Antenatal depression predicts depression in adolescent offspring: Prospective longitudinal community-based study

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Abstract

Background: Depression is familial. Evidence shows that untreated postnatal depression is associated with adverse outcomes for the child. Few studies have traced prospectively the course of maternal depression through pregnancy, the postnatal period and the following 16 years in relation to adolescent offspring depression.

Method: The sample was recruited from two general practice antenatal clinics. Of 151 mother–child dyads followed from pregnancy to 16 years, information on the course of maternal depression and on depression in adolescent offspring was available for 127 (84%).

Results: Two-thirds (82/125) of the women had been depressed during the 17-year time period, with the majority (54/82) experiencing more than one episode. A third of the women were depressed in pregnancy (41/124). Over half of these women (23/41) had consulted a doctor about their mental health prior to being pregnant and almost 90% (35/39) had further episodes during the child’s lifetime. 14% (18/127) of the adolescent offspring were diagnosed with a depressive disorder at 16 years. Every depressed adolescent had been exposed to maternal depression. The risk of depression for the 16-year-olds exposed to antenatal depression was 4.7 times greater than for offspring not so exposed. The effect of antenatal depression was mediated by repeated exposure.

Limitations: The number of study participants is small and limited to an inner-city population. Only depression spectrum diagnoses in the adolescent offspring have been considered.

Conclusions: Detection of depression in pregnancy identifies mothers at risk of further depressive episodes and a group of children who are at risk of depression in adolescence.

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Keywords: Adolescent depression; Antenatal depression; Prospective study

1. Introduction

Longitudinal studies have consistently shown that children of depressed parents have a two- to threefold higher risk of developing a depressive disorder in their lifetime than children of parents who have never been depressed (Beardslee et al., 1998; Weissman et al., 2006). Recently, such studies have begun to investigate the importance of factors such as the timing, severity and chronic nature of maternal depression in determining the outcome for adolescent offspring, and in explaining the intergenerational transmission of depression (Hammen and Brennan, 2003). Particular attention has been paid to
the development of psychiatric disorder in the offspring of mothers suffering from depression in the postnatal period (Abbott et al., 2004; Murray et al., 1999; Halligan et al., 2007). However, few longitudinal studies have begun in pregnancy, despite the fact that pregnancy potentially represents the period of highest risk for the development of depressive symptoms in women (O’Keane, 2006) and that these predict a high number of depressive symptoms in the puerperium (Josefsson et al., 2001; Evans et al., 2001). Where studies have taken into account the antenatal period, they have either relied on the retrospective reporting of events occurring many years before (in pregnancy), or they have looked prospectively at the effect of self-reported anxiety and depressive symptoms in pregnancy, rather than of a diagnosis obtained through psychiatric interview, on children’s emotional and behavioural outcomes in early and middle childhood (Allen et al., 1998; Luoma et al., 2001; O’Connor et al., 2002).

We studied maternal mood during pregnancy and the postnatal period in a community cohort of women recruited during the antenatal period, and followed them up, along with their offspring, for 16 years. We have previously reported findings up to 11 years on this cohort (Sharp et al., 1995; Hay et al., 2001, 2003). We interviewed the mothers on seven occasions and identified episodes of maternal depression in pregnancy, the postnatal period and in subsequent years and tested for adolescent depression through diagnostic interview at age 16 to ascertain the timing of maternal depression with the greatest predictive value for adolescent depression.

2. Method

2.1. Participants

155 women, representing 87% of a random sample of antenatal patients in two general practices in South London, provided information on their mental health during pregnancy and the postnatal period. 151 (97%) of these women were followed up beyond the child’s first year. We assessed mother–child dyads at 4, 11 and 16 years of age. Methods have previously been described (Sharp et al., 1995; Hay et al., 2001, 2003).

Based on the 2001/2002 data collected throughout England, the deprivation scores of the two South London communities that we studied ranked on the 6th and 11th percentiles, where a lower rank indicates greater deprivation. Compared to national norms, the sample had a higher proportion of working class families and families from ethnic minorities (ONS, 2006). The mothers’ IQs \((N=136)\) ranged from 69 to 127 but with a below average mean of 90.60 (SD = 13.40).

Of the 151 families followed up, 137 (91%) participated when the index child was 16 years old. Eight families had moved abroad or could not be traced, and 6 families were not willing to participate at 16 years. However, in 10 families, insufficient information on the adolescent’s emotional state at 16 years was obtained for a clinical diagnosis to be made. In 7 cases the Strength and Difficulties Questionnaires (Goodman, 1997) were completed but not the interview, 2 adolescents were living with their fathers and 1 independently and the mothers had no contact. There were no significant differences in the mother-rated total difficulties score or the emotional problems score for those with and without full interview data. Analyses in this paper are carried out on data from 127 families, 82% of the original sample of 155. Demographic characteristics of this sample are presented in Table 1.

