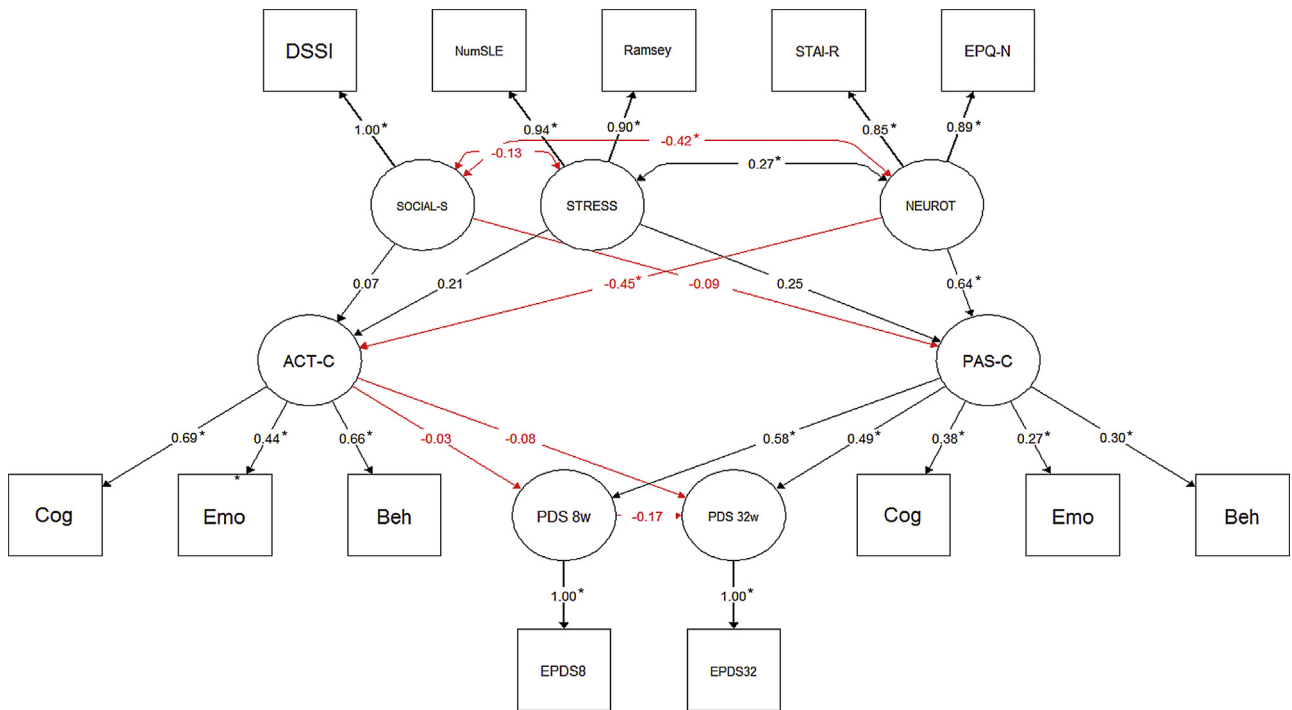

Fig. 3. Structural equation modelling analysis of the relationship between coping strategies and postpartum depressive symptoms in women with clinical postpartum depression (*n* = 161). DSSI: Duke Social Support Index; NumSLE: number of stressful life events; Ramsey: St. Paul Ramsey's life events perceived stress score; STAI-T: State-Trait Anxiety Inventory – Trait scale; EPQ-N: Eysenck Personality Questionnaire – neuroticism; SOCIAL-S: social support; STRESS: stressful life events; NEUROT: neuroticism; ACT-C: active coping; PAS-C: passive coping; Cog: cognitive; Emo: emotional; Beh: behavioural; PDS 8w: postpartum depressive symptoms (8 weeks); PDS 32w: postpartum depressive symptoms (32 weeks); EPDS8: Edinburgh postpartum depression scale (8 weeks); EPDS32: Edinburgh postpartum depression scale (32 weeks). Black lines represent positive associations and red lines represent negative associations. Significant associations (*P* < 0.05) are indicated with an asterisk.

