Maternal trait anxiety, depression and life event stress in pregnancy: relationships with infant temperament

Marie-Paule Austin[a,b],*, Dusan Hadzi-Pavlovic[a,b], Leo Leader[c], Karen Saint[a], Gordon Parker[a,b]

[a]School of Psychiatry, University of New South Wales, Prince of Wales Hospital, Sydney, Australia
[b]Mood Disorders Unit, Black Dog Institute, Prince of Wales Hospital, Sydney, Australia
[c]School of Women's and Children's Health (Obstetrics and Gyneacology), University of New South Wales, Prince of Wales Hospital, Sydney, Australia

Abstract

Aims: To assess whether links exist between maternal trait anxiety (STAI), perceived life event (LE) stress and depression (Edinburgh scale) and infant temperament.
Study Design and Subjects: Women in the third trimester of pregnancy returned psychological self-report questionnaires; infant temperament was evaluated at 4 and 6 months by maternal and paternal report, while depression (concurrent Edinburgh scale) was also assessed at four and six months. As data were returned inconsistently at 4 and 6 months, we combined these two time points for simplicity of reporting and optimisation of numbers.
Results: Univariate logistic regressions on 970 subjects indicated that the pregnancy STAI (>40) scores were associated with 2.56- and 1.57-fold increases (maternal and paternal, respectively), in the odds of "difficult" infant temperament at 4 or 6 months. Concurrent Edinburgh scores (OR of 3.06 and 2.64 for maternal reports, respectively) were also predictive of infant temperament. Age, education, income, marital status, obstetric complications, infant gender and prematurity were not predictive of infant temperament. In stepwise multiple logistic regression analyses, the antenatal trait STAI (odds ratio 1.96) significantly predicted maternal reports of "difficult" temperament at 4 or 6 months independent of both antenatal and

postnatal depression scores. There were similar trends for paternal reports of "difficult" temperament but these were not significant. Antenatal depression and perceived LE stress were not predictive of temperament. Finally, women (*N*=14) reporting domestic violence (DV) in pregnancy had highly significant increased Edinburgh and STAI scores.

Conclusions: Maternal trait anxiety was predictive of "difficult" infant temperament, independent of "concurrent" depression and key sociodemographic and obstetric risk factors. These findings, while needing replication using objective measures of infant temperament, suggest that antenatal psychological interventions aimed at minimising anxiety may optimize infant temperament outcomes. There may be some benefit in shaping specific interventions to women reporting specific risk factors such as DV or past abuse.

1. Introduction

The impact of prenatal maternal stress, anxiety and depression on child behavioural outcomes has become acknowledged as an important area of research over the last few years [1]. A number of animal studies have demonstrated that maternal stress in pregnancy impacts on the offspring's behavioural adjustment and regulation of stress-induced changes in physiology and behaviour, and that these changes continue into adulthood [2,3].

In humans, there is a well-documented literature demonstrating that maternal emotional state impacts on obstetric outcomes, in particular prematurity (for review, see Ref. [4]). We also know that maternal anxiety and stress in pregnancy are associated with reduced neonatal heart rate variability (an index of capacity to self-regulate via autonomic reactivity) [5]. Newborns borne to women who were depressed in pregnancy have been shown to have reduced motor tone, activity and endurance as well as increased irritability [6] and excessive crying and fussiness at birth after controlling for smoking, drug and alcohol intake, income and birthweight [7].

Huizink et al. [8] prospectively studied 170 mothers looking at the impact of reported stressors, perceived stress, and pregnancy-related anxiety at 15—17 weeks on infant temperament as assessed by maternal report and direct infant observation at 3 and 8 months. They found that perceived stress, but not reported stressors or pregnancy-related anxiety, accounted for 8.2% of the variance of difficult infant behaviour at 3 months after adjusting for smoking and alcohol intake, socioeconomic status, obstetric complications and postnatal stress and depression. O'Connor et al. [9] in a large epidemiological study found that increased antenatal maternal state anxiety scores (but not depression scores) at 32 weeks gestation and postnatal depression scores

were associated with an increased risk of offspring hyperactivity at 4 years. This was independent of low socioeconomic status, obstetric history, and maternal depression scores postpartum. Neither study [8,9] assessed the impact of trait measures of maternal psychological function on infant temperament.

