Original Research

Early Temperament Prospectively Predicts Anxiety in Later Childhood

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Objective: To investigate the contribution of early childhood temperamental constructs corresponding to 2 subtypes of general negative emotionality—fearful distress (unadaptable temperament) and irritable distress (fussy–difficult temperament)—to later anxiety in a nationally representative sample.

Method: Using multiple linear regression analyses, we tested the hypothesis that caregiver-reported child unadaptable temperament and fussy–difficult temperament scales of children aged 2 to 3 years (in 1995) would prospectively predict caregiver-reported child anxiety symptoms at ages 4 to 5, 6 to 7, 8 to 9, and 10 to 11 years, and child-reported anxiety at 10 to 11 years (controlling for sex, age, and socioeconomic status) in a nationally representative sample from Statistics Canada's National Longitudinal Survey of Children and Youth (initial weighted n = 768 600).

Results: Only fussy–difficult temperament predicted anxiety in children aged 6 to 7 years. In separate regressions, unadaptable temperament and fussy–difficult temperament each predicted anxiety at 8 to 9 years, but when both were entered simultaneously, only unadaptable temperament remained a marginal predictor. Temperament did not significantly predict caregiver- or child-reported anxiety at 10 to 11 years, suggesting that as children age, environmental factors may become more important contributors to anxiety than early temperament.

Conclusion: Our results provide the first demonstration that early temperament is related to later childhood anxiety in a nationally representative sample.

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Clinical Implications

- Biologically based traits such as temperament can predispose children to anxiety.
- The current results are consistent with calls for increased efforts to intervene directly with temperament in the prevention of childhood anxiety pathology.

Limitations

- The anxiety scales used in the analyses were very brief.
- The anxiety scales measured anxiety-relevant symptoms, not anxiety disorders.
- Temperament was measured with caregiver-reported subscales, which could potentially be biased by caregiver motivations or perceptions.

Key Words: *anxiety, temperament, unadaptable, behavioural inhibition, fearful distress, fussy–difficult, irritable distress, population*

Many children and adolescents experience fears and anxiety during the course of normal development.[1] For some, anxiety reaches a clinically significant level. A recent review revealed that anxiety disorders are common in preadolescents.[2] Anxiety disorders in children are important not only due to their prevalence but also because of the significant impairment in social and academic domains that they can cause.[3] Further, there is retrospective[4] and prospective[5] evidence to indicate that childhood anxiety disorders are not simply transient problems that will resolve on their own. Although current psychological treatments for childhood anxiety disorders are effective, many children still meet diagnostic criteria for an anxiety disorder at treatment completion.[6] Therefore, recent research has focused on prevention: intervention that takes place before the onset of an anxiety disorder with the aim of averting new cases.[7]

It is important to determine the risk factors for anxiety because they could be useful for identifying targets of selective prevention strategies.[8] One prominent line of anxiety risk factor research has focused on temperament—biologically based behavioural traits appearing very early in life.[9] A wide array of measures and terms have been used to describe temperament, but a review indicates that the findings converge.[10] Two different types of "general negative emotionality" constructs consistently emerge, in both infancy and childhood temperament research: "fearful distress" and "irritable distress."[10, p 113] Behavioural inhibition, which corresponds to unadaptable temperament or fearful distress, is the temperamental construct that has received the most attention in the anxiety risk factor literature. Behaviourally inhibited children tend to be unadaptable to new people or situations[11] and display shyness, cautiousness, and emotional restraint in the face of unfamiliar people or situations.[12] Fussy–difficult temperament corresponds to the irritable distress construct and is exemplified by infants and children who are irritable, easy to upset, difficult to soothe, and who frequently display negative affect.[9]

There have been 2 primary approaches to the study of temperament–anxiety relations: relatively small-scale investigations involving convenience samples (for example, in the laboratory), and large-scale epidemiologic explorations of population-representative samples. In the laboratory, studies using small samples selected to have high or low behavioural inhibition (assessed through behavioural observation) have demonstrated that behavioural inhibition early in life predicts later anxiety,[13] particularly when the behavioural inhibition is stable across time.[14] Research using parent reports of child temperament has also revealed a positive relation between behavioural inhibition and anxiety.[15] In addition, some cross-sectional[16] and prospective[13] findings suggest that behavioural inhibition confers a specific vulnerability for social anxiety.