allowed us to examine complex pathways that explain with greater parsimony depressive postpartum symptomatology. Our results show a strong association between passive coping strategies and depressive symptoms at weeks 8 and 32 both in the whole sample and in the PPD group. These results agree with previous studies that highlight the importance of strategies for coping with postpartum stress in particular. Associations were stronger for early postpartum depressive symptoms (at week 8) when compared to late postpartum depressive symptoms (at week 32). As women with early postpartum depressive symptoms may receive medical care that improves these symptoms at the last visit (week 32), the strongest relationships between coping strategies and EPDS scores at week 8 may be explained by a greater severity of depressive symptoms in the early postpartum. In accordance with this, as it is described in Table 2, women with postpartum depression had more severe postpartum depressive symptoms at week 8 (mean EPDS score of 12.2) when compared to week 32 (mean EPDS score of 9.6). Under normal circumstances, pregnant women make the best use of strategies by focusing on their problem [35,56] or by using active coping. However, in a prospective 10-year study, Holahan et al. [30] demonstrated that avoidant coping at the beginning of the study was associated with more acute and chronic stress 4 years later. In a recent review [59], emotional coping strategies (a type of avoidant coping) were consistently related to depression during pregnancy and postpartum.

SEM analysis revealed that passive coping strategies were more clearly associated with postpartum depressive symptoms, when compared to active coping strategies. Of all different independent variables that had an influence on coping strategies (social support, life stress and neuroticism), neuroticism had a stronger effect on coping strategies (more passive copy strategies; less active coping strategies). Life stress and social support were also associated with coping, although the effect was weaker. All these findings suggest that neuroticism is a key variable in the relationship between coping strategies and postpartum depressive symptoms. The CFI of all SEM models (in all participants and in women with PPD) were 0.90. A value of CFI $\geq$ 0.95 is recognized as indicative of good fit, and values close to 0.90 are considered to be acceptable [32]. Thus, the proposed theoretical SEM model for postpartum depressive symptoms seems to be relatively valid.

Our results are in accordance with previous studies reporting that high levels of neuroticism are related to the risk of depression [54,4] and in particular to PPD [45]. Women with negative cognitive attributional styles (e.g., pessimism, anger, ruminations), previously shown to be good indicators of depression [4], were more likely to develop PPD [54].

Our results associate a lower use of adaptive strategies with higher neuroticism and depression. A high score for neuroticism itself involves negative emotionality, self-consciousness, physiological reactivity to stress and behavioural inhibition [47,49,62]. This trait predicts exposure to interpersonal relationship problems and the tendency to evaluate events as highly threatening and to relieve unpleasant arousal with strategies that include disengagement from threats [17]. Recurrent negative emotions in highly neurotic women have been associated with ineffective coping [73], which could increase levels of stress in certain circumstances. Similarly, women with high neuroticism have more chronic feelings of guilt and frustration [46], with many consequences for self-esteem and worse perceived self-efficacy.

In our sample, women with PPD reported lower social support in line with previous studies [54,5]. The beneficial effect of social support has been shown with different coping resources. In this way, women who perceive themselves as being adequately supported are more likely to report personal competence, better coping behaviours, a sense of stability, increased self-esteem and

fewer feelings of anxiety and depression [29,37,42]. Personality traits may influence coping styles. Pierce et al. [57] report that perceived support primarily reflects the personality of the perceiver. In fact, as in our results neuroticism is one of the variables that relate to social support in other studies. Sarason et al. [64] found that satisfaction with social support correlated negatively with neuroticism. Swickert et al. [68] found that higher extroversion and lower neuroticism relate to perceived availability of social support.

In conclusion, our results suggest that passive and avoidant coping strategies are related to major depressive symptoms postpartum. The perceived social support and subjective stress related to life events are related to depression but moderated by a strong negative effect of dispositional dimension of neuroticism.