Temperament is a concept about which limited agreement exists among researchers. Broadly speaking it can be defined as the infant's threshold for positive and negative reactivity and the intensity of its reaction to stimuli [10]. While several dimensions of infant temperament have been described, the authors of the temperament self-report tool used in this study have chosen to focus on five broad dimensions: irritability, approachability (i.e., reactivity to new stimuli), cooperation, activity, and rythmicity (regularity of biological rhythms) [11]. It is assumed that temperament is rooted in the infant's neurophysiology and that it is shaped by both genetic and environmental factors. It is thought that over time, temperament, modulated by attachment style, evolves into a predictable pattern of behaviour or personality style. In a prospective longitudinal study over the last 25 years, Kagan and Snidman [12,13] have demonstrated that a greater proportion of infants with high levels of behavioral inhibition will go on to have anxiety disorders in childhood and adolescence than infants with behavioural disinhibition. This group has recently proceeded to demonstrate a link between "inhibited" childhood temperament and hyperactivity in the amygdala, a brain region known to mediate the stress response in adults [14], suggesting that there may be early modifications to the stress response associated with behavioural inhibition from infancy onwards. Sanson et al. [15] have also identified continuities between infant and toddler "difficult" temperament and subsequent psychosocial adjustment in

late childhood. These findings highlight the relevance of infant temperament to subsequent mental health outcomes.

There is now some speculation that maternal behavioural factors arising in utero—in particular maternal stress, depression and anxiety in pregnancy—may impact on infant temperament (for review, see Ref. [2]). While previous studies have tended to examine the impact of life events and state anxiety on infant outcomes, we wish to examine the potentially more significant impact of enduring maternal trait anxiety on infant temperament. Such a measure of maternal psychological function is important to assess, as it may be amenable to psychological intervention during pregnancy. Indeed several studies have reported significant reductions in trait anxiety following cognitive behavioural therapy interventions in non-perinatal subjects (for review, see Ref. [16]).

1.1. Objectives

The aim of this study was to evaluate the relationship between (i) antenatal trait anxiety, (ii) life event stress in pregnancy and (iii) parental reports of infant temperament at 4 or 6 months. Our hypotheses were that antenatal maternal trait anxiety and perceived life event stress in pregnancy would be associated with reports of "difficult" infant temperament; that this relationship would be corroborated by paternal reports of infant temperament; and that this association would be modulated by, but still independent of, concurrent (postnatal) depression scores.

2. Method

2.1. Participants and Recruitment

Participants were recruited between September 1999 and March 2002 as part of a prospective study undertaken at Royal Hospital for Women (RHW). The RHW is a large obstetric hospital which acts as a tertiary referral centre, with approximately 4000 deliveries per annum. Approximately 35% of women are seen through the doctor's clinics, 65% through the midwives' clinics (including 10% through the birth centre). Recruitment was through the midwife-based clinics only and after further excluding women needing an interpreter (about 22%) approximately 2250 women/annum (45/week) were eligible for recruitment and it was this subsample which was

randomly approached for participation. On average we recruited 15 women/week which was a third of all eligible study participants seen at the midwives' clinics. Recruitment was dependent on the availability of research assistant time with only 5% of women declining participation.

2.2. Exclusion criteria

Those women needing an interpreter, and those with higher obstetric risk (attending the doctors' clinics).

2.3. Study design

Study participants were given a number of self-report questionnaires at baseline—mean 32 weeks gestation—with most women choosing to post them back. As a result of this, we lost approximately one fifth of data at baseline. Women were followed up at 2, 4 or 6 months postpartum by postal questionnaire. We report only the 4- or 6-month follow-ups for the purposes of this study.

2.4. Baseline (pregnancy) assessment

(1) *Trait anxiety* was assessed using the trait component of the State-Trait Anxiety Inventory (STAI [17]). This 20-item questionnaire asks about the presence of anxious symptoms "generally". We defined high trait anxiety as those with a STAI score >40 as reported in prior Australian studies [18,19]. The median alpha coefficient for the trait STAI is reported as 0.9.