Compared with the literature on behavioural inhibition (unadaptable temperament or fearful distress), information concerning fussy–difficult temperament (irritable distress) is relatively sparse. Research findings with convenience samples have generally indicated that parent-reported fussy–difficult temperament is associated concurrently[17] and prospectively[18] with both internalizing[9] (for example, depression and anxiety) and externalizing[9] (for example, aggressiveness) problems. However, several of the studies in this area were limited in that they examined only one component of fussy-difficult temperament[19] or used broad-based measures of internalizing problems that are not specific to anxiety.[18]

In comparison with the many smaller-scale studies, there are relatively few epidemiologic investigations that report the relation between temperament and anxiety using large population-representative samples. One such study investigated prospective mother-rated temperamental predictors of child anxiety in adolescence, including fearful distress (shy-inhibited temperament) and a single aspect of irritable distress (reactive temperament), in a cohort of children selected to be representative of one Australian state.[20] Shy-inhibited children were significantly more likely than non–shy-inhibited children to be clinically anxious (by child- and mother-reported composite ratings) in adolescence. However, reactive temperament (an indicator of difficultness[9]) did not predict anxiety problems in adolescence.

The temperamental precursors of child and adolescent psychopathology were assessed in a longitudinal sample recruited from a complete cohort of consecutive births occurring during a 1-year period in one New Zealand city.[21] Experimenter-rated approach temperament (the conceptual inverse of unadaptable temperament) in early childhood was inversely related to aggregated parent and teacher ratings of anxiety in late childhood and to parent-rated anxiety in adolescence. "Lack of control, irritability, and distractibility"[21, p 59] (a temperamental construct including some elements of irritable distress), measured in early childhood was positively related to parent and teacher ratings of

Abbreviations used in this article

BSSE	bootstrap standard error
ICQ	Infant Characteristics Questionnaire
OCHS	Ontario Child Health Study
NLSCY	National Longitudinal Survey of Children and Youth
SES	socioeconomic status

anxiety in late childhood and parent-rated anxiety in adolescence.

In the extant literature, there are no investigations of the relation between early childhood temperament and later anxiety symptoms in a nationally representative sample. The current study is the first to investigate the contribution of early childhood temperamental constructs corresponding to both subtypes of general negative emotionality—fearful distress and irritable distress—to later anxiety in a nationally representative sample (from the NLSCY[22]).

Basic demographic characteristics that have been shown to be related to internalizing problems in children (that is, sex,[18] SES,[23] and age[24]) were statistically controlled in the data analyses to ensure a stringent test of the temperamental predictors, in contrast to prior research that has failed to account for the potential impact of some of these basic demographics characteristics (for example, Prior et al[20] did not control for SES in their analyses). The hypothesis was that caregiver-reported child unadaptable temperament (fearful distress) and fussy–difficult temperament (irritable distress) at ages 2 to 3 years would prospectively predict caregiver-reported child anxiety symptoms at ages 4 to 5 , 6 to 7 , 8 to 9 , and 10 to 11 years, and child-reported child anxiety symptoms at ages 10 to 11 years, while controlling for child sex, age, and SES.

Method

The National Longitudinal Survey of Children and Youth

The NLSCY is a national, longitudinal, probabilistic survey, designed to track the development of a sample representative of the Canadian civilian population living in the 10 provinces.[22] The first cycle of data collection was executed in 1994/95, with additional cycles of data collection occurring every 2 years. For the sample used in the current investigation, data collection was conducted by telephone or in person using computer-assisted interviewing, with the exception of child-reported anxiety information at ages 10 to 11 years, which was collected through written questionnaire. The overall response rate to the NLSCY was 86.3%.[25] The current investigation was a component of a larger project, headed by one of the authors, for which data access was approved by an adjudicating committee with representation from the Social Sciences and Humanities Research Council and from Statistics Canada. Ethical approval for the entire study was provided by the IWK Health Centre's Research Ethics Board.

Statistics Canada created survey weights that are used to ensure that the NLSCY data represent the Canadian population at the time of selection into the survey (that is, January 1995 for the longitudinal cohort that began in Cycle 1).[22] Each person in the sample is assigned a weight equivalent to the number of people in the population that it represents. For the current investigation, the Cycle 5 longitudinal funnel weights were applied, which are appropriate for respondents who participated in each of the first 5 cycles of data collection.

