

Severity, Chronicity, and Timing of Maternal Depression and Risk for Adolescent Offspring Diagnoses in a Community Sample

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Background: Risk for depression and other disorders is known to be high among children of depressed mothers, but little is known about the parameters of severity, chronicity, and timing of depression and its effects on children. The study addresses these issues, disaggregating their overlapping effects.

Methods: A sample of 816 women and their 15-year-old children in an Australian community were selected from a large birth cohort study to represent variation in maternal depression history during the child's first 10 years of life. Quantification of maternal depression severity and duration, and dates of occurrence, permitted analyses of youth depression and nondepressive disorders as a function of relative severity, chronicity, and timing of maternal depression.

Results: Diagnosable depression in children as old as 15 years was twice as likely among offspring of depressed, as compared with never-depressed mothers. After controls for demographic factors, severity of maternal depression contributed more to children's risk for

depression than did chronicity. Children exposed even to 1 to 2 months of maternal major depression, or to more than 12 months of mild depression had elevated risks of depression; however, chronicity of maternal depression was associated more with nondepressive outcomes than was severity. Timing of exposure did not differentially predict risk for the disorder in children when separated from confounding chronicity and severity parameters.

Conclusions: Even relatively brief maternal major depression, but more prolonged mild depression, predicted children's risk for depressive disorders by age 15 years in a community sample. Nondepressive outcomes were more complex to predict, which was due in part to difficulty dating disorder onset in relation to maternal depression. Exposure to maternal depression at any period in the first 10 years equally predicted youth depression if the mother was depressed only once. Further studies are needed to shed light on the mechanisms by which maternal depression has its effects.

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STUDIES OF the offspring of clinically depressed parents show that having a depressed parent is one of the strongest predictors of depression in youth.¹ Half or more of the children of clinical populations of depressed women experience depressive disorders, as well as disruptive, anxiety, and substance use disorders,²⁻⁵ and they may experience persisting or recurring depression and other disorders over time.⁶⁻⁸ Many nonclinical studies have also shown that infants and children of women with elevated self-reported depressive symptoms may display distress or impaired functioning.^{2,3,9}

One important question, however, has rarely been addressed, and that is the focus of the present study: how much, how often, and when does maternal depression take a toll on children? As a syndrome, de-

pression may vary in severity from mild with little impairment, to severe with immobilization, psychosis, or risk of suicide. Moreover, depression may vary in length from days to months, and it may be persistent or episodic, recurrent or nonrecurrent.

To fully develop the clinical, treatment, and prevention implications of maternal depression, it is important to understand the conditions under which depressive experiences are likely to cause concern for children's healthy development.^{1,10,11} Women themselves are beginning to ask relevant questions such as, "is my single major depressive episode putting my child at risk?" "Does even mild depression cause problems (how long must it persist)?" "Does the timing of the child's exposure to parental depression matter?"

To date, research has been remarkably silent regarding the severity, chronicity, and timing issues, and relatively few

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studies report information on characteristics of depression in their samples. Several studies have indicated that more chronically depressed women have more negative interactions with their infants than those with shorter periods of depression or with intermittent depressive symptoms, but the long-term consequences are unknown.^{9,12-13} Severity of maternal depression in clinical samples has been studied less often, and operationalized in varying ways with varying outcomes.¹⁴⁻¹⁶ However, in all of these studies, severity and chronicity were potentially confounded with each other. We located only one study that attempted to separate the effects of chronicity and severity of maternal depression,¹⁷ finding that chronicity (persistently elevated scores throughout several follow-up periods) and severity of self-reported symptoms made separate contributions to behavior problems and lower vocabulary scores at age 5 years, and the interaction of chronicity and severity contributed to the prediction of child scores.

Regarding the importance of timing of maternal depression, most investigators have assumed that earlier exposure is especially disruptive of normal development.¹⁰ Most studies of infants of depressed mothers have indeed demonstrated various indicators of maladjustment during these early years, including insecure attachment^{12,18} and behavioral and cognitive or linguistic dysfunction.⁹ However, the stability and implications for children's future diagnostic outcomes has yet to be evaluated. We located only 3 studies, yielding different results, that evaluated timing of maternal depression, comparing exposure at one age with exposure at a different age.^{17,19,20}

Methodological issues contribute to the neglect of important questions about severity, chronicity, and timing. These include the relative lack of longitudinal studies, use of clinical samples that may be atypical in severity and with limited generalizability, and relatively small sample sizes, precluding the ability to disentangle the overlapping issues of severity, chronicity, and timing. A fourth problem unique to most community-based studies, has been the reliance on self-reported symptoms with uncertain application to clinically significant depression.

