

Pathways to Violence in the Children of Mothers Who Were Depressed Postpartum

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The impact of postnatal depression on a child's risk for violent behavior was evaluated in an urban British community sample ($N = 122$ families). Mothers were interviewed during pregnancy, at 3 months postpartum, and when the child was 1, 4, and 11 years of age. Mothers, teachers, and children reported on violent symptoms at age 11. Structural equation modeling revealed that the child's violence was predicted by the mother's postnatal depression even when her depression during pregnancy, her later history of depression, and family characteristics were taken into account. Violence was associated with symptoms of attention-deficit/hyperactivity disorder and problems with anger management. Children were most violent if mothers had been depressed at 3 months and at least once thereafter.

Violent youth often have troubled childhoods. Although violent symptoms may emerge in middle childhood or adolescence (Loeber et al., 1993), some violent individuals show a pattern of temperamental features, cognitive deficits, and behavioral problems that is already evident in infancy and early childhood (Moffitt & Caspi, 2001). Aggressive behavior has been found to be associated with medical and social risk factors in pregnancy and early postnatal life (Raine, 2002). Our aim in the present study was to examine the specific contribution of one such early risk factor, the

mother's postnatal depression, to the development of children's violent behavior.

Postnatal Depression and Children's Problems

Maternal depression is a known risk factor for disruptive behavior in childhood, and the timing of the mother's episodes of depression is important (Goodman & Gotlib, 1999). In particular, the mother's depression after childbirth is associated with behavioral and emotional problems in early childhood (e.g., Caplan et al., 1989; Murray, Sinclair, Cooper, Ducournau, & Turner, 1999; Sinclair & Murray, 1998). Infants of mothers who were depressed postpartum also have attentional and cognitive problems (Breznitz & Friedman, 1988; Galler, Harrison, Ramsey, Forde, & Butler, 2000; Hart, Field, del Valle, & Palaez-Noguera, 1998; Hay & Kumar, 1995; Murray, 1992) and atypical brain function (Dawson, Frey, Pangiotides, Osterling, & Hessel, 1997). Some investigators found that the effects of postnatal depression are explained by the mother's subsequent mental health problems or by family difficulties (Campbell & Cohn, 1997; Caplan et al., 1989; Ghodsian, Zajicek, & Wolkind, 1984), but others documented enduring legacies of postnatal depression (Murray et al., 1999; Wrate, Rooney, Thomas, & Cox, 1985). The problems developed by the children of postnatally depressed women endure over the subsequent years of childhood (Hay et al., 2001; Murray et al., 1999).

Hay (1997) argued that the problems shown by children whose mothers had postnatal depression partly derive from characteristic features of interaction with a depressed mother, which could have long-term implications for those infants' ability to regulate attention and emotion. During the first months of life, infants, through species-typical interactions with caregivers, learn how to calm themselves and deploy their attention effectively (Reddy, Hay,

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Murray, & Trevarthen, 1997). The regulation of attention and the regulation of emotion are themselves intertwined (Bornstein & Suess, 2000). This normative developmental process is disrupted by postnatal depression. Postnatally depressed mothers are less able to respond contingently to their babies, and their interactions are characterized by distress on the part of infants as well as mothers (Cohn, Campbell, Matias, & Hopkins, 1990; Field et al., 1988; Murray, Kempton, Woolgar, & Hooper, 1993).

The experience of distressing, noncontingent interaction makes it harder for infants to achieve self-regulation (Weinberg & Tronick, 1998), and so they are less able to direct their attention and actions efficiently and to regulate their responses to frustration. Furthermore, the lack of contingent responsiveness to the infant's needs that is characteristic of depressed mothers itself predicts disruptive behavior disorders in middle childhood (Wakschlag & Hans, 1999). This relation suggests that there may be a developmental pathway from postnatal depression to the child's risk for disruptive behavior, including overt violence, in later life.

In particular, we hypothesize that the link between postnatal depression and later violent behavior is associated with the child's problems in regulating attention and activity and in controlling anger. Problems in regulating one's attention and activity and in managing anger and responses to frustration are associated with violent behavior and the disruptive behavior disorders (for reviews, see Coie & Dodge, 1998; Lahey, Waldman, & McBurnett, 1999; Loeber & Hay, 1997; Rutter, Giller, & Hagell, 1998). Indeed, it has been argued that attention-deficit/hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD) are possible developmental precursors to the more serious antisocial symptoms of conduct disorder (CD; Lahey, McBurnett, & Loeber, 2000).

It is also possible that an increased proclivity for violence in the children of depressed mothers is due to an association with cognitive problems. Aggression and conduct symptoms are known to be associated with academic difficulties and cognitive problems (Hinshaw, 1992; Loeber & Hay, 1997). Postnatal depression is similarly associated with cognitive deficits in infancy and thereafter (Galler et al., 2000; Hay & Kumar, 1995; Hay et al., 2001; Murray, 1992). Therefore, we tested whether any link between postnatal depression and violence would be mediated by the child's cognitive ability.

Alternative Explanations

It is important to evaluate the influence of postnatal depression on children's violent behavior with reference to factors that are associated with the mother's mental health and the child's violent behavior. Two sets of factors were examined in this study, those pertaining to the mother's mental health at other points in the child's lifetime and other characteristics of the family.

The Specificity of the Timing of the Mother's Depression

First, it is important to demonstrate the specificity of the effect of postnatal depression, as opposed to depression in pregnancy or at a later point in the child's lifetime. It is possible that the behavioral outcomes of postnatal depression are actually due to prenatal influences, given that depression in pregnancy increases the risk of depression after childbirth (O'Hara, 1997). Depression

during pregnancy may be a marker of other prenatal insults that affect cognitive and emotional development. Furthermore, depression in pregnancy predicts anomalies in newborn behavior (Hart, Field, & Roitfarb, 1999). Thus the problems shown by the infants of postnatally depressed mothers may actually derive from prenatal experience.

Furthermore, for some women, depression in the months postpartum is one episode in a lifelong history of chronic depression; some investigators have argued that it is chronic depression, not postnatal depression per se, that creates risk for children's development (Campbell & Cohn, 1997). Thus, we tested the hypothesis that there is a specific association between postnatal depression and children's violent behavior that is not accounted for by the mother's depression in pregnancy or later in childhood or by her current psychological functioning.

