Antenatal depression and offspring psychopathology: the influence of childhood maltreatment

Susan Pawlby, Dale Hay, Deborah Sharp, Cerith S. Waters and Carmine M. Pariante

Background
Antenatal depression and childhood maltreatment have each been associated with offspring psychopathology, but have never been examined in the same sample.

Aims
To determine whether childhood maltreatment influences the association between antenatal depression and offspring psychopathology.

Method
Prospectively collected data on antenatal depression, offspring maltreatment (age 11) and offspring psychopathology (age 11 and 16) were analysed in 120 mother–offspring dyads from the community-based South London Child Development Study.

Results
Antenatal depression increased the risk of maltreatment in the offspring by almost four times. Children exposed only to antenatal depression or only to childhood maltreatment were no more at risk of developing psychopathology; however, children exposed to both antenatal depression and childhood maltreatment were at almost 12 times greater risk of developing psychopathology than offspring not so exposed.

Conclusions
Research investigating exposure to adverse events *in utero* and offspring psychopathology should take account of postnatal adverse events such as maltreatment.

Declaration of interest
None.

Correlation is not causation. A recent editorial in this *Journal*[1] warns against assuming that associations between exposure to adverse events *in utero* and later offspring psychiatric disorder imply causation, because postnatal events may confound the association between exposure to prenatal events and later childhood or adulthood difficulties. There have been many studies suggesting that exposure to antenatal maternal psychopathology has particular effects that are distinct from exposure to postnatal events. For example, we have shown in a prospective study of women who were pregnant in 1986 and their offspring,[2,3] that exposure to antenatal depression *in utero* is associated with adolescent offspring having depression and antisocial problems. Another study on a much larger cohort has found an association between exposure to antenatal anxiety *in utero* and children's emotional and behavioural problems at age 4.[4] None of the associations described above is present when offspring are exposed only to postnatal (maternal) psychopathology.[3,4] However, there remains the possibility of what Thapar & Rutter[1] call 'unrecognised, unmeasured "residual" confounding not tapped by the available measures'. Oates[5] also cautions us against the risk that such research may lead to 'distraught mothers blaming themselves' when something does not go well for the offspring. Hence the importance of testing the effects of newly identified potential confounders in the associations between antenatal events and offspring outcome, in order to guarantee the quality of information given to pregnant mothers.

One such important confounder, which has not yet been examined in this context, is childhood maltreatment. There is substantial research evidence showing that childhood maltreatment is associated with a high risk of developing adult depression and adult antisocial behaviour. For example, retrospective reporting of childhood maltreatment (psychological abuse, sexual abuse, physical abuse, neglect) has been shown to be associated with a significant increase in lifetime depression for both men and women.[6–9] So, could childhood maltreatment be a yet unrecognised 'residual confounder' in the association between

exposure to maternal depression *in utero* and psychopathology in offspring? There is some evidence suggestive of an association between perinatal events and later childhood trauma. Zhou *et al*[10] identified the offspring of young, unmarried mothers who smoked in pregnancy and had inadequate prenatal care, as particularly vulnerable to maltreatment. However, they did not examine antenatal depression, and, to our knowledge, nobody has investigated the association between antenatal maternal depression and occurrence of childhood maltreatment in the offspring. If antenatal depression is associated with childhood trauma, it may not be exposure to maternal depression *in utero* that explains later childhood psychopathology, but rather, the experience of childhood trauma. We thus test three specific hypotheses:

(1) there is an association between maternal antenatal depression and experience of childhood maltreatment in the offspring;

(2) maltreatment in childhood influences the effect of maternal depression in pregnancy on adolescent offspring psycho-pathology;

(3) hypothesis 2 remains true independently of the mother's own history of childhood abuse, her own perceived emotional security within her family of origin, her current family stress and the chronic nature of her depression.

Method

Participants

In total, 120 women were included in this study. They represent 77% of a random sample of 155 pregnant women who were recruited into the South London Child Development Study in 1986 and provided information on their mental health when they were 36 weeks pregnant. In subsequent follow-up assessments, these 120 women and the index children independently provided information on the children's experiences of maltreatment at age

11 and psychopathology at ages 11 and 16. Methods have previously been described.[2,3,11] Demographic characteristics of this sample are presented in Table 1.

Measures

Additional details on the measures used are described in the online supplement to this paper.

Maternal depression

Maternal depression was assessed at 36 weeks of pregnancy, and at 3 and 12 months postpartum. ICD-9 diagnoses were made of the women's current mental state over the 2 weeks prior to the interview using the Clinical Interview Schedule (CIS).[12]

Maternal depression at 4, 11 and 16 years

Diagnoses of maternal depression, both current and retrospective to the last assessment, were made according to Research Diagnostic Criteria (RDC), using the lifetime version of the Schedule for Affective Disorders and Schizophrenia (SADS-L).[13]

Maternal history of childhood physical and/or sexual abuse

This was obtained 4 years after the birth of offspring.