To conform to the release guidelines put forth by Statistics Canada, a minimum of 5 contributing respondents was required for the estimates reported here.[22] Further, the Statistics Canada rounding guidelines were followed herein.[22]

Bootstrap Approach to Variance Estimation

The NLSCY has a complex sample design that involves stratification, multiple selection stages, and unequal probabilities of selecting respondents.[22] Correct point estimates (for example, means and correlations) can be calculated by simply applying the appropriate survey weights. However, typical methods for estimating variance, based on the assumption of a simple random sample, are unsuitable and may lead to underestimates of true variance, which might in turn lead to inappropriate rejection of the null hypothesis in statistical testing.[22]

To permit proper inference, bootstrap weights must be used for variance estimation. The bootstrap approach is a replicate-based variance estimation technique.[26] This technique involves the random selection (from the full sample) of synthetic subsamples, or replicates, each of which has the same design as the entire sample.[22] Then, weights for the cases within each subsample are recalculated in the same manner as is used for the full sample (see previous paragraph) to create a final set of, in the case of the NLSCY, 1000 bootstrap weights per person. Population estimates for a given characteristic are calculated for each subsample using the bootstrap weights. Then, to estimate the sampling variance (see definition in the following paragraph) in the population, the variance among the 1000 subsample estimates is calculated. In the current investigation, the set of 1000 Cycle 5 longitudinal funnel bootstrap weights was used for all analyses requiring variance estimation.

Sampling variance refers to the variability in an estimate resulting from use of a sample instead of a census.[22] It reflects sampling error, which is influenced by population variance, sample design, sample size, and response rate to the survey. The standard error of an estimate is equivalent to the square root of the sampling variance and is the variance estimation statistic used in the present data analyses. The confidence intervals presented herein are based on standard errors that were derived using bootstrap weights (that is, BSSE).

Participants

Respondents were people most knowledgeable about (that is, caregivers of) children from the longitudinal cohort that began participation in the NLSCY in Cycle 1 (that is, 1995). Child-report data from Cycle 5 were also included. Respondents who had participated in all 5 cycles were selected to

Table 1 Description of Canadian subpopulation studied in multiple regression analyses

Variable (weighted n[a])	% (95% CI)
Sex of child (768 600)	
Girls	50.0 (48.7 to 51.4)
Boys	50.0 (48.6 to 51.3)
Age of child (initial) (768 600), years	
2	47.7 (45.5 to 50.0)
3	52.3 (50.0 to 54.5)
Ethnicity of child (data collected at ages 4 to 5 years) (623 700)[b]	
White	90.3 (87.4 to 93.2)
South Asian (for example, Indian, Pakistani)	2.1 (0.5 to 3.7)
Chinese	1.8 (0.7 to 3.0)
Filipino	1.8 (–0.1 to 3.7)
Native and (or) Aboriginal	0.9 (0.4 to 1.4)
Black (for example, African, Haitian)	0.7 (–0.2 to 1.7)
Latin American	0.4 (0.0 to 0.9)
Other (Arab and [or] West Asian, Southeast Asian, Japanese, and Other)[c]	2.8 (1.0 to 4.7)
Relationship of caregiver to child (768 600)	
Birth mother	91.2 (89.1 to 93.3)
Adoptive mother	0.5 (0.0 to 1.1)
Stepmother, foster mother, or other related female	0.8 (0.0 to 1.5)
Birth father, stepfather, foster father, or other related male	7.5 (5.5 to 9.5)
Age of caregiver (768 600), years	
15 to 24	8.4 (6.6 to 10.1)
25 to 29	24.1 (21.0 to 27.1)
30 to 34	39.8 (35.9 to 43.7)
35 to 39	20.6 (17.6 to 23.6)
≥40	7.2 (4.7 to 9.6)

[a] Weighted using Cycle 5 longitudinal funnel weights.

[b] Race categories are not mutually exclusive.

[c] The Arab and (or) West Asian, Southeast Asian, and Japanese categories were combined with the original Other category to follow Statistics Canada guidelines that there be at least 5 unweighted cases per category.

heighten the comparability of the sample across cycles. The sample was further restricted to caregiver respondents whose children were aged 2 to 3 years at Cycle 1 (and 10 to 11 years at Cycle 5), leaving weighted n = 790 400 (unweighted n = 2037). The rationale for this restriction was that information about temperament (collected about young children in Cycle 1 only) and about child-reported anxiety (collected at Cycle 5 only from children aged 10 years and older) was provided by this subgroup.