The effects of any early experience on a child's development may depend on subsequent reexposure to that experience. Thus, we compared the outcomes for children who had never been exposed to maternal depression with those for children whose mothers were (a) depressed at 3 months postpartum but not thereafter, (b) depressed at some time point later in the children's lives, and (c) depressed at 3 months postpartum and at least once thereafter. These analyses permit us to examine whether children whose mothers had postnatal depression are at risk for violence whether or not the mother's illness recurred. The comparison of these four groups is analogous to the classic experimental design recommended for studies of early experiences (Solomon & Lessac, 1968) and thus addresses theoretical debates about whether the impact of early social experiences may be reversed by later, more optimal, conditions.

Family Factors

It is also important to determine whether any apparent effects of postnatal depression on the development of violent behavior are associated with other characteristics of the family that are known to be risk factors for violence and are also associated with the mother's risk for postnatal depression. The potential confounds tested here include measures of maternal and paternal antisocial behavior, social disadvantage, and family structure, all of which increase the risk that a child will show antisocial behavior (e.g., Hill, 2002; Loeber & Hay, 1997; Rutter et al., 1998).

In particular, with respect to antisocial behavior on the part of mothers, it is important to recall that girls with CD often develop internalizing symptoms as adults (Rutter et al., 1998). In a large community sample of Québec families, the mother's antisocial behavior was a predictor of postnatal depression (Tremblay, 2001). This fact raises the possibility that some children of depressed women show violent symptoms through processes of familial transmission (both genetic and environmental). Furthermore, in view of the evidence for assortative mating with respect to psychiatric disorder (Maes et al., 1998), those antisocial girls who later become depressed may be more likely than other women to have antisocial and potentially violent partners. In such cases, the father's own violent tendencies would provide environmental as well as genetic risk for the child. With the present design, we could not test genetic hypotheses directly, but we did inquire whether measures of maternal and paternal antisocial behavior removed the effect of postnatal depression on children's later risk for violence.

We also tested whether the impact of postnatal depression remained when measures of socioeconomic disadvantage and family structure were controlled for in the model.

Defining and Measuring Children's Violent Behavior

The literature relating to children's violent behavior is complicated by a confusing use of terms. Social and developmental psychologists tend to use the term *aggression* (e.g., Coie & Dodge, 1998; Loeber & Hay, 1997), but relevant studies conducted in either clinical or legal frameworks use such terms as *externalizing problems*, *disruptive behavior*, *antisocial behavior*, *delinquency*, and *criminal offending*. Longitudinal studies often attempt to predict the rate of psychiatric diagnostic categories such as ODD or CD that include a range of overt and covert symptoms. Because of the diversity of phenomena that are studied, we actually know less than we might about the development of violence (see Tremblay, 2000).

In an effort to study the impact of early experiences on serious violence, we conducted an interdisciplinary study. We worked within a clinical framework, using diagnostic interviews with parent and child. Use of the *DSM-IV* (4th edition of the *Diagnostic and Statistical Manual of Mental Disorders*; American Psychiatric Association, 1994) diagnostic framework permitted comparisons with other longitudinal samples (for reviews, see Hill, 2002; Loe-

ber & Hay, 1997; Rutter et al., 1998) and ensured that we were measuring seriously violent behavior as opposed to aggression in the normal range (see Coie & Dodge, 1998) or more global ratings of externalizing problems (e.g., Achenbach & Edelbrock, 1983). Within the diagnostic framework, violent behavior is assessed in the context of CD. We constructed a continuous measure of CD symptoms that entail overt violence directed against other human beings. In particular, we focused on an *overt pathway to serious violence* identified by Loeber and his colleagues, who distinguished three developmental pathways to serious problem behavior and delinquency (Loeber & Hay, 1994; see Figure 1).

In Loeber's theory (Loeber & Hay, 1994), many children are expected to take preliminary steps along each pathway, especially the one characterized by conflict with parents and other authority figures, but relatively few individuals will show the more severe forms of violence, deception, and rebellion that represent the endpoints of each pathway. Loeber's theory is based on longitudinal analyses of the Pittsburgh Youth Study, a representative community sample of boys in the middle childhood years. Here we sought to extend their findings by including girls as well as boys in the analyses and by examining the contribution of the infant's early experience with a depressed mother. Thus we evaluated the impact of the mother's postnatal depression on the development of overt, violent behaviors as reported by child and parent.

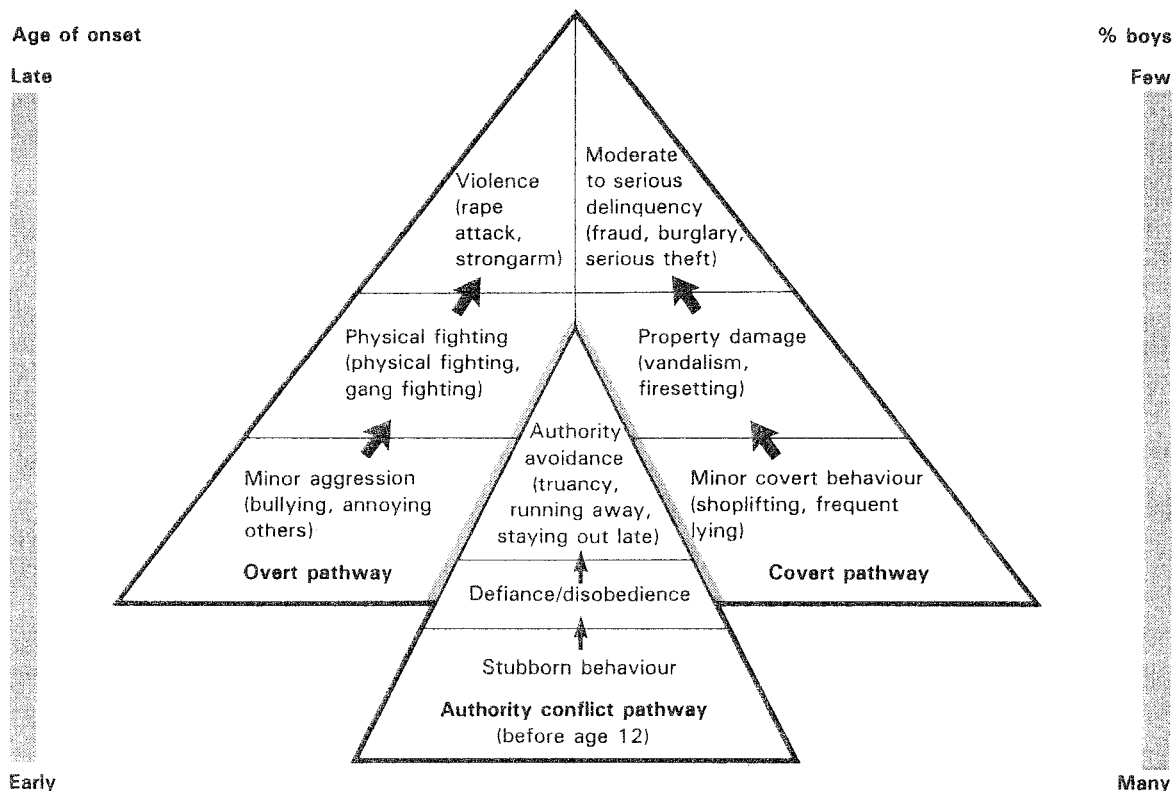


Figure 1. Loeber's model of developmental pathways to problem behavior and delinquency. Reprinted from "Developmental Approaches to Aggression and Conduct Problems" by R. Loeber and D. F. Hay, 1994, in M. L. Rutter and D. F. Hay (Eds.), *Development Through Life: A Handbook for Clinicians* (p. 504), Oxford, England: Blackwell Scientific. Copyright 1994 by Blackwell Scientific. Reprinted with permission.