Maternal perceived emotional security within her family of origin

A rating of emotional security was made on a 4-point Likert scale by the mother and further dichotomised into secure and insecure.

Family stress

This was measured by the number of parental relationship changes experienced during the offspring's lifetime from 0 to 16 years.

Mothers' juvenile conduct symptoms

We obtained mothers' retrospective reports of their own conduct symptoms before the mothers' age of 15.[3]

Biological fathers' history of arrest

Mothers reported on the biological fathers' history of arrest at interviews at 11 and/or 16 years.

Children's experience of maltreatment

A dichotomous measure of childhood maltreatment was made from the combined reports (parent and child) of the children's experiences of harsh parental discipline during the 3-month period prior to the interview at 11 years, along with information about any lifetime experiences of physical or sexual abuse.

Offspring depression at 11 and 16 years

DSM-IV diagnoses were generated from the combined reports of parent and child using the Child and Adolescent Psychiatric Assessment.[14–16]

Offspring conduct disorder at 11 and 16 years

DSM-IV diagnoses of conduct disorder, based on combined reports of parent and child, using the Child and Adolescent Psychiatric Assessment,[14–16] are reported.

Ethics

All phases of the study were approved by the ethics committee of the Institute of Psychiatry, King's College London (at 16 years, study no. 259/01).

Statistical analysis

Offspring outcome measures in each group (with antenatal maternal depression $v.$ without antenatal maternal depression) were compared using the χ^2-test with odds ratios and 95% confidence intervals. Logistic regression analyses determined the effects of potential confounding variables, mediators and moderators on the offspring outcome measures.

Results

Association between exposure to antenatal maternal depression and childhood maltreatment

Of the 120 children (57 boys and 63 girls), 25 (21%) reported physical and/or sexual abuse and/or harsh parenting at 11 years. Girls and boys were equally likely to have experienced childhood maltreatment ($n = 120$, χ^2 (1) = 1.98, $P = 0.16$). Reports of maltreatment were not associated with maternal depression at the time of the interview ($n = 116$, χ^2 (1) = 0.52, $P = 0.47$) or with the child's emotional well-being, as measured by the child's own reports of emotional difficulties on the Strength and Difficulties Questionnaire[17] (Mann–Whitney U-test, $z = 0.08$, $P = 0.93$). Overall, 15 children (13%) reported physical ($n = 9$) and/or sexual ($n = 6$) abuse at some time during their childhood, and 20 children (17%) reported experiencing harsh discipline in the 3 months prior to the interview at 11 years. Fifteen children had experienced one form of abuse, and ten children two forms. No child had experienced all three forms (see Appendix for a representative case study). Twelve children were maltreated by the biological mother (alone or with father/stepfather). Specifically, four of the nine children who experienced physical abuse had been abused by their mother (alone or with father), and five by their biological father. Of the six children who had experienced sexual abuse, none of the perpetrators was the biological mother (or father): in five cases the perpetrator was another child (in one case a sibling) and in one case a teacher.

Table 1 Characteristics of the sample ($n = 120$)

Characteristic	
Mother's age in pregnancy, years: mean (s.d.) (range)	26.4 (5.1) (17–44)
Marital status in pregnancy, %	
Married	64
Cohabiting	28
Single	8
Working class,[41] %	88
Mother's ethnicity, %	
White British	80
Black and minority ethnic	18
Other	2
Maternal education, %	
Basic qualifications	59
Post compulsory education	13
Parent in household at 16, %	
Two biological parents	53
Biological mother	39
Biological father	5
No biological parent[a]	3
Child's gender, female: %	53
Child's birth order, first born: %	47

a. Other relative, $n = 1$; independently, $n = 2$; under supervision of Social Services, $n = 1$.

Twelve of the 20 children who had experienced harsh discipline had been disciplined either by their biological mother ($n = 8$) or by both their biological mother and their biological father/stepfather ($n = 4$), while the remaining 8 had been disciplined by their biological father, stepfather or stepmother.

Of the 120 children, 25 (21%) were exposed to antenatal maternal depression as defined by their mothers reaching ICD-9 threshold for a diagnosis of depression at 36 weeks of pregnancy. Compared with children who had not been exposed to antenatal maternal depression, children who were exposed were significantly more likely to have experienced childhood physical or sexual abuse or harsh parenting ($n = 120$, χ^2 (1) = 7.03, $P = 0.008$; OR = 3.6, 95% CI 1.4–9.4) by the age of 11 years (Table 2), thus confirming hypothesis 1. In contrast, neither maternal depression after the birth nor maternal depression at any other time during the child's first 11 years was associated with the children's experience of abuse ($n = 116$–119, all χ^2 (1) < 1.04, P values > 0.30). As mentioned above, of the 25 children who had been maltreated, 12 were maltreated by the biological mother (alone or with father/stepfather); however, there was no association between antenatal depression and whether or not the perpetrator of the maltreatment was the biological mother ($n = 25$, χ^2 (1) = 0.03, $P = 0.87$). In other words, having antenatal depression did not increase the risk of the mothers themselves being the perpetrators of the maltreatment. Furthermore, there were no significant effects of maternal juvenile conduct symptoms (Mann–Whitney U-test, $z = 1.14$, $P = 0.25$) or of the biological fathers' history of arrests ($n = 113$, χ^2 (1) = 0.49, $P = 0.48$) on risk of offspring maltreatment.

