

# Infant temperament and childhood psychiatric disorder: longitudinal study

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## Abstract

**Background** Temperamental characteristics emerge early in life and can shape children's development, adjustment and behaviour. We aimed to investigate the association between early infant temperament and later childhood psychiatric disorder in a community sample.

**Methods** This prospective, population-based study used data from the Avon Longitudinal Study of Parents and Children (ALSPAC). In a sample of 7318 children, we investigated whether temperamental characteristics assessed at the ages of 6 months and 24 months are associated with an independent diagnosis of psychiatric disorder ascertained at age 7 years.

**Results** After adjusting for confounders, temperamental characteristics assessed at 6 and 24 months of age were associated with psychiatric disorder at age 7 years. In particular, intensity of emotional reaction at age 6 months was associated with later disorder (adjusted odds ratio = 1.56; 95% confidence interval 1.19, 2.04;  $P = 0.002$ ). These associations were stronger in girls and in those children with high levels of intensity at both 6 and 24 months of age.

**Conclusions** Temperamental characteristics involving high levels of emotional intensity within the first year of life are longitudinally associated with psychiatric disorder in mid-childhood, suggesting that the roots of psychiatric disorder may, in some cases, lie very early in life.

## Keywords

ALSPAC, infant, psychiatric disorder, temperament

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## Introduction

Temperament reflects constitutionally based characteristics involving domains such as emotional regulation, affect, adaptability, activity and inhibition (Thomas & Chess 1977). Some temperamental traits may predispose children to and be predictive of later psychiatric disorders and impairment in function (Barker & Maughan 2009). With regard to early infant temperament (assessed before the age of 1 year), infants with high levels of reactivity have been shown to have more anxious symptoms at school-age (Kagan *et al.* 1999). However, there has been little work investigating the role of early infant temperament as a risk factor across a range of childhood psychiatric disorders and it is

unclear as to which children might benefit from further monitoring by health professionals working with children. Although temperamental characteristics have some stability over time, other factors (such as child gender, parental mental health, and family socio-economic status) might also influence how temperament predisposes to later problems (Hanington *et al.* 2010). Much work has relied on the same informant for all predictor and outcome information or focused on parental perceptions of an overall 'difficult' temperament (Thomas & Chess 1977; Prior *et al.* 2001; Lahey *et al.* 2008). Previous work has mainly either addressed the association between 'difficult' temperament and later problems or the association between specific temperament domains and specific psychiatric outcomes but, in

contrast, there has been little work investigating the association between early infant temperament and the broad range of childhood psychiatric disorders. A broader focus on the dimensions of temperament, for example as conceptualized by Thomas and Chess (1977) in the New York Longitudinal Study, may expand our knowledge around predictors of mental health outcomes. Such work has implications for our understanding of the development of psychiatric disorders and may turn out to have implications for possible early intervention.

In a large population-based birth cohort, we investigate which temperamental traits (assessed at the ages of 6 months and 24 months) are associated with the presence of psychiatric disorder at age 7 years. We hypothesized that temperamental characteristics assessed during infancy (aged 6 months) are associated with later psychiatric disorder.

## Methods

Avon Longitudinal Study of Parents and Children (ALSPAC) is a prospective population-based study in the South West of England (Boyd *et al.* 2012). All pregnant women resident in the Avon area with an expected delivery date between April 1991 and December 1992 were invited to take part. Approximately 85% of all eligible women participated, involving a cohort of 14 541 pregnancies resulting in 14 062 live births. Participants were broadly representative of the local population of mothers with infants and comparable against national census data although they were slightly more likely to be Caucasian, married or cohabiting, and home owner-occupiers (see <http://www.bristol.ac.uk/alspac/>). Further details are described elsewhere (Boyd *et al.* 2012). Ethical approval for the study was obtained from the ALSPAC Ethics and Law Advisory Committee and the Local Research Ethics Committees.