Method

The Families

The families studied here participated in an ongoing, prospective longitudinal study of child development in two communities in South London (Hay et al., 2001; Sharp, 1993; Sharp et al., 1995). The families were recruited at routine prenatal check-ups in two general medical practices when the mothers were pregnant with the focal children. In Britain, most pregnant women are cared for by the National Health Service, and so this sampling frame provides a representative sample of all children born in those communities. Of the 252 women who entered the study during the first trimester of pregnancy, 179 (71%) were randomly chosen to receive full psychiatric assessments in the third trimester of pregnancy and at 3 months postpartum. This random sample of women whose mental health was to be assessed at all time points in the study provided the cases used in the present analyses. Members of the random sample were not significantly different from the full sample on variables assessed during pregnancy (Sharp, 1993).

Of the 179 women in the random sample, 171 gave birth to live infants, and 148 (87%) of these completed the psychiatric interview at 3 months postpartum. In 1 family, the infant had died; 6 families had moved or could not be traced; 15 refused to participate in this stage of the study; and the mother in 1 family was unavailable because she was hospitalized, suffering from a postnatal depression. Because we have independent corroboration from hospital records, she was included in the subsample of 149 women whose mental health was assessed by psychiatric interview at all time points.

Of the 149 families, 134 (90%) were available for follow-up when the focal children were 11 years old. In 1 family, the child had died. In another, the child had been taken into care by the Social Services and access was denied; 2 families withdrew from the study before the child's 1st birthday; 7 had moved abroad or could not be traced, and 4 families were not willing to participate at 11 years. In 2 cases we were unable to see the child because the boys were in the custody of their fathers and the mothers were unwilling for us to make contact. Thus this article concentrates attention on the 132 families with a full assessment of the mother's mental health and measures of the child's behavior at age 11. Characteristics of the sample are presented in Table 1.

The sample is representative of urban populations in contemporary Britain. National surveys show that in Great Britain, 90% of the population lives in urban areas (see Office for National Statistics website, <http://www.statistics.gov.uk>), and the majority of families (62%) view themselves as working class, as opposed to middle class (K. Prandy, personal communication, June 26, 2002). In this sample from a large metropolitan area, there was a relatively higher proportion of working-class families (as well as some very affluent families), and a higher proportion of families from minority ethnic groups, compared with national norms (Office for National Statistics, 2000). However, in other ways, the sample conformed to national norms. In this sample, the rate of children's behavioral problems at 4 years of age was in line with British population norms (Hay et al., 1999). In terms of family structure, the sample was almost identical to national norms for births to single women (Office for National Statistics, 2000) and, at 4 years of age, to findings in the large British community study of around 10,000 children born in the county of Avon in 1991 (Dunn, Deater-Deckard, Pickering, O'Connor, & Golding, 1998).

Procedure

Pregnancy and the first postnatal year. The mothers were interviewed twice during pregnancy, at 14 and 36 weeks, and twice during the 1st year postpartum, at 3 and 12 months (for details, see Sharp, 1993). Sociodemographic data and information on events during pregnancy and surrounding the birth were collected, and at each interview an assessment was made of the women's current psychiatric state with the Clinical Interview Schedule (CIS; Goldberg, Cooper, Eastwood, Kedward, & Shepherd, 1970).

Table 1

Characteristics of the Sample (N = 132)

Variable	Description
Child's sex	53% female
Child's birth order	47% firstborn
Sibling status at age 11	90% with siblings (<i>Mdn</i> = 2, range = 1–7)
Mother's age at birth	<i>M</i> = 25.8 years (<i>SD</i> = 5.1, range = 16–43)
Marital status at birth	63% married, 29% cohabiting, 8% single
Marital status at age 11	58% married (89% to biological fathers), 14% cohabiting (39% with biological fathers), 28% single-parent household
Parent in household at age 11	56% with two biological parents, 40% with biological mother, 2% with biological father, 2% with other guardians
Social class	89% working class (Goldthorpe & Hope, 1974)
Maternal education	72% basic qualifications, 14% further education
Ethnicity	72% White British, 6% White non-British, 22% other (Caribbean, African, South Asian, East Asian)
Parental employment	75% with at least one parent employed, 58% with mother employed

4th birthday. The families were visited at home when the children were approaching their 4th birthdays. Diagnoses of maternal mood and other disorders, both current and retrospective to the last assessment, were made with the lifetime version of the Schedule for Affective Disorders and Schizophrenia (SADS-L; Spitzer, Endicott, & Robbins, 1978).

11th birthday. Maternal mental health was again assessed currently and retrospectively to the last visit with the SADS-L. During the interview, sociodemographic information and details of the child's schooling were collected. Mothers and children assessed the child's behavior with the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). Class teachers also completed the SDQ for all but 2 children.

In independent interviews, the primary caregivers (in all but 2 cases, the mother) and children were asked in more detail about the child's psychological problems, using the Child and Adolescent Psychiatric Assessment (CAPA; Angold et al., 1995). The CAPA is a wide-ranging, structured, *DSM-IV*-based diagnostic interview for use with children aged 9 and above and their parents.

For most of the children (83%), cognitive testing, consisting of the Wechsler Intelligence Scale for Children (WISC-III^{UK}; Wechsler, 1992), was conducted in school, with parental permission. When it was not possible to carry out the assessments in school, either because the children's birthdays fell in holiday time (14%) or because of the children's own preference (3%), they were carried out in the home.

Measures

Frequency and severity of violent activities. In the CAPA interviews, mothers and children reported on severe psychological problems of clinical concern. The analysis of the CAPA measures was conducted on the subsample of 122 families in which both mother and child had successfully completed the interview.

