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The Effect of Postpartum Depression and Current Mental Health Problems of the Mother on Child Behaviour at Eight Years

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Abstract *Background* Maternal postpartum depression (PPD) could affect children's emotional development, increasing later risk of child psychological problems. The aim of our study was to assess the association between child's emotional and behavioural problems and mother's PPD, considering maternal current mental health problems (CMP). *Methods* This is a secondary analysis from the EU-Childhood Obesity Project (NCT00338689). Women completed the Edinburgh Postnatal Depression Scale (EPDS) at, 2, 3 and 6 months after delivery and the General Health Questionnaire (GHQ-12) to assess CMP once the children reached the age of 8 years. EPDS scores > 10 were defined as PPD and GHQ-12 scores > 2 were defined as CMP. The psychological problems of the children at the age of eight were collected by mothers through the Child's Behaviour Checklist (CBCL). *Results* 473, 474 and 459 mothers filled in GHQ-12 and CBCL tests at 8 years and EPDS at 2, 3 and 6 months, respectively. Anxiety and depression was significantly increased by maternal EPDS. Children whose mothers had both PPD and CMP exhibited the highest levels of psychological problems, followed by those whose mothers who had only CMP and only PPD. PPD and CMP had a significant effect on child's total psychological problems ($p = 0.033$, $p < 0.001$, respectively). Children whose mothers had PPD did not differ from children whose mothers did not have any depression. *Conclusions* Maternal postpartum depression and current mental health problems, separately and synergistically, increase children's psychological problems at 8 years.

Keywords Children behaviour problems · Maternal depression · Postpartum · Nutrimenthe · Early programming

Significance

Infants' exposure to postpartum depression during early development could have adverse long-term effects on emotional and behavioural functioning.

Maternal postpartum depression at 3 months of age of the infant was associated with child's Total, Internalizing and Externalizing problems at 8 years, suggesting that 3 months may be the most vulnerable period.

Children whose mothers presented postpartum depression and later mental health problems had worse scores than children whose mothers presented only postpartum depression at 3 months, without mental problems later.

Postpartum depression could have a long term effect on child behaviour problems when the emotional problems of the mother persist.

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Introduction

The current classification system defines postpartum depression not as a discrete disorder but as a sub-category of major depressive disorder (APA 2000, 2013; Organization, 1992). Postpartum depression is characterized by sadness or lost of interest, including poor concentration, appetite disturbance, sleep deficit beyond that required for care of the baby, lack of or excessive concern for the baby, constant fatigue and anxiety or irritability.

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), postpartum depression is a specific episode with a "peripartum onset", defined as "the most recent episode occurring during pregnancy as well as in the 4 weeks following delivery" (A. P. Association, 2013). There are controversial opinions about the time frame during which a depressive episode might be considered postpartum depression. Several authors propose extending this time frame from 4 weeks to 3 months (Andrews-Fike 1999) or to 6 months, but the evidence is not compelling (O'Hara and McCabe 2013).

Published studies showed that maternal postpartum depression affects approximately 10–15% of recently delivered women (Gavin et al. 2005; O'hara and Swain 1996), but there are wide ranges of prevalence depending on the criteria used to diagnose and in different countries. Thus, Halbreich and Karkun (2006) reported rates of almost 60% in Guyana and Taiwan (Halbreich and Karkun 2006). Postpartum depression is diagnosed clinically, however, in research, it is usually identified by using screening tools, for example, the Edinburgh Postnatal Depression Scale (EPDS) (Cox et al. 1987), which proposed a cut-off level of 10 when the EPDS is used for screening purposes in the postnatal period.Maternal postpartum depression is an important mental health issue that affects women and their families, including the newborn (Brockington 2004). The importance of maternal postpartum depression lies in the fact that it occurs within the period of mother–child bonding and the newborn emotional regulation (Sullivan et al. 2011). This timing represents a "sensitive period" for the infant, during which the stimulation and optimization of learning opportunities depend on the primary caretaker (Essex et al. 2001). Infants' exposure to postpartum depression during this stage of development could have adverse long-term effects on the cognitive and behavioural functioning of the child (Hay et al. 2003; Luoma et al. 2001; Murray et al. 1999). Therefore, not only maternal morbidity and mortality by postpartum depression should be considered, but also the effect of postpartum depression on the mother-baby interaction, and how this interaction could affect the child development should be explored (Brockington 2004; Grace et al. 2003).