Offspring psychopathology

Thirty-six children (30%) were given a diagnosis of either a depressive disorder ($n = 21$) or conduct disorder ($n = 22$) at 11 and/or 16 years. Seven had comorbid diagnoses. There was a significant association between the two sets of disorders ($n = 119$, χ^2 (1) = 4.3, $P = 0.04$). There were no significant gender differences.

Exposure to antenatal maternal depression and/or childhood maltreatment, and offspring psychopathology

Logistic regression analysis was used to test the hypothesis that any association between antenatal maternal depression and adolescent offspring psychopathology might be explained by maltreatment in childhood. Of the 25 offspring whose mothers had depression in pregnancy, 52% ($n = 13$) were diagnosed with either a depressive disorder or conduct disorder, as opposed to 24% of offspring ($n = 23$) whose mothers had not had depression (χ^2 (1) = 7.3,

Table 2 Exposure to maternal depression *in utero* and experience of childhood maltreatment

	Childhood maltreatment	
	No, % (*n*)	Yes, % (*n*)
Exposure to depression *in utero*		
No	84.2 (80)	15.8 (15)
Yes	60.0 (15)	40.0 (10)

χ^2 (1) = 7.03, $P = 0.008$.

$P = 0.007$; OR = 3.4, 95% CI 1.3–8.5). This is an extension of our previously published findings.[2,17] Of the 25 offspring who had been maltreated, 48% ($n = 12$) were diagnosed with a psychiatric disorder, in contrast to 25% ($n = 24$) who had not been maltreated (χ^2 (1) = 4.9, $P = 0.027$; OR = 2.7, 95% CI 1.1–6.8). Therefore, in univariate analysis, both antenatal depression and childhood maltreatment separately predict offspring psychopathology.

The first logistic regression model tested for associations with antenatal maternal depression and childhood maltreatment, and for the two-way interaction between them. When antenatal depression was entered at the first step, it significantly predicted offspring psychopathology (Wald statistic = 6.85, d.f. = 1, $P = 0.009$; OR = 3.4, 95% CI 1.4–8.5). When childhood maltreatment was entered at the second step, it did not significantly predict offspring psychopathology, and antenatal depression continued to predict offspring psychopathology (Wald statistic = 4.81, d.f. = 1, $P = 0.03$; OR = 2.9, 95% CI 1.1–7.4). Therefore, childhood maltreatment did not mediate the effect of antenatal depression on offspring psychopathology. Finally, when the interaction was entered at the third step, the model was significant (χ^2 (3) = 12.40, $P = 0.006$): neither antenatal depression nor childhood maltreatment independently predicted offspring psychopathology, but the presence of both did. Specifically, in a second logistic regression analysis, the interaction of antenatal depression and childhood maltreatment, entered at the first step, significantly predicted offspring psychopathology (Table 3(a)). The children who had been exposed to both maternal antenatal depression and to childhood maltreatment were almost 12 times as likely to have psychopathology, either in the form of a depressive disorder or in the form of conduct disorder. In contrast, children who were exposed only to maternal antenatal depression or childhood maltreatment were no more at risk of having any psychopathology. This finding remained unchanged when controlling for the mother's own experience of childhood abuse and lack of emotional security, for the child's exposure to chronic maternal depression and to parental relationship changes (see analyses in the online supplement).

Table 3 Logistic regression models with the indicators of exposure to maternal depression *in utero* and to maltreatment in childhood in the prediction of child and adolescent psychopathology ($n = 119$–120)

		95% CI for EXP(B)		
Predictor variables	β (s.e.)	Lower	EXP(B)	Upper
(a) Any psychopathology (depression and/or conduct disorder)[a] Depression × maltreatment	2.46 (0.82)	2.35	11.71	58.47
(b) Depressive disorder[b] Depression × maltreatment	1.48 (0.72)	1.07	4.38	17.98
(c) Conduct disorder[c] Depression × maltreatment	2.69 (0.74)	3.44	14.78	63.51

a. Any disorder: $R^2 = 0.09$ (Cox and Snell) 0.13 (Nagelkerke); Model χ^2 (1) = 11.80, $P = 0.001$.
b. Depressive disorder: $R^2 = 0.03$ (Cox and Snell) 0.05 (Nagelkerke); Model χ^2 (1) = 3.83, $P = 0.05$.
c. Conduct disorder: $R^2 = 0.11$ (Cox and Snell) 0.19 (Nagelkerke); Model χ^2 (1) = 14.49, $P < 0.001$.