(2) *Perceived stress relating to life event(s) in the course of the pregnancy*: this was assessed as part of an antenatal psychosocial risk questionnaire using the following question: "have you had any major stresses, changes or losses in the course of this pregnancy? (e.g., separation, moving house, domestic violence, bereavement). If so, to what extent has this stress affected your emotional well being?" (rated 1—5: from not at all [1], somewhat [3] to very much [5]). Low stress was defined as either no stress or a rating of 1; medium stress as a rating of 2—3; and high stress as a rating of 4—5.

(3) *Antenatal depression* was assessed by means of the Edinburgh Postnatal Depression Scale (Edinburgh [20]) which is a 10 item self-report scale assessing depressive symptoms in the preceding week. Scores above 12 were used to indicate probable depression with a reported

sensitivity of 86% and specificity of 78% when used in the postnatal context [20].

2.5. Postnatal assessment

(1) *Infant temperament*. The Short Infant Temperament Questionnaire (SITQ [11]): a 30-item parental report developed for the Australian context with good population norms [21]. This was performed at 4 or 6 months independently by mother and father—the easy difficult score (EDS) reflects infant "difficulty" with scores >3.14 (1 S.D. above mean) suggesting "difficult" temperament.

(2) *Postnatal depression*. The Edinburgh was repeated at the time of filling out the infant temperament reports; these are henceforth referred to as "concurrent" Edinburgh scores.

As data were returned unevenly at 4 or 6 months, we combined these two time points as one for simplicity of reporting and optimising of numbers. An infant was scored as difficult if at least one of the two reports was scored as difficult. To obtain a concurrent indicator of postnatal depression we took the average when both EPDS scores were available or else the single available one. For the purposes of the logistic regression analyses we used STAI scores >40 and Edinburgh scores falling between the 75th and 100th percentiles.

3. Results

3.1. Descriptive analyses

Two thousand and five women initially agreed to enter the study with 81% recruited from the midwives' clinics and 19% from the birth centre. Four hundred and thirty-eight women (21.8%) provided only partial baseline pregnancy (or Time 1) data and thus became dropouts, while a further 5 women were excluded for other reasons, leaving a baseline cohort of 1562 women. This number reduced varyingly over time, both through further dropout or missing data.

While women needing interpreter services were excluded at the outset (see above), 14.5% of our participants were of non-English speaking background. We excluded them from our analyses as we felt cultural factors might confound their response to the infant temperament questionnaire.

As numbers fluctuate with missing data, the following results are based on all women who provided a temperament report at *either* 4 or 6

months postpartum (N=970). At 4 months, we obtained temperament reports from 67% of mothers, 59% of fathers and 58% of both mothers and fathers. At 6 months these figures were 52%, 40% and 40%, respectively. Maternal reports of temperament on at least one occasion (at either 4 or 6 months) were obtained for a total of 970 (73%) cases. This sample forms the basis of our analysis both for dependent variables and potential covariates. Those women not returning temperament questionnaires tended to be single and/or of low socio-economic status, suggesting that there was a significant level of self-selection in study respondents. This was in contrast to those women returning one or more temperament reports, 94.2% of whom were partnered. Compared to women who did not return any temperament reports, women who returned at least one report had lower baseline Edinburgh rates (6.3 vs. 7.7, p<0.001) and lower STAI scores (34.3 vs. 36.8, p<0.001).

Baseline measures were reported at a mean of 32.2 weeks gestation (5th—95th percentiles=26—38 weeks). Our sample consisted of predominantly middle class women as assessed by income and educational status. Only 6.8% reported smoking (defined as >10 cigarettes/day), 1.9% had an alcohol intake of >2 standard drinks/day and 1.6% admitted to illicit drug use. There were 28.4% women with obstetric or perinatal complications defined as: fetal distress, emergency caesarian section, delivery by forceps or ventouse or breech delivery. Ninety-six (10%) babies were born by elective caesarian section, 135 (14%) by emergency caesarian, and 589 (61%) by normal vaginal delivery. Only 4.2% babies were born at <37 weeks (Table 1).

