

# Timing of initial exposure to maternal major depression and children's mental health symptoms in kindergarten<sup>†</sup>

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**Background** Little is known about the influence on child mental health symptoms of the timing of initial exposure to maternal major depression or whether the timing is associated with 'pure' or co-occurring internalising and externalising symptoms.

**Aims** To address these issues, while also taking account of child gender and family socio-economic status.

**Method** In a prospective community-based study, 421 kindergarten teachers rated children's symptoms. Previous assessments of maternal major depression indicated whether children were first exposed during infancy, in the toddler/pre-school period, or never.

**Results** Exposure during infancy was associated with high internalising symptoms, especially when co-occurring with high externalising symptoms. Initial exposure in the toddler/pre-school years increased the risk of 'pure' externalising symptoms among girls.

**Conclusions** The association of child mental health symptoms with the timing of initial exposure to maternal depression highlights the need for effective prevention and intervention strategies addressed to the developmental issues of each period.

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Children of depressed mothers suffer various emotional and behavioural difficulties, but little is known about the influence of the timing of children's initial exposure to maternal depression. Furthermore, previous research has not consistently addressed the question of specificity by considering whether the timing is differentially associated with internalising or externalising symptoms. These issues were addressed in a prospective study of kindergarten children who had been initially exposed to maternal depression in infancy, the toddler/pre-school period, or never, and who were rated by their teachers as evidencing high levels of 'pure' internalising, 'pure' externalising, or co-occurring symptoms.

## Background

It is well established that offspring of depressed mothers suffer a variety of adverse outcomes (reviewed by Cummings & Davies, 1994; Gotlib & Goodman, 1999). Infants of depressed mothers have been found to be more withdrawn, to have more difficult temperaments, and to be less securely attached to their mothers (Field, 1992; Murray *et al.*, 1996; Campbell & Cohn, 1997). Toddlers and pre-school children of depressed mothers have been found to have more difficulties with self-regulation and in relationships with peers and adults (Lyons-Ruth, 1992; Cicchetti *et al.*, 1998). School-age children of depressed mothers have been found to have even more difficulties (Anderson & Hammen, 1993; Fergusson *et al.*, 1995).

With few exceptions (for example, Sinclair & Murray, 1998), prior studies have not employed a developmental perspective or prospective longitudinal designs of sufficient duration to investigate the association of earlier maternal depression

with children's problems at later points, and none has specifically looked at the timing of depression. Timing is critical because it may interfere with mastery of developmental tasks such as attachment and emotion regulation during infancy, or self-regulation and social competence in the toddler/pre-school years (reviewed by Goodman & Gotlib, 1999). Also, to our knowledge, studies have not distinguished between child outcomes with co-occurring internalising and externalising symptoms, and those with 'pure' forms of these symptoms.

## Aims

The study addressed these issues by investigating the association of the timing of maternal depression with child symptoms during the spring of the children's kindergarten year, an important developmental point when vulnerabilities established earlier may become risk factors as children negotiate new relationships and the increased structure of school (Entwisle & Alexander, 1989). We also distinguished between 'pure' internalising, 'pure' externalising, and co-occurring symptoms. We addressed three questions. First, are the risks of internalising and externalising symptoms associated with differences in the timing of children's initial exposure to maternal depression? Second, is the effect of the timing different if 'pure' forms of symptoms are distinguished from co-occurring forms? And third, do symptom patterns vary according to child gender or family socio-economic status as indexed by maternal education?

## Hypotheses

Two major hypotheses were tested:

- (a) Exposure to maternal depression in infancy would be associated with internalising symptoms, either alone or co-occurring with externalising symptoms, because this is a 'sensitive' period for attachment and the development of emotional regulation.
- (b) Initial exposure to maternal depression in the toddler/pre-school years would be associated with externalising symptoms alone, because this is a period when children learn to self-regulate and gain social skills.

<sup>†</sup>See editorial, pp. 93–94, this issue.

## METHOD

### Sample

Women were recruited from prenatal clinics in two Midwestern cities in the USA. Participants were required to be over 18 years old, in the second trimester of pregnancy (12–21 weeks), and, because the original focus of the project was on issues of family and work, to be living with the child's father, and either employed or a homemaker – see Hyde *et al* (1995) for details. Of those who met inclusion criteria, 570 (75%) consented to participate; 560 had live births. The analyses presented here are of 421 mothers (75% of the live births) whose children were attending formal kindergarten programmes and whose teachers provided ratings.