The CAPA (Angold et al., 1995) is a psychiatric interview for children aged 9 and above that elicits information about symptoms contributing to a wide range of *DSM-IV* (American Psychiatric Association, 1994) diagnoses. Interviews take at least 2 or 3 hours to complete. Like respondent-based interviews such as the Composite International Diagnostic Interview (Robins et al., 1988), the CAPA uses a highly structured protocol, with

required questions and probes. However, the onus throughout is on the interviewer to ensure that subjects (a) understand the question being asked, (b) provide clear information on behavior or feelings relevant to the symptom, and (c) show the symptom at a prespecified level of clinical severity, as defined in detail. A 3-month "primary period" is used rather than a longer period, because shorter periods are associated with more accurate recall (Angold, Erkanli, Costello, & Rutter, 1996).

Diagnoses and symptom scales are generated by computer algorithms. Separate algorithms are available for child and parent reports and "combined reports" in which a symptom is regarded as being present if either the parent or the child reports it. In this article we report *DSM-IV* diagnoses based on combined reports. Diagnoses were made with reference to the *functional impairment or incapacities* section of the CAPA, which relates the symptoms to the child'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 provided kappas ranging from .55 for CD to 1.0 for substance abuse (Angold & Costello, 1995; Costello, Angold, March, & Fairbank, 1998). The intraclass correlation for judgments of impairments and incapacities was .76. The construct validity of CAPA diagnoses is supported by a wide range of findings (summarized in Angold & Costello, 2000).

Individual items from the CAPA interview were used to construct a composite measure of violent activities in the overt pathway identified by Loeber and Hay (1994). Parents and children showed significant agreement in this domain of problem behavior, $\rho(121) = .38, p < .01$. To make use of all available information from both informants, we judged a violent behavior as present if it was reported by either the parent or the child. To maintain Loeber's concept of an escalating pathway to more severe forms of violence (Loeber & Hay, 1994), we weighted conduct symptoms according to their position on the theoretical pathway (see Figure 1). Weights of 1, 2, or 3 are assigned to behaviors at early, middle, or later stages of the overt pathway. The weighting procedure increased the possible range of scores and thus provided a measure of violent behavior along a broad continuum (possible scores ranging from 0 to 11). This procedure ensured that 2 children who each had a single symptom but who were at different stages on the pathway did not receive the same score. In other words, highly violent children who had engaged in street crime or used weapons were clearly distinguishable from children who might have gotten into less severe fights at school.

Thus, the composite variable *overt violence* was constructed through the following weighted combination of CAPA items: 1("bullies") + 2("fights at least once a month") + 2("cruelty to people") + 3("stealing with confrontation") + 3("use of weapon"). The composite violence score thus summarized information about the diversity and severity of violent behavior at age 11, that is, how far along the overt pathway the child had traveled according to the two informants. Use of the composite measure was further validated by the fact that it was significantly correlated with teachers' reports of fighting, $\rho(120) = .34, p < .01$.

The distribution of scores was highly skewed and could not be normalized (because 0 was the modal score). Thus, the composite violence score was treated as an ordinal measure in all subsequent analyses.

Anger. SDQ and CAPA items were used to construct a measure of the child's *expression of anger*. This was a combination of the child's several reports of anger and irritability on the SDQ and the CAPA, plus the mother's and teacher's reports of the child's temper tantrums on the SDQ, plus the mother's reports of the child's anger and irritability during the CAPA interview (scores ranging from 0 to 10). The items expressing irritability or anger in the CAPA interview included symptoms of ODD. The derived composite measure had acceptable internal consistency across the three informants and two instruments ($\alpha = .72$). The distribution did not depart from normality.

General cognition. The WISC-III^{UK} is an individually administered clinical instrument for assessing the intellectual abilities of children from 6

to 16 years of age. Eleven of the 13 WISC-III^{UK} subtests were administered to yield three composite scores for each child: Verbal IQ, Performance IQ, and Full Scale IQ. Each scale has a mean of 100 and a standard deviation of 15.

Problems with attention and activity. The SAS software algorithms applied to the CAPA data identified children who met *DSM-IV* criteria for ADHD. Because only 4 of the 11-year-olds in this sample met the diagnostic criteria, we also used a continuous measure of the total number of ADHD symptoms as revealed by the mothers' reports in the CAPA interviews. (On the basis of past practice, only mothers were given the ADHD section of the CAPA interview.) Because this distribution was skewed, and the modal score was 0, the ADHD symptoms score was treated as an ordinal measure in all subsequent analyses. Mothers' ratings of ADHD symptoms were further validated by teacher reports of symptoms of hyperactivity on the SDQ, $\rho(120) = .42, p < .01$.

Measures of maternal depression. The interviews used in pregnancy and immediately after the birth of the child (the CIS) permitted contemporaneous diagnoses of clinical depression using *ICD-9* (World Health Organization, 1978) criteria. The SADS-L interviews given at 4 and 11 years of age provided contemporaneous and lifetime diagnoses of depression in line with the Research Diagnostic Criteria (RDC). Both sets of criteria identify clinically significant cases of depression; previous research has demonstrated substantial agreement between *ICD-9* diagnoses of depression and RDC criteria in a large sample of psychiatric inpatients (Philipp, Maier, & Delmo, 1991).

The CIS covers disorder at the nonpsychotic end of the spectrum and thus is acceptable to people who are not mentally ill. In this study, the women were asked about 10 specific psychiatric symptoms occurring in the 2-week period before the interview. A rating was made on a 5-point scale for each of the 10 symptoms after the frequency, severity, and duration of the symptoms were established. Ratings for the presence of 12 "manifest abnormalities" of behavior and affect shown at the interview were also made.

Two medical doctors underwent training in the use of the CIS. In order to increase reliability for rating items pertaining to fatigue or sleep, the criteria were operationalized to take into account the fact that the women were pregnant or postpartum. The ratings produce a total weighted score as well as an overall severity rating or case/noncase distinction made by the interviewer. Interrater reliability on the total weighted score was computed for 19 pilot interviews ($\kappa = .81$). An *ICD-9* diagnosis was then assigned to cases (World Health Organization, 1978).

The SADS-L was used at the 4- and 11-year assessments to provide detailed information about the respondent's mental health, both current and retrospective. The SADS-L interviews were carried out by trained interviewers with degrees in psychology who had either achieved or were studying for postgraduate qualifications. Interviewers at the 4- and 11-year assessments were unaware of the mother's previous psychiatric history. A researcher who interviewed the mother was unaware of information obtained in interviewing and assessing the child, and vice versa. Diagnoses of depression in line with the RDC were made in case-conference meetings in discussion with the psychiatrist on the team, an internationally recognized expert in women's mental health.