Korhonen et al. found a relation between maternal postpartum depression and child's social competence at 16–17 years (Korhonen et al. 2012). Some authors found that infants born to women who suffered postpartum depression during the first year of life had higher behavioural problem indices at 6–8 and 8–9 years of life respectively (Fihrer et al. 2009; Luoma et al. 2001).

A recent study showed that children of women with subclinical depressive symptoms and increasing and persistently high depressive symptoms had, at least, two times more emotional and behavioural difficulties at 4 years than children whose mothers had minimal depressive symptoms (Giallo et al. 2015).

Josefsson and Sydsjö assessed the effect of maternal postpartum depression and also the women's mental health problems that occurred later, when the child's behaviour was assessed (at age 4 years). They found that current maternal depression had a stronger effect on the child's behavioural problems than postpartum depression, and described a significant interaction between postpartum and current maternal depression that affected the child's behaviour problems (Josefsson and Sydsjo 2007).

In this scenario we identify an open question: is it really a long-lasting effect of postpartum depression itself? Or is postpartum depression affecting child's health only among women predisposed to have mental health problems? In this sense, it would not be only important to screen for postpartum depression symptoms, but also to monitor the maternal emotional status within the paediatric care during child development.

We hypothesized that postpartum depression manifestations may have long-term effects on the child's behaviour if the child's mother tends to suffer from mental health problems later in life.

The aim of our study was to examine the effect of maternal postpartum depression and maternal current mental health problems on child behaviour problems at 8 years.

Methods

Design and Study Population

This study used data from a randomized controlled multicenter study assessing the effect of higher- vs lower-protein formula on overweight and obesity later in childhood. Detailed information about the study was published elsewhere (Koletzko et al. 2005, 2009). This study was conducted in five European countries: Germany, Belgium, Italy, Poland, and Spain and the participants were healthy, singleton, and term infants born between October 2002 and July 2004. For this study, data from children in the interventional groups (high and low protein formula fed infants)

and the observational group (breastfed infants) were combined.

Materials and Methods

For the purposes of this study we have used data collected from women whose child participated in the study. They were asked to complete the Edinburgh Postnatal Depression Scale (EPDS) (Cox et al. 1987) at study visits 2, 3 and 6 months after delivery. These children were followed up to the age of 8 years, when women filled in a questionnaire on their child's emotional and behavioural problems (Child Behaviour Checklist, CBCL) (Achenbach and Rescorla 2001; Achenbach 1991) and a questionnaire to assess the current mental health of the woman (General Health Questionnaire, GHQ-12) (Goldberg et al. 1997).

Outcome Measures

The CBCL is a widely used instrument, filled in by the parents, that assesses the psychological problems of their children (Achenbach 1991). The problems are classified in eight clinical syndrome scales: Anxious/Depressed, Withdrawn/Depressed, Somatic Complaints, Social Problems, Thought Problems, Attention Problems, Rule Breaking Behaviour and Aggressive Behaviour. This part consists of 113 items with three possible answers (scored as 0–1–2). Also, Internalizing, Externalizing and Total Problems dimensions were calculated; the Anxious/Depressed, Withdrawn/Depressed, and Somatic complaints scales configure the Internalizing dimension. The Rule-Breaking Behaviour and Aggressive Behaviour scales configure the Externalizing dimension. Finally, Total Problems dimension is the sum of scores from all the problems items. CBCL has good reliability with internal coefficients ranging from 0.78 to 0.97 on the Syndrome scales, 0.72–0.91 in the DSM-Oriented scales (Achenbach and Rescorla 2001).