Exposure to antenatal maternal depression and/or childhood maltreatment, and offspring depression

These findings hold true also when depressive disorder and conduct disorder are assessed separately. Of the 24 offspring whose mothers had depression in pregnancy, 8 (33%) were diagnosed with a depressive disorder at 11 and/or 16 years as opposed to 14% of offspring ($n = 13$) whose mothers had not had depression (χ^2 (1) = 5.1, $P = 0.024$; OR = 3.2, 95% CI 1.1–8.8). Of the 24 offspring who had been maltreated by the age of 11 years, 6 (25%) were diagnosed with depression at 11 and/or 16 years, in contrast to 16% ($n = 15$) who had not been maltreated. This association was not significant (χ^2 (1) = 1.12, $P = 0.29$; OR = 1.8, 95% CI 0.61–5.2).

In the first logistic regression analysis, the significant main effect of antenatal depression became non-significant when the interaction with childhood maltreatment was entered into the analysis. In the second logistic regression analysis, the interaction of antenatal depression and childhood maltreatment, entered at the first step, significantly predicted offspring depression (Table 3(b)). Offspring who had been exposed both to maternal depression *in utero* and to childhood maltreatment were 4.4 times more likely than those exposed to neither, to have a diagnosis of a depressive disorder at 11 and/or 16 years. In contrast, children who were exposed only to maternal antenatal depression or to childhood maltreatment were no more at risk of having depression. The finding remained unchanged when controlling for the mother's current depression at 11 years and 16 years, which did not add significantly (Wald statistic = 0.86, d.f. = 1, $P = 0.35$) to the variance accounted for by the interaction between antenatal depression and childhood maltreatment.

Exposure to antenatal maternal depression and/or childhood maltreatment, and offspring conduct disorder

Of the 25 offspring whose mothers had depression in pregnancy, 9 (36%) were diagnosed with conduct disorder at 11 and/or 16 years as opposed to 14% of offspring ($n = 13$) whose mothers had not had depression (χ^2 (1) = 6.6, $P = 0.01$; OR = 3.6, 95% CI 1.3–9.7). Of the 25 offspring who had been maltreated by the age of 11 years, 10 (40%) were diagnosed with conduct disorder at 11 and/or 16 years, in contrast to 13% ($n = 12$) who had not been maltreated (χ^2 (1) = 9.9, $P = 0.002$; OR = 4.6, 95% CI 1.7–12.6).

In the first logistic regression analysis, the significant main effects of both antenatal depression and of maltreatment on offspring conduct disorder became non-significant when the interaction with childhood maltreatment was entered into the analysis. In the second logistic regression analysis, the interaction of antenatal depression and childhood maltreatment, entered at the first step, significantly predicted offspring conduct disorder (Table 3(c)). Offspring who had been exposed both to maternal depression *in utero* and to childhood maltreatment were 14.5 times more likely than those exposed to neither, to have a diagnosis of conduct disorder at 11 and/or 16 years. In contrast, children who were exposed only to maternal antenatal depression or to childhood maltreatment were no more at risk of having a conduct disorder. The finding remained unchanged when controlling for the mother's own juvenile conduct symptoms, which did not add significantly (Wald statistic = 3.08, d.f. = 1, $P = 0.08$) to the variance accounted for by the interaction between antenatal depression and childhood maltreatment.

Discussion

Here we demonstrate for the first time that antenatal maternal depression is associated with an increased risk of the offspring being subjected to childhood maltreatment. Moreover, we also find that the association between antenatal depression and offspring psychopathology[2,18] is only due to the high prevalence of depression and of conduct disorder (OR of approximately 4.4 and 14.8 respectively) in children exposed to both antenatal depression and childhood maltreatment – not in those with either one or the other exposure. In other words, although antenatal depression is associated with both offspring exposure to childhood maltreatment and with offspring psychopathology, childhood maltreatment does not mediate the effect of antenatal depression on offspring psychopathology, but rather acts as a moderator. Our findings are strengthened by the fact that the assessment of both risk factors (depression in pregnancy, maltreatment at age 11) and outcomes (psychopathology at age 11 and/or 16) were conducted prospectively, in a unique longitudinal study that has been following up mothers and their offspring from pregnancy, more than 20 years ago.[2,3]