The SADS-L interview also provided a continuous measure of the mother's current psychological functioning, the Global Assessment Scale (GAS), for which scores range from 0 to 100 (Endicott, Spitzer, Fleiss, & Cohen, 1976). A higher score implies better psychological functioning.

These contemporaneous and retrospective assessments of maternal depression at various points in the study were used to construct the following summary variables: (a) *prenatal depression* (the mother's caseness for depression, according to *ICD-9* criteria, during pregnancy), (b) *postnatal depression* (the mother's caseness for depression, using *ICD-9* criteria, at 3 months postpartum), and (c) *depression after 3 months postpartum* (using a combination of contemporaneous and retrospective assessments,

with ICD-9 criteria used at 12 months and SADS-L RDC criteria used thereafter).

Parental antisocial personality disorder. The SADS-L interview enabled a diagnosis of antisocial personality disorder (ASPD) to be made for the mother and for the biological fathers who were interviewed.

The father's criminal activity. The mother's report of the biological father's history of arrests at the 11-year assessment was used as a proxy measure of the father's antisocial activity; maternal reports provide a conservative but reliable estimate of the father's antisocial behavior (see Caspi et al., 2001). Mothers reported that 29% of the biological fathers had been arrested.

Family characteristics. Characteristics of the family that have previously been found to influence antisocial behavior (Hill, 2002; Loeber & Hay, 1997; Rutter et al., 1998) were used as control variables in the analysis of the impact of postnatal depression on children's violence. These included social class, family structure at age 11 (whether the child was living in a one-parent household), and the experience of major financial problems as reported by mothers at the 11-year assessment (see Table 2). This information was obtained from the semistructured sociodemographic interviews administered to the mother at each time point.

Data Analysis

Analyses were conducted in a series of steps that addressed four primary research questions: (a) Are there effects of postnatal depression on the child's violent behavior? (b) Are these effects explained by other family characteristics that might be confounded with maternal depression? (c) Is the impact of postnatal depression on violence linked to the child's other problems, including cognitive deficits and difficulties in regulating attention, activity, and emotion? (d) Is risk minimized if mothers who have recovered from postnatal depression do not become depressed again?

Analyses of the impact of the timing of maternal depression. In view of the ordinal nature of the composite violence score, structural equation modeling based on maximum likelihood estimation (LISREL 8.51; Jöreskog & Sörbom, 2000) was used in all subsequent analyses of the violence scores. Preliminary analysis using a preprocessing package (PRELIS 2.51; Jöreskog & Sörbom, 2000) generated polyserial variance-covariance matrices that took into account the categorical, ordinal, or interval levels of measurement of particular predictor variables, as well as the ordinal outcome variable.

The predictor variables included the mother's depression in pregnancy, at 3 months postpartum, and at some time thereafter, plus the interaction between prenatal and postnatal depression. Because of the elevated rate of violence in boys, and findings in the literature indicating that boys might

be more likely to react to maternal depression with disruptive behavior (e.g., Sinclair & Murray, 1998), the child's sex and the interaction between maternal depression and the child's sex were also examined. Interaction terms in this and all subsequent analyses were centered to reduce the potential for collinearity problems between these product terms and the original variables. Finally, we evaluated whether the impact of postnatal depression on violence could be accounted for by the mother's current psychological functioning.

Evaluation of family factors. Family factors that might be associated with postnatal depression and with the child's risk for violent behavior were then examined. The potentially confounding factors of social class, economic problems, family structures, and parental criminality were considered.

Analyses of the contribution of the child's other problems. In view of Hay's (1997) claim that the impact of postnatal depression on later outcomes for the child is mediated by dysregulated emotion and attention, as well as debates about whether problems with attention and activity and defiant behavior are developmental precursors to severe conduct symptoms (Lahey et al., 2000), we asked a preliminary question: whether violence was associated with *contemporaneous* symptoms of ADHD and expressed anger. We then tested whether the pathway from postnatal depression to violence was mediated by the child's cognitive ability.

Comparison of families in which the women did and did not become depressed again. A final set of nonparametric analyses compared four groups of children: those who were not exposed to maternal depression, those whose mothers were depressed at 3 months postpartum but not again, those whose mothers were not depressed at 3 months postpartum but became depressed at least once thereafter, and those whose mothers were depressed at 3 months postpartum and at least once again.

Results

Violent Symptoms at Age 11

As expected, most children in this representative community sample were not violent. However, a proportion of informants reported repeated instances of serious violence in the 3 months preceding the CAPA interviews. Thirty-seven children (30%) had been perpetrators of violent acts, and their weighted violence scores ranged from 1 to 8 (the maximum possible being 11). The majority of these children (62%) had scores of 1 or 2, having bullied others or engaged in fights at least once a month over the previous 3-month period. Most fights were with peers; only a few children fought only with siblings. The fights were reported to involve punching, kicking, hair pulling, and biting. Both mothers and children reported intense fighting and the child being out of control. For example, a mother described her two sons as "fighting like volcanoes." One child reported how he "kneaded" a peer at school in the stomach and threw him on the floor, jumping on him and "strangling" him. Fighting often led to injury and suspension from school.

Fourteen children had used weapons in their confrontations with other people, and 1 child stole during a violent confrontation with a peer. Weapons used included brooms, cricket bats, sticks, stones, bricks, and chairs. One child threatened another with a metal bar.

The Impact of Postnatal Depression on Violence

The subsequent analyses were conducted on the children's composite violence scores, and polyserial variance-covariance matrices and structural equation modeling were used, as described previously. The violence score provides a combined measure of

Table 2
Family Characteristics and Their Associations With Postnatal Depression

Family characteristic	Percentage of families showing characteristic	
	Mother depressed (n = 26)	Mother not depressed (n = 96)
Biological father has been arrested	28.6	29.2
Single-parent household	34.6	26.0
Major financial crisis	23.1	21.1
Working class	88.5	89.6

Note. There was no significant difference between those families in which the mother was depressed at 3 months postpartum and those in which the mother was not depressed at 3 months postpartum on any of these family characteristics.

the occurrence of violent symptoms and the severity of the child's violent actions in terms of Loeber and Hay's (1994) model of an escalating pathway to serious violent crime. The predictor variables used in the analysis included the child's sex, the mother's depression during pregnancy and its interaction with the child's sex, the mother's depression at 3 months postpartum and its interaction with the child's sex, the mother's depression at any point after 3 months, and the interaction between the mother's prenatal and postnatal depression.

The test of the model revealed that at age 11, girls were less likely than boys to show violent behavior ($\beta = -.52, p < .01$). Furthermore, the mother's depression at 3 months postpartum was a significant predictor of violence at age 11 ($\beta = .34, p < .02$). None of the other variables or interactions tested in the model made a significant contribution to the prediction of violence.