The present study was designed to address these issues in a sample of more than 800 community women with varying degrees, durations, and timing of depressive experiences. Analyses included overall evaluation of the roles of severity and chronicity, and the effects of duration of mild-only and severe-only maternal depression, predicting depressive and nondepressive disorders in the women's 15-year-old children. Analyses of timing of exposure compared offspring of women who had been (equally) depressed only during one period, from birth through 2 years, 3 to 5 years, and 6 to 10 years.

METHODS

SUBJECTS

The participants were 816 women and their 15-year-old adolescent children selected from a large birth cohort study of children born between 1981 and 1984 at the Mater Misericordiae Mother's Hospital in Brisbane, Queensland.²¹ Included mothers were selected to oversample those with depression histo-

ries or who were never depressed, as described below. A follow-up questionnaire was given by the prior investigators to families when the child was 13 years old, identifying 68% of the original birth cohort still in the Brisbane area; participants in the present study were drawn from this group. Most attrition had occurred by age 5 years, and the retained sample included women who were significantly less depressed at the birth of their child and less likely to have been married at the time of birth. Participants in the present study did not differ from the original cohort in family income and maternal education.

The current study included 816 (414 boys and 402 girls) 15-year-old youth (mean age was 15 years 2 months [SD=0.29 years]) and their mothers (fathers were included where available, but are not reported in the present study). The overall sample was 92% white, 8% minority (Asian, Pacific Islander, and Aboriginal). Median family income at the 15-year follow-up was AU \$35 000 to \$45 000, indicating middle and lower middle class. Median level of mothers' education was grade 10 (approximately equivalent to US high school graduation), and mothers' mean age at the time of the study was 41 years; 76.8% of the mothers were currently married or cohabiting.

Sample selection was based on mothers' depression scores on the Delusions-Symptoms States Inventory (DSSI) of Bedford and Foulds.^{22,23} Mothers had provided information during pregnancy, after delivery, when the child was 6 months old, and when the child was 5 years old. The scores were then used to identify women who varied in level and frequency of elevated depression histories (or who were never depressed). Actual diagnostic information was collected in the present study as described in the following subsection.

We targeted 991 families for inclusion; 816 families (82%) consented and were studied; 3 families with a child who had severe hearing or visual impairment were not included; 1 child had died; 103 declined to participate; and 68 families could not be contacted.

PROCEDURES

Interviews were conducted in the families' homes. Interviewers were blinded to the mothers' depression status or history, and a team of 2 interviewers conducted the parent and child interviews separately and privately. The parents and children gave written informed consent (assent), and were paid for their participation, which lasted approximately 3.5 hours.

Interviewers

A team of 6 clinical psychology graduate students conducted the diagnostic interviews. All had prior clinical and research interview experience. They were trained by the authors, and were closely supervised via audiotape and periodic visits by the investigators. Systematic reviews of samples of interviews were conducted at 6-month intervals throughout the 3-year course of data collection.

Maternal Diagnostic Evaluation

The DSSI was used to select women into the study, but the diagnostic information used as data in the present study was based on the Structured Clinical Interview for DSM-IV (SCID).²⁴ The presence of lifetime and current diagnoses was ascertained with the investigators blinded to the woman's prior scores on the DSSI, and dating of onsets and episodes was performed as carefully as possible. Ratings by independent judges yielded weighted κ statistics for current diagnoses of major depressive episode, dysthymic disorder, and subsyndromal depression ($\kappa=0.87$), and for past depressive diagnoses or symptoms ($\kappa=0.84$). Clinical ratings of mother depression (based on the SCID from the

period between the child's birth and 5 years of age) corresponded significantly with categorizations based on the DSSI of severity of depressive symptoms assessed directly during the same period, $\chi^2=40.83$ ($n=811$), $P<.001$, and recurrence (a proxy for chronicity) during the interval of birth to 5 years of age, $\chi^2=42.59$, $P<.001$. Four women were omitted from subsequent analyses because their depression occurred in the context of a possible bipolar disorder.