The postpartum depression and the current mental problems of the woman were analysed with the EPDS and the GHQ tests, respectively. The EPDS is a ten items self-reported instrument proposed by Cox, et al. and is one of the most frequently mentioned methods for postpartum depression screening (Cox et al. 1987) (Andrews-Fike 1999). The total score is the sum of the ten items, and each item is scored from 0 to 3. We used scores higher or equal than 10 to identify mothers at risk of being depressed (O'Brien et al. 2004). One study revealed that a cut off point of 10.5 has a high specificity (88.3%) and sensitivity to detect minor and major depressions (73.2 and 92.6% respectively) with this test (Murray and Carothers 1990). The results of Cronbach's alpha coefficient were 0.77 at first weeks and 0.86 at 12–14 weeks after delivery, indicating a satisfactory reliability (Montazeri et al. 2007).

To provide information about the woman's mental well-being, we used the GHQ which has been used both in epidemiological and psychological research, and in clinical practise. We used the shorter version of the GHQ, the GHQ-12 that has become the most widely used scale for assessing short-term changes in mental health and psychological distress (Fernandes and Vasconcelos-Raposo 2013). This questionnaire comprises 12 items to evaluate the common mental state, with main attention to the depression and anxiety areas. Six items are positive and six negative, and each item has four possible response options (scored with 0-0-1-1) (Hankins 2008). The maximum possible score was 12, and a cut off point of three to identify current mental problems was used in accordance with previous publications (Makowska et al. 2002). The reliability estimate of this questionnaire varies between 0.53 and 0.874, depending on the method used (Hankins 2008). A Spanish validation of this questionnaire in adults showed high reliability (Cronbach alpha = 0.86) (Sánchez-López and Dresch 2008).

We classified children in four different groups according to their mothers' mental health (postpartum depression at any time point and/or current mental problems): the first group were children whose mothers had no depression (neither postpartum depression nor current mental problems); the second were children whose mothers had only postpartum depression; the third group were children whose mothers only had current mental problems, but didn't have postpartum depression; and the fourth group were the children whose mothers had both postpartum depression and current mental problems.

Statistics

The descriptive results were expressed as means (± SD) or medians and interquartile ranges (IQR: 25th and 75th percentiles). ANOVA test were used for statistical comparisons among the four groups of children depending on the mother's mental problems, and Pearson's chi-squared test was used for the statistical comparison of the categorical data.

We performed multiple linear regression analyses to show the effects of postpartum depression and current mental health problems on the CBCL scales and subscales. Before running the regression models, we performed a simple linear regression for each CBCL scale, including every single possible confounding variable individually. We then adjusted the multiple linear regression models for each scale only with confounders showing significant associations. The regressions were adjusted by infant's gender, infant's birth weight (Kg), infant's head circumference (cm), maternal smoking during pregnancy, maternal

education level, and current occupation of the woman and country.

We examined the differences between the four groups of children (on the basis of the status of the mother) with the Kruskall-Wallis test and the Mann–Whitney U Test applying the Bonferroni correction for multiple testing, and analysed the interaction between PPD and CMP.

The statistical significance was accepted at $p < 0.05$. The data management and statistical analyses were conducted using the IBM SPSS version 20.0 (IBM Corp., Armonk, NY, USA).

Ethics

The study was performed according to the Declaration of Helsinki II Principles (W. M. Association, 2001) and approved by the local ethics committees. All families were informed about all procedures and signed written consent to participate in the study.

Results

Descriptive Data

From the total 1678 recruited newborns, a total of 1298 mothers completed the EPDS at 2 months, 1241 mothers at 3 months and 1097 at 6 months after delivery. At 8 years 507 mothers completed the GHQ and 526 the CBCL. Of the 491 mothers who had completed the GHQ and the CBCL, 473 mothers also completed the EPDS at 2 months, 474 at 3 months and 459 at 6 months. The detailed number of participants through the study is presented in Fig. 1.

We did not find significant differences in birth weight, head circumference at birth, delivery type and education and occupation of the woman depending on the maternal mental problems (four groups). However, we found significant differences in the distribution of gender and smoking during pregnancy between the four groups (Table 1).