Exposure to antenatal depression and childhood maltreatment

The association between antenatal maternal depression and offspring childhood maltreatment is a completely novel finding. The association between lifetime psychopathology in mothers and increased risk of childhood maltreatment in offspring has been described before – but never in the context of the perinatal period. Specifically, certain parental personality attributes have been associated with offspring maltreatment, such as low self-esteem, negative affectivity (depression and anxiety) and antisocial behaviours.[19] In a recent study, Kaplan *et al*[20] found that mothers of physically abused adolescents have more unipolar depressive disorders than comparison mothers. However, no other study, of which we are aware, has assessed maternal psychopathology in the perinatal period for mothers of maltreated children. Only Oliver,[21] when describing a case series of 147 extremely complex families with multiagency involvement and a history of cross-generational childhood maltreatment, noticed that 7 (out of 147) mothers had been diagnosed with postpartum depression by their treating psychiatrist, but that all of them were rediagnosed at some point in later years as having a personality disorder. Our study therefore is the first methodologically sound, prospective study able to assess the impact of maternal perinatal psychopathology on the risk of the offspring being maltreated.

Our data point to a specific effect of antenatal, rather than postnatal, depression, in increasing the risk of childhood maltreatment. Indeed, the effect remains, even when we account for the fact that almost all the mothers who had depression in pregnancy went on to have further depressive episodes during their children's lifetimes. Clearly, the mechanisms underlying this specific effect are as yet unknown, and further research on this is required. Indeed, a variety of pathways may explain this finding, including putative effects of antenatal depression on attachment, offspring temperament or a mother's ability to protect her young from maltreatment by other family members.[22] However, it is important to highlight two key aspects of our results: first, our study does not suggest that mothers who have depression in pregnancy are more likely to be perpetrators of the maltreatment; and second, these analyses refer to women who had depression in pregnancy more than 20 years ago. It is possible that this association would be no longer present today, thanks to the increased emphasis on psychosocial support and treatment for women with antenatal depression. Clearly, this must be tested in more recent cohorts; but in the meantime, one can only continue to advocate assertive treatment of depression during pregnancy[23]

and governmental support for Foundation Years services beginning in pregnancy.[24]

Interestingly, our data are consistent with observations available from preclinical and clinical studies. Specifically, Champagne & Meaney[25] have observed that stress during gestation alters maternal behaviour in the rat by reducing pup maternal care ('licking and grooming') in lactating mothers previously characterised as expressing high levels of maternal care. It is of note that rat maternal behaviour is very stable, and this makes the impact of stress during gestation even more relevant. Moreover, lactating mothers who have been subjected to gestational stress also show a reduction of the brain expression of the receptor for oxytocin, a neurotransmitter regulating maternal care and social behaviour, which in turn may be due to a stress-induced increase in glucocorticoid hormones during gestation.[25] Consistent with these preclinical data, we have recently shown that depression during pregnancy is associated with increased levels of glucocorticoids,[26] and another clinical study has shown that plasma oxytocin levels of women during pregnancy and the postpartum period are related to maternal bonding behaviours postnatally.[27] Therefore, it is possible to speculate that biological abnormalities induced by depression during pregnancy, such as elevated glucocorticoids,[28] may alter the oxytocin system and thus contribute to changes in maternal care. This biological pathway may be in addition to psychological and psychosocial pathways that could also affect maternal care and protection following antenatal depression.

Childhood maltreatment and child psychopathology

The relationship between childhood maltreatment and child psychopathology has been well documented, but all the evidence comes from studies in samples of children who have been abused.[29,30] Indeed, large community studies have found less evidence of immediate and unavoidable effects of childhood maltreatment on child psychopathology. For example, in the Environmental Risk Longitudinal Twin Study, we found that, out of 82 children aged 12 years with experience of maltreatment in the family, only 13 (16%) had depression.[31] There is also some evidence that childhood sexual abuse increases the risk of being a polysubstance misuser[32] and of engaging in risky sexual behaviours[33] in adolescence. Therefore, it is reassuring that in our prospective studies, as in other similar community ones, not all children exposed to maltreatment express frank psychopathology. We clearly show that the previous exposure to antenatal depression is indeed one of the moderating factors determining why some children do develop psychopathology when exposed to maltreatment.

Maternal depression, childhood maltreatment and child psychopathology

We find that it is really the co-occurrence of maternal depression and childhood maltreatment that leads to offspring depression and conduct disorder. Indeed, only exposure to both depression *in utero* and to maltreatment in childhood is associated with depression and conduct disorder in childhood and adolescence. This is also a completely novel finding. The association between lifetime maternal mental illness and child mental illness in offspring victims of maltreatment has been described before, but never in the context of the perinatal period, and usually in small case–control studies rather than epidemiologically based cohorts. For example, Kaufman et al[34] reported that in 26 children with a history of maltreatment and of major depression, their first-degree relatives had approximately a ninefold increased risk for major

depression and a three- to ninefold increased risk for other disorders such as antisocial personality, alcohol and substance dependence. Similarly, De Bellis et al,[35] in a case–control study of 53 children from maltreating families referred to a clinical service for post-traumatic stress disorder, showed that mothers of maltreated children exhibited a significant lifetime incidence of anxiety disorders (58%, especially post-traumatic stress disorder), mood disorders (72%, indicating major depression and dysthymia), and alcohol and/or substance misuse or dependence disorder (32%). The majority of the children (72%) had comorbid diagnoses involving both emotional and behavioural regulation disorders.[35] Because our data point to a specific effect of antenatal depression in increasing the risk of offspring maltreatment, it is tempting to speculate that the association between lifetime maternal mental illness and childhood psychopathology in offspring victims of maltreatment described in these studies may indeed be due to maternal mental illness already active in the antenatal period. However, none of these studies has addressed this hypothesis.