2.2. Chronology and assessments

2.2.1. Pregnancy and the first postnatal year

Two academic GPs, one from each practice, interviewed mothers from each other’s practice, twice during pregnancy, between 14 and 20 weeks and at 36 weeks, and twice during the first postnatal year, at 3 and at 12 months. Socio-demographic data and information on

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Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother’s age at birth</td>
<td>(M=26.0, \text{SD}=5.1) (range, 16 to 43)</td>
</tr>
<tr>
<td>Marital status at birth</td>
<td>63% married, 28% cohabiting, 9% single</td>
</tr>
<tr>
<td>Social class(^a)</td>
<td>89% working class</td>
</tr>
<tr>
<td>Mother’s ethnicity</td>
<td>72% white British, 6% white, non-British,</td>
</tr>
<tr>
<td></td>
<td>22% other (Caribbean, African, South Asian, East Asian, mixed)</td>
</tr>
<tr>
<td>Maternal education</td>
<td>72% basic qualifications, 14% further education</td>
</tr>
<tr>
<td>Marital status at age 16</td>
<td>57% married (87% to biological father)</td>
</tr>
<tr>
<td></td>
<td>14% cohabiting (35% to biological father)</td>
</tr>
<tr>
<td></td>
<td>29% single parent household</td>
</tr>
<tr>
<td>Parent in household at 16</td>
<td>51% two biological parents</td>
</tr>
<tr>
<td>Child’s sex</td>
<td>54% female</td>
</tr>
<tr>
<td>Child’s birth order</td>
<td>47% firstborn</td>
</tr>
<tr>
<td>Child’s age at assessment</td>
<td>(M=16.3) years, (\text{SD}=.25) (range, 16 to 17.3)</td>
</tr>
<tr>
<td>Child’s educational attainm</td>
<td>46% 5 or more GCSEs A* to C</td>
</tr>
</tbody>
</table>

\(^a\) Ns vary slightly (120–127) because of missing data on some variables.  
\(^b\) Goldthorpe and Hope, 1974.
events during pregnancy and surrounding the birth were collected. At each interview, details of the women’s past contact with their GP for mental health problems were recorded and an assessment was made of the women’s current mental state over the past two weeks, using the Clinical Interview Schedule (CIS), to generate ICD-9 diagnoses (Goldberg et al., 1970). The overall agreement of the reported symptoms on the CIS from the tape-recorded interviews, given as a weighted kappa coefficient, was .80. Consensus ICD-9 diagnoses were made by the two GPs on the basis of the content of these interviews.

2.2.2. 4th, 11th and 16th birthdays

We visited families at home when the children were approaching 4 years and at 11 and 16 years. At each time point, mothers provided socio-demographic information, current and retrospective to the last visit, to one of two research psychologists who was unaware of the information collected at previous visits. Diagnoses of maternal major depression (probable and definite), minor depression (definite), and intermittent depression, both current and retrospective to the last assessment, were made according to Research Diagnostic Criteria (RDC). We used the lifetime version of the Schedule for Affective Disorders and Schizophrenia (SADS-L — Spitzer et al., 1978). All interviews were tape-recorded. Diagnoses were made on the basis of the content of these interviews, by a senior research psychologist and a psychiatrist who had not participated in the interviews.

In tape-recorded interviews at 16 years, mothers and children were independently asked, each by a different researcher, about the child’s psychological problems, using the Child and Adolescent Psychiatric Assessment (Angold et al., 1995). The CAPA is a psychiatric interview for children that elicits information about symptoms contributing to a wide range of DSM-IV diagnoses. A three-month ‘primary period’ is used rather than a longer period, because shorter periods are associated with more accurate recall (Angold et al., 1996).

Diagnoses and symptom scales were generated by computer algorithms. Separate algorithms are available for child, parent and ‘combined reports,’ where a symptom is regarded as being present if either the parent or child reports it. In this paper, we report DSM-IV diagnoses of major depressive disorder, dysthymic disorder and depression not otherwise specified, based on combined reports. Diagnoses are made with reference to the functional impairment or incapacities section of the CAPA, which relates the symptoms to the adolescent’s ability to function at a developmentally appropriate level in relationships with family, peers, and teachers, and in activities at school, home and in the community. A test–retest reliability study of the CAPA resulted in kappa coefficients of .85 for dysthymia and .90 for major depression (Angold and Costello, 1995). The intraclass correlation coefficient for judgements of impairments and incapacities was .76. The construct validity of CAPA diagnoses is supported by a wide range of findings (Angold and Costello, 2000).