In the resultant sample, none of the respondents were missing any of the demographic predictor variables for the multiple regression analyses used to test the hypothesis. Next, the following missing value exclusion rule was applied: respondents were required to have at least 60% of the component items for each of the predictor temperament subscales employed in the regression analyses (that is, 3 of the 5 unadaptable subscale items and 6 of the 9 fussy–difficult subscale items) and to have a minimum of 67% of the component items for at least one of the possible anxiety outcome subscales (that is, 2 of the 3 items for the caregiver-reported child anxiety items for either Cycle 2, Cycle 3, Cycle 4, or Cycle 5, or the child-reported anxiety items for Cycle 5).

Following the application of this missing value exclusion rule, a weighted n = 768 600 (unweighted n = 2001) remained. Table 1 displays the sample demographic characteristics. Among those who had enough data to be included in the regression analyses, 38.1% (95% CI 34.6% to 41.6%) had at least one missing value on one of the variables used for the scales that were entered in the regression analyses. The mean number of missing values on variables comprising the regression subscales was 1.2 (95% CI 1.1 to 1.3). A small percentage (6.3%; 95% CI 3.6% to 9.0%) of child targets shared a household with another child in this sample. Except for the weighting variable, the Canadian Research Institute for Social Policy-NLSCY files (version 1.1), which are essentially groomed versions of the original Statistics Canada NLSCY files, were analyzed herein.[27]

Materials

Child Sex and Age. Child sex was a dichotomous variable (0 = boys; 1 = girls). The child's age in years (that is, 2 or 3 years) at the time of the interview in Cycle 1 was used in the analyses.

Socioeconomic Status. This composite variable was derived from the level of education and occupation(s) of the target child's parent(s), along with the target child's household income, scaled to 1994 values.[27] This measure was standardized on the entire sample of households surveyed in the NLSCY (that is, it is a z score). The mean SES in the current sample was 0.0 (95% CI –0.1 to 0.0).

Temperament Measures. The NLSCY measured child temperament at Cycle 1 only. The (caregiver-reported) temperament items used in the NLSCY were derived from the ICQ for infants aged 6 months, which has subscales corresponding to fussy-difficult, unadaptable, dull, and unpredictable temperaments.[11,25] The 6-month version of the ICQ has shown adequate factor structure, internal consistency, and test–retest reliabilities for the subscales.[11] In addition, parent-reported fussy-difficultness was correlated with objective observations of fussiness, demonstrating the validity of this subscale.[11] Further, there was convergence of the fussy–difficult and unadaptable subscales with conceptually related subscales on other measures.[11]

The ICQ items were slightly modified to be more appropriate for NLSCY children aged 3 years; thus the wording of temperament items differed somewhat for 2- compared with 3-year-olds included in our study.[25] In our investigation, fussy-difficult and unadaptable subscales were created from means of component items. Each item was scored on a scale of 1 (more favourable) to 7 (more unfavourable, inhibited, or difficult). The fussy-difficult subscale was comprised of 9 items (for example, "How easy or difficult is it for you to calm or soothe [child's name] when he/she is upset?"). The unadaptable subscale had 5 items (for example, "How does he/she respond to being in a new place?"). Descriptive statistics and Cronbach's alphas (internal consistencies) for the temperament subscales are presented in Table 2. Though the unadaptable subscale internal consistency reliability is less than the widely accepted cut-off of 0.70, it is adequate according to Loewenthal's standard, which suggests that a Cronbach's alpha of greater than 0.60 is acceptable for short scales.[28]

Anxiety Scales. There were 5 anxiety scales analyzed in our study (that is, caregiver-reported at ages 4 to 5, 6 to 7, 8 to 9, and 10 to 11 years, and child-reported at ages 10 to 11 years). Each anxiety scale was comprised of the mean of 3 anxiety-relevant items taken from the broader NLSCY emotional disorder scale,[25] which was adapted from the original OCHS emotional disorder scale.[29] The original OCHS emotional disorder scale consists of items selected to reflect essential components of affective disorder, overanxious disorder, and obsessive–compulsive disorder.[30] Boyle et al[29] found that the emotional disorder scale had satisfactory internal consistency and test–retest reliability. In addition, the validity of the emotional disorder scale was demonstrated by its prediction of psychiatric status (that is, whether or not a child attended a mental health clinic) in 6- to 16-year-olds.[29] Further, Boyle et al[29] found the emotional disorder scale to be significantly associated with overanxious disorder scale scores on a revised version of the OCHS scales. In turn, both parent-report[31] and youth-report[32] versions of the revised OCHS were found to have reliability and validity comparable with a structured diagnostic interview.