Our study has several strengths:

- the results are based on a large, well-characterised sample of the general population without a previous history of psychiatric disorder;
- the study has a prospective design with a follow-up period of 32 weeks postpartum with assessments of PPD symptoms at 8 and 32 postpartum weeks. Recently Vliegen et al. [70], in a review of the course of postpartum depression, found that the severity of the depression (mean level of depression) in mothers with PPD decreased at different time points in the postpartum period, but not always to a nondepressed level (below the cutoff), and that the decrease is not always statistically significant;
- we included an assessment of major depression with a structured interview (DIGS);
- we included common variables considered in relation to stress and depressive symptomatology, such as personality, social support, coping strategies and stressful events.

However, because we exclude women with psychiatric disorders requiring medical treatment before or during pregnancy, this could be considered a selection bias, which could partially limit the generalisation of our findings in other populations. There were about 20% of dropouts at the second visit. These women were younger and had greater depressive symptoms, which could have an impact on the results, particularly in those analyses related to women with clinical postpartum depression. It could be considered a limitation that we did not include some PPD risk factors (e.g. biological factors, obstetric complications, family history of depression) in the SEM analyses. However, as our study was focused on coping strategies as risk factors for PPD, we opted to include neuroticism, social support and perceived stress as covariates.

Our results corroborate the need for preventive interventions into coping resources of the mother. Changing coping strategies through psychoeducational programs is one of the most effective approaches for preventing vulnerability to stress in patients at risk for developing depression after childbirth. Psychological group therapy and social support added to standard antenatal/postnatal care are recommended by NICE guidance [51] in women with identified psychosocial risk factors and/or sub-threshold depressive symptoms in the antenatal period.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

PI0411761, PI041791, PI041766 and PI041782), as well as the Spanish Psychiatric Genetics and Genotyping network G03/184, RTA (RD06/001/1009), and Generalitat de Catalunya (SGR2009/1435).

References

[1] Asselmann E, Wittchen H-U, Lieb R, Höfler M, Beesdo-Baum K. Does low coping efficacy mediate the association between negative life events and incident psychopathology? A prospective-longitudinal community study among adolescents and young adults. Epidemiol Psychiatr Sci 2015;25:1–10.

[2] Baca-Garcia E, Parra CP, Perez-Rodriguez MM, Sastre CD, Torres RR, Saiz-Ruiz J, et al. Psychosocial stressors may be strongly associated with suicide attempts. Stress Heal 2007;23(3):191–8.

[3] Bagner DM, Pettit JW, Lewinsohn PM, Seeley JR. Effect of maternal depression on child behavior: a sensitive period? J Am Acad Child Adolesc Psychiatry 2010; 49(7):699–707.

[4] Barnett PA, Gotlib IH. Psychosocial functioning and depression: distinguishing among antecedents, concomitants, and consequences. Psychol Bull 1988; 104(1):97–126.

[5] Beck CT. A meta-analysis of predictors of postpartum depression. Nurs Res 1996;45(5):297–303.

[6] Beck CT. The effects of postpartum depression on child development: a meta-analysis. Arch Psychiatr Nurs 1998;12(1):12–20.

[7] Beck CT. Predictors of postpartum depression: an update. Nurs Res 2001;50(5):275–85.

[8] Bellón Saameño JA, Delgado Sánchez A, Luna del Castillo JD, Lardelli Claret P. Validity and reliability of the Duke-UNC-11 questionnaire of functional social support. Aten Primaria 1996;18(4):153–6 [158–63].

[9] Besser A, Priel B. Trait vulnerability and coping strategies in the transition to motherhood. Curr Psychol 2003;22(1):57–72.

[10] Billings AG, Moos RH. The role of coping responses and social resources in attenuating the stress of life events. J Behav Med 1981;4(2):139–57.

[11] Bloch M, Rotenberg N, Koren D, Klein E. Risk factors associated with the development of postpartum mood disorders. J Affect Disord 2005;88(1):9–18.

[12] Bolger N. Coping as a personality process: a prospective study. J Pers Soc Psychol 1990;59(3):525–37.

[13] Britton JR. Maternal anxiety: course and antecedents during the early postpartum period. Depress Anxiety 2008;25(9):793–800.

[14] Brockington I. Postpartum psychiatric disorders. Lancet 2004;363(9405):303–10.