There were three clinical predictors of infant temperament measured at baseline: trait anxiety

Table 1 Sociodemographic and obstetric variables at baseline

Age	<=24	7.5%
	25—34	64.8%
	35+	27.8%
Education (years)	≤10	11.8%
	>10—15	50.3%
	>15	37.9%
Family income	<$20,000	4.6%
	$20,000—60,000	39.1%
	>$60,000	56.3%
Substance use	Alcohol	1.9%
	Smoking	6.8%
	Drug use	1.6%
Obstetric outcomes	Complications	28.4%
	Gestation <37 weeks	4.2%
	Mean weeks gestation at birth	39.4 (1.5)

Table 2 Descriptive statistics for psychological measures and temperament

		N	Mean	S.D.	Range	% positive*
STAI (trait)		964	34.3	8.3	20—70	25.3
Edinburgh	Baseline	966	6.3	4.2	0—26	6.8
	4 months	885	5.1	4.4	0—28	6.9
	6 months	700	4.7	4.3	0—24	5.7
Temperament (SITQ)	4 months	894	2.26	0.58	1—4.9	6.0
	6 months	699	3.35	0.63	1—8.0	10.3

STAI: State Trait Anxiety Inventory: *score >40.
Edinburgh Postnatal Depression Scale: *score >12.
SITQ: Short Infant Temperament Questionnaire: *score: >3.14.

(STAI), depression (Edinburgh) score and perceived distress in response to a life event (LE stress). Forty-three percent (677) of women responded "yes" to experiencing at least one life stressor with a mean score of 3.11/5 on the visual analog stress scale indicating that this was associated with medium stress levels for the group as a whole. Of these 677 women, only 2% (N=14) reported domestic violence (DV), which was associated with a mean score of 4.14/5 on the visual analog stress scale (indicating high stress). Because of the small numbers we were unable to identify whether these women experiencing DV had more concurrent stressors or more infants with difficult temperament. However, there were highly significant differences ($p<0.001$) between the group of women experiencing DV and those not experiencing DV on the Edinburgh depression scale both antenatally (score of 12.2 vs. 5.9) and postnatally (score 8.9); and the antenatal STAI (score of 46.6 vs. 34.0). Using a score of >40 for the STAI [17,18], 25.3% women were high scorers. At baseline 6.8% women had Edinburgh scores >12 compared to 6.9% at 4 months postpartum and 5.7% at 6 months.

Six percent of infants scored positive on the "difficulty" index at 4 months and 10.3% at 6 months. This compares with a rate of 12.4% in a sample of 4- to 8-month-olds in the normative study [20] (Table 2).

3.2. Correlations

Table 3 shows correlations between continuous measures of infant difficulty scores at 4 or 6 months and trait anxiety and perceived LE stress (moderate and severe) at baseline as well as depression on the Edinburgh at baseline, 4 or 6 months.

Most correlations were significant with the strongest association arising between the STAI and Edinburgh baseline scores ($r=0.62$). Also substantial were those correlations between baseline and postnatal Edinburgh scores at 4 or 6 months. There were modest correlations between most psychological variables and temperament scores, however there was no correlation between the antenatal stress measure and infant temperament.

The agreement between mothers and fathers (inter-rater reliability) for reported "difficult" temperament was moderate; thus for the continuous measure we found a correlation of 0.58 at 4 and 6 months, respectively, with similar intra-class correlations.

3.3. Univariate logistic regression analyses

Sociodemographic factors (age, education, family income and marital status) and perinatal factors (obstetric complications—emergency caesarian; forceps, ventouse, and breech delivery; fetal

Table 3 Correlations between psychological predictors and maternal reports of infant temperament

	Edinburgh			Stress	Temperament	
	Baseline	4 months	6 months	Baseline	4 months	6 months
STAI	**0.618**	**0.439**	**0.426**	**0.259**	**0.237**	**0.210**
Edinburgh						
Baseline		**0.447**	**0.404**	**0.357**	**0.124**	**0.110**
4 months			**0.589**	**0.191**	**0.237**	**0.168**
6 months				**0.148**	**0.173**	**0.261**
Stress					0.055	0.042
Temperament						
4 months						**0.525**

Correlations in bold are significant at $p<0.05$.