Three subscales comprise the original OCHS emotional disorder scale: dysphoric mood, strong feelings of tension, and compulsive, obsessive behaviour.[29] The caregiver- and child-reported anxiety-relevant items selected for the current study (for example, "How often would you say that [child's name] is too fearful or anxious?" [caregiver-reported]) corresponded to the 3 items on the OCHS strong feelings of tension subscale, which each showed good convergent and discriminant validity in item analyses.[29] The anxiety items used in the current investigation were each scored on a scale of 1 = never or not true to 3 = often or very true.[22] See Table 2 for descriptive statistics of the anxiety scales, which all had acceptable internal consistencies.

Data Analyses

Data analysis for inferential tests and for variance estimation (that is, calculating BSSEs) was conducted with Stata software.[33] This software has the capacity to analyze complex survey data using a set of survey (svy) commands. Software packages (such as Stata Release 9) that can accommodate balanced repeated replication weights in their analyses can use a balanced repeated replication variance estimator along with bootstrap weights to generate bootstrap variance estimates.[26] In our investigation, the svy:regress command was used with the Stata balanced repeated replication variance estimator to produce regression coefficients based on bootstrap weights.

Stata does not have a svy command for correlation. Following recent recommendations, the point estimates for correlations were derived using the correlate command weighted with the longitudinal Cycle 5 funnel weights.[34] Then the svy:regress command (as described above) was used to derive the associated significance level by regressing each of the 2 values to be correlated on each other and taking the largest (that is, most conservative) P value of the 2.[34]

The central analyses involved a series of multiple linear regression analyses in which child sex, age, SES, and temperamental subscales (that is, the unadaptable subscale or the fussy–difficult subscale) measured at ages 2 to 3 years were entered as predictors. Criteria variables were the caregiver-reported anxiety scales for children at ages 4 to 5, 6 to 7, 8 to 9, and 10 to 11 years. The child-reported anxiety scale at ages 10 to 11 years served as an additional criterion variable.

Results

The correlations among the temperament and anxiety variables are displayed in Table 2. Unadaptable and fussy–difficult temperament had a small, significant positive correlation. Fussy–difficult temperament was positively

Table 2 Descriptive statistics and correlations among temperament variables and child anxiety variables

Scale, ages in years	Weighted n[a] (Weighted n for α)[c]	M (95% CI)	α	Correlations (P) among temperament and child anxiety variables[b]						
				1	2	3	4	5	6	7
1. Unadaptable temperament	768 600	2.5 (2.4 to 2.5)	0.65	—	0.24	0.00	0.05	0.11	–0.02	–0.02
2 to 3	(767 500)				(<0.001)	(0.90)	(0.32)	(0.05)	(0.60)	(0.73)
2. Fussy-difficult temperament	768 600	3.1 (3.0 to 3.1)	0.75		—	0.04	0.12	0.09	0.03	0.01
2 to 3	(767 400)					(0.44)	(0.004)	(0.03)	(0.60)	(0.78)
3. Caregiver-reported child anxiety 4 to 5	768 600	1.3 (1.3 to 1.4)	0.64			—	0.44	0.26	0.28	0.06
	(766 000)						(<0.001)	(<0.001)	(<0.001)	(0.13)
4. Caregiver-reported child anxiety 6 to 7	719 300	1.4 (1.4 to 1.4)	0.72				—	0.50	0.35	0.19
	(718 200)							(<0.001)	(<0.001)	(<0.001)
5. Caregiver-reported child anxiety 8 to 9	739 800	1.5 (1.4 to 1.5)	0.70					—	0.50	0.21
	(738 000)								(<0.001)	(<0.001)
6. Caregiver-reported child anxiety 10 to 11	732 900	1.5 (1.4 to 1.5)	0.75						—	0.16
	(730 500)									(<0.001)
7. Child-reported anxiety	579 200	1.6 (1.6 to 1.7)	0.67							—
10 to 11	(551 100)									

[a] *Weighted using Cycle 5 longitudinal funnel weights.*

[b] The weighted n for each correlation may be less than either of the weighted ns for the correlated scales as only those cases with both scales could be included in a given bivariate correlation. Point estimates of correlations are calculated with the Cycle 5 longitudinal funnel weights applied. To derive significance levels for correlations, each variable in a particular bivariate correlation was regressed on the other (using bootstrap weights) and the higher P value (most conservative) from the 2 regressions was followed.