### Demographic characteristics

The sample of 421 mothers used in the study was composed of 6% ethnic minorities, 96% married, and 40% first-time mothers. The age range was 20–43 years, median 30 years. Two per cent had less than a high-school degree, 42% were high-school graduates, 35% were college graduates and 21% had some education beyond college. Annual family income ranged from \$7500 to \$200 000, median \$47 000. There were no significant differences between the 421 families who are included in these analyses and the 139 who comprised the remainder of the original eligible sample in terms of ethnicity, family income, maternal education or parity, but the participating mothers were more frequently married (96% *v.* 91%) and older (30 years *v.* 28 years).

### Measures

#### Maternal major depression

The depression section of the National Institute of Mental Health Diagnostic Interview Schedule (DIS) (Robins *et al*, 1981) was administered in home interviews to diagnose maternal major depression during the first year post-partum and when the children were aged 3½ and 4½ years. Responses were scored for the presence of major depression according to the DSM-III-R requirement of symptoms corresponding to five or more criteria, including either depressed feelings or loss of interest (American Psychiatric Association, 1987). Two indices of the timing of children's initial exposure were then derived:

- (a) the presence of maternal major depression during infancy, defined as any time from the child's birth to age 12 months;
- (b) *only* in the absence of depression during infancy, its presence during the toddler/pre-school period (age 2–4½ years; the DIS was not given between years 1 and 2).

For each index, 1 denotes initial exposure to maternal depression during that period and 0 denotes that the child was not first exposed during that period. Children who were never exposed to maternal major depression had scores of 0 on both indices.

#### Teacher ratings of child internalising and externalising symptoms

Teachers completed the Health and Behaviour Questionnaire (HBQ) in the spring of the kindergarten year. The HBQ is a multi-dimensional and multi-informant instrument for middle childhood assessment (described fully by Essex *et al*, 2001). The mental health symptom items used in the study were derived from the Ontario Child Health Study scales – revised (OCHS-R), well-established measures with known reliability and validity (Boyle *et al*, 1993). The teacher form included a 14-item internalising scale (sub-scales of depression and overanxious disorder) and a 24-item externalising scale (sub-scales of oppositional defiant and conduct problems, and overt aggression). Internal consistencies for all scales and sub-scales exceeded 0.70 and test-retest reliabilities ranged from 0.71 to 0.94. A cut-off point of the upper 25% of the distributions on the internalising and externalising scales was used to define the children evidencing 'high' symptoms. This cut-off point was selected to ensure that the children's scores fell within 1 standard deviation of the mean for clinic samples in the multi-site case-control study that established the effectiveness of the HBQ in discriminating between clinic-referred and community groups of young children (Ablow *et al*, 1999). Effect sizes of 1.0 (internalising) and 1.3 (externalising) were found for discriminations between community and clinic-referred children. In addition, in a selected sample of children from the present study, teacher HBQ ratings of externalising symptoms discriminated between children who were 'high' and 'low' on a parent-rated composite score for temperamental anger, activity, low

control and poor attention (effect sizes from 1.3 to 2.1). Teacher internalising ratings on the HBQ, however, did not identify children who were temperamentally fearful or sad.

#### Child gender and maternal educational level

Measures of child gender (boys, 0; girls, 1) and maternal education (high school or less, 0; more than high school, 1) were also included, based on prior findings demonstrating gender differences and the association of maternal education with child problems (Lyons-Ruth, 1992; Sinclair & Murray, 1998). The addition of income and paternal education, as components of socio-economic status, did not improve any models described below.

### Data analysis

In addition to descriptive statistics and chi-squared analyses, two sets of logistic regression analyses addressed the main questions. Predictors were the indices of the timing of children's initial exposure to maternal depression ('never exposed' was always the contrast group), child gender and maternal education. Interactions of the timing indices and the other two predictors were tested in separate models because of problems of multi-collinearity. One-tailed tests were used for tests of stated hypotheses; two-tailed tests of all other predictions. To reduce the risk of type II error, only interactions significant at a 0.01 level or less are reported.