## Measures

### Predictor measures

Child temperament was measured using the well-validated, internally consistent, and reliable Carey Infant and Toddler Temperament Scales completed by the parent (usually mother) at the ages of 6 and 24 months respectively (Carey & McDevitt 1978; Fullard *et al.* 1984; Joinson *et al.* 2008). Each item reflects a specific behaviour or characteristic (e.g. '(S)he responds intensely (screams, yells) when frustrated'; '(S)he is fussy on waking up and going to sleep (frowns, cries)'). Each question has a six-point response range, from 'almost never' to 'almost

always', with higher scores indicating a more difficult temperament. The nine sub-scales (activity, adaptability, approach, distractibility, intensity, mood, persistence, rhythmicity, and threshold) relate to the temperament domains developed by Thomas and Chess (1977).

### Outcome measures

Psychiatric disorder at age 7 years (91 months) was based on the reliable and well-validated Development and Well-Being Assessment (DAWBA) which consists of a structured combined package of parent and teacher questionnaires and incorporates open questions allowing free-text answers (Goodman *et al.* 2000; Ford *et al.* 2003). The DAWBA has been widely used in other large epidemiological studies, including the two nationally representative British Child and Adolescent Mental Health Surveys (Ford *et al.* 2003). Questions focus on current symptoms and impairment. To emulate the clinical diagnostic process as closely as possible, experienced clinicians reviewed all available symptom and impairment information obtained from parents and/or teachers in assigning DSM-IV (American Psychiatric Association 1994) psychiatric diagnoses reflecting externalizing (e.g. attention deficit/hyperactivity disorder, oppositional defiant disorder or conduct disorders) and internalizing disorders (depression and anxiety disorders). This independent approach emulated the clinical diagnostic process as closely as possible (Wolke *et al.* 2009). However, clinicians were blinded to the earlier temperament ratings. Overall, 6.8% [95% confidence intervals (CI) 6.2–7.4%] of our sample (9.0% of boys and 4.4% of girls) had a psychiatric disorder.

### Confounder measures

Confounding variables (also covering factors potentially influencing raters) included maternal social class (measured during pregnancy) and maternal depression (measured when the child was aged 8 and 21 months) using the well-validated Edinburgh Postnatal Depression Scale (EPDS; Cox *et al.* 1987; Murray & Carothers 1990).

## Analyses

Temperament data at both time points and DAWBAs were available on 7318 children. In terms of DAWBA availability, there was no consistent pattern of association with most temperament sub-scale scores (and no association with intensity

and persistence scores at either time point). However, lower maternal social class was associated with attrition. Using correlations, we first examined the stability of each scale from 6 to 24 months. Next, at each time point, the univariable relationships between temperament scores and psychiatric disorder were examined. At each time point, all temperament variables that were associated with psychiatric disorder ( $P < 0.05$ ) were then entered into a multivariable logistic regression analysis, adjusting for social class and maternal EPDS at the nearest time point. We report adjusted odds ratios, reflecting each one-point increase in the scale.

## Results

### Correlations

Across the 6 and 24 month time points, there were moderate within-domain correlations over time for eight of the nine temperament domains (correlation coefficients ranging from 0.20 to 0.37;  $P < 0.01$ ). The only exception was distractibility ( $r = -0.07$ ).

### Longitudinal associations

In univariable analyses, four temperament domains at 6 months and seven domains at 24 months were associated ( $P < 0.05$ ) with the presence of psychiatric disorder at age 7 (Table 1). Higher scores (indicating more difficulties) on these temperament domains were associated with disorder. However, there was one exception at 24 months involving lower scores on the threshold domain, reflecting threshold of responsiveness to sensory factors.

At 6 months, in multivariable analyses, only intensity scores were associated with a later psychiatric disorder [adjusted odds ratio (OR) = 1.03; 95% confidence intervals (CI) 1.01, 1.05;  $P = 0.003$ ]. At 24 months, in multivariable analyses, five temperament domains were associated with disorder: intensity (OR = 1.05; 95% CI 1.02, 1.08;  $P = 0.001$ ), activity (OR = 1.04; 95% CI 1.02, 1.07;  $P = 0.003$ ), adaptability (OR = 1.03; 95% CI 1.00, 1.05;  $P = 0.043$ ), and threshold (OR = 0.97; 95% CI 0.95, 0.997;  $P = 0.025$ ). As continuous predictor measures, these odds ratios reflect an increase in one point on the temperament sub-scale.