Other potential confounders

We began our introductory argument by describing the importance of potential confounders when examining the association between two variables. Therefore, having clearly demonstrated the moderating effect of childhood maltreatment in the association between exposure to antenatal depression and offspring psychopathology, we have also examined some other potential contributory factors – namely: the mother's own experience of childhood abuse and her perception of an emotionally insecure childhood (both of which predicted maternal depression in pregnancy); current family instability (measured by the number of relationship changes that the offspring experienced during their lifetime); and the chronic nature of mothers' depressive illness. Even after accounting for the potential confounders, the significant effect of the double exposure to maternal depression in pregnancy and maltreatment during childhood remained.

Limitations

The number of study participants is small and limited to a city population with high levels of social and economic deprivation and high levels of adolescent psychopathology. It is therefore difficult to generalise the findings presented here to other socioeconomic groups and geographical locations. Furthermore, although the prevalence rates of maternal depression in this community cohort are high, the low levels of other psychiatric disorders (substance misuse, personality disorders, post-traumatic stress disorder) preclude an investigation of their association with antenatal depression and childhood maltreatment, and of their impact on offspring psychopathology. In addition, the small sample size made it difficult to separate out the effects of harsh discipline, physical and sexual abuse, and to compare the effects on the offspring of maltreatment made by different perpetrators. Moreover, reports of sexual abuse at 11 years were limited to peer and sibling involvement of the child in activities for the purpose of their own sexual gratification, and it is unclear whether children who were still living with their parents would have reported sexual abuse. For example, when the 11-year-old child in the reported case history (Appendix) was asked whether he had been sexually abused, he replied that he did not know. Only when we interview the offspring as adults will we be able to see whether the reports of sexual abuse made as children were reliable. Clearly, reassessing

the offspring as adults will be fundamental to clarifying these doubts.

Implications

Our study has implications for both clinical and biological psychiatry. From a clinical point of view, our study supports the notion that exposure to maternal antenatal depression is important in the link between childhood maltreatment and childhood psychiatric disorder: both by increasing the risk of offspring maltreatment *per se*, and by increasing the risk of psychopathology in the offspring when maltreatment does take place. This should inform the still controversial decision-making process around the treatment of depression in pregnancy[36] and give priority to psychological, psychosocial and parenting programmes aimed at reducing antenatal depression as a pathway to reduce child and adolescent psychopathology. From a biological point of view, the mechanism by which fetal exposure to maternal depression (and, in general, to stress in pregnancy) contributes to later offspring psychopathology is still not clear. We and others have described persistent biological abnormalities in adults with a history of childhood maltreatment, which may participate in the pathogenesis of adult major depression[37,38] or of adult aggressive behaviour.[39] However, if childhood maltreatment is associated with antenatal depression, then it is possible that some of these biological abnormalities are due to the antenatal depression, or to the 'double insult' perpetrated through exposure to both maternal depression *in utero* and to maltreatment in childhood, rather than simply to childhood maltreatment. Indeed, stress *in utero* in animal models, and antenatal maternal anxiety in clinical studies, has long-lasting effects on the biology of the offspring, some resembling those described in animal models of early trauma.[40] Future studies should dissect how antenatal and childhood events differentially and concomitantly contribute to biological changes that put an individual on the trajectory to adult psychopathology.

Susan Pawlby, MA, PhD, CPsychol, Section of Perinatal Psychiatry, Institute of Psychiatry, King's College London; **Dale Hay**, PhD, School of Psychology, Cardiff University; **Deborah Sharp**, MA, FRCGP, PhD, Academic Unit of Primary Health Care, University of Bristol; **Cerith S. Waters**, MSc, PhD, School of Psychology, Cardiff University; **Carmine M. Pariante**, MD, MRCPsych, PhD, Section of Perinatal Psychiatry & Stress, Psychiatry and Immunology, Department of Psychological Medicine, Institute of Psychiatry, King's College London, The James Black Centre, London, UK

Correspondence: Dr Susan Pawlby, Section of Perinatal Psychiatry, PO Box 71, Institute of Psychiatry, Kings College London, De Crespigny Park, London SE5 8AF, UK. Email: susan.pawlby@kcl.ac.uk

First received 27 Sep 2010, final revision 21 Feb 2011, accepted 17 May 2011

Appendix

Case study: Gary[a]

Gary is 16 years old. He has a conduct disorder. He describes how he has been in trouble with the police for breaking into a telephone box with a screwdriver and stealing the money, for vandalism and for low-level fire-setting. He has been in trouble for fighting, breaking his parents' curfew, and running away from home. He has problems with his teachers at school. He is defiant, restless and disruptive in class. He is bullied by his peers. He is anxious about going to school. Gary does not reach criteria for a depressive disorder but suffers from low self-esteem and describes himself as ugly.