Following an analytic strategy used in other studies that have not differentiated children with 'pure' symptoms from those with co-occurring symptoms, the first set of logistic regression analyses estimated separate models for internalising and externalising symptoms. These were followed by multinomial logistic regressions that included the distinction between the 'pure' and co-occurring symptom groups. The model simultaneously estimated three equations to evaluate the influence of the predictors on the children's membership in the groups 'high internalising symptoms only' *v.* 'low symptoms', 'high externalising symptoms only' *v.* 'low symptoms', and 'high co-occurring symptoms' *v.* 'low symptoms'.

Because we used a clinically validated cut-off point of 25% to define high symptom groups, we also checked to see whether these results were robust. We were particularly sensitive to the common problem with this categorical approach that children

whose symptoms were just above or below the threshold would not be distinguished from those at the more extreme ends of the distributions. When analyses were conducted using the upper 20% and the upper 30% of the distributions, no differences in results were obtained. Similarly, when analyses were conducted omitting the children in the third quartile, no differences in results were obtained. We therefore report only the results of the analyses using the 25% cut-off points.

**RESULTS**

**Sample characteristics**

In the spring of their kindergarten year, the average age of the children was 73 (s.d.=3.5) months; there were 207 boys and 214 girls. Twenty-seven per cent of their mothers had experienced at least one episode of major depression since the birth. Of these, 38% (n=44) had an episode within the first year of the child's life and 61% (n=69) experienced the initial episode in the child's toddler/pre-school years. Mothers of girls

were significantly more likely than mothers of boys to have had major depression during the first year (14% v. 7%),  $\chi^2$  (1, n=421)=5.17, P=0.023. There was no child gender difference for mothers' first episodes during the toddler/pre-school period.

**Effects of child gender and maternal education on child symptoms**

Both child gender and maternal education were associated with children's symptoms. When the 'pure' and co-occurring symptom groups were not distinguished, boys were significantly more likely than girls to be in the high externalising group,  $\chi^2$  (1, n=421)=5.89, P=0.015. However, when the group with 'pure' externalising symptoms was analysed separately from the group with co-occurring symptoms, this gender effect was seen in the 'pure' externalising group,  $\chi^2$  (1, n=421)=12.79, P<0.001, but not in the 'both' group,  $\chi^2$  (1, n=421)=0.52, P=0.470. There were no significant gender differences for internalising symptoms.

Maternal education was also related to child symptoms. Children whose mothers had a high-school education or less were significantly more likely to be rated by teachers as high in co-occurring symptoms,  $\chi^2$  (1, n=421)=16.68, P=0.001. There were no significant associations between maternal education and teacher reports of 'pure' internalising or externalising symptoms (Table 1).

**Timing of initial exposure to maternal depression and child symptoms**

*Exposure in the infancy period (0–12 months)*

Results from the first set of logistic analyses showed that when children with 'pure' forms of symptoms were combined with those with co-occurring symptoms, exposure to maternal depression during infancy was associated with greater odds of being in the high internalising (odds ratio (OR) 3.01, 95% CI 1.55–5.83, P=0.001) and the high externalising symptom groups (OR 2.15, 95% CI 1.07–4.32, P=0.016) (Table 2). However, when children with high co-occurring symptoms were distinguished from those with 'pure' symptoms, the multinomial logistic regressions showed differences in risk. While children exposed to maternal depression during infancy were more than twice as likely to be rated by kindergarten teachers as high in 'pure' symptoms (OR 2.23, 95% CI 0.94–5.37, P=0.035), these odds were more than doubled for high levels of co-occurring symptoms (OR 5.00, 95% CI 2.05–12.30, P<0.001). Of particular importance is the finding that exposure to maternal depression in infancy was not associated with risk for 'pure' externalising symptoms. None of the interaction terms

**Table 1** Numbers and percentages of children in low, 'pure', and co-occurring mental health symptom groups according to child gender and maternal education

	Boys		Girls	
	Low maternal education <sup>1</sup> n (%)	High maternal education n (%)	Low maternal education n (%)	High maternal education n (%)
Low symptoms group	24 (51)	88 (55)	36 (58)	103 (68)
High 'pure' internalising group	8 (17)	22 (14)	6 (10)	25 (16)
High 'pure' externalising group	8 (17)	40 (25)	6 (10)	15 (10)
High 'both' group	7 (15)	10 (6)	14 (23)	9 (6)

n=421.