Table 4   Univariate logistic regression of "difficult" temperament (maternal and paternal reports), at either 4 or 6 months, on individual maternal antenatal psychological measures

	OR (95% CI)[§]	
Antenatal measure	Maternal (4 or 6 months)	Paternal (4 or 6 months)
STAI (>40)	**2.56** (1.68—3.90)	**1.57** (1.05—2.36)
Stress		
Medium	1.24 (0.79—1.96)	1.13 (0.76—1.67)
High	1.70 (0.98—2.96)	1.09 (0.62—1.90)
Edinburgh		
Baseline 75—100th percentile	**2.07** (1.34—3.19)	1.46 (0.97—2.22)
Concurrent 75—100th percentile	**3.06** (2.04—4.60)	**2.64** (1.82—3.82)

[§] Confidence intervals which exclude an odds ratio of 1 are given in bold and are equivalent to significant tests with $p<0.05$.

distress; infant gender and prematurity, i.e., gestation <37 weeks) were all examined as predictors of temperament in a series of logistic regressions; none of these were significant. The STAI (>40), LE stress (medium and high) scores, and baseline and concurrent Edinburgh (75th—100th percentiles) scores were all entered in their categorized version into separate logistic regressions with "difficulty" at 4 or 6 months as the outcome variable. Results in Table 4 indicate that significantly elevated antenatal STAI (>40) and concurrent depression were associated with increased rates of maternal report of difficult temperament at 4 or 6 months. Perceived LE stress (medium and high level) was not predictive of infant temperament. STAI (>40) and concurrent Edinburgh predicted paternal reports of infant difficulty.

3.4. Multiple Logistic Regression analyses

A multiple regression analysis adding in the independent sociodemographic and perinatal variables—age, education, family income and marital status, obstetric complications (as defined previ-

ously), infant gender and prematurity—showed none of these factors to be significantly predictive of infant temperament.

A series of stepwise regression analyses were then performed to examine whether baseline Edinburgh, cognitive style, LE-related stress or trait anxiety mediated infant difficulty, independent of concurrent Edinburgh score. In each case, the antenatal psychological measures were entered with the STAI first, followed by baseline Edinburgh and LE related stress, and finally concurrent Edinburgh. The results for maternal-rated infant "difficulty" at 4 or 6 months are given in Table 5.

In Table 5, we can see that the antenatal STAI (odds ratio 1.96) significantly predicted difficult temperament at 4 or 6 months independent of both antenatal and postnatal depression scores. Not surprisingly, concurrent Edinburgh (odds ratio 2.31) was also significantly predictive. When these same psychological variables were used to predict paternal reports of infant "difficulty" at 4 or 6 months, only concurrent depression was a significant predictor.

Table 5   Logistic regression models for maternal report of infant "difficult" temperament (EDS score >3.14) at either 4 or 6 months

Step	Variable	OR	95%CI	β	Se(β)	$\Delta\chi^2$	df	p
I						18.7	1	<0.001
	STAI	**2.66**	1.74—4.09	0.98	0.22			
II						3.9	3	0.277
	STAI	**2.24**	1.39—3.61	0.81	0.24			
	Stress (medium)	1.27	0.79—2.01	0.24	0.24			
	Stress (high)	1.15	0.63—2.10	0.14	0.31			
	Baseline Edinburgh	1.50	0.91—2.49	0.41	0.26			
III						15.4	1	<0.001
	STAI	**1.96**	1.20—3.20	0.67	0.25			
	Stress (medium)	1.23	0.77—1.96	0.21	0.24			
	Stress (high)	1.12	0.61—2.06	0.11	0.31			
	Baseline Edinburgh	1.22	0.73—2.07	0.20	0.27			
	Concurrent Edinburgh	**2.31**	1.58—3.78	0.89	0.22			

Predictors significant at $p<0.05$ are in bold.
$\Delta\chi^2$=change in chi-square due to additional variables added at that step.

4. Discussion

Our findings suggest that trait anxiety measured antenatally is a predictor of maternal report of difficult infant temperament at 4 or 6 months. These findings suggest an interaction between infant temperament and both concurrent (postnatal) depression and antenatal maternal trait measures with no predictive value from the antenatal Edinburgh and perceived life event stress.