Considering an EPDS score ≥ 10, we found postpartum depression in 19.3% of the women at 2 months, in 12.7% of the women at 3 months and in 12.7% of the women at 6 months. When we analyzed only the women who completed all the questionnaires (EPDS, GHQ and CBCL) we found maternal postpartum depression in 9.6–15.4% depending on the infant's age (2, 3 or 6 months) (data not shown). The percentage of women with postpartum depression at 2, 3 or 6 months did not differ between women who completed only the EPDS questionnaires and women whose children were followed up until the age of 8 years and also completed the GHQ and CBCL questionnaire (data not shown).

Maternal postpartum depression significantly correlated to later maternal mental health problems ($r = 0.261$,

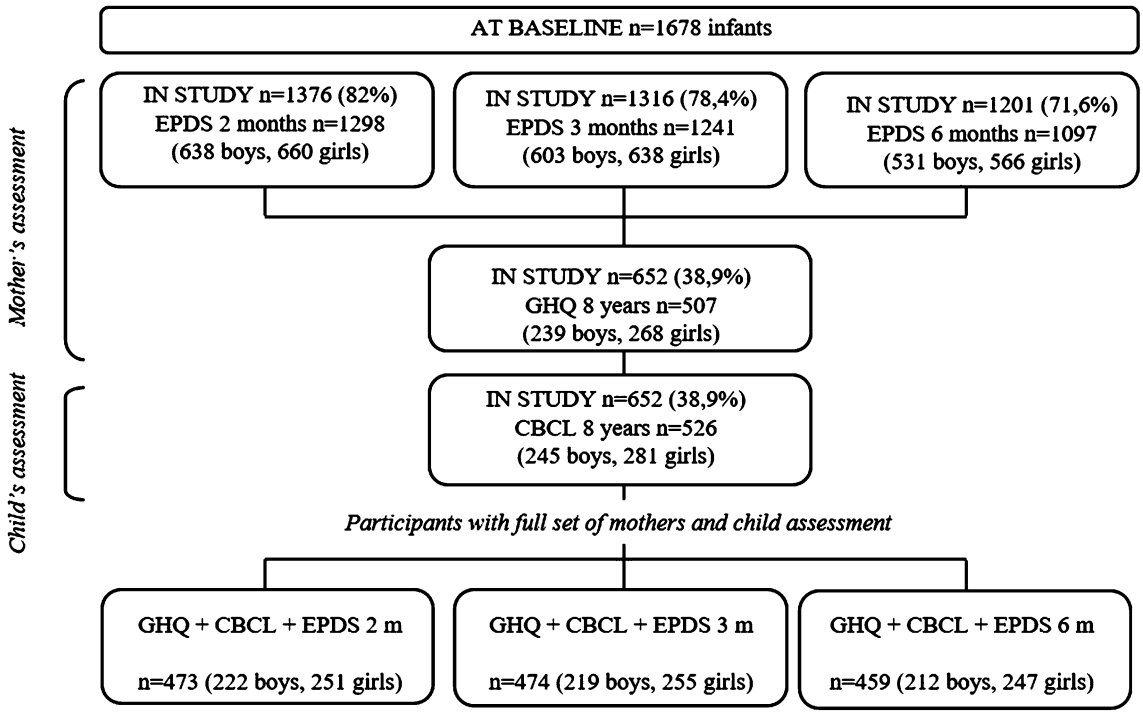

Fig. 1 Top: Flow-chart at each timepoint. **EPDS* Edinbugh Postnatal Depression Scale, *GHQ-12* General Health Questionnaire, *CBCL* Child's Behaviour Checklist

Table 1 Baseline characteristics of the children depending on the mother's status (4 categories)

	No PPD & No CMP	Yes PPD & No CMP	No PPD & Yes CMP	Yes PPD & Yes CMP
	N = 248	N = 59	N = 89	N = 50
Gender (M/F) (%)***	40.3/59.7	59.3/40.7	51.7/48.3	48/52
Birth Weight	3299.7 (316.0)	3265.3 (304.9)	3278.5 (343.7)	3283.4 (377.9)
HC at birth	34.2 (1.2)	34.3 (1.2)	34.1 (1.2)	33.9 (1.5)
Smoking pregnancy (No/Yes) (%)***	23/77	40.7/59.3	25.8/74.2	36.7/63.3
Delivery type (caesarean/vaginal) (%)	22.4/77.6	32.2/67.8	19.1/80.9	22/78
Woman's education (Low/Medium/High) (%)	14.6/47.2/38.2	18.6/55.9/25.4	21.3/43.8/34.8	14.3/53.1/32.7
Woman's occupation at 7 y (Yes/No) (%)	79.6/20.4	87.5/12.5	77.9/22.1	76.9/23.1

