

Research report

## The course of anxiety and depression through pregnancy and the postpartum in a community sample

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### Abstract

**Background:** Postnatal and antenatal depression are a focus of considerable clinical and research attention, but little is known about the patterns of anxiety across this period. **Methods:** Self-reported anxiety and depression were assessed at 18 and 32 weeks gestation and 8 weeks and 8 months postnatally in a prospective longitudinal study of a community sample of women in England ( $n=8323$ ). **Results:** The majority of cases of postnatal depression were preceded by antenatal depression; similarly, postnatal anxiety was preceded by antenatal anxiety. Despite the stability of anxiety and depression across this period, there was a mean decrease in both anxiety and depression. Finally, antenatal anxiety predicted postnatal depression at 8 weeks and 8 months, even after controlling for antenatal depression ( $OR=3.22, p<0.001$ ). **Limitations:** Data were based on self-report only and there was evidence of selective attrition. **Conclusion:** The findings confirm that antenatal anxiety occurs frequently, overlaps with depression and increases the likelihood of postnatal depression.

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Maternal mood across the transition from pregnancy to the postnatal period is a focus of research and clinical attention because maternal mood disturbances during this period may affect developmental outcomes in the child. Most existing research has focused on depression; less is known about the patterns of anxiety, or the connections between depression and anxiety during this period.

This paper adds to existing research by examining depression and anxiety prospectively from pregnancy to the postnatal period in a large community sample of women in England.

One aim of this research was to examine the rates and stability of depression and anxiety across the transition from pregnancy to the postnatal period. Previous research has found that, despite the substantial hormonal, psychological and social changes experienced from pregnancy to the postpartum period, individual differences in depression are stable. Thus,

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much the strongest predictor of postnatal depression is depression in pregnancy (Llewellyn et al., 1997; O'Hara and Swain, 1996).

In contrast, little is known about the stability of anxiety during this period. Although substantial stability might be expected, it is possible that some women are more prone to develop anxiety from the particular physiological changes and psychological processes associated with birth. The current study examines whether or not a substantial portion of women reporting heightened anxiety in the postnatal period also showed heightened anxiety prior to birth.

In addition to assessing individual differences or the rank-ordering of individuals over time, another way of defining change or stability is by tracking mean changes. One study, based on the ALSPAC cohort, found that symptoms of depression were higher in the antenatal than postnatal period (Evans et al., 2001). The current study examines whether a parallel drop exists for anxiety symptoms from pregnancy to the postnatal period.

Anxiety is a focus of the current research for several reasons. First, anxiety is common and often co-morbid with depression (Kessler et al., 2001), but often neglected in studies of pregnancy and the postnatal period. Second, maternal antenatal anxiety may pose a significant risk for children's development. Results from animal investigations suggest that antenatal stress/anxiety causes a range of disturbances in the offspring in adulthood (Schneider and Moore, 2000). Evidence for similar adverse effects in humans is accumulating. Antenatal anxiety or stress has been linked with physical defects in the child (Hansen et al., 2000), low birth weight (Hedegaard et al., 1993), fetal activity and development (DiPietro et al., 2002) and behavior/emotional problems (O'Connor et al., 2002). Thirdly, depression may be secondary to anxiety, a result from altered physiological pathways or the psychological consequences of experiencing and failing to manage stress.

In summary, the study has three aims: (a) to report the longitudinal patterns of anxiety and depression from pregnancy to the postnatal period; (b) to examine the overlap between depression and anxiety throughout this period; (c) to assess the extent to which antenatal anxiety increases the likelihood of postnatal depression.

## 1. Methods

### 1.1. Sample and procedure

The study is based on the Avon Longitudinal Study of Parents and Children (ALSPAC) a longitudinal, prospective study of women, their partners and an index child (Golding et al., 2001). The study included all pregnant women living in the geographical area of Avon, England who were to deliver their baby between 1 April 1991 and 31 December 1992. It was estimated that 85–90% of the eligible population took part. All data were collected via postal questionnaires.