2.3. 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). After complete description of the study to the participants, written informed consent was obtained from both mothers and their adolescent offspring.

2.4. Statistical analysis

Maternal depression in pregnancy was rated as being present if an ICD diagnosis was given at the second and/or third trimester interviews. The current and ‘retrospective to last visit’ data were used to assess the rates of maternal depression over four subsequent developmental time periods. In the first postnatal year, a diagnosis of maternal depression was given if the mother had a current ICD diagnosis at 3 months and/or at 12 months. Where data were missing, retrospective RDC diagnoses from the interview given at 4 years were used to cover the first year. The RDC, current and retrospective, were used in early childhood (1–4 years), middle childhood (4–11 years) and adolescence (11–16 years). The developmental time period in which each child was first exposed to maternal depression was determined. The number of periods (ranging from 0 to 5) during which the offspring were exposed to maternal depression depended on the number of developmental periods in which mothers reported having had a depressive episode.

Outcome measures in each group (depressed versus non-depressed) were compared using the $\chi^2$ test with odds ratios and 95% confidence intervals and, where appropriate, the nonparametric Mann–Whitney U test. Logistic regression analyses determined the effects of potential confounding variables and mediators on the adolescent outcome measure.

3. Results

3.1. Maternal depression from pregnancy to 16 years

Of the 127 women, 82 (64.6%) had had at least one depressive episode during the period from pregnancy to the
index child’s 16th birthday. The point prevalence of depression\(^1\) was higher at both time points in pregnancy and at 3 months postpartum than at any of the other time points studied. Point prevalence of maternal depression was 20% in the second trimester of pregnancy, 21% in the third trimester of pregnancy, 21% at 3 months after the birth, 18% at 1 year, 14% at 4 years, 6% at 11 years and 2% at 16 years. There was, however, little difference in the period prevalence of maternal depression between the developmental periods from pregnancy to 16 years (Table 2), and there was substantial continuity for individual women, from pregnancy to the adolescent period (N=119, kappa coefficient = .30, \(p < .001\)). Of the depressed women, 63.4% experienced more than one episode.

The incidence of depression among the women was highest during pregnancy (Table 2), with over half (23/41) of the women reporting that they had seen a GP for mental health problems at some point in their lives before becoming pregnant with the index child. Women who had previously sought help from a GP were three times more likely than women who had not sought help to become depressed in pregnancy (\(N=124, \chi^2 (1) = 7.65, p < .01, OR = 3.00 [CI 1.36 to 6.63]\)). Just over half (51.3%) of the women who were depressed during the child’s lifetime were initially identified as depressed in pregnancy. Almost all (89.7%) of the mothers who were depressed in pregnancy became depressed again, having a nine-fold increased odds of a further episode of depression (\(N=119, \chi^2 (1) = 18.74, p < .001, OR = 9.20 [CI 2.99 to 28.29]\)). They were also depressed during a greater number of time periods over the 16 years following the child’s birth than mothers who were not depressed in pregnancy (\(N=121, Mann–Whitney U = 812.5, z = -4.74, p < .001\)). Only 4 mothers were depressed in pregnancy alone. There were no significant differences between mothers who were depressed and those who were well in pregnancy in terms of maternal age, marital status in pregnancy, social class, level of education, parity, ethnicity or gender of the offspring.

### 3.2. Adolescent depression at 16 years

Eighteen (14.2%) of the 127 adolescents, 14 (20.3%) girls and 4 (6.9%) boys, were diagnosed as having a depressive disorder according to DSM-IV criteria in the 3-month period immediately preceding the interview at 16 years. Ten adolescents had a major depressive disorder, in all cases superimposed on dysthymia. A further 6 adolescents had a diagnosis of depression not otherwise specified, 3 of which were superimposed on dysthymia. Two adolescents had a diagnosis of dysthymia. A third (6/18) of the depressed adolescents (4 girls and 2 boys) had planned or made suicide attempts. Girls were more likely than boys to be diagnosed with a depressive disorder (\(N=127, \chi^2 (1) = 4.60, p < .05, OR = 3.18 [CI 1.06 to 9.55]\)).

### 3.3. Timing of maternal depression and adolescent depression\(^2\)

Just over a fifth (20.7%) of the adolescents who had been exposed to maternal depression had a depressive disorder at 16 years. Each depressed adolescent had been exposed to maternal depression. Adolescent offspring who had been exposed to maternal depression at some point since conception were significantly more likely to be depressed at 16 years than adolescent offspring who had never been exposed (\(N=123, \chi^2 (1) = 9.86, p < .01\)). This was not explained by the mother’s retrospective history of mental health problems before becoming pregnant with the index child.