[15] Carver CS. You want to measure coping but your protocol's too long: consider the brief COPE. Int J Behav Med 1997;4(1):92–100.

[16] Carver CS, Scheier MF, Weintraub JK. Assessing coping strategies: a theoretically based approach. J Pers Soc Psychol 1989;56(2):267–83.

[17] Connor-Smith JK, Flachsbart C. Relations between personality and coping: a meta-analysis. J Pers Soc Psychol 2007;93(6):1080–107.

[18] Crespo M, Cruzado JA. La evaluación del afrontamiento: adaptación española del cuestionario COPE con una muestra de estudiantes universitarios. Anal Modif Conduct 1997;23:797–830.

[19] Da Costa D, Larouche J, Dritsa M, Brender W. Psychosocial correlates of prepartum and postpartum depressed mood. J Affect Disord 2000;59(1):31–40.

[20] De Tychey C, Spitz E, Briançon S, Lighezzolo J, Girvan F, Rosati A, et al. Pre- and postnatal depression and coping: a comparative approach. J Affect Disord 2005;85(3):323–6.

[21] Dennis C-L, Ross L. Women's perceptions of partner support and conflict in the development of postpartum depressive symptoms. J Adv Nurs 2006;56(6):588–99.

[22] Eysenck HJ, Eysenck SBG. Cuestionario revisado de personalidad de Eysenck: versiones completa (EPQ-R) y abreviada (EPQ-RS) [Eysenck Personality Questionnaire-Revised: Full Version (EPQ-R) and Short (EPQ-RS)]. Madrid: TEA; 2001.

[23] Faisal-Cury A, Tedesco JJA, Kahhale S, Menezes PR, Zugaib M. Postpartum depression: in relation to life events and patterns of coping. Arch Womens Ment Health 2004;7(2):123–31.

[24] Gao L-L, Chan SW, Mao Q. Depression, perceived stress, and social support among first-time Chinese mothers and fathers in the postpartum period. Res Nurs Health 2009;32(1):50–8.

[25] Garcia-Esteve L, Ascaso C, Ojuel J, Navarro P. Validation of the Edinburgh Postnatal Depression Scale (EPDS) in Spanish mothers. J Affect Disord 2003; 75(1):71–6.

[26] Gavin NI, Gaynes BN, Lohr KN, Meltzer-Brody S, Gartlehner G, Swinson T. Perinatal depression: a systematic review of prevalence and incidence. Obstet Gynecol 2005;106(5 Pt 1):1071–83.

[27] Georgiopoulos AM, Bryan TL, Wollan P, Yawn BP. Routine screening for postpartum depression. J Fam Pract 2001;50(2):117–22.

[28] Guardino CM, Schetter CD. Coping during pregnancy: a systematic review and recommendations. Health Psychol Rev 2014;8(1):70–94.

[29] Hall LA, Kotch JB, Browne D, Rayens MK. Self-esteem as a mediator of the effects of stressors and social resources on depressive symptoms in postpartum mothers. Nurs Res 1996;45(4):231–8.

[30] Holahan CJ, Moos RH, Holahan CK, Brennan PL, Schutte KK. Stress generation, avoidance coping, and depressive symptoms: a 10-year model. J Consult Clin Psychol 2005;73(4):658–66.

[31] Honey KL, Bennett P, Morgan M. Predicting postnatal depression. J Affect Disord 2003;76(1–3):201–10.

[32] Hooper D, Coughlan J, Mullen M. Structural equation modelling: guidelines for determining model fit. Electron J Bus Res Methods 2008;6(1):53–60.

[33] Howell EA, Mora P, Leventhal H. Correlates of early postpartum depressive symptoms. Matern Child Health J 2006;10(2):149–57.

[34] Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct Equ Model A Multidiscip J 1999;6(1):1–55 [Taylor & Francis Group].

[35] Huizink AC, de Medina PGR, Mulder EJH, Visser GHA, Buitelaar JK. Coping in normal pregnancy. Ann Behav Med 2002;24(2):132–40.