Of the 13,617 ALSPAC mothers who were enrolled and had a live singleton pregnancy, a total of 13,446 filled in at least one questionnaire; 10,174 mothers returned all 4 questionnaires at 18 and 32 weeks gestation and 8 weeks and 8 months postnatal. From each questionnaire, we obtained a depression score based on 10 questions and an anxiety score based on 8 questions (see measures below). Thus, we required complete answers on a total of 72 questions. One thousand and twenty-five mothers missed 1 or more questions from the first questionnaire assessment, 598 from the second, 296 from the third and 233 from the fourth; this resulted in a loss of 1705 (or an  $n$  of 8469) because of incomplete information. Finally, since these questionnaires were administered and returned by post, the date of completion was occasionally not as it was intended. A number of cases were removed since the date of completion was either unknown or some distance from the four ages specified above. The final sample included 8323 (see attrition analyses below).

### 1.2. Measures

Maternal anxiety was measured using the anxiety items from the Crown–Crisp experiential index (CCEI), a validated self-rating inventory (e.g., Crisp et al., 1978; example items include “worry a lot” and “feeling strung up inside”). In a pilot study of a random sample of 54 pregnant women attending a routine check-up, Crown–Crisp index correlated 0.70 and 0.76 with the State and Trait (respectively) subscales of the Spielberger State-trait Anxiety Inventory. Internal consistencies ( $\alpha$ ) exceeded 0.80 for each of the four assessments. There is no established cut-off

for this measure; we therefore identified as anxious mothers who scored in the top 15% (or as close as possible) at the 18 weeks antenatal assessment (a score of 9 or more on the 16-point scale at each assessment).

Maternal depression was assessed using the Edinburgh Postnatal Depression Scale (EPDS), a widely-used 10-item self-report questionnaire that has been shown to be valid in and outside the post-natal period (Cox et al., 1987). A pilot study of a random sample of pregnant women attending a routine check-up (referred to above) indicated substantial overlap between the EPDS and the CES-D [ $r(54)=0.87$ ,  $p<0.001$ ]. Internal consistencies of the EPDS exceeded 0.80 at each of the four assessments. A cut-off of 13 and above was used because it predicts clinical depression based on diagnostic criteria in the postpartum period (Murray and Carothers, 1990).

### 1.3. Data analysis

We used cut-off scores using established thresholds or high scores defined statistically to define elevated anxiety and depression because we were interested in whether the findings were of clinical relevance. Nevertheless, the same conclusions were reached when we used continuous scores and ordinary least squares regression instead of logistic regression. Categorical analyses are presented because they provide a reasonable index of the level of clinically significant symptoms.

## 2. Results

### 2.1. Attrition

We tested whether women who reported high levels of anxiety and/or depression in pregnancy were disproportionately likely to drop out of the study by 8 months postpartum. One-way ANOVAs for each of the 8 scores (4 depression assessments and 4 anxiety assessments) comparing the final sample of 8323 with those cases removed from the sample but with a valid figure for the relevant score showed differences of between 0.9 and 1.4 points for EPDS (on a 30-point scale) and between 0.4 and 0.8 points for Crown–Crisp anxiety (on a 16-point scale). This indicates that

women with mental health problems were less likely to return the questionnaires at each wave than those without self-reported anxiety and depression.

#### 2.1.1. Longitudinal patterns of depression from 18 weeks gestation to 8 months postpartum

The stability of depression across the four occasions of measurement was moderate, and showed the expected pattern in which measures closer in time were more strongly correlated than measures separated by longer time intervals. Across the approximately 1.5-year period covered, the correlations ranged from  $r=0.49$  ( $p<0.001$ ) for the 18 weeks gestation to 8 months postnatal assessments to  $r=0.63$  ( $p<0.001$ ) for the 18 weeks and 32 weeks gestation assessments.

Fig. 1 shows several notable features of depression across this time period. First, most (76%,  $n=6284$ ) women reported no elevated depression over the period. Second, the layout of the figure also makes possible a calculation of the percentage of women who were new cases of depression in the postnatal period. Numbers within the round shapes below the birth line indicate postnatal depression. At 8 weeks postpartum, 8.9% of women scored above 12 on the EPDS, but only 3.5% were new cases (i.e., not depressed antenatally). Summing across the 8-week and 8-month postnatal assessments, 1105 (13%) women out of the total sample of 8323 scored above the clinical cut-off on at least one postnatal assessment. Of these 1105 women, antenatal depression was not apparent in 483 (44%; i.e.,  $290+193$  from Fig. 1). Fig. 1 also shows that there were 934 women (i.e.,  $397+327+210$  from Fig. 1) out of the total of 8323 (11%) who reported elevated depression *only* in the antenatal period.