1. Low maternal education, high-school degree or less; high maternal education, more than high-school degree.

**Table 2** Numbers and percentages of children in mental health symptom groups, combining 'pure' and co-occurring groups, according to timing of initial exposure to maternal depression and child gender

	Timing of initial exposure to maternal depression					
	Never		Infancy period		Toddler/pre-school period	
	Boys n (%)	Girls n (%)	Boys n (%)	Girls n (%)	Boys n (%)	Girls n (%)
Low symptoms group	81 (53)	110 (71)	5 (36)	14 (46)	26 (65)	15 (52)
High internalising group ('pure'+ 'both')	32 (21)	34 (22)	7 (50)	13 (44)	8 (20)	7 (24)
High externalising group ('pure'+ 'both')	51 (33)	23 (15)	5 (35)	11 (37)	9 (23)	10 (34)

n=421.

**Table 3** Numbers and percentages of children in low, 'pure', and co-occurring mental health symptom groups according to timing of initial exposure to maternal depression and child gender

	Timing of initial exposure to maternal depression					
	Never		Infancy period		Toddler/pre-school period	
	Boys n (%)	Girls n (%)	Boys n (%)	Girls n (%)	Boys n (%)	Girls n (%)
Low symptoms group	81 (53)	110 (71)	5 (36)	14 (46)	26 (65)	15 (52)
High 'pure' internalising group	21 (14)	22 (14)	4 (29)	5 (17)	5 (12)	4 (14)
High 'pure' externalising group	40 (26)	11 (7)	2 (14)	3 (10)	6 (15)	7 (24)
High 'both' group	11 (7)	12 (8)	3 (21)	8 (27)	3 (8)	3 (10)

n=421.

including exposure in the infancy period was significant (Table 3).

#### *Initial exposure in the toddler/pre-school period (age 2–4 years)*

When children with 'pure' forms of symptoms were combined with those with co-occurring symptoms, initial exposure to maternal depression in the toddler/pre-school period was associated with greater odds of being rated by teachers as being in the high externalising group, but only for girls (OR 4.30, 95% CI 1.32–14.06,  $P=0.008$ ) (see Table 2). However, when girls with high co-occurring symptoms were distinguished from those with 'pure' symptoms, initial exposure in the toddler/pre-school period posed a risk for high levels of 'pure' externalising symptoms (OR 9.03, 95% CI 2.16–37.71,  $P=0.002$ ) but not for co-occurring symptoms (OR 1.84, 95% CI 0.27–12.43,  $P=0.267$ ). Exposure to maternal depression in the toddler/pre-school period was not associated with risk for high internalising symptoms, in either 'pure' or co-occurring forms. The interaction term including exposure in the toddler/pre-school period and maternal education was not significant (see Table 3).

## DISCUSSION

### **Exposure during the infancy period**

Although the majority of studies of maternal depression during infancy have been limited to investigations of the concurrent or short-term effects on infants, there is evidence that exposure to maternal depression in this period is associated with more enduring problems (Alpern & Lyons-Ruth, 1993; Sinclair & Murray,

1998; Murray *et al*, 1999). Our findings parallel these studies – that is, the children who were exposed to maternal depression during infancy were more likely to be rated by their kindergarten teachers as evidencing high internalising and high externalising symptoms. However, when the co-occurring symptom group was distinguished from the 'pure' symptom groups, it was clear that exposure to maternal depression in infancy increased the risk of externalising problems primarily as they occurred in the context of high internalising symptoms.

These findings support the idea that infancy may be a 'sensitive period' for the occurrence of internalising symptoms later in childhood because it is an important time for the development of a secure mother–infant attachment, which in turn provides a framework for the infant's regulation of emotion (Campbell & Cohn, 1997). Maternal depression may impede achievement of these stage-salient tasks and have a longer-range impact on the child's affective, behavioural or cognitive development.

### **Initial exposure during the toddler/pre-school period**

Our findings indicated that initial exposure to maternal depression in the toddler/pre-school period increased the risk only of high 'pure' externalising symptoms in kindergarten, and then only among girls. This stands in contrast to other studies that do not distinguish initial exposure during this developmental period from episodes that began earlier, and which generally find increased concurrent internalising and externalising symptoms. However, caution must be exercised in interpreting this finding because the cell sizes are small. Moreover, reports of gender differences in

prior studies on this subject have been inconsistent (reviewed by Goodman & Gotlib, 1999).