[c] The weighted n for each scale's Cronbach's α is less than that for the corresponding mean as only cases without missing values for any of the component variables for each scale were included in the Cronbach's α analyses.

correlated with caregiver-reported child anxiety at 6 to 7 years. Also, both fussy-difficult and unadaptable temperament were positively correlated with caregiver-reported child anxiety at 8 to 9 years.

The results of the multiple linear regression analyses (Table 3) are consistent with the pattern of correlations. In the multiple regression analyses, caregiver-reported fussy-difficult temperament at ages 2 to 3 years predicted caregiver-reported child anxiety at ages 6 to 7 years and at ages 8 to 9 years, while controlling for basic demographics. Caregiver-reported unadaptable temperament at ages 2 to 3 years also predicted caregiver-reported child anxiety at ages 8 to 9 years, while controlling for basic demographics. However, when unadaptable and fussy–difficult temperament (along with child sex, age, and SES) were entered in the same regression equation to predict caregiver-reported child anxiety at ages 8 to 9 years, unadaptable temperament remained a marginally significant predictor (B = 0.05, t = 1.71, P = 0.09), but fussy–difficult temperament did not (B = 0.03, t = 1.45, P = 0.15). Neither of the temperamental subscales predicted caregiver-reported child anxiety at ages 4 to 5 years or at ages 10 to 11 years, while controlling for basic demographics. Likewise, temperament did not predict child-reported anxiety at ages 10 to 11 years.

Discussion

The results of the current investigation represent the first demonstration in a nationally representative sample that 2 types of early temperament, both broadly classified as general negative emotionality,[10] each prospectively predicted anxiety in later childhood, even with the effects of basic demographic characteristics statistically controlled. As hypothesized, caregiver-reported fussy–difficult temperament at ages 2 to 3 years prospectively predicted caregiver-reported child anxiety at ages 6 to 7 and 8 to 9 years, controlling for basic demographic variables. In addition, consistent with expectation, caregiver-reported unadaptable temperament at ages 2 to 3 years predicted caregiver-reported anxiety at ages 8 to 9 years, controlling for basic demographic characteristics. The results of the multiple regression and correlation analyses suggest that unadaptable temperament was a relatively more powerful predictor of anxiety at ages 8 to 9 years than fussy–difficult temperament.

One possible reason why early fussy-difficult temperament predicted anxiety at ages 6 to 7 years whereas early unadaptable temperament was a more powerful predictor of anxiety at ages 8 to 9 years is related to the changing social demands that children experience as they age. Social worries begin to increase at age 8 years, reflecting a growing importance of social interactions.[35] The fact that social fears mount as children age, taken with prior findings that behavioural inhibition appears to confer a specific vulnerability for social anxiety,[13] is consistent with the current result that unadaptable temperament predicts anxiety in older (but not younger) children.

Contrary to expectation, early caregiver-reported child temperament did not prospectively predict child anxiety at ages 4 to 5 years (caregiver-reported) or at ages 10 to 11 years (caregiver- or child-reported). Perhaps temperament at ages 2 to 3 years did not predict anxiety at ages 4 to 5 years because of the challenges inherent in assessing anxiety at that young age.[36] Indeed, a review of the internal consistency results for the caregiver-reported child anxiety scales indicates that reliability improves after ages 4 to 5 years. Early temperament might not have predicted child- or caregiver-reported anxiety at ages 10 to 11 years because, as children age, environmental factors (for example, peer influences) become more important contributors to anxiety than early temperament. In addition, the failure of temperament to predict anxiety at ages 10 to 11 years might be related to the fact that this occasion of anxiety measurement was the most temporally distal from the measurement of temperament (at ages 2 to 3 years).