[36] Hung C-H. Predictors of postpartum women's health status. J Nurs Scholarsh 2004;36(4):345–51.

[37] Hung CH, Chung HH. The effects of postpartum stress and social support on postpartum women's health status. J Adv Nurs 2001;36(5):676–84.

[38] Jacobsen T. Effects of postpartum disorders on parenting and on offspring. In: Miller LJ, editor. Postpartum mood disorders. Washington, DC: American Psychiatric Association; 1999. p. 119–39.

[39] Johnstone SJ, Boyce PM, Hickey AR, Morris-Yatees AD, Harris MG. Obstetric risk factors for postnatal depression in urban and rural community samples. Aust N Z J Psychiatry 2001;35(1):69–74.

[40] Josefsson A, Angelsiöö L, Berg G, Ekström C-M, Gunnervik C, Nordin C, et al. Obstetric, somatic, and demographic risk factors for postpartum depressive symptoms. Obstet Gynecol 2002;99(2):223–8.

[41] Lakey B, Cronin A. Low social support and major depression. Research, theory and methodological issues. Risk factors in depression. San Diego, CA: Elsevier Inc.; 2008.

[42] Leahy Warren P. First-time mothers: social support and confidence in infant care. J Adv Nurs 2005;50(5):479–88.

[43] Leung SSK, Martinson IM, Arthur D. Postpartum depression and related psychosocial variables in Hong Kong Chinese women: findings from a prospective study. Res Nurs Health 2005;28(1):27–38.

[44] Logsdon MC, Usui W. Psychosocial predictors of postpartum depression in diverse groups of women. West J Nurs Res 2001;23(6):563–74.

[45] Martín-Santos R, Gelabert E, Subirà S, Gutierrez-Zotes A, Langorh K, Jover M, et al. Research letter: is neuroticism a risk factor for postpartum depression? Psychol Med 2012;42(7):1559–65.

[46] McCrae RR. The five-factor model and its assessment in clinical settings. J Pers Assess 1991;57(3):399–414.

[47] McCrae RR, John OP. An introduction to the five-factor model and its applications. J Pers 1992;60(2):175–215.

[48] McWilliams LA, Cox BJ, Enns MW. Use of the Coping Inventory for Stressful Situations in a clinically depressed sample: factor structure, personality correlates, and prediction of distress. J Clin Psychol 2003;59(4):423–37.

[49] Miles J, Hempel S. The Eysenck personality scales: the Eysenck Personality Questionnaire-Revised (EPQ-R) and the Eysenck Personality Profiler (EPP). In: Hersen M, Hilsenroth M, Segal D, editors. Comprehensive handbook of psychological assessment: personality assessment, Vol 2. New York: Wiley; 2003. p. 99–107.

[50] Morling B, Kitayama S, Miyamoto Y. American and Japanese women use different coping strategies during normal pregnancy. Pers Soc Psychol Bul 2003;29(12):1533–46.

[51] National Collaborating Centre for Mental Health. Antenatal and postnatal mental health. The NICE guideine on clinical management. Leicester (UK): British Psychological Society; 2007.

[52] Nurnberger JI, Blehar MC, Kaufmann CA, York-Cooler C, Simpson SG, Harkavy-Friedman J, et al. Diagnostic interview for genetic studies. Rationale, unique features, and training. NIMH Genetics Initiative. Arch Gen Psychiatry 1994;51(11):849–59 [discussion 863–4].

[53] O'Hara MW, Rehm LP, Campbell SB. Postpartum depression. A role for social network and life stress variables. J Nerv Ment Dis 1983;171(6):336–41.

[54] O'Hara MW, Swain AM. Rates and risk of postpartum depression – a meta-analysis. Int Rev Psychiatr 1996;8:37–54.

[55] Pakenham KI, Smith A, Rattan SL. Application of a stress and coping model to antenatal depressive symptomatology. Psychol Health Med 2007;12(3):266–77.

[56] Peñacoba-Puente C, Carmona-Monge FJ, Marín-Morales D, Naber K. Coping strategies of Spanish pregnant women and their impact on anxiety and depression. Res Nurs Health 2013;36(1):54–64.