#### 2.1.2. Longitudinal patterns of anxiety from 18 weeks gestation to 8 months postpartum

The stability of anxiety across the four assessments was moderate and consistent with a simplex pattern. Across the approximately 1.5-year period covered, correlations ranged from  $r=0.52$  ( $p<0.001$ ) for the 18 weeks gestation to 8 months postnatal assessments to  $r=0.66$  ( $p<0.001$ ) for the 18 and 32 weeks gestation assessments.

Fig. 2 shows the longitudinal patterns of anxiety across the four measurement occasions. Specifically,

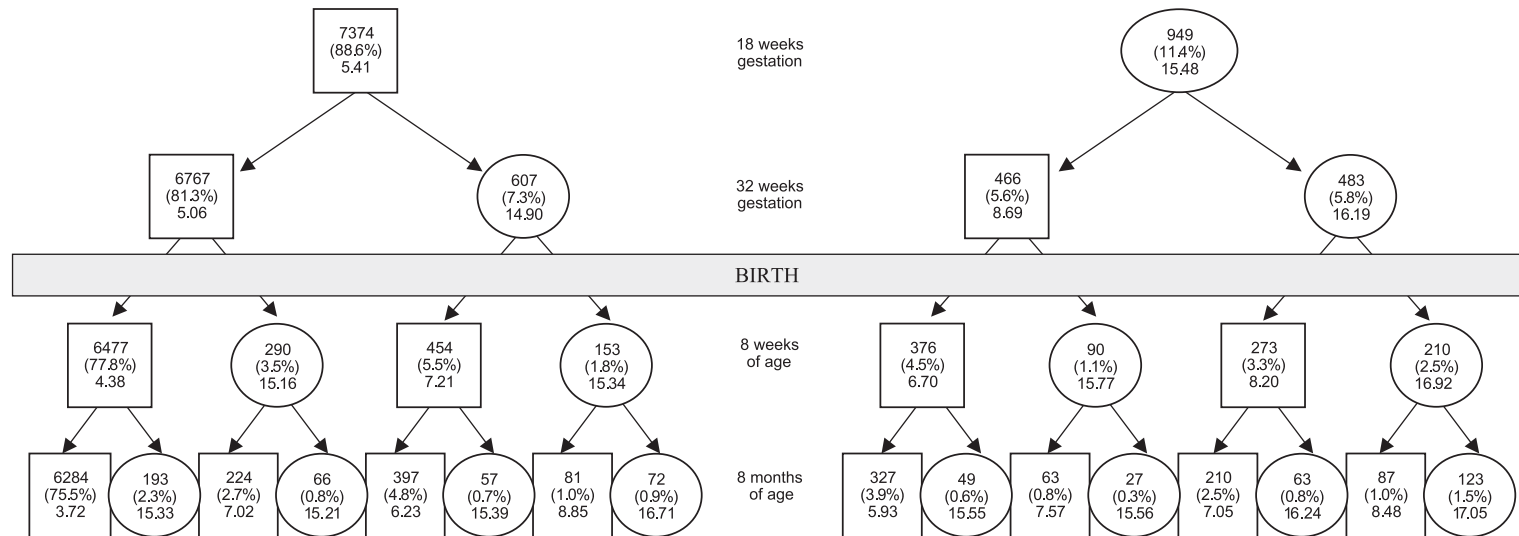


Fig. 1. Flow chart of depression (EPDS) across the four occasions of measurement. At each row (i.e., occasion of measurement), the sample is divided between those who scored above the cut-off for depression (round) and those who did not score above the cut-off for depression (square). The three entries in each cell in this figure represent, respectively, the number of women in the cell, percent (of total sample) and the mean depression score of individuals in that group (not controlling for anxiety).