PPD postpartum depression of the mother, *CMP* Current mental problems of the mother, *M* male, *F* female, *HC* Head circumference

***Significant differences (gender $p = 0.034$ and smoking during pregnancy $p = 0.019$)

$p < 0.001$; $r = 0.256$, $p < 0.001$; $r = 0.258$, $p < 0.001$, for postpartum depression at 2, 3 and 6 months respectively). Children whose mothers had postpartum depression at any time point were more likely ($p < 0.017$) to have mental problems after 8 years (45.9% of the mothers), as compared to those whose mother did not had postpartum depression (26.4% of mothers).

Relation Between Maternal Postpartum Depression and Current Mental Problems and Child's Psychopathological Problems

Table 2 shows the results from multiple linear regression models of the effect of EPDS scores (at 2, 3 and 6 months) together with GHQ score on Internalizing, Externalizing and Total Problems of the CBCL scales, considering country, gender, birth weight, head circumference at birth, woman education level and woman's occupation and smoking during pregnancy as confounding factors.

Maternal postpartum depression (EPDS score) at every single time point significantly affected child's Total and Internalizing Problems (except from Internalizing Problems at 2 and 6 months, and Total Problems at 6 months that were borderline significant in all cases). Maternal postpartum depression at 3 months had a significant effect on child's Externalizing Problems, as well (but not postpartum depression at 2 and 6 months). Maternal current mental problems (GHQ score) showed a significant effect on child's Total, Internalizing and Externalizing Problems in all the models (together with EPDS score at 2, 3 and 6 months).

Table 3 shows the multiple linear regression analyses for all the CBCL scales. We found that maternal current mental problems (GHQ score) had a significant effect on all child's CBCL scales, while maternal postpartum depression (EPDS score) had a significant effect in some of them. Maternal EPDS score at child's age of 3 months had the highest effect on later child's behaviour (since affected significantly Anxious/Depressed Problems, Social Problems, Attention Problems, Rule-Breaking Behaviour and Aggressive Problems scales). The child's Anxious/Depressed problems were significantly increased by maternal EPDS scores at every moment of the study, while child's Withdrawn/Depressed problems

Table 2 Effect of PPD (EPDS) and current mental health problems (GHQ) on Total, Internalizing and Externalizing Problems of the CBCL questionnaire

	Child's Total Behaviour Problems			Child's Internalizing Problems			Child's Externalizing Problems		
	B	P value	R^2 (significance model)	B	P value	R^2 (significance model)	B	P value	R^2 (significance model)
EPDS score at 2 months	0.352	0.049	14.9% (<0.001)	0.119	0.057	12.4% (<0.001)	0.087	NS	11.5% (<0.001)
GHQ score at 8 years	1.379	<0.001		0.490	<0.001		0.426	<0.001	
EPDS score at 3 months	0.670	<0.001	17.7% (<0.001)	0.172	0.005	14.1% (<0.001)	0.232	0.001	13.1% (<0.001)
GHQ score 8 years	1.221	<0.001		0.481	<0.001		0.351	0.001	
EPDS score at 6 months	0.378	0.054	14.9% (<0.001)	0.121	0.061	12.9% (<0.001)	0.069	NS	11.7% (<0.001)
GHQ score 8 years	1.445	<0.001		0.523	<0.001		0.445	<0.001	

NS no significant effect, All models adjusted by country, gender, birth and head circumference at birth, woman's education, woman's occupation and smoking during pregnancy

Table 3 Effect of PPD (EPDS) and current mental health problems (GHQ) on the scales of the CBCL questionnaire