[57] Pierce GR, Lakey B, Sarason IG, Sarason BR, Joseph H. Personality and social support processes: a conceptual overview. In: Pierce GR, Lakey B, Sarason IG, Sarason BR, editors. Sourcebook of social support and personality. New York: Plenum Press; 1997. p. 3–18.

[58] Podolska MZ, Bidzan M, Majkowicz M, Podolski J, Sipak-Szmigiel O, Ronin-Walknowska E. Personality traits assessed by the NEO Five-Factor Inventory (NEO-FFI) as part of the perinatal depression screening program. Med Sci Monit 2010;16(9):PH77–81.

[59] Razurel C, Kaiser B, Sellenet C, Epiney M. Relation between perceived stress, social support, and coping strategies and maternal well-being: a review of the literature. Women Health 2013;53(1):74–99.

[60] Robertson E, Grace S, Wallington T, Stewart DE. Antenatal risk factors for postpartum depression: a synthesis of recent literature. Gen Hosp Psychiatry 2004;26(4):289–95.

[61] Roca M, Martin-Santos R, Saiz J, Obiols J, Serrano MJ, Torrens M, et al. Diagnostic Interview for Genetic Studies (DIGS): inter-rater and test-retest reliability and validity in a Spanish population. Eur Psychiatry 2007;22(1):44–8.

[62] Rothbart MK, Hwang J. Temperament and the development of competence and motivation. In: Elliot AJ, Dweck CS, editors. Handbook of competence and motivation. New York: Guilford; 2005. p. 167–84.

[63] Sanjuan J, Martin-Santos R, Garcia-Esteve L, Carot JM, Guillamat R, Gutierrez-Zotes A, et al. Mood changes after delivery: role of the serotonin transporter gene. Br J Psychiatry 2008;193(5):383–8.

[64] Sarason BR, Shearin EN, Pierce GR, Sarason IG. Interrelations of social support measures: theoretical and practical implications. J Pers Soc Psychol 1987;52(4):813–32.

[65] Soliday E, McCluskey-Fawcett K, O'Brien M. Postpartum affect and depressive symptoms in mothers and fathers. Am J Orthopsychiatry 1999;69(1):30–8.

[66] Spielgberger CD, Gorsuch R, Lushene R, Vagg PR, Jacobs GA. Manual for the State-Trait Anxiety Inventory. Palo Alto, CA: Consulting Psychologists Press; 1983.

[67] Suls J, Fletcher B. The relative efficacy of avoidant and nonavoidant coping strategies: a meta-analysis. Health Psychol 1985;4(3):249–88.

[68] Swickert RJ, Hittner JB, Foster A. Big five traits interact to predict perceived social support. Pers Individ Di 2010;48(6):736–41.

[69] Taylor SE, Stanton AL. Coping resources, coping processes, and mental health. Annu Rev Clin Psychol 2007;3:377–401.

[70] Vliegen N, Casalin S, Luyten P. The course of postpartum depression: a review of longitudinal studies. Harv Rev Psychiatry 2014;22(1):1–22.

[71] Wang S-Y, Chen C-H. Psychosocial health of Taiwanese postnatal husbands and wives. J Psychosom Res 2006;60(3):303–7.

[72] Wang Z, Gan Y. Coping mediates between social support, neuroticism, and depression after earthquake and examination stress among adolescents. Anxiety Stress Coping 2011;24(3):343–58.

[73] Watson D, Pennebaker JW. Health complaints, stress, and distress: exploring the central role of negative affectivity. Psychol Rev 1989;96(2):234–54.

[74] Wells JD, Hobfoll SE, Lavin J. Resource loss, resource gain, and communal coping during pregnancy among women with multiple roles. Psychol Women Q 1997;645–62.

[75] Wills TA. Social support and interpersonal relationships. In: Clark MS, editor. Prosocial behavior. Newbury park, CA: Sage; 1991. p. 265–89.

[76] Wisner KL, Parry BL, Piontek CM. Clinical practice. Postpartum depression. N Engl J Med 2002;347(3):194–9.