The investigators constructed timelines of significant maternal depressive episodes occurring in the first 10 years of the child's life. Each period of depression was coded for severity, number of months' duration (chronicity), and timing (whether it occurred during child's age birth-2 years, 3-5 years, or 6-10 years). There were 3 levels of severity: level 4 indicated severe major depression requiring hospitalization, or psychotic features, suicidality, or severe impairment; level 3, moderate (typical) major depressive episodes; and level 2, dysthymic disorder, minor depressive episodes, or significant subsyndromal depression nearly meeting criteria for major depressive episodes. Thus, *chronicity* is the total duration across any separate periods of depressive disorder. The symptom timelines were constructed with investigators blinded to children's diagnostic status.

We coded only maternal depression during the first 10 years of the child's life to ensure its temporal precedence over children's disorders. However, inspection of children's age of onset revealed 4 cases in which maternal depression occurred at the same time or after the child's disorder, and these were omitted from analyses. Determining onset of children's nondepressive disorders was more problematic owing to lack of distinct onsets, such as attention deficit disorder or generalized anxiety disorder, which often occurred in early childhood. Onset was therefore coded as "early childhood" if it was estimated to occur before age 5 years. In 7 such cases, the mother did not report depression during the first 5 years of life, and these cases were omitted from analyses.

Child Diagnostic Evaluation

Presence of current and lifetime depressive and nondepressive disorders in the child was ascertained using the *Schedule for Affective Disorders and Schizophrenia for School-Age Children — Revised for DSM IV* (K-SADS-E),²⁵ administered separately to the parent and the child. Diagnostic decisions were reviewed by the clinical rating team, with best-estimate judgments based on all available information.²⁶ Orvaschel²⁵ reported excellent κ value reliability coefficients for major depression and dysthymia in children. In the current sample, the weighted κ value was 0.82 on youth and mother interviews for current depressive diagnoses (major depressive episode or dysthymia) or subclinical depression, and $\kappa=0.73$ for past depressive diagnoses or subclinical depression. Reliabilities for current anxiety disorders, substance use disorders, disruptive disorders (conduct disorder or oppositional defiant disorder), and "other" (primarily eating disorders) ranged from 0.67 to 1.0, with a mean of 0.82; reliabilities for these disorders in the past ranged between 0.72 and 1.0, with a mean of 0.81.

STATISTICAL ANALYSES

Logistic regression analyses were used to predict youth lifetime diagnostic outcomes as a function of maternal depression history. In all regression analyses, several demographic factors were included at the first step to control for their possible effects in obscuring the role of maternal depression—child's sex, whether the mother was currently married to the father of the child, mother's occupational status, and family income. Analyses of variance or χ^2 were used to compare groups consisting of women with depression only during a particular pe-

Table 1. Characteristics of Maternal Depression in the First 10 Years of Child's Life

Diagnostic Features of Entire Sample	Mothers and Children
No. with no significant depression	566
No. with significant period of mood disorder*	246
No. with bipolar disorder	4
No. with MDE	131
No. with dysthymic disorder†	107
Mean (SD) duration at level, mo‡	
Level 4 (severe MDE; n = 16)	0.70 (5.05)
Level 3 (MDE; n = 113)	6.73 (18.63)
Level 2 (dysthymic disorder, minor depression, subsyndromal MDE; n = 160)	33.08 (42.90)
All levels (n = 234)	40.78 (47.38)
Mean (SD) severity level per month at each child age interval	
0-2 y	0.71 (1.01)
3-5 y	0.75 (1.03)
6-10 y	0.75 (0.97)

*Diagnosis of major depressive episode (MDE), dysthymia, minor depression, or significant subsyndromal MDE.

†At least 1 year overlapping with child age 0 to 10 years.

‡Excludes bipolar disorder and women with depression occurring after child's disorder.

riod of the child's life. Specific procedures for disentangling the effects of severity, chronicity (total duration), and timing of maternal depression are described in the "Results" section.

RESULTS

OVERVIEW OF MATERNAL DEPRESSION AND CHILD DIAGNOSTIC OUTCOMES

Maternal Depression

Table 1 presents the maternal diagnoses of depression, mean duration at each severity level, and mean severity in each of 3 age intervals during the first 10 years of the child's life. As Table 1 indicates, milder depressions were longer than the more severe depressions. Overall, women who experienced any of the 3 levels of depression had a mean depression duration of 40 months (median=19.5 months) during the 10-year period. As the lower portion indicates, women were equally depressed across different child ages (within-subject $F_{2,798}=1.0$; P was not significant).