### Role of intensity

Given the finding of the association with the intensity domain (reflecting the level of energy with which emotional responses

**Table 1.** Associations between temperament subscales at 6 and 24 months and the presence of a psychiatric disorder at age 7 years

Temperament domain (range)	Psychiatric disorder		P value
	Yes <i>n</i> = 496	No <i>n</i> = 6822	
	Mean (SD)		
6-month			
Activity (0–60)	40.96 (6.53)	40.41 (6.36)	0.063
Rhythmicity (0–50)	16.90 (7.80)	15.89 (6.82)	0.005
Approach (0–50)	15.23 (6.80)	15.11 (6.26)	0.699
Adaptability (0–50)	14.46 (6.12)	13.93 (5.58)	0.064
Intensity (0–50)	25.78 (5.78)	25.06 (5.67)	0.006
Mood (0–45)	16.70 (6.29)	16.14 (5.81)	0.037
Persistence (0–35)	13.65 (5.53)	13.73 (5.09)	0.755
Distractibility (0–50)	14.73 (6.07)	14.11 (5.47)	0.029
Threshold (0–60)	27.79 (6.44)	27.33 (6.00)	0.103
24-month			
Activity (0–36)	24.87 (4.83)	22.96 (4.48)	<0.001
Rhythmicity (0–44)	17.79 (5.93)	16.75 (5.72)	<0.001
Approach (0–44)	19.59 (8.62)	20.24 (7.60)	0.101
Adaptability (0–28)	14.51 (4.53)	12.62 (4.10)	<0.001
Intensity (0–36)	23.18 (4.76)	21.29 (4.51)	<0.001
Mood (0–48)	19.95 (6.32)	17.81 (5.55)	<0.001
Persistence (0–36)	17.73 (5.43)	16.19 (4.84)	<0.001
Distractibility (0–40)	24.47 (5.13)	24.64 (4.65)	0.461
Threshold (0–32)	18.52 (4.43)	19.08 (4.36)	0.005

are made) at both time points, we further explored the increase in risk for the highest scorers (top 10%) on intensity at each time point as well as for those who were in the top 10% at both time points ('persistent' high intensity). Initial assessment was made for gender interaction and these analyses were repeated separately for each gender.

As shown in Table 2, high intensity (present at either time point or persistently) was associated with increased risk for psychiatric disorder, especially in girls. This gender difference in risk was not explained by differences in rates of persistent intensity as these were similar in boys (2.1%) and girls (1.7%) or by differences in the predominating type of disorder as both internalizing (3.8% vs. 2.6%;  $P < 0.01$ ) and externalizing (6.3% vs. 2.2%;  $P < 0.001$ ) disorders were more common in boys. As described above in relation to the other temperament domains, the associations involving the 6-month measure of intensity were weaker.

In terms of associations with type of disorder, the clearest associations involve high intensity at 24 months which was associated with both internalizing and externalizing disorders. In contrast, persistent intensity (high at both time points) was only associated with externalizing disorders, perhaps reflecting much smaller numbers (OR = 2.65; 95% CI 1.50, 4.67;  $P < 0.001$ ; no evidence of gender interaction).

**Table 2.** Relationships between high levels of intensity and the presence of a psychiatric disorder at age 7 years

	Whole sample		OR (95% CI)	P	Girls	Boys	OR (95% CI)	P	P for gender interaction
	Disorder n = 496 (%)	No disorder n = 6822 (%)			(n = 3574)	(n = 3744)			
High intensity (6 months)	66 (13.3)	612 (9.0)	1.56 (1.19, 2.04)	0.002	2.36 (1.54, 3.61)	<0.001	1.19 (0.84, 1.70)	0.331	0.016
High intensity (24 months)	93 (18.8)	598 (8.8)	2.40 (1.89, 3.06)	<0.001	2.79 (1.86, 4.19)	<0.001	2.17 (1.61, 2.93)	<0.001	0.330
Persistent high intensity	19 (3.8)	116 (1.7)	2.30 (1.41, 3.77)	0.001	4.04 (1.95, 8.37)	<0.001	1.55 (0.79, 3.04)	0.201	0.058

## Discussion

Our findings suggest that infant temperament measured from 6 months of age is associated with the presence of a psychiatric disorder at the age of 7 years. Although there were associations with a broader range of predictors measured at the age of 24 months, there appeared to be particular risks associated with intense emotional reactivity, especially in girls. Intensity of emotional reaction measured at either 6 or 24 months of age was associated with psychiatric disorder assessed at 91 months. One in seven of the small group of children with persistent high intensity had a later psychiatric disorder with a greater risk for girls. There were no gender differences in rates of persistent high intensity suggesting that this category was not picking out a more extreme group of girls. At the age of 24 months, we also found that high levels of activity were a strong predictor of later disorder. If parents of young children have concerns, these temperamental domains could be enquired about routinely as they may be early indicators of psychiatric disorder in mid-childhood.