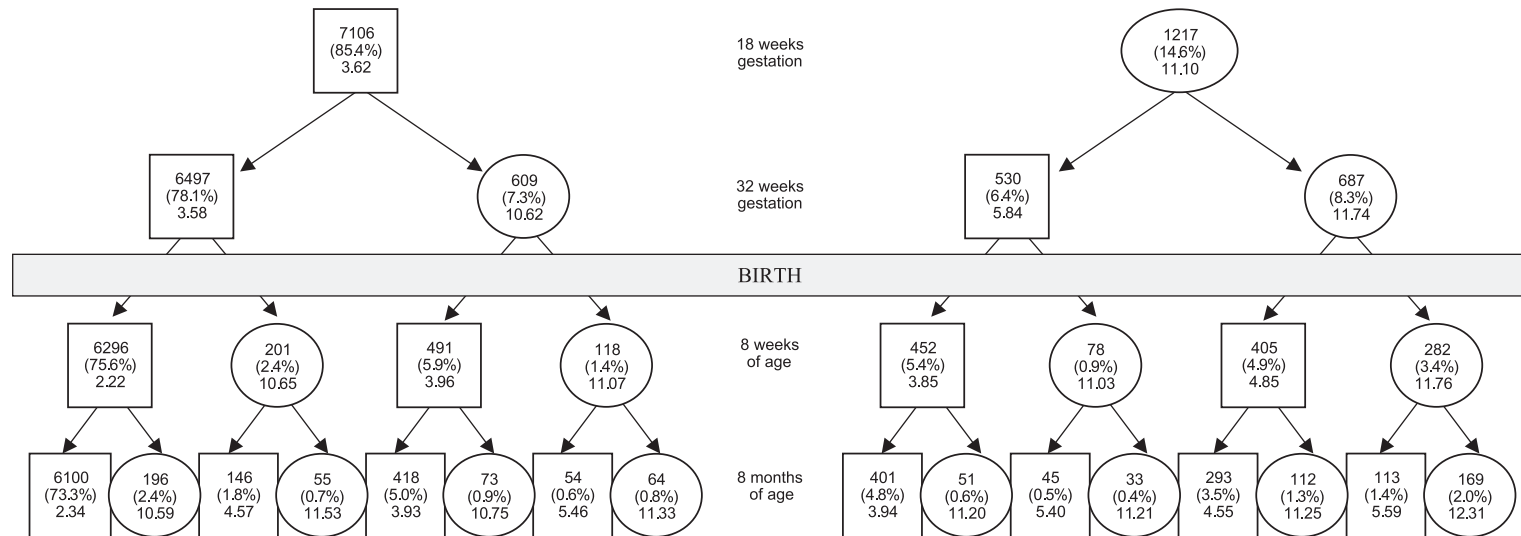


Fig. 2. Flow chart of anxiety (CCEI) across the four occasions of measurement. At each row (i.e., occasion of measurement), the sample is divided between those who scored above the cut-off for anxiety (round) and those who did not score above the cut-off for anxiety (square). The three entries in each cell in this figure represent, respectively, the number of women in the cell, percent (of total sample) and mean anxiety score of individuals in that group (not controlling for depression).

73% ( $n = 6100$ ) of women reported no elevated symptoms of anxiety. At 8 weeks postpartum, 8.1% of the cohort scored above the cut-off; this was “new anxiety” in 2.4%. Summing across the 8-week and 8-month postnatal assessments, 1111 (13%) women out of the total sample of 8323 scored above the cut-off on at least one postnatal assessment. Of these 1111 women, antenatal anxiety was not apparent in 397 (i.e.,  $201 + 196$ ), or 35.7%. Thus, of those women who reported anxiety in the postnatal periods, two-thirds experienced anxiety in pregnancy. Fig. 2 also shows that there were 1112 women (i.e.,  $418 + 401 + 293$ ) out of the total of 8323 (13%) who reported elevated anxiety *only* in the antenatal period.

### 2.1.3. Mean changes in depression and anxiety from pregnancy to postpartum

The next set of analyses examined the mean changes in symptoms at each of the four measurement occasions. These analyses are based on the continuous scores for each dimension. For depression, repeated measures analyses indicated a significant effect of occasion [ $F(3, 24,966) = 411.43$ ,  $p < 0.001$ ]. Follow-up analyses indicated that a substantial contrast between measures of depression in pregnancy and the postnatal period (means [S.E.] were 6.55 [0.05], 6.62 [0.05], 5.78 [0.05] and 5.17 [0.05], for 18 and 32 weeks gestation and 8 weeks and 8 months postnatal, respectively).