If we assume that trait anxiety is an enduring maternal psychobehavioural characteristic, then its impact on infant temperament is likely to extend into the postpartum period. This poses the question of whether we are simply observing a link between parental characteristics and parental reports and perception of infant characteristics or a true association between a high stress environment in utero and infant temperament. An independent observation of infant temperament would take out the confounder of maternal report. Studies examining the physiological correlates (e.g., cortisol or other stress hormones) of maternal stress in pregnancy and "difficult" infant temperament might also shed more light on this central issue.

The significant association found in our study between concurrent (postnatal) depression and temperament suggests three possibilities: that depressed mothers report their infants as more "difficult"; that difficult infant temperament leads to elevated depression scores as mothers become distressed with their "difficult" infants; or that concurrent (postnatal) depression impacts negatively on infant temperament. The possible distortion of reported infant temperament by depressed mothers has previously been highlighted [22,23]. In our study, the predictive capacity of the antenatal STAI was sustained after covarying for concurrent (postnatal) depression, suggesting that maternal reporting bias—related to concurrent depression—was not likely to be significant.

However, we were not able to assess the direction of the interaction between concurrent (postnatal) Edinburgh scores and temperament scores. The possibility that the relationship between postnatal depression and infant temperament is bidirectional needs to be considered, with McMahon et al. [18] reporting significant correlations between maternal reports of infant temperament and maternal Edinburgh scores and Whiffen and Gotlieb [24] reporting a significant association between both maternal infant reports and observed infant temperament on the Bayley scales [25] and depression scores.

Contrary to expectation, there was no correlation between the pregnancy stress measure and infant temperament. This could be the result of a number of factors; it's possible that this brief measure of stress was insufficient to capture the complexities of life event stress both in terms of number of stressors and perceived distress. Alternatively, many life events and stressors are circumscribed in time (unlike trait anxiety) and may thus exert a limited impact on maternal stress mechanisms and thus be less likely to impact on infant temperament.

Our finding of increased depression and anxiety scores in the subset of women experiencing DV compared to those not experiencing DV, support the growing body of evidence highlighting the importance of domestic violence during pregnancy for both maternal and infant outcomes [26,27]. This was further underscored by the fact that although the DV sample was very small (N=14), the results were highly significant. These findings suggest there may be some benefit in shaping specific interventions to women reporting specific risk factors such as current (e.g., DV) or past abuse.

4.1. Methodological strengths and limitations

Our study is unique in obtaining infant temperament reports, both maternal and paternal, at 4 or 6 months, on a large sample. We are also the first to explore the predictive value of trait anxiety on temperament.

The fact that we lost about 50% of women to follow-up—with more of those dropping out being of lower socio-economic status and unpartnered, and having slightly higher baseline Edinburgh and STAI scores than the total cohort—makes it difficult for us to generalize our findings.

In common with many studies evaluating infant temperament, we lacked an independent temperament measure. Parental reports of infant temperament are confounded by poor external validity and relatively low levels of agreement being reported between parents' and observers' ratings [24]. Clearly, this study would have been enhanced by the use of an external measure of infant reactivity such as the Bayley scales [28].

4.2. Clinical implications

Antenatal trait anxiety appears to represent independent risk factors for difficult infant temperament. These findings suggest that the use of antenatal psychological interventions—such as cognitive behavioural therapy—aimed at minimising negative cognitions and anxiety, may optimize infant temperament outcomes. It is hoped that this

would lead to more optimal subsequent maternal and infant mental health outcomes.

Acknowledgement

References

[1] Glover V. Maternal stress or anxiety in pregnancy and emotional development of a child. Br J Psychiatry 1997; 171:105−6.

[2] Glover V, O'Connor T. Effects of antenatal stress and anxiety: implications for development and psychiatry. Br J Psychiatry 2002;180:389−91.

[3] Weinstock M. Does antenatal stress impair coping and regulation of hypothalamic−pituitary−adrenal axis? Neurosci Biobehav Rev 1997;21:1−10.

[4] Austin M-P, Leader L. Maternal stress and obstetric and infant outcomes: epidemiological findings and neuroendocrine mechanisms. Aust N Z J Obstet Gynaecol 2000;40: 331−7.

[5] Di Pietro JA, Hodgson DM, Costigan KA, Johnson TRB. Fetal antecedents of infant temperament. Child Dev 1996; 67:2568−83.