Sixty-five percent (11/17) of adolescents with depression were initially exposed in the antenatal period. There

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\(^1\) The \(N\)s vary slightly (range 120 to 127, except at 4 years when \(N=112\)) because of missing data.

\(^2\) The mother’s complete history of depression during the child’s lifetime was unavailable for one of the 18 depressed adolescents as she had left the UK when her son was aged 10 to 13 and he had been looked after by a guardian.
was a 4.7-fold greater odds of adolescent depression among the 16-year-olds who had been exposed to maternal antenatal depression than for offspring who were not so exposed (CI 1.60 to 13.86). Initial exposure of the child to maternal depression during each of the other developmental periods in the child’s lifetime was not associated with adolescent offspring depression (Fig. 1).

Adolescent depression was also associated with a greater number of periods of exposure to maternal depression \( (N=123, \ U=425.5, \ z=-3.59, \ p<.001). \) Depressed adolescents were exposed to over twice as many time periods of maternal depression \( \text{mean}=2.82 \ [SD, \ 1.59] \) versus 1.31 \( [SD, \ 1.40]\) as non-depressed adolescents. Logistic regression showed that initial exposure to maternal depression in the antenatal period was no longer itself a significant predictor when account was taken of the chronic nature of the mother’s depression (Table 3). Rather, identification of maternal depression in pregnancy was a strong predictor of depression in the adolescent offspring, mediated by subsequent periods of depression during the child’s lifetime. The odds of the offspring being depressed at 16 years increased by 1.74 \( (1.12 \text{ to } 2.71) \) for every period of maternal depression from pregnancy to 16 years.

The family variable associated with adolescent depression – not living with two biological parents at 16 years – was also associated with maternal depression in pregnancy. Logistic regression showed that maternal depression in pregnancy remained a significant predictor of adolescent depression when accounting for family structure at 16 years, whereas family structure did not (Table 4).

4. Discussion

The strong familial association between maternal and adolescent depression, already well-documented (Lieb et al., 2002; Beardslee et al., 1998; Moffitt et al., 2007a,b), was replicated in our study. All of the 16-year-old adolescents who became depressed had been exposed to maternal depression at some point in their lives. Pregnancy was found to be the time period when the greatest number of offspring was initially exposed to maternal depression, and children who were exposed during pregnancy were almost four times as likely as those not exposed to become depressed at 16 years. For the

Table 3
Predictors of depression in adolescent offspring

<table>
<thead>
<tr>
<th>Inclusion</th>
<th>95% CI for EXP ((B))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B (SD)</td>
</tr>
<tr>
<td>Included</td>
<td>--</td>
</tr>
<tr>
<td>Constant</td>
<td>-3.33 (.58)</td>
</tr>
<tr>
<td>Depression in pregnancy</td>
<td>.59 (.73)</td>
</tr>
<tr>
<td>Total no of depressive time</td>
<td>.55 (.23)</td>
</tr>
<tr>
<td>periods (range 0–5, pregnancy</td>
<td></td>
</tr>
<tr>
<td>to 16 years)***</td>
<td></td>
</tr>
</tbody>
</table>

Note \( R^2=.12 \) (Cox and Snell) .22 (Nagelkerke); Model \( \chi^2(2)=15.47, \ p<.001***.\)

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3 Adolescent offspring who were first exposed to maternal depression in utero were over 4× as likely as those not then exposed to be depressed at 16 years \( (N=124, \ \chi^2(1)=8.91, \ p<.01, \ OR=4.71 \ [CI 1.60 \text{ to } 13.86]). \) Initial exposure at other time periods did not predict adolescent outcome.
women in our study, episodes of depression in pregnancy were part of a wider picture of depression throughout their children’s lifetimes. Episodes in pregnancy showed strong continuity with those that occurred outside it. Women who were depressed during pregnancy were almost 10 times as likely as those not depressed in pregnancy to have a recurrence. Although our data did not show that it was the effect of maternal depression in pregnancy per se that predicted adolescent depression, they did show that the majority of children who were depressed at 16 years had initially been exposed in the antenatal period and were at risk of further exposure because of the strong likelihood of recurrence of maternal depression later in the child’s life.