	Anxious/Depressed			Withdrawn/Depressed			Somatic Complaints			Social Problems		
	B	P value	R^2 (S model)	B	P value	R^2 (S model)	B	P value	R^2 (S model)	B	P value	R^2 (S model)
EPDS score at 2 M	0.074	0.037	10.4% (<0.001)	0.014	NS	7.6% (<0.001)	0.009	NS	6.6% (<0.001)	0.030	NS	7.6% (<0.001)
GHQ score at 8Y	0.207	<0.001		0.110	<0.001		0.173	<0.001		0.143	0.001	
EPDS score at 3 M	0.094	0.007	11.9% (<0.001)	0.030	NS	8.2% (<0.001)	0.034	NS	7.2% (<0.001)	0.093	0.001	9.7% (<0.001)
GHQ score at 8Y	0.204	<0.001		0.100	0.001		0.157	<0.001		0.104	0.015	
EPDS score at 6 M	0.075	0.046	10.2% (<0.001)	0.004	NS	7.5% (<0.001)	0.048	0.046	7.9% (<0.001)	0.039	NS	7.3% (<0.001)
GHQ score at 8Y	0.207	<0.001		0.119	<0.001		0.164	<0.001		0.139	0.002	
	Thought Problems			Attention Problems			Rule Breaking Behaviour			Aggressive Behaviour		
EPDS score at 2 M	0.039	NS	6.5% (<0.001)	0.062	NS	15.9% (<0.001)	0.017	NS	10.0% (<0.001)	0.038	NS	11.7% (<0.001)
GHQ score at 8Y	0.124	0.001		0.221	0.001		0.092	0.004		0.365	<0.001	
EPDS score at 3 M	0.043	NS	5.8% (<0.001)	0.106	0.010	18.1% (<0.001)	0.041	0.037	10.1% (<0.001)	0.150	0.005	12.4% (<0.001)
GHQ score at 8Y	0.110	0.004		0.182	0.005		0.077	0.014		0.291	0.001	
EPDS score at 6 M	0.031	NS	5.6% (<0.001)	0.089	0.039	17.1% (<0.001)	-0.009	NS	10.6% (<0.001)	0.050	NS	12.0% (<0.001)
GHQ score at 8Y	0.126	0.001		0.209	0.002		0.103	0.001		0.354	< 0.001	

Models adjusted by gender, birth weight, smoking during pregnancy, mother education and country

M months, *Y* years, *NS* no significant effect, *S* Significance

were not affected by maternal EPDS scores at any month of the study.

The analyses of child's psychological problems according to mother's mental health groups (four possible combinations of postpartum depression and current mental problems), showed that children whose mothers had both postpartum depression and current mental problems, had the highest scores of Total, Internalizing and Externalizing problems, followed by those whose mothers had only current mental problems, only postpartum depression and those whose mother did not exhibit mental problems (Fig. 2). The group of children whose mothers had postpartum depression and current mental problems had significantly higher Total, Internalizing and Externalizing problems than those whose mothers only had postpartum depression ($p=0.006$, $p<0.001$ and $p=0.024$, respectively), and those whose mothers did not have mental problems ($p<0.001$ in all cases). The children whose mothers only had current mental problems showed increased Total, Internalizing and Externalizing scores than those whose mothers didn't had any depresion ($p<0.001$, $p<0.001$, $p=0.036$ respectively). Children whose mothers only had postpartum depression did not differ from children whose mothers had no depression. From the Kruskall-Wallis test we observed a significant trend to increase Total, Internalizing and Externalizing Problems according to the mother's mental health group ($p<0.001$ in all cases).

We performed two-way ANOVA analysis to find the interaction between postpartum depression at any time point (yes/no) and current mental problems (yes/no) in Total, Internalizing and Externalizing Problems. We found a positive interaction between postpartum depression and current mental problems in Total Problems and Externalizing Problems ($p=0.067$ and $p=0.007$, respectively). No significant interaction was found in Internalizing Problems ($p=0.607$).

Discussion

The results of this study confirm that woman's postpartum depression and later mental problems (anxiety and depression) had both an individual and synergic significant effect on child's behaviour problems at 8 years.