We then tested whether the impact of postnatal depression on children's violent behavior at age 11 could be explained by the mother's current psychological functioning. The analysis revealed that well-functioning mothers had children who were significantly less violent than other 11-year-olds ($\beta = -.27, p < .05$), but the impact of postnatal depression on violence remained significant ($\beta = .30, p < .05$).

Alternative Explanations: Family Factors That Might Influence Violent Symptoms

The next analysis tested whether the link between postnatal depression and violence at age 11 might be explained by other factors in the family environment that might be associated with postnatal depression. The dependent variable was again the child's composite violence score.

Of primary concern was whether an antisocial family climate is associated with postnatal depression and with the child's subsequent violence. Only one mother and two biological fathers met criteria for ASPD, and so the sample size did not permit a test for co-occurrence of postnatal depression with severe antisocial behavior on the part of either parent. However, the biological father's history of arrest, as reported by the mother at the 11-year assessment, was included in a model that examined the extent to which violence at age 11 was predicted by family characteristics at age 11. Other family factors that might influence antisocial behavior were also tested (see Table 2): measures of social class, financial crises, and family structure (single-parent households).

Violence at age 11 was significantly predicted by the mother's depression at 3 months postpartum ($\beta = .38, p < .01$) even when other family characteristics were included in the model (mean violence scores are presented in Table 3). The structural equation modeling analysis showed that the child's violence at age 11 was also significantly predicted by the father's history of arrests ($\beta = .37, p < .01$), the family's experience with financial crises ($\beta = -.30, p < .05$), and social class ($\beta = -.18, p < .05$). Violent activities were more characteristic of the children of antisocial fathers. In this predominantly working-class sample, violence was not attributable to socioeconomic disadvantage; the relatively few children from more affluent families living in these urban areas were at elevated risk for violence (see Table 3).

Table 3
Family Risk Factors and Children's Mean Violence Scores

Family risk factor	Violence score			
	Risk factor present		Risk factor absent	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Postnatal depression**	1.88	2.57	0.66	1.24
Biological father arrested**	1.38	2.04	0.65	1.38
Single-parent household	1.12	1.70	0.84	1.67
Major financial crisis*	0.85	1.74	0.93	1.68
Working class*	0.89	1.66	1.15	1.86

Note. Significance levels are derived from the multivariate structural equation modeling analyses described in the text.

* $p < .05$. ** $p < .01$.

Links With the Child's Other Problems

The foregoing analyses demonstrated a direct effect of the mother's postnatal depression on the child's proclivity for violence at age 11 that was not accounted for by maternal depression at other points in the child's life, by interactions with the child's sex, or by family characteristics. A final model tested whether the link between postnatal depression and the violence score was bound up with contemporaneous measures of children's problems with anger, attention, and activity (i.e., anger management and ADHD symptoms).

Results from two analyses are presented in Figures 2 and 3. In the first model (contemporaneous analyses undertaken in line with Hay's [1997] theoretical model), the mother's postnatal depression predicted children's ADHD symptoms ($\beta = .37, p < .01$) and anger ($\beta = .26, p < .05$). Each of these measures in turn predicted children's violent symptoms (ADHD symptoms, $\beta = .39, p < .01$; anger, $\beta = .36, p < .01$). However, when the measures of ADHD symptoms and anger were included in the model, the direct effect from postnatal depression to violence at age 11 was no longer significant ($\beta = .07$; see Figure 2).

It is possible that some problems in regulating attention and activity and in controlling anger in frustrating circumstances are related to general cognitive ability, which is known to be affected by postnatal depression (Galler et al., 2000; Hay & Kumar, 1995; Hay et al., 2001). To control for this factor, we estimated a model that included the measures of attentional problems and anger as well as the child's IQ at age 11 (see Figure 3). The model revealed significant direct effects of the mother's postnatal depression on the child's ADHD symptoms ($\beta = .37, p < .01$), anger ($\beta = .26, p < .05$), and IQ ($\beta = -.26, p < .05$). The children's attentional problems, but not their problems with managing anger, were significantly and negatively associated with the child's IQ ($\beta = -.27, p < .05$). Attentional problems and anger were both significantly and positively associated with the composite violence score ($\beta = .39, p < .01$, and $\beta = .36, p < .01$, respectively). The path from IQ to overt violence was not significant ($\beta = -.06, p > .10$). The fit statistics suggest that the model provides an excellent fit to the data: $\chi^2(1, N = 118) = 0.06$, goodness-of-fit index = 1.00, adjusted goodness-of-fit index = 0.97, $p = .43$ (see Figure 3). Thus the mother's postnatal depression predicted later prob-

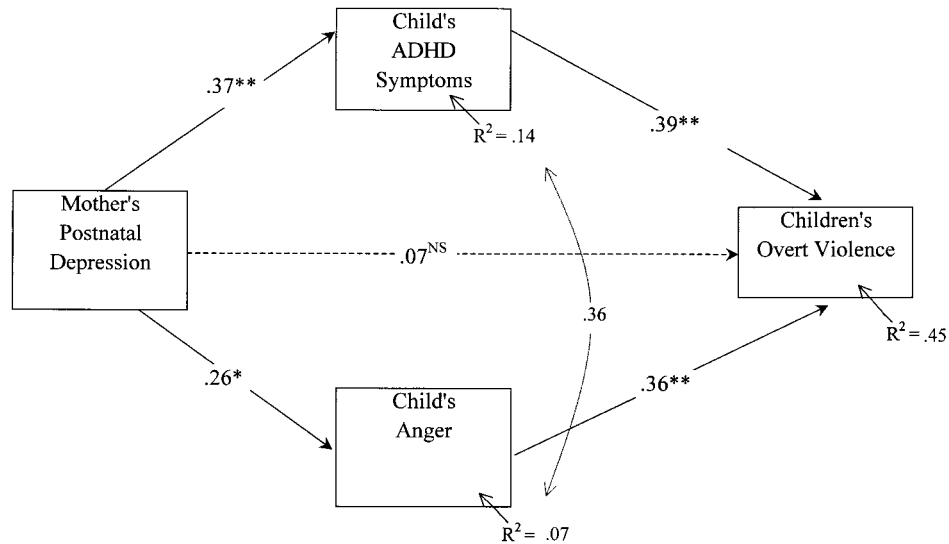


Figure 2. A pathway from postnatal depression to violence at age 11 that is mediated by the child's symptoms of attention-deficit/hyperactivity disorder (ADHD) and problems in managing anger. NS = nonsignificant. * $p < .05$. ** $p < .01$.

lems in the realms of cognition, attention, and emotion; however, only the latter two sets of problems in regulating attention and managing anger were correlated with severe violent behavior.