Among depressed women, 71% with mild depression had only level 2 severity; 61% with major depressive episodes had only level 3; and 33% with severe depression had only level 4. Overall, 42% of depressed women had episodes at different levels of severity.

Children's Diagnostic Outcomes

Lifetime depression (major depressive episode or dysthymic disorder) before age 15 years occurred in 105 children of the 800 families. Children of mothers with major depression, dysthymic disorder, or significant minor depressions were, by age 10, significantly more likely to have experienced major depression or dysthymia than

Table 2. Logistic Regression Analysis Predicting Lifetime Diagnosis in Youth by Maternal Depression to Age 10 Years

Variable/Step	Odds Ratio (95% Confidence Interval)
Prediction of depressive diagnosis in overall sample	
Sex	2.81 (1.76-4.48)
Marital status	0.86 (0.62-1.19)
Occupational status	1.07 (0.87-1.33)
Family income	0.85 (0.74-0.98)*
Highest depression level	1.27 (1.05-1.53)*
Chronicity of depression	1.01 (0.99-1.03)
Severity × chronicity interaction	1.00 (0.99-1.01)
Correlates of nondepressive diagnosis in overall sample	
Sex	0.64 (0.43-0.96)*
Marital status	0.92 (0.68-1.23)
Occupational status	0.87 (0.72-1.05)
Family income	0.96 (0.86-1.08)
Highest depression	1.07 (0.89-1.29)
Chronicity of depression	1.02 (1.00-1.04)†
Severity × chronicity interaction	1.00 (0.99-1.00)

* $P < .05$.

† $P = .09$.

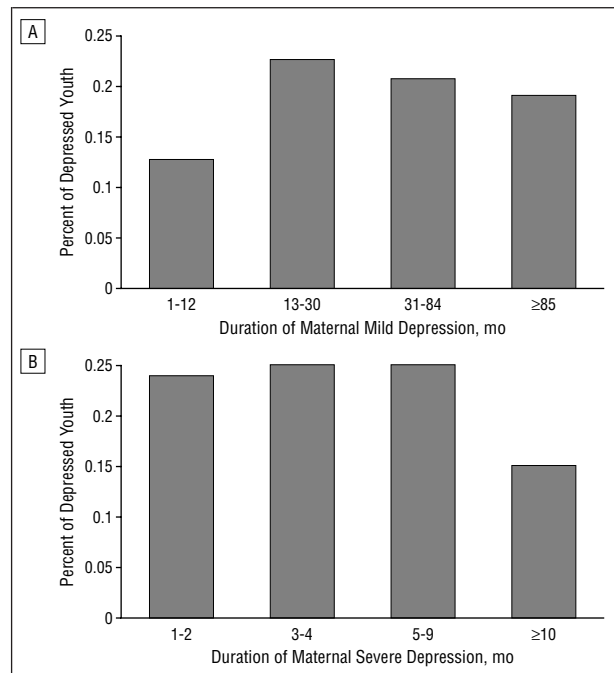
children of nondepressed women ($\chi^2_1 = 14.05$ [N=800] and $P < .001$ for 47/234 [20.1%] depressed mothers and 58/566 [10.2%] nondepressed mothers). Children of depressed women had significantly higher rates of anxiety disorders (10.7%; excluding simple phobia and nongeneralized social phobia) compared with children of nondepressed women (4.9%) ($\chi^2_1 = 8.81$ [N=800]; $P < .001$). Rates of attention deficit disorder, conduct disorder, oppositional defiant disorder, and substance use disorder were higher among children of women depressed in the first 10 years, but the effects were not statistically significant. Overall, 9% of children of depressed women had comorbid depressive and nondepressive disorders (27% of all those with disorders), compared with 3% of children of nondepressed women (14% of those with disorders).

EFFECTS OF MATERNAL DEPRESSION IN CHILD'S FIRST 10 YEARS: PREDICTING YOUTH DISORDERS

Prediction of Depression

As the upper half of **Table 2** indicates, in analyses of the entire sample, the contribution of the mother's highest depression severity to youth depressive disorder was statistically significant after demographic factors were controlled for (overall model: $\chi^2_7 = 37.48$ [n=767]; $P < .001$). However, neither chronicity (duration) of maternal depression nor the interactive effects of severity and chronicity added to the prediction of depressive diagnoses in our youth. Note also that sex (female) and family income (lower) were significantly predictive of depression.