Multiple linear regressions showed a significant effect of postpartum depression on Total Problems, Internalizing Problems and Externalizing Problems at 3 months, suggesting that this time may be the most vulnerable period during which the child might be sensitive to develop subsequent psychopathological problems. In this sense, the explained variances were higher at 3 months than at 2 or 6 months. Our results are consistent with those from Luoma et al. (2001), who found that Total Problems were higher in

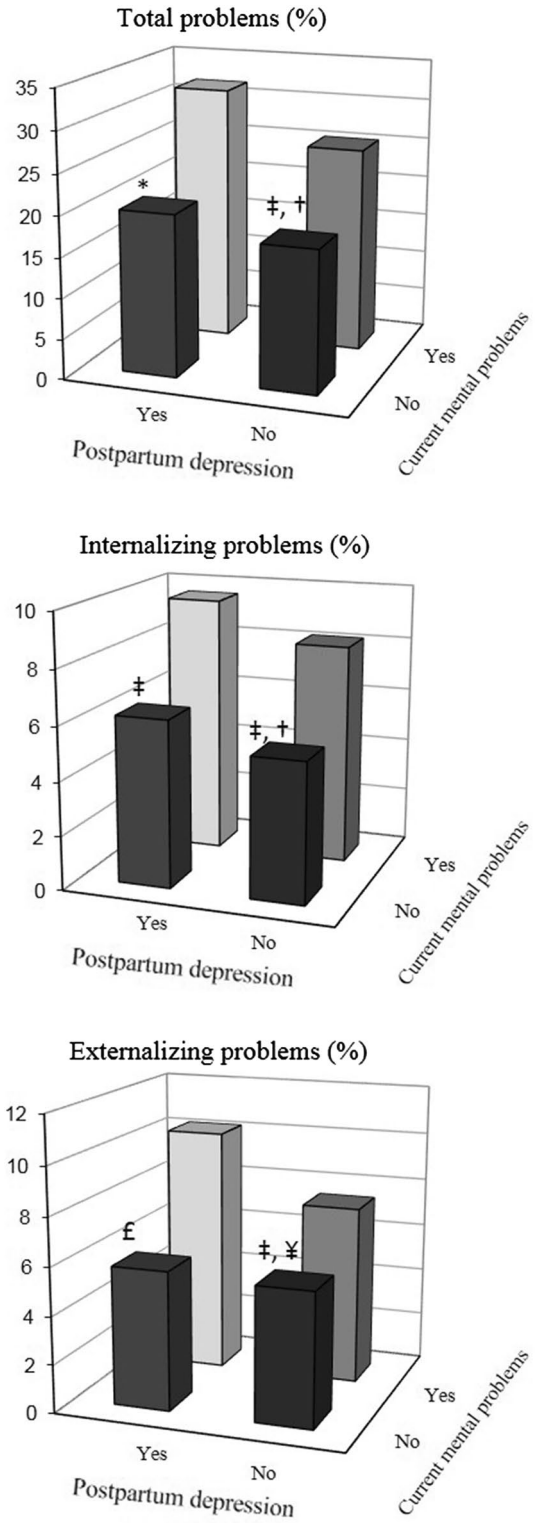

Fig. 2 *Top* Behaviour problems in children classified by maternal mental problems. *Differences between groups from Mann–Whitney U Test applying the Bonferroni correction. ‡$p<0.001$, *$p=0.006$, £ $p=0.024$ vs postpartum depression and current mental problems. † $p<0.001$, ¥ $p=0.036$ vs current mental problems. P for interaction between PPD and CMP was significant for Total and Internalizing problems ($p=0.059$ and $p=0.019$ respectively) and was not significant for Externalizing problems ($p=0.154$)