Does the Risk for Violence Depend on Reexposure to Maternal Depression?

The final analyses compared four groups: families in which children were not exposed to maternal depression (Group 1, $n = 54$), those in which mothers were depressed only at 3 months

postpartum (Group 2, $n = 7$), those in which mothers became depressed at some point after the postpartum period (Group 3, $n = 42$), and those in which mothers experienced postnatal depression and became depressed at least once again (Group 4, $n = 19$). The four groups of mothers differed not only in terms of the timing of the mother's illness but also in terms of their current psychological functioning. The two groups who had been depressed after 3 months postpartum were functioning significantly less well than the group of women who had never been depressed (see Table 4).

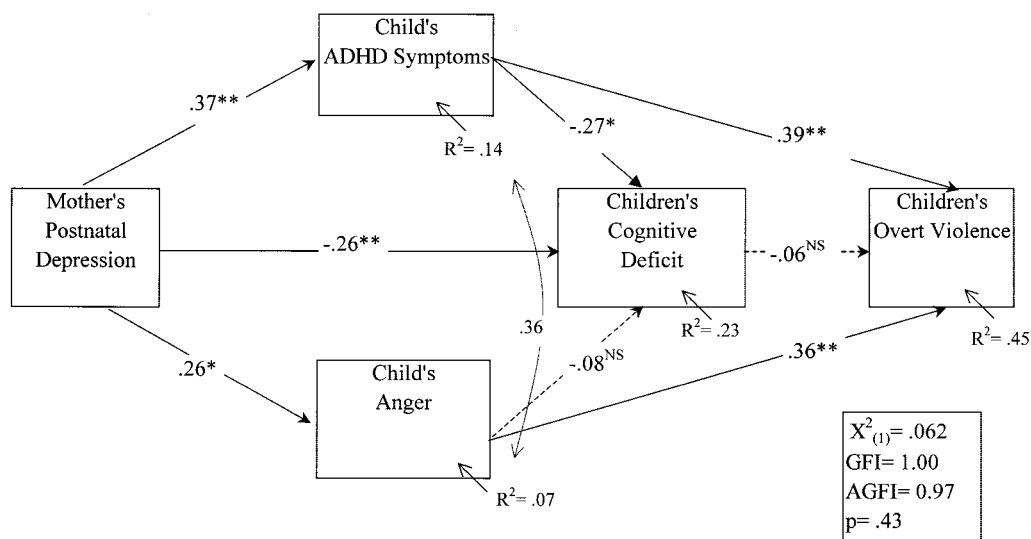


Figure 3. The mediating role of symptoms of attention-deficit/hyperactivity disorder (ADHD) and problems in managing anger is not changed when the child's cognitive ability is taken into account. GFI = goodness-of-fit index. AGFI = adjusted goodness-of-fit index. NS = nonsignificant. * $p < .05$. ** $p < .01$.

Table 4

A Comparison of Four Groups of Families in Which the Mother Became Depressed at Different Points After Childbirth

Measure	Group 1: mother well (<i>n</i> = 54)	Group 2: depression at 3 months (<i>n</i> = 7)	Group 3: depression after 3 months (<i>n</i> = 42)	Group 4: depression at 3 months and later (<i>n</i> = 19)
Mother's GAS				
<i>M</i>	85.5 _a	84.3 _{a,b}	77.7 _{b,c}	75.6 _c
<i>SD</i>	6.3	5.4	10.6	9.4
Child's violence score				
<i>M</i>	0.5 _a	1.0 _{a,b}	0.9 _{a,b}	2.2 _b
<i>SD</i>	1.0	1.9	1.4	2.7

Note. Higher GAS (Global Assessment Scale) scores imply better psychological functioning. Groups with the same subscripts are not significantly different from one another. Planned contrasts showed that mothers who had been depressed after 3 months (Groups 3 and 4) were functioning significantly less well than mothers who had never been depressed (Group 1): $t(62.7, \text{equal variances not assumed}) = 4.19, p < .01$, and $t(24.0, \text{equal variances not assumed}) = 4.28, p < .001$, for contrasts with Groups 3 and 4, respectively. Higher violence scores imply more severe violent symptoms. Planned contrasts showed that children of mothers who were depressed postpartum and at least once thereafter were significantly more violent than children whose mothers had remained well, Mann-Whitney $U = 346.0, z = -2.64, p < .01$.

The comparison of the four groups of children permits inferences about ways in which maternal depression might put children at risk for violence. If there is a general effect of maternal depression, all three groups of children who were exposed to depressed mothers should show more violence than those children who were not exposed. If there is a direct effect of early experience with a depressed mother, regardless of later events, the children whose mothers were depressed at 3 months (Groups 2 and 4) should be at greatest risk. If the child's violence is linked to the mother's more recent functioning, children whose mothers were depressed *after* 3 months postpartum (Groups 3 and 4) should be most at risk. Finally, if a tendency to be violent is affected by early experience but potentiated by reexposure to the mother's illness, the group of children whose mothers had postnatal depression and at least one subsequent episode (Group 4) should be most at risk.

Indeed, planned contrasts showed that the risk for violence was greatest in the group of children whose mothers were depressed in the postpartum period and at least once thereafter (see Table 4). In particular, these children were more likely than other children to use weapons, and their violence was noted outside the family, with teachers reporting that they fought frequently at school (see Figure 4).

Discussion

Children whose mothers were depressed after childbirth were at elevated risk for violence at age 11, especially if the mothers became depressed again. As expected, violent behavior at age 11 was more common in boys than in girls and in the children of men who had been arrested than in other children. Nevertheless, when other dimensions of family life were taken into account, those children whose mothers had been depressed in the months after childbirth were more violent than other children. In contrast to their peers, children whose mothers had been depressed at 3 months postpartum showed more diverse and more severe aggressive behaviors than other children, as reflected in the weighted violence score. These findings extend current knowledge about the

contribution of family influences to the development of aggression (Coie & Dodge, 1998; Loeber & Hay, 1997) by highlighting the link between children's earliest social experiences and their proclivity for clinically significant violent behavior.