Additional analyses were undertaken to disentangle confounded chronicity and severity. Two subgroups were defined: women with *only* mild depression (level 2; n=111), and those with *only* moderate or se-



A, Depressed youth of depressed mothers divided into quartiles by duration of maternal mild-only depression prior to child's age 10 years (n=20 youth). B, Depressed youth of depressed mothers divided into quartiles by duration of maternal moderate or severe-only depression prior to child's age 10 years (n=17 youth).

vere depression (coded as level 3 or 4, with no mild depression; n=77). Twenty children of mildly depressed women (18%) had diagnoses of depression. After controlling for the demographic variables, duration of mild depression was a nonsignificant predictor of depression in youth ($\chi^2_1 < 1$ [n=102]; P was not significant). Part A of the **Figure** shows that although there was no significant effect of duration, only when the mothers' depression exceeded at least 12 months did the probability of depression in the youth substantially exceed that of children of never-depressed women (9.8%). For the severe or moderate depression-only women, 17 children (22%) had a depressive diagnosis. A logistic regression analysis showed that after controlling for the demographic variables, duration of depression nearly reached statistical significance ($\chi^2_5 = 3.67$ [n=74]; $P = .06$). However, the effect was not linear. Part B of the **Figure** suggests that extremely long durations of major depression were *less* likely predictive of youth depression. Youth exposed to severe or moderate maternal depressive episodes of only 1 to 2 months were as likely to become depressed as those exposed to episodes of longer duration.

Correlates of Nondepressive Disorders in Youth

Overall, 52 offspring (22.2%) of depressed women had a nondepressive disorder (14.8%), excluding minor disorders such as specific phobia or nongeneralized social phobia ($\chi^2_1 = 6.39$ [N=800]; $P = .01$). As noted however, it is more difficult to determine the timing of early-onset chronic nondepressive disorders in relation to maternal depression. We omitted cases in which maternal depression had not occurred prior to child age 5 years

in children who had nondepressive early disorders, but retained cases cannot precisely determine that maternal depression occurred prior to youth onset of disorders such as attention-deficit/hyperactivity disorder. To be conservative, the analyses must be interpreted to represent maternal depression “correlates” rather than temporally precedent predictors.

The lower half of Table 2 presents logistic regression analyses to predict youth nondepressive disorders for the entire sample. After controlling for demographic factors, maternal highest severity of depression was not a significant incremental predictor, but there was a marginally significant incremental contribution by maternal duration of depression ($P < .09$). The interaction of chronicity and severity was nonsignificant, and sex was also a significant correlate of nondepressive disorders.

To disentangle severity and chronicity of maternal depression, separate analyses were computed to evaluate chronicity at severe-only and mild-only maternal depression. Among the women with only mild depression, chronicity ($P = .02$) and marital status ($P = .05$) were significant correlates of youth nondepressive disorders in the final model. For mothers with only severe or moderate major depression, duration was nonsignificant, and none of the demographic variables were also associated with youth nondepressive disorders.

TIMING OF MATERNAL DEPRESSION IN RELATION TO CHILDREN'S RISK FOR DISORDER

Women with depression in one period of their child's life tended to have depressive episodes at other times. Scores for maternal depression during the periods between birth and age 2 years, age 3 to 5 years, and age 6 to 10 years were highly intercorrelated (r values = 0.61-0.77); thus, timing of depression and total exposure (chronicity) are confounded with each other. It was therefore necessary to identify groups of women who were depressed only during one interval and not at any other time. There were 31 women with depression only during the first 2 years of the child's life, 27 women with depression only during child age 3 to 5 years, and 72 women with depression only during child age 6 to 10 years. These women differed neither on the mean severity ($F_{2,129} < 1$; P was not significant) nor mean duration ($F_{2,129} < 1$; P was not significant) of their depression.

Overall, there were no differences in the 3 age periods in the proportions of children who received diagnoses of depression (19%, 22%, and 17%, respectively; $\chi^2_2 < 1$ [$n = 130$]; P was not significant) or diagnoses of a nondepressive disorder (26%, 15%, and 14%, respectively; $\chi^2_2 < 1$ [$n = 130$]; P was not significant). However, compared with children whose mothers were never depressed, children with depressed mothers during only any one interval of their lives had significantly higher rates of diagnosable depression (19% vs 10%; $\chi^2_1 = 6.83$ [$n = 696$]; $P < .001$). However, they were no more likely to have higher rates of nondepressive disorders than did children of never-depressed women (17% vs 15%; $\chi^2_1 < 1$ [$n = 696$]). Finally, the 3 maternal timing groups did not differ significantly in features of children's depression: severity and duration ($F_{2,129} = 1.18$ and $F_{2,129} = 1.02$, re-

spectively; P was not significant; age of onset was not significant).