Gary was physically abused by his biological father. He describes how his father held his fingers over the gas flame until it hurt and he called out in pain, how he was hit with a belt and how he was forced to sit on the floor at night, with his hands on his head and his father's feet holding him down, and to watch adult TV programmes.

Gary's mother suffered from depression when she was pregnant with Gary, and was unable to protect Gary from his father's abuse. Gary's father left the home when Gary was 6 years old. Gary remains with his mother. The interviewer describes Gary as 'crushed'.

a. The name and some details have been changed to ensure anonymity and confidentiality. The descriptions were given during interviews with Gary at age 11 and 16.

References

1 Thapar A, Rutter M. Do prenatal risk factors cause psychiatric disorder? Be wary of causal claims. *Br J Psychiatry* 2009; **195**: 100–1.

2 Pawlby S, Hay DF, Sharp D, Waters CS, O'Keane V. Antenatal depression predicts depression in adolescent offspring: prospective longitudinal community based study. *J Affect Disord* 2009; **113**: 236–43.

3 Hay DF, Pawlby S, Waters CS, Perra O, Sharp D. Mothers' antenatal depression and their children's antisocial outcomes. *Child Dev* 2010; **81**: 149–65.

4 O'Connor TG, Heron J, Golding J, Beveridge M, Glover V. Maternal antenatal anxiety and children's behavioural/emotional problems at 4 years. Report from the Avon Longitudinal Study of Parents and Children. *Br J Psychiatry* 2002; **180**: 502–8.

5 Oates MR. Adverse effects of maternal antenatal anxiety on children: causal effect or developmental continuum? *Br J Psychiatry* 2002; **180**: 478–9.

6 Bifulco A, Moran PM, Baines R, Bunn A, Stanford K. Exploring psychological abuse in childhood: II. Association with other abuse and adult clinical depression. *Bull Menninger Clin* 2002; **66**: 241–58.

7 Cicchetti D, Toth S. A developmental psychopathology perspective on child abuse and neglect. *J Am Acad Child Adolesc Psychiatry* 1995; **34**: 541–65.

8 Widom SP, DuMont K, Czaia SJ. A prospective investigation of major depressive disorder and comorbidity in abused and neglected children grown up. *Arch Gen Psychiatry* 2007; **64**: 49–56.

9 Danese A, Moffitt TE, Pariante CM, Ambler A, Poulton R, Caspi A. Elevated inflammation levels in depressed adults with a history of childhood maltreatment. *Arch Gen Psychiatry* 2008; **65**: 409–15.

10 Zhou Y, Hallisey EJ, Freymann GR. Identifying perinatal risk factors for infant maltreatment: an ecological approach. *Int J Health Geographics* 2006; **5**: 53–64.

11 Sharp DJ, Hay DF, Pawlby SJ, Schmücker G, Allen H, Kumar R. The impact of postnatal depression on boys' intellectual development. *J Child Psychol Psychiatry* 1995; **36**: 1315–36.

12 Goldberg D, Cooper B, Eastwood MT, Kedward HB, Shepherd M. A standardised psychiatric interview for use in community surveys. *Br J Prev Soc Med* 1970; **24**: 18–23.

13 Spitzer RL, Endicott J, Robbins E. *The Schedule for Affective Disorders and Schizophrenia – Lifetime version (SADS-L) 3rd Edn.* Biometric Research, 1978.

14 Angold A, Prendergast M, Cox A, Harrington R, Simonoff E, Rutter M. The Child and Adolescent Psychiatric Assessment (CAPA). *Psychol Med* 1995; **25**: 739–53.

15 Angold A, Erkanli A, Costello EJ, Rutter M. Precision, reliability and accuracy in the dating of symptom onsets in child and adolescent psychopathology. *J Child Psychol Psychiatry* 1996; **37**: 657–64.

16 Angold A, Costello EJ. The Child and Adolescent Psychiatric Assessment (CAPA). *J Am Acad Child Adolesc Psychiatry* 2000; **39**: 39–48.

17 Goodman R, Meltzer H, Bailey V. The strengths and difficulties questionnaire: A pilot study on the validity of the self-report version. *Eur Child Adolesc Psychiatry* 1998; **7**: 125–30.