Given that the objective of the NLSCY was to cover a broad range of factors that influence or provide an index of children's development,[22] practical constraints precluded the use of lengthy, comprehensive measures of any one construct (for example, anxiety). The brevity of the anxiety scales in our study is a limitation, as this brevity is likely related to the somewhat low reliabilities of the anxiety scales and to the fairly low proportion of variance in anxiety scores explained by the predictor variables. Even so, it is impressive that early temperament significantly predicted later anxiety, despite being measured by short anxiety scales.

The current anxiety scales are further limited in that they simply measure anxiety-relevant symptoms, not anxiety disorder diagnoses, and they were not designed to distinguish among subtypes of anxiety (for example, social anxiety or panic). Nonetheless, as mentioned in our Method section, Boyle et al[29] found that scores on the emotional disorder scale from which our anxiety scales were derived may be appropriate proxies of psychological disorder. In addition, Ferdinand et al[37] determined that preadolescent children could not be divided into distinct groups displaying similar constellations of anxiety symptoms, thereby supporting the use of a more general measure of anxiety as in our study.

In our investigation, temperament was measured with caregiver-reported subscales, which may be biased by caregiver perceptions or motivations.[38] Thus some researchers (for example, Biederman et al[16] and Schwartz et al[13]) have relied on direct observation of behaviour to determine temperament, which has the advantage (compared with caregiver

Table 3 Multiple linear regression analyses prospectively predicting child anxiety at ages 4 to 5, 6 to 7, 8 to 9, and 10 to 11 years from predictor variables at ages 2 to 3 years

	With unadaptable temperament at ages 2 to 3 years as a predictor					With fussy–difficult temperament at ages 2 to 3 years as a predictor				
Outcome variable, age in years (Weighted n[a])	Predictor variable	B	t	P	R^2 (P)	Predictor variables	B	t	P	R^2 (P)
Caregiver-reported child anxiety										
4 to 5 (768 600)	(Constant)	1.16	11.79	<0.001		(Constant)	1.13	8.79	<0.001	
	Child sex[b]	–0.08	2.42	0.02		Child sex	–0.08	2.42	0.02	
	Child age[c]	0.08	2.55	0.01		Child age	0.08	2.59	0.01	
	SES	–0.02	1.21	0.23		SES	–0.02	1.23	0.22	
	Unadaptable	0.00	0.05	0.96	0.025 (<0.001)	Fussy–difficult	0.01	0.60	0.55	0.026 (<0.001)
Caregiver-reported child anxiety										
6 to 7 (719 300)	(Constant)	1.05	12.03	<0.001		(Constant)	0.98	9.70	<0.001	
	Child sex	0.02	0.42	0.67		Child sex	0.02	0.41	0.68	
	Child age	0.11	3.31	0.001		Child age	0.10	2.93	0.003	
	SES	0.00	0.02	0.98		SES	0.00	0.10	0.92	
	Unadaptable	0.02	1.13	0.26	0.019 (0.003)	Fussy–difficult	0.05	2.68	0.008	0.027 (0.001)
Caregiver-reported child anxiety										
8 to 9 (739 800)	(Constant)	1.21	12.34	<0.001		(Constant)	1.24	10.37	<0.001	
	Child sex	0.00	0.03	0.97		Child sex	0.00	0.03	0.97	
	Child age	0.05	1.29	0.20		Child age	0.03	0.86	0.39	
	SES	0.01	0.63	0.53		SES	0.01	0.42	0.68	
	Unadaptable	0.05	2.21	0.03	0.015 (0.05)	Fussy–difficult	0.05	2.20	0.03	0.010 (0.26)
Caregiver-reported child anxiety										
10 to 11 (732 900)	(Constant)	1.53	12.75	<0.001		(Constant)	1.46	12.51	<0.001	
	Child sex	0.02	0.65	0.52		Child sex	0.02	0.68	0.50	
	Child age	–0.01	0.35	0.73		Child age	–0.02	0.43	0.67	
	SES	–0.02	1.34	0.18		SES	–0.02	1.35	0.18	
	Unadaptable	–0.01	0.59	0.55	0.004 (0.59)	Fussy–difficult	0.02	0.62	0.54	0.004 (0.50)