children whose mothers had postpartum depression than in children whose mothers didn't have depression. In addition to this association with Total Problems we found significant associations of maternal postpartum depression (at child's 2, 3 and 6 months) with child's Internalizing problems at 8 years. Specifically, child's Anxiety problems were significantly affected by maternal postpartum depression suffered at any child's age. This finding may have several interpretations. First, the postpartum depression may biologically predispose emotional problems, and at the age of 8 years, anxious manifestations are more prevalent than the depression manifestations (Merikangas et al. 2010). A second explanation may be the insecure mother–child bonding from postpartum depression which may produce more anxiety symptoms. Third, and taking into account that almost 50% of the women with postpartum depression followed with later emotional problems, the depressive periods of the mother from early child development could influence the child's behaviour and the cognitive style through the modelling or the type of parenting. Similarly, Fihrer et al. (Fihrer et al. 2009) showed significant differences in both Internalizing and Externalizing Problems at the age of 6–8 years depending on whether the mother had or did not have depression during the first year after delivery. We only found an association of Externalizing Problems with maternal postpartum depression if this was detected at 3 months. On the other hand, when we considered the current mental problems of the mother, our results support those suggested by Joseffson and Sydsjö (Josefsson and Sydsjo 2007), who showed that the greater effect on child's behaviour was done by CMP.

We observed a high prevalence of CMP in our sample, which could be due to the low thresholds used, with justified since even slight maternal health problems have shown to affect child's behaviour in our study sample.

When we analyzed both mother problems (postpartum depression and current mental problems) in the same regression model, we obtained higher scores and higher significant effect on the CBCL scales among children whose mothers presented current mental problems than among children whose mothers presented postpartum depression at 3 months.

When we analyzed Total, Internalizing and Externalizing Problems of the children depending on the status of their mothers in the first 6 months after delivery and at 8 years (mothers who didn't have any depression, mothers who only had postpartum depression, mothers who only had current mental problems and mothers who have both emotional problems, the postpartum depression and the current mental problems) the children with the highest Total, Internalizing and Externalizing Problems were those children whose mothers had both depression manifestations (the postpartum depression and the current mental problems). Moreover, we found that problem levels from children whose mothers only had postpartum depression didn't differ from those whose mothers didn't suffer emotional problems (neither postpartum depression nor current mental problems) (although they had higher levels of problems in different domains, those differences were not significant).

The novelty of this work lies on the fact that children from mothers who suffered postpartum depression but not later mental health problems did not differ from children of healthy mothers (neither postpartum depression nor current mental problems) in psychological problems at 8 years.

These results suggest that postpartum depression could have a long term effects on child behaviour problems when the emotional problems of the mother persist. We detected higher levels of current mental problems among mothers who had suffered postpartum depression, which in turn could be a predictor of development of later problems.

It is worth commenting that postpartum depression at 3 months could be the period of highest effect on later child's behaviour problems, which probably affected more specifically Internalizing problems than other behavioural problems.

These analyses highlight the importance of screening mother's depression, both postpartum and during postnatal development of the children. Our findings may have implications for health care polices that should consider following mothers with postpartum depression later in life to try to minimize or to prevent possible psychological problems on the child.

This study has some potential limitations. The CBCL questionnaire was filled in by mothers. There are several authors who affirm that a mother with depression could have a negative perception of child's behaviour. Another limitation is that we don't have any questionnaire about the mood of the mother from 6 months to 8 years. Therefore, we cannot assess if the mother had mental problems in between, as well, and neither the duration of these. We also consider a limitation the fact that the mother was not diagnosed of postpartum depression or current mental problems with standardized clinical criteria, but was only screened by a questionnaire. Further limitations might be that we could not adjust our results by marital status, income and number of children at 8 years. However, we considered these factors at baseline and they did not affect our results. Finally, we cannot neglect that these analyses were not the primary objective of the study, which could potentially bias our results. However, the fact that we recruited general population fed with both maternal and formula feeding, born in five European countries and analyses have been adjusted by multiple socioeconomic factors, minimize this potential bias.

It is worth highlighting that we have been able to demonstrate the effect of maternal mental health on child's behaviour in a European cross-country sample, and this provides strength and consistency to our results.

In summary, our study shows that postpartum depression and current mental health problems of mothers affect child's behaviour problems at 8 years. Maternal current mental health problems tend to have a stronger effect on child's behaviour problems than postpartum depression.

Further studies are needed to detect those mothers who may have mental problems beyond postpartum depression to reduce the trans-generational transmission of emotional problems.

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Compliance with Ethical Standards

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

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