COMMENT

A large community sample of women varying in histories of depression permitted analyses of the unconfounded effects of depression severity, chronicity, and timing on children's risk for depression up to age 15 years, controlling for demographic variables predictive of depression. Children exposed to maternal depression prior to age 10 years (and before the onset of a youth disorder) were twice as likely to have major depression or dysthymic disorder as children of never-depressed mothers (20% vs 10%). Overall, severity of maternal depression was a better predictor than duration, and the interaction of the factors was nonsignificant. Controlling for severity, patterns of chronicity suggested that if exposed only to mild depression, duration had to be 12 months or more to elevate youth risk, while at moderate or severe levels, even 1 or 2 months' exposure significantly elevated risk, although the overall effect was not linear. Whether the effects are owing to genetic factors or to psychosocial variables that endure even when the mother is no longer depressed cannot be determined in this study and requires further investigation.

Nondepressive disorders in youth were also more common among offspring of depressed women (22% vs 15%), with anxiety disorders especially associated with maternal depression. It was difficult to precisely time the onset of early childhood disorders in relation to maternal depression. Results suggested an association between longer duration of mild maternal depression and occurrence of youth nondepressive disorders, but the duration of severe depression did not add to the prediction of youth nondepressive disorders. In view of the large number of early-onset nondepressive disorders in the sample, the role of maternal depression as a causal (temporally precedent) factor cannot be claimed without more precise timing of maternal depression. Also, sample sizes precluded analyses of specific nondepressive disorders.

Comparisons of the timing of exposure unconfounded with severity and duration found no differences in youth risk for groups of women with single periods of depression during one of 3 intervals. All were equally predictive of youth depression compared with never-depressed women. Absence of timing effects does not dispute research that demonstrates the negative developmental effects on children in their early years.⁹ However, it does suggest that postpartum depressions are not in themselves more risky than depression at other periods. It is possible that adverse effects of postpartum depression occur particularly in women with chronic or intermittent depression subsequent to the postpartum period.

Overall rates of disorder in youth of depressed mothers are lower than those reported in many offspring studies; however, the sample was community-based rather than clinically ascertained. Also, the present study controlled for demographic factors that are known to be associated with children's risk for depression, such as sex, maternal marital status, and socioeconomic status to make the effects of maternal depression characteristics more salient. In future work, however, we plan to examine the specific

role of situational and interactional factors to help clarify their contribution. Finally, of course, the offspring were assessed up to age 15 years and have not passed through the age of risk for disorders. Outcomes during the transition to adulthood are currently being studied.

Limitations of the study include the relatively small samples resulting from disaggregation of severity, chronicity, and timing. The analyses focused only on the first 10 years of the child's life to assure temporal precedence of maternal depression, and it is possible that the picture might have been different if all 15 years had been considered. It is acknowledged that the study relied on women's retrospective reports of their past depressions, and the reliability of such reports is known to be modest.²⁷ However, as noted, there was significant agreement between contemporaneous reports of symptoms during the most distant recalled period (birth – age 5 years) and retrospective SCID interview reports of depression occurring during the same period. Such agreement, while not perfect, increases our confidence that the severity, chronicity, and timing parameters were valid. It should also be noted that the study was based on a birth cohort of a particular period in Queensland, Australia. Accordingly, there may be limits to generalization to cohorts born in different decades, or to US samples. The culture of Australia is highly similar to that of the US and other Western industrialized nations, and there is no clear reason to expect that the maternal depression variables would operate differently in Australia than elsewhere. Finally, we acknowledge focusing exclusively on depressed mothers. The combinations of fathers' and mothers' disorders seem to be highly important and are emphasized in a separate report.²⁸

Overall, the study gives a more precise answer to the question of children's risk for disorders due to maternal depression. It underscores concern about the deleterious effects of significant maternal depression—whether even brief major depressions or subsyndromal but enduring depression—and the need to increase our efforts to reach parents who are reluctant to seek treatment. At the same time, it may reassure those who have been worried that mild, but brief periods of depression are harmful. The findings encourage further efforts to shed light on the risk mechanisms and processes by which parental depression affects children.

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