This longitudinal, prospective, community-based study found that during the 16-year period following their index pregnancy, almost two-thirds of mothers reported episodes of depression that were of sufficient severity to require care from a GP or to impair their daily functioning. Over half of these women had first been identified as being depressed in pregnancy. Several factors may explain these high rates of depression. First, the two communities were selected on the basis that a high prevalence and persistence of depression would identify the two communities were selected on the basis that a high level of socio-economic deprivation would identify the two communities.

<table>
<thead>
<tr>
<th>Included</th>
<th>B(SD)</th>
<th>Lower</th>
<th>EXP(B)</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>3.00 (.55)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression in pregnancy**</td>
<td>1.40 (.56)</td>
<td>1.34</td>
<td>4.04</td>
<td>12.18</td>
</tr>
<tr>
<td>Family structure</td>
<td>.83 (.59)</td>
<td>.72</td>
<td>2.29</td>
<td>7.24</td>
</tr>
</tbody>
</table>

Note $R^2 = .08$ (Cox and Snell), .15 (Nagelkerke); Model $\chi^2 (2) = 10.43$, $p<.01**$.

Table 4
Predictors of depression in adolescent offspring
Logistic regression model with depression in pregnancy and family structure at 16 years ($N=124$)

The disease are likely to be an underestimate of the actual number of sufferers. Similar high cumulative prevalence rates of depression and of other psychiatric disorders are emerging from other prospective longitudinal cohort studies (Angst et al., 2005; Moffitt et al., 2007a,b). The 14% point prevalence rate of adolescent depression at 16 years found in our study was similar to that reported in the Dunedin, New Zealand study, where peak incidence was between the ages of 15 and 18 (Hankin et al., 1998). A recent report revealing that less than a third of parents of children aged 5 to 16 years with emotional disorders in England and Scotland had sought help from the primary health care services suggests that official statistics underestimate the number of adolescents suffering from depression (Green et al., 2004).

This study has many strengths. It is a community-based study, begun in pregnancy with mothers and their offspring followed through 16 years. Assessments of maternal mental health were made using structured clinical interviews on seven occasions throughout this time period and diagnoses were made after discussion with a psychiatrist. We identified mainly cases of moderate depression typically found in the community. Our retention rate was extremely high. In pregnancy and the postnatal period, the interviews were carried out by a doctor unfamiliar with the patient group. Interviewers at each further phase of the study were blind to the participants’ psychiatric histories.

However the study should also be interpreted in the context of some potentially important limitations. Many of the depressed women in the sample suffered from an episode in pregnancy. Mothers’ symptoms of affect disorder in pregnancy are often associated with unhealthy behaviours (e.g., smoking cigarettes or drinking alcohol), and may disrupt the developing HPA axis in the foetus (see O’Keane, 2006). However, in the present sample, only four women who were depressed in pregnancy had not become depressed again, and so our study did not have adequate statistical power to disentangle antenatal influences from the effects of cumulative exposure to maternal depression. Secondly, the number of study participants is small and limited to a city population with high levels of social and economic depravation. It is therefore difficult to generalize the findings presented here to other socio-economic groups and geographical locations. However, the rates of adolescent depression are comparable with those of other much larger studies (Hankin et al., 1998). A third limitation is that no consideration is given here to paternal mental health. Fourthly, assessments of the mothers’ mental health prior to pregnancy were not made with standardized instruments. Compared to the
rigorous way in which the mothers’ mental health was assessed at all other time points, this represents a limitation. A further limitation is that only maternal diagnoses of depression are considered in relation to adolescent depression. Comorbid cases have been included but not considered independently. In addition, only depression spectrum diagnoses in the adolescent offspring have been considered here.

In this particular prospective analysis we have shown that adolescent offspring depression is predicted by maternal depression in pregnancy. Identification of depression in pregnancy has several advantages. Pregnancy is a period in a woman’s life when she is likely to have frequent contact with health care professionals. Early detection of maternal depression may accelerate treatment and offer support for women who are vulnerable to further recurrent depressive episodes in the postnatal period and later in her child’s lifetime. Until recently, research has focused on the detection of maternal depression in the postnatal period and its effect on the child’s development. However, evidence that depression in pregnancy is more common than in the postpartum is accumulating (Evans et al., 2001; Andersson et al., 2006). The recent NICE guidance on antenatal and postnatal mental health is now advocating asking pregnant women about their mental health at their first contact with primary care services (NICE, 2007). Detection and treatment of depression in pregnancy would seem to be important in preventing mothers suffering a lifetime of depression and in reducing the intergenerational transmission of depression. We know that the outlook for adolescents with depression is poor and that they themselves are at risk of further episodes in adulthood (Harrington et al., 1990; Weissman et al., 2006).

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Conflict of interest
All authors declare that they have no conflicts of interest.

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