An occasion effect was also found in a repeated measures analysis of variance for anxiety [ $F(3,$

$24,966) = 1211.16$ ,  $p < 0.001$ ]. Follow-up analyses indicated a substantial difference only between the antenatal and postnatal assessments, and only marginal differences between the two antenatal or two postnatal assessments (means [S.E.] were 4.71 [0.04], 4.91 [0.04], 3.27 [0.04] and 3.50 [0.04] for 18 and 32 weeks gestation and 8 weeks and 8 months postnatal, respectively).

### 2.1.4. Anxiety in the antenatal period predicts postnatal depression

The concurrent association between anxiety and depression was high at each assessment, ranging from  $r = 0.74$  at 18 weeks gestation to  $r = 0.77$  at 8 months postnatal. The next question to be addressed was whether or not anxiety in pregnancy predicted postnatal depression after controlling for the stability of depression.

Because of the interest in assessing postnatal depression at 8 weeks and 8 months separately, analyses were run using three definitions of postnatal depression: (1) postnatal depression at both 8 weeks and 8 months (i.e., persistent); (2) postnatal depression at 8 weeks only; (3) postnatal depression at 8 months only. The findings are similar (Table 1). Predictor variables were depression and anxiety at 18 and 32 weeks gestation.

Several findings stand out from Table 1. The first is that depression at both antenatal assessments was associated with a substantial increase in the likelihood of depression in the postnatal period, regardless of

Table 1  
Prediction of postnatal depression from antenatal mood

	1. PND at both 8 weeks and 8 months		2. PND at 8 weeks only		3. PND at 8 months only	
	OR [95% CI]	Wald	OR [95% CI]	Wald	OR [95% CI]	Wald
<i>Depression</i>						
18 weeks gestation	3.17 [2.29, 4.37]	48.87***	2.36 [1.80, 3.11]	37.52***	2.30 [1.69, 3.12]	28.45***
32 weeks gestation	6.55 [4.68, 9.17]	120.08***	2.54 [1.94, 3.32]	45.78***	2.14 [1.58, 2.89]	24.24***
<i>Anxiety</i>						
18 weeks gestation	1.47 [1.06, 2.04]	5.21*	1.73 [1.32, 2.27]	15.41***	1.72 [1.27, 2.32]	12.25***
32 weeks gestation	3.22 [2.28, 4.55]	44.26***	2.10 [1.59, 2.75]	28.19***	2.17 [1.60, 2.93]	25.21***

Results are reported for three separate sets of analyses: persistent postnatal depression, postnatal depression at 8 weeks only, postnatal depression at 8 months only. For each predictor variable (i.e., antenatal anxiety and depression), the control condition is no anxiety or depression according to the cut-off score. Estimates reported are adjusted for other measures in the model. PND = postnatal depression defined by a score on the EPDS > 12.

\*  $p < 0.05$ .

\*\*\*  $p < 0.001$ .

how postnatal depression was defined (as anticipated from Fig. 1). The prediction of postnatal depression from depression at 32 weeks gestation was particularly strong, and strongest for the persistent definition of postnatal depression (OR = 6.55, 95% CI = 4.68–9.17). Second, despite the stability of depression from the antenatal to postnatal period, anxiety in pregnancy predicted a significant increased likelihood of depression in the postnatal period; the effect was stronger for the anxiety at 32 weeks gestation than 18 weeks gestation. So, for example, for persistent postnatal depression, anxiety at 32 weeks gestation was associated with a greater than three-fold (OR = 3.22) increase in postnatal depression, even after controlling for depression at 18 and 32 weeks gestation and anxiety at 18 weeks gestation.

### 3. Discussion

The aims of this study were to examine symptoms of depression and anxiety across the transition from pregnancy to the postpartum. The central findings were that, for both depression and anxiety, there was considerable stability in individual differences as well as a mean decrease in symptoms from pregnancy to postpartum. For anxiety, the drop in mean level amounted to approximately 0.4 of a standard deviation. Furthermore, only a minority of cases of either depression or anxiety were not already detected at either antenatal assessment, according to the cut-offs used in the analyses. Finally, anxiety in pregnancy was associated with a substantial increased likelihood of postnatal depression, even after controlling for antenatal depression.