When outcomes were assessed in terms of broad types of disorder, high levels of intensity (difficulties with regulating emotions) at 24 months were associated with both internalizing and externalizing disorders. In contrast, persistent intensity was only associated with externalizing disorders. It might be that, if a pattern of negative emotional responses becomes established from infancy, children may display defiant or disobedient behaviours when facing emotionally stressful situations.

## Methodological issues

Strengths of our study include the use of prospectively collected measures in a large representative community sample. We employed a well-validated and independent outcome measure, the DAWBA (Goodman *et al.* 2000). This measure has the

advantage of incorporating both teacher and parental report which acts to reduce the possibility of information bias (shared method variance) whilst also remaining clinically relevant as parents are usually responsible for help-seeking and presentation to services. Although experienced clinicians reviewed all available information, it could nevertheless be argued that this is not the same as conducting a clinical assessment. We bypassed some of the difficulties associated with relying on a categorical predictor of 'difficult' temperament as this assumes that only children with a predetermined cluster of difficulties are likely to be at risk and possible risks related to other specific domains may be obscured. Previous research on longitudinal outcomes of early temperamental characteristics has yielded inconsistent findings (Oberklaid *et al.* 1993; Guerin *et al.* 1997; Teerikangas *et al.* 1998; Prior *et al.* 2001; Lahey *et al.* 2008). Methodological issues affecting many studies include the use of small or clinical samples, sample attrition, choice of measures including reliance on the 'difficult temperament' cluster, information bias whereby both predictor and outcome measures are obtained from the same informant (most usually the mother), or risks of confounding particularly with parental mental health and family socio-economic status influencing the relationship between early temperament and later psychiatric disorder. Our analyses adjusted for maternal mental health and socio-economic status as these are potential confounders and may also influence how child temperament is rated. Previous research using the ALSPAC cohort has clearly indicated that sample attrition does not influence estimations of risk of psychiatric disorder (Wolke *et al.* 2009).

## Implications

Temperament reflects individual differences in the regulation of emotions, activity, and attention that emerge from infancy. Our findings have potential implications for the early identification

of temperamental difficulties and possible interventions. Previous research suggests that temperamental difficulties in infancy and early childhood are associated with common problems which might present in practice such as recurrent abdominal pain (Ramchandani *et al.* 2006). Temperamental difficulties may be a source of stress to parents and impact on how they parent their child. As most young children are seen regularly in primary healthcare settings, professionals based in these services should be aware of these traits (Carey 1998; Stein *et al.* 2005), particularly as they may be early indicators of psychiatric disorder in mid-childhood. Interventions such as parenting support might be considered if persistent difficulties involving high levels of intensity are present alongside other risk factors for later mental health problems.

### Future research

It might be that a specific cluster of temperamental traits, distinct from the 'difficult' temperament concept, are associated more strongly with later psychiatric disorder. As well as acting as direct risk factors for later problems, temperamental difficulties may have an indirect role through their impact on parental perceptions, the quality of parenting received and the child's wider environment. As infant temperament might interact with later environment in influencing vulnerability to disorder, future research should also determine potential mediating and moderating factors for child psychiatric outcomes and, particularly how temperament might interact with other risk factors either in parallel or sequentially.

### Key messages

- Temperamental characteristics emerge early in life and can shape children's development, adjustment and behaviour.
- Although difficult childhood temperament can predispose to later problems, there has been little work investigating the role of early infant temperament (assessed before the age of 1 year) as a risk factor for having a later psychiatric disorder.
- Intensity of emotional reaction in early life, especially in girls, is particularly associated with later disorder.

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