[6] Field TF, Sandberg D, Garcia R, Vega-Lahr N, Goldstein S, Guy L. Pregnancy problems, postpartum depression, and early mother−infant interactions. Dev Psychol 1985; 21:1152−6.

[7] Zuckerman B, Bauchner H, Parker S, Cabral H. Maternal depressive symptoms during pregnancy and newborn irritability. Dev Behav Paediatr 1990;11:190−4.

[8] Huizink AC, Robles De Medina PG, Mulder EJH, Visser GHA, Buitelaar JK. Psychological measures of prenatal stress as predictors of infant temperament. J Am Acad Child Adolesc Psych 2002;41:1078−85.

[9] O'Connor T, Heron J, Glover VThe Alspac Study Team. Antenatal anxiety predicts child behavioural/emotional problems independently of postnatal depression. J Am Acad Child Adolesc Psych 2002;41(12):1470−7.

[10] Calkins SD, Fox NA, Marshall TR. Behavioural and physiological antecedents of inhibited and uninhibited behaviour. Child Dev 1996;67:523−40.

[11] Sanson A, Prior M, Oberklaid F, Smart D. The structure of infant temperament: a factor analysis. Inf Behav Dev 1987; 10:97−104.

[12] Kagan J, Snidman N. Temperamental factors in human development. Am Psychol 1991;46:856−62.

[13] Kagan J, Snidman N. Early childhood predictors of adult anxiety disorders. Biol Psychiatry 1999;46:1536−41.

[14] Schwartz CE, Wright CI, Shih LM, Kagan J, Rauch SL. Inhibited and uninhibited infants "grown up": adult amygdalar response to novelty. Science 2003;300:1952−3.

[15] Sanson A, Prior M, Oberklaid F, Smart D. Temperamental influences on psychosocial adjustment: from infancy to adolescence. Aust Educ Dev Psychol 1998;15:7−38.

[16] Fisher P, Durham RC. Recovery rates in generalised anxiety disorder following psychological therapy: an analysis of clinically significant changes in the STAI-T across outcome studies since 1990. Psychol Med 1999;29:1425−34.

[17] Spielberger CD. State Trait Anxiety Inventory for Adults. The Manual. California: Mind Garden; 1983.

[18] McMahon C, Barnett B, Kowalenko N, Tennant C, Don N. Postnatal depression, anxiety and unsettled infant behaviour. Aust N Z J Psychiatry 2001;35:581−8.

[19] Barnett B, Schaafsma MF, Guzman AM, Parker G. Maternal anxiety: a five year review of an intervention study. J Child Psychol Psychiatry 1995;32:423−38.

[20] Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression. Br J Psychiatry 1987;150:782−6.

[21] Oberklaid F, Sanson AV, Prior M. The development of Australian normative data for infant temperament. Austral Paediatr 1986;22:185−7.

[22] Edhborg M, Seimyr L, Lundh W, Widstrom AM. Fussy child−difficult parenthood? Comparison between families with a "depressed" mother and non-depressed mother 2 months postpartum. J Reprod Infant Psychol 2000;18:225−38.

[23] Najman J, Williams G, Nikles J, Spence S, Bor W, O'Callaghan M, et al. Mother's mental illness and child behaviour problems: cause−effect association or observer bias? J Am Acad Child Adolesc Psych 2000;39:592−602.

[24] Whiffen V, Gotlieb IH. Infants of postpartum depressed mothers: temperament and cognitive status. J Abnorm Psychology 1989;98:274−9.

[25] Bailey N. Bayley Scales of Infant Development. The Psychological Corporation, 2nd edition. San Antonio: Harcourt Brace, 1993.

[26] Campbell JC. Health consequences of intimate partner violence. Lancet 2002;359:1331−6.

[27] Janssen PA, Holt VL, Sugg NK, Emanuel I, Critchlow CM, Henderson AD. Intimate partner violence and adverse pregnancy outcomes: a population based study. Am J Obstet Gynecol 2003;188:1341−7.

[28] Seifer R, Sameroff AJ, Barrett LC, Krafchuk E. Infant temperament measured by multiple observations and mother report. Child Dev 1994;65:1478−90.