#### 3.1. Limitations

Several limitations of the study need to be considered. The first is that there are limitations of relying exclusively on self-reports for determining severity of clinical symptoms. Second, individuals who reported the highest initial levels of symptoms were disproportionately likely to drop out of the study, although the bias introduced by selective attrition was modest. Third, the use of categorical data carries with it the risk of mis-classification. Thus, caution must be applied when interpreting the percent of cases con-

sidered “depressed” or “anxious” in Figs. 1 and 2. Nevertheless, the empirical findings are robust across both categorical and continuous methods. These limitations are offset by major strengths, including the large community sampling frame, prospective design and multiple assessments in the antenatal and postnatal periods.

#### 3.2. Stability and change in symptom patterns

43.7% of women with high levels of depression in the postnatal period also reported elevated symptoms of depression at early/mid or late pregnancy. The implication is that it is possible to target a substantial percentage of those women who are at risk for postnatal depression; indeed, attempts to screen for depression in the antenatal period are becoming common. The continuity of depressive symptoms is complemented by a mean decrease in depressive symptoms from pregnancy to the postpartum period (Evans et al., 2001). This points to the existence of a sizable group of women who are depressed antenatally but not postnatally. These individuals have been largely ignored in research, but provide an interesting comparison group for testing alternative mechanisms of risk associated with antenatal and postnatal depression.

A novel feature of the study is the demonstration that the same patterns hold for anxiety. Individual differences in anxious symptoms were stable from early pregnancy to 8 months postpartum; most (64%) of women who reported elevated levels of anxious symptoms in pregnancy also reported elevated levels of anxiety postpartum. This is an important set of findings because it highlights the significance of anxiety in the pregnancy and postpartum periods and, in so doing, underscores the limitations of studies relying exclusively on depression as the single form of mental illness to be assessed in this period.

In contrast to the considerable amount of interest in depression in perinatal psychiatry, anxiety has been neglected. Yet, anxiety is a common mental disorder that responds well to psychological treatments. Moreover, there is mounting evidence that antenatal anxiety is a specific and significant risk for behavioral/emotional problems in children (O'Connor et al., 2002). We still know little about the effects of maternal mood during pregnancy on the developing child, but this



increasingly important area of research has begun to forge connections between the specialities of developmental psychology/child psychiatry and perinatal psychiatry.

The decrease in mean level of depressive and anxious symptoms from pregnancy to the postpartum period warrants further attention. Both physiological and social–psychological explanations seem likely. Anecdotal and clinical experience indicates that there may be some specific concerns of expectant mothers that may make them more vulnerable to anxiety or depression. It is possible that some reasons for anxiety in pregnant women (e.g., concerns about having a healthy baby) would be resolved by a healthy birth. On the other hand, there are very large physiological alterations associated with both pregnancy and delivery, including those systems implicated in the vulnerability to depression and anxiety, notable the HPA axis (e.g., cortisol levels are higher during pregnancy than postnatally; Kammerer et al., 2002). It remains to be seen how such alterations co-occur with mood changes during this transition.

The results also revealed another notable finding, namely, that anxiety in pregnancy predicted an increased likelihood of postnatal depression, after accounting for the stability of depression from the antenatal period. This may be a particularly important finding for understanding the nature of maternal mood and their effects on the developing child. Researchers may have over-emphasized the role of postnatal depression on child development and under-estimated the effects of antenatal depression and anxiety. Thus, the current findings indicate that anxiety should be a focus of increased attention in perinatal psychiatry because it forecasts subsequent illness and may also have a direct effect on the fetus (O'Connor et al., 2002).

### 3.3. *Clinical implications*

The need for systematic efforts to develop mental health services for women in pregnancy is recognized (Dragonas and Christodoulou, 1998). The need for clinical attention is reinforced by the current findings based on a community sample of women followed prospectively since pregnancy. Treatment effectiveness for postnatal depression has been established (O'Hara et al., 2000); efforts to treat anxiety in the

antenatal and postnatal periods are less well-established, but likely to achieve comparable success. It remains to be seen if the benefits of interventions during pregnancy carry over to prevent the ill-effects of stress and anxiety in pregnancy on children's development. Regardless of the success of such preventive strategies, evidence of this kind is needed to elucidate mechanisms of risk, and to identify likely successive targets of intervention/prevention to benefit children and their families (Glover and O'Connor, 2002).

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