continued

Table 3 continued

Outcome variable, age in years (Weighted n^a)	With unadaptable temperament at ages 2 to 3 years as a predictor					With fussy–difficult temperament at ages 2 to 3 years as a predictor				
	Predictor variable	B	*t*	*P*	R^2 (*P*)	Predictor variables	B	*t*	*P*	R^2 (*P*)
Child-reported anxiety										
10 to 11 (579 200)	(Constant)	1.36	12.62	<0.001		(Constant)	1.35	11.35	<0.001	
	Child sex	0.07	1.73	0.08		Child sex	0.08	1.74	0.08	
	Child age	0.09	2.19	0.03		Child age	0.09	2.18	0.03	
	SES	−0.02	0.82	0.41		SES	−0.02	0.81	0.42	
	Unadaptable	0.00	0.20	0.84	0.014 (0.05)	Fussy–difficult	0.00	0.04	0.97	0.014 (0.05)

All *t* and R^2 values are derived from calculations using bootstrap weights. All predictor variable data were collected at Cycle 1, when children were aged 2 to 3 years.

[a] Weighted using Cycle 5 longitudinal funnel weights.

[b] Boys = 0; Girls = 1.

[c] Child age in years (either 2 years or 3 years).

report) of objectivity of measurement.[38] However, the direct observation approach generally relies on just a single occasion of assessment. Conversely, caregiver-reported information most likely reflects child temperament across a broad range of situations and occasions.[38]

The primary strength of the current investigation was the use of a large, nationally representative, longitudinal sample. The inclusion of basic demographic statistical control subjects to ensure that the effects of temperament on later anxiety were not entirely due to demographic variables commonly associated with anxiety was another strong point. Moreover, 2 potential temperamental predictors of anxiety were examined herein, in contrast to most past research that has focused on only one type of temperament (for example, Schwartz et al[13]).

The results of our investigation are important in that they are from a large, nationally representative, longitudinal sample and support other findings implicating early childhood temperament as a risk factor for anxiety disorders in later childhood (for example, Schwartz et al[13]). Although our analyses yielded statistically significant associations between early temperament and later anxiety, the relations were modest in magnitude and present in only 3 of the 10 instances tested, precluding us from drawing strong conclusions regarding the study's clinical implications. Nonetheless, the current results are consistent with calls for increased efforts to intervene directly with temperament in the prevention of childhood anxiety pathology.[38]

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Résumé : Le tempérament précoce prédit prospectivement l'anxiété ultérieure dans l'enfance

Objectif : Investiguer la contribution des constructs du tempérament de la petite enfance correspondant à 2 sous-types d'émotionnalité négative générale — la détresse angoissée (tempérament inadaptable) et la détresse irritable (tempérament tatillon-difficile) — à l'anxiété ultérieure dans un échantillon nationalement représentatif.

Méthode : À l'aide de multiples analyses de régression linéaire, nous avons vérifié l'hypothèse que les échelles de tempérament inadaptable et de tempérament tatillon-difficile déclarées par un soignant pour des enfants de 2 à 3 ans (en 1995) prédiraient prospectivement les symptômes d'anxiété déclarés par un soignant chez l'enfant de 4 à 5 ans, de 6 à 7 ans, de 8 à 9 ans, et de 10 à 11 ans, et l'anxiété déclarée par l'enfant de 10 à 11 ans (contrôle selon le sexe, l'âge, et le statut socioéconomique) dans un échantillon nationalement représentatif de l'Enquête longitudinale nationale sur les enfants et les jeunes de Statistique Canada (*n* initial pondéré = 768 600).

Résultats : Seul le tempérament tatillon-difficile prédisait l'anxiété chez les enfants de 6 à 7 ans. Dans des régressions distinctes, le tempérament inadaptable et le tempérament tatillon-difficile prédisaient chacun l'anxiété de 8 à 9 ans, mais quand les deux étaient entrés simultanément, seul le tempérament inadaptable demeurait un prédicteur marginal. Le tempérament ne prédisait pas significativement l'anxiété déclarée par le soignant ou l'enfant de 10 à 11 ans, ce qui suggère que lorsque les enfants grandissent, les facteurs environnementaux peuvent devenir des contributeurs à l'anxiété plus importants que le tempérament précoce.

Conclusion : Les résultats actuels offrent la première démonstration que le tempérament précoce est lié à l'anxiété ultérieure dans l'enfance, dans un échantillon nationalement représentatif.