Nevertheless, there is evidence in prior studies to suggest several plausible explanations for the risk in girls. Each is predicated on the assumption that girls identify more strongly with their mothers than do boys. To the extent that maternal depression may arise in the context of family stressors (Cicchetti *et al*, 1998) that are also known to be associated with externalising disorders (Fendrich *et al*, 1990) and accompanying increased irritability and harsher parenting (reviewed by Cummings & Davies, 1994; Goodman & Gotlib, 1999), girls may be especially likely to react with increased negativity. Further, it may be the change from maternal health and a secure relationship in infancy to maternal depression later that has a uniquely damaging effect on girls, who may be especially reactive to this shift.

### **The timing of maternal depression**

Taken together, the findings suggest that the impact of maternal depression may be more severe with earlier exposure (Goodman & Gotlib, 1999). It is also possible that these effects are due to the persistence or recurrence of maternal depression into the toddler/pre-school period, so that it is the length of the exposure, rather than its timing, that is important (Anderson & Hammen, 1993; Campbell & Cohn, 1997; NICHD Early Child Care Research Network, 1999). However, the results of the study did not change when we took account of children who were exposed to maternal depression in both periods. Although it is important to investigate this issue more fully, these findings suggest that exposure in the

infancy period does have important and lasting effects on children's mental health symptoms, consistent with studies such as those by Murray and colleagues (Murray *et al*, 1999).

It is possible, of course, that children's difficult temperaments or emotional and behavioural problems precede the onset of maternal depression in the toddler/pre-school period. Although some studies have demonstrated that these are reciprocal and not one-way relationships (Hammen *et al*, 1991; Gotlib & Wheaton, 1997), others have shown that maternal depression affects children's symptoms independent of any effects of children on mothers (Murray *et al*, 1996).

### The distinction between pure and co-occurring symptoms

The findings from this study underscore the importance of distinguishing the co-occurring symptom group from those with 'pure' forms. To the extent that children exposed to maternal depression during infancy experience disruptions in attachment and security, they may be especially vulnerable to internalising problems as they negotiate the challenges of developing new relationships with peers and teachers during the first year of formal schooling. If disruptions in attachment also have interfered with children's learning to regulate emotions, they may also be vulnerable to externalising symptoms during this potentially stressful time. For girls especially, initial exposure to maternal depression in the toddler/pre-school period, when the stage-salient tasks are to develop autonomy and self-control, may pose a special risk for 'pure' externalising symptoms as new social relationships and the structured setting of the kindergarten classroom are encountered.

Unfortunately, in attempting to clearly define and measure child mental health symptoms, researchers have taken pains to distinguish internalising from externalising symptoms but have typically ignored their frequent co-occurrence (Zoccolillo, 1992). While 'pure' forms of symptoms may often (but not always) have different aetiologies, their co-occurring forms may arise from problems of attachment and emotional dysregulation (Cole & Zahn-Waxler, 1992) originating in infancy.

The importance of distinguishing the co-occurring symptom group from the 'pure' symptom groups is also emphasised when considering the direct influence of child gender and maternal education on

### CLINICAL IMPLICATIONS

- Early postnatal detection and treatment of maternal depression is important for identifying children at risk for 'pure' internalising problems, but especially for children at risk for co-occurring problems.
- Identification and treatment of maternal depression that first occurs during the toddler/pre-school years may be especially important for mothers of girls.
- If children present with externalising problems, the possibility of co-occurring internalising problems and the role of early maternal depression in their development should be considered.

### LIMITATIONS

- Although the importance of the timing of initial exposure to maternal depression has been suggested, the influences of other aspects of parental psychopathology (severity and duration, potentially confounding comorbid psychopathologies, paternal psychopathologies), contextual stressors and individual child characteristics have not been considered.
- The focus on teacher-reported child symptoms during the kindergarten year limits the ability to generalise the findings to the more serious persistent (across several years) and pervasive (across school and home contexts) child problems. Teacher ratings were chosen to avoid bias from maternal depression, but such ratings may themselves be biased.
- Small cell sizes, especially girls in the high 'pure' externalising symptom group, argue for the importance of replication of these results.

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children's symptom patterns. In this study boys were more likely to be in the high 'pure' externalising group, possibly because externalising behaviours in their 'pure' form are more normative for boys than for girls. In addition, children whose mothers had less education were more likely to have co-occurring symptoms. These results suggest that the associations between family socio-economic status and externalising symptoms found in other studies (Sinclair & Murray, 1998) may actually reflect an association between socio-economic status and co-occurring symptoms, rather than an association with externalising symptoms *per se*.

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