The findings also provide evidence that an escalating pathway to overt violence (Loeber & Hay, 1994), first documented in boys in Pittsburgh, can also be discerned in the behavior of girls and boys in another culture. It is worth noting that although boys had significantly higher violence scores, some girls were extremely violent. Informants provided vivid examples of such violence. For

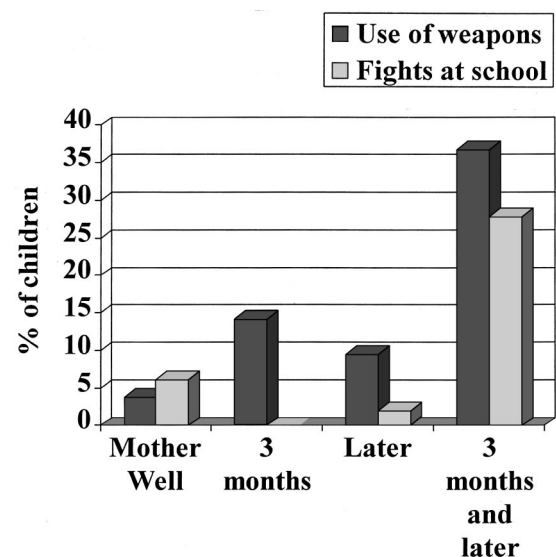


Figure 4. Children whose mothers had been depressed at 3 months postpartum and at least once thereafter were most likely to fight frequently, as reported by teachers on the Strengths and Difficulties Questionnaire, and to use weapons in their confrontations, as reported by children and mothers on the Child and Adolescent Psychiatric Assessment.

example, one mother described her daughter as being "out for the kill." Girls as well as boys were affected by the mother's postnatal depression.

The link between postnatal depression and violence at age 11 was associated with the children's problems in regulating attention and emotion. In particular, the children of depressed mothers were also angry and inattentive at age 11, and these tendencies were linked to their propensity for violence. The children's general cognitive ability did not explain these effects.

The findings can partly be explained in terms of shared method variance and in terms of correlations among different measures derived from the CAPA interview. However, the mothers' reports of ADHD symptoms were validated by teachers' reports, and the composite measure of expressed anger drew on the reports of two informants on the CAPA and three informants on the SDQ. Thus the findings cannot be entirely attributed to method variance. Although one must interpret cross-sectional data with caution, the findings are consonant with Hay's (1997) account of a developmental progression from experiences with a depressed mother to problems in self-regulation and early cognitive abilities and then on to later deficits in intellectual ability and behavioral problems. The findings also bear on current debates about whether ADHD and ODD are developmental precursors to CD (Lahey et al., 2000). These possibilities need to be tested in prospective longitudinal designs.

It is possible that the dysregulation of attention and emotion shown by the children of depressed mothers had biological origins. For example, there may be hormonal mechanisms at work. Disrupted caregiving in early life is associated with both hypo- and hypersecretion of the adrenal hormone cortisol (Gunnar, Morison, Chisholm, & Schuder, 2001). Cortisol levels in the developing organism affect hippocampal function, memory, and self-control (Heffelfinger & Newcomer, 2001), and so some of the cognitive and self-regulatory problems found in the infants of postnatally depressed mothers may be linked to cortisol hypersecretion in early postnatal life. This possibility also deserves test in new samples.

It is also of course possible that babies with heritable "difficult temperament" provoke depression in their mothers and thus that the continuity from postnatal depression to the child's later violence is entirely explained by preexisting factors within the child. In this view, the mother's postnatal illness might be a mere epiphenomenon of the child's disruptive tendencies at both time points. The fact that the newborn's characteristics predict the mother's postnatal depression (Murray, Stanley, Hooper, King, & Fiori-Cowley, 1996) lends some credibility to this argument. Thus in the future it will prove important to study the effects of postnatal depression in the context of genetically informative research designs. Whether cause or effect, however, it is clear that postnatal depression is an important clinical marker for the child's later problems, and a child's capacity for violence can be predicted with some reliability in the months after birth.

The experiences that accrue in families when the mother is depressed after childbirth appear to provide a context in which the infant's difficult behavior consolidates and persists. The risk for violence may be linked to the mother's chronic mental health problems following an episode of postnatal depression (Campbell & Cohn, 1997); it is important to recall that, in this sample, most mothers who were depressed after childbirth became depressed

again. Although the structural equation modeling analyses showed that it was depression in the postnatal period, not later in the child's lifetime, that predicted violence, it is in the context of the mother's continuing vulnerability to depression that children were most at risk.

The conclusions to be drawn about the timing and recurrence of the mother's illness are somewhat limited by the sample size and by the combination of retrospective and contemporaneous measures of the mother's mental state. It is important to make similar comparisons in a larger sample in which the mother's mental health is assessed at regular intervals. Nevertheless, the present findings represent one of the few existing attempts to examine the effects of clinically diagnosed postnatal depression in the context of later experiences in a representative sample of children followed up to childhood's end. As such, the patterns found for different outcome variables are worthy of note. Our earlier analyses of this sample showed that the mother's postnatal depression had a significant impact on the child's intellectual ability whether or not the mother became depressed again (Hay et al., 2001; Sharp et al., 1995). In contrast, it appears that violence is not an inevitable outcome of postnatal depression, but rather one that is made more likely under conditions of continued adversity. Early and recurring exposure to maternal depression puts children at risk for the overt pathway toward serious violence.

We had proposed that there might be intergenerational continuities in antisocial behavior on the part of mothers and children that accounted for any apparent effects of postnatal depression. This proposal received no direct support. In this sample, there was no co-morbidity between postnatal depression and ASPD in the mother, nor was there evidence for assortative mating with antisocial men. However, in view of previous research demonstrating links between girls' conduct problems and later vulnerability to depression (Rutter et al., 1998), it is certainly possible that some postnatally depressed women have a history of behavioral problems in childhood and adolescence that do not quite meet criteria for ASPD. It is also possible that some of these mothers might have had problems in regulating their own attention or managing their anger, which would not equip them well for the demands of caring for a young infant. These issues deserve further study.

What is clear from this study, and in line with the growing literature on postnatal depression (e.g., Goodman & Gotlib, 1999; Hay et al., 2001; Murray et al., 1999), is that the mother's mental state after childbirth is an easily identifiable risk factor for her child's intellectual and social development. As such, the children whose mothers are depressed after childbirth are a distinct subgroup who should be targeted for programs designed to prevent antisocial behavior.

What is not yet clear is the mechanism whereby this risk factor exerts its influence. Interventions designed to lift the mother's mood state in the postpartum period treat the mother's symptoms but have fewer effects on mother-infant interaction and on the problems shown by the child (e.g., Cooper & Murray, 1997). Thus, psychotherapeutic attempts to ameliorate the mother's illness may not actually affect the underlying processes that mediate the link between the mother's postnatal depression and the child's later violence. Future interventions that focus on the child's temperament and developing strategies for self-control, and the effect of the child's behavior on the mother's behavior, as well as on the cumulative risk provided by the episodic nature of the mother's

illness, may be more successful in preventing the development of violence.

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