18 Hay DF, Pawlby S, Waters CS, Sharp D. Antepartum and postpartum exposure to maternal depression: Different effects on different adolescent outcomes. *J Child Psychol Psychiatry* 2008; **49**: 1079–88.

19 National Research Council, Commission on Behavioral and Social Sciences and Education. *Understanding Child Abuse and Neglect*. National Academy Press, 1993.

20 Kaplan SJ, Sunday SR, Labruna V, Pelcovitz D, Salzinger S. Psychiatric disorders of parents of physically abused adolescents. *Fam Viol* 2009; **24**: 273–81.

21 Oliver JE. Successive generations of child maltreatment: social and medical disorders in the parents. *Br J Psychiatry* 1985; **147**: 484–90.

22 Misri S, Kendrick K. Perinatal depression, fetal bonding, and mother-child attachment: a review of the literature. *Curr Pediatr Rev* 2008; **4**: 66–70.

23 Pariante CM, Seneviratne G, Howard L. Should we stop using tricyclic antidepressants in pregnancy? *Psychol Med* 2011; **41**: 15–7.

24 Field F. *The Foundation Years: Preventing Poor Children Becoming Poor Adults. The Report of the Independent Review on Poverty and Life Chances*. HM Government, 2010 (http://www.frankfield.co.uk/review-on-poverty-and-life-chances/).

25 Champagne FA, Meaney MJ. Stress during gestation alters postpartum maternal care and the development of the offspring in a rodent model. *Biol Psychiatry* 2006; **59**: 1227–35.

26 O'Keane V, Lightman S, Marsh M, Pawlby S, Papadopoulos AS, Taylor A, et al. Increased pituitary-adrenal activation and shortened gestation in a sample of depressed pregnant women: a pilot study. *J Affect Disord* 2010; **130**: 300–5.

27 Feldman R, Weller A, Zagoory-Sharon O, Levine A. Evidence for a neuroendocrinological foundation of human affiliation: plasma oxytocin levels across pregnancy and the postpartum period predict mother-infant bonding. *Psychol Sci* 2007; **18**: 965–70.

28 Pariante CM, Lightman SL. The HPA axis in major depression: classical theories and new developments. *Trends Neurosci* 2008; **31**: 464–8.

29 Kashani J, Shekim W, Burk J, Beck N. Abuse as a predictor of psychopathology in children and adolescents. *J Clin Child Psychol* 1987; **16**: 43–50.

30 Famularo RMD, Kinscherff R, Fenton T. Psychiatric diagnoses of maltreated children: Preliminary findings. *J Am Acad Child Adolesc Psychiatry* 1992; **31**: 863–7.

31 Danese A, Caspi A, Williams B, Ambler A, Sugden K, Mika J, et al. Biological embedding of stress through inflammation processes in childhood. *Mol Psychiatry* 2011; **16**: 244–6.

32 Shin SH, Hong HG, Hazen AL. Childhood sexual abuse and adolescent substance use: a latent class analysis. *Drug Alcohol Depend* 2010; **109**: 226–35.

33 Fergusson DM, Horwood LJ, Lynskey MT. Childhood sexual abuse, adolescent sexual behaviors and sexual revictimization. *Child Abuse Negl* 1997; **21**: 789–803.

34 Kaufman J, Birmaher B, Brent D, Dahl R, Bridge J, Ryan ND. Psychopathology in the relatives of depressed-abused children. *Child Abuse Negl* 1998; **22**: 171–81.

35 De Bellis MD, Broussard ER, Herring DJ, Wexler S, Moritz G, Benitez JG. Psychiatric co-morbidity in caregivers and children involved in maltreatment: a pilot research study with policy implications. *Child Abuse Negl* 2001; **25**: 923–44.

36 Chambers C. Selective serotonin reuptake inhibitors and congenital malformations. *BMJ* 2009; **339**: b3525.

37 Heim C, Newport DJ, Mletzko T, Miller AH, Nemeroff CB. The link between childhood trauma and depression: insights from HPA axis studies in humans. *Psychoneuroendocrinology* 2008; **33**: 693–710.

38 Danese A, Pariante CM, Caspi A, Taylor A, Poulton R. Childhood maltreatment predicts adult inflammation in life-course study. *Proc Natl Acad Sci USA* 2007; **104**: 1319–24.

39 Hart J, Gunnar M, Cicchetti D. Salivary cortisol in maltreated children: evidence of relations between neuroendocrine activity and social competence. *Dev Psychopathol* 1995; **7**: 11–26.

40 Glover V, O'Connor TG, O'Donnell K. Prenatal stress and the programming of the HPA axis. *Neurosci Biobehav Rev* 2010; **35**: 17–22.

41 Goldthorpe JH, Hope K. *The Social Grading of Occupations: A New Approach and Scale*. Oxford University Press, 1974.

EXTRA CONTENT ONLINE