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The relative importance of child, family, school and neighbourhood correlates of childhood psychiatric disorder

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Abstract *Background* Many studies have described associations between childhood psychiatric disorder and characteristics of the child, and their family, school and neighbourhood, but few studies have studied them simultaneously. Also, most investigators have failed to allow for the extent to which different exposures are correlated, or for clustering at different levels of observation. Our objective was to establish which correlates were independently associated with psychiatric disorder. *Method* Data on DSM-IV psychiatric diagnoses, as well as child and family characteristics, were obtained on 8772 English 5- to 15-year-olds included in a large British prevalence survey of mental health. These data were supplemented by independent measures of school and neighbourhood disadvantage. We entered child and family variables with the measures of school and neighbourhood disadvantage into a logistic regression analysis to establish which variables were independently associated with child psychiatric disorder. *Results* No variables were associated with all types of disorder. Poor general health and life events were related to emotional disorders, while conduct disorders were most closely associated with family variables, and ADHD was only related to child characteristics. Disadvantaged schools, deprived neighbourhoods, low socioeconomic status, parental unemployment, cohabiting, large family size, and poverty were not independently associated with disorder. *Conclusions* Individually assessed child and family factors may be more influential than aggregate measures of school and neighbourhood factors. Different disorders have distinctive correlates. Many of the best known "risk factors" are not independently related to childhood psychiatric disorder, and are, therefore, acting distally in the causal pathway or irrelevant.

Key words correlates – epidemiology – child psychiatry

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Introduction

Risk factors are potential targets for prevention or intervention, and their identification is part of the process of elucidating the aetiology of childhood psychiatric disorders. Although cross-sectional survey data cannot determine the causal nature and direction of an association, they can identify the characteristics that are *not* independently associated with child psychiatric disorder, and are, therefore, either distal on the causal pathway or irrelevant to the aetiology. Establishing the factors that *are* independently associated with childhood psychiatric disorders would inform future pathway analyses by demonstrating which variables were the closest to disorder. Epidemiological studies spanning a quarter of a century on different populations repeatedly link childhood psychiatric disorder to characteristics associated with the child, family, neighbourhood and school, but few have investigated characteristics of these four domains simultaneously.

Several studies have suggested that boys are more likely to have disruptive disorders while girls predominate among the emotional disorders (Breton et al. 1999; Ferguson et al. 1993; Goodman et al. 1998; Lewinsohn et al. 1993; McGee et al. 1990; Offord et al. 1989; Simonoff et al. 1997; Verhulst et al. 1997). The prevalence of childhood psychiatric disorder increases with age, but there may also be an interaction between age and gender with younger boys and older girls more at risk (Waddell et al. 2002). Poverty, poor general health, family dysfunction, parental psychiatric illness, adverse life events, low socioeconomic status and ethnicity have all been associated with an increased prevalence of all or specific types

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of psychiatric disorder (Bird et al. 1989; Costello et al. 1996; Goodman et al. 1998; McGee et al. 1990; Munroe-Blum et al. 1988; Rutter et al. 1976). In one of the earliest studies, Rutter et al. (1976) concluded that higher levels of familial and school disadvantage in the inner city explained the excess psychiatric disorder in inner London as compared to the Isle of Wight, but school characteristics were analysed separately to child and family factors. Munroe-Blum et al. (1988) reported that children from single-parent families had a higher prevalence of conduct disorder and hyperactivity, while age and gender interacted so that younger boys and older girls had a higher prevalence of all disorders combined.

School and neighbourhood influences on childhood psychiatric disorder have been studied to a lesser extent than family and child characteristics, probably because researchers find the data harder to access and analyse. Information at school and neighbourhood level is likely to be clustered, with several children in a study living in the same area or attending one school, and failure to adjust for clustering is a weakness of many earlier investigations.

Most studies comparing urban and rural environments demonstrate an excess of disorder in cities, which seems to be largely explained by the concentration of disadvantaged families within these areas (Costello et al. 1996; Fombonne 1994; Offord et al. 1989; Rutter et al. 1976). However, two recent studies from the Netherlands suggest that behavioural problems in both childhood (Kaif et al. 2001) and early adolescence (Schnieders et al. 2003) were more common among children living in deprived neighbourhoods, even after adjusting for family socioeconomic status, age and gender. These studies used samples obtained via school medical examinations and a dimensional measure of psychopathology. The concept of social capital, understood as the level of trust and reciprocity and integration within a community, intuitively seems important to child mental health. However, this relationship may be complex with one recent study of behaviour problems suggesting an interaction of social capital with neighbourhood socioeconomic status (Caughty et al. 2003).

Rutter et al. (1976) used teacher and pupil turnover, and the proportion of children from immigrant families to examine school influence, and demonstrated elevated rates of behavioural disturbance in disadvantaged schools. The education literature also suggests that schools can have both beneficial and adverse effects on child development, which vary according to gender, social class and perceived ability (Mortimore 1995). Investigators have used attendance, behaviour and academic attainment as outcome measures, with most demonstrating differences among schools after adjusting for the demographic characteristics of the pupils. Academic failure has also been associated with an increased prevalence of childhood psychiatric disorder (Offord et al. 1989).

In older epidemiological surveys, differences in sample selection, diagnostic criteria, and the age of the children investigated make comparisons across studies difficult (Canino et al. 1995; Offord 1995; Roberts 1998). Although more recent studies have addressed some of these difficulties, issues relating to the measurement of impairment, how to combine information from informants and differences in the types of disorder, correlates and service use variables investigated remain unresolved (Waddell et al. 2002). For instance, the Great Smoky Mountain Study of Youth suggests that the type of impairment (family, school or peer related disability) varies by gender, age, ethnicity and diagnosis (Ezpeleta et al. 2001). Most investigators have ignored the highly interrelated nature of these correlates and few studies have examined risk factors among child, family, school and neighbourhood characteristics simultaneously.

Aims

The evidence to date provides a sketchy picture, with many highly correlated variables associated with childhood psychiatric disorder, and few data from which to judge the relative impact of these influences on the individual child. By supplementing data on the child and family characteristics of a large population-based sample with measures of neighbourhood deprivation and school disadvantage, we aimed to identify those correlates that are independently associated with childhood psychiatric disorder, after adjusting for all other measured variables and comorbidity. Independent correlates would provide potential targets for intervention in addition to providing clues to the aetiology of childhood psychiatric disorder.

Subjects and methods

Participants

The methodology of the British Child and Adolescent Mental Health Survey 1999 has been described in detail elsewhere (Meltzer et al. 2000; Ford et al. 2003). Briefly, the "child benefit" register was used to develop a sampling frame of postal sectors from which a probability sample was selected. Information was collected on 10 438 (83 %) of the 12 529 eligible children: 10 405 (99.7 %) parent interviews, 9347 (95.3 %) child assessments and 8382 (80.3 %) teacher reports (Meltzer et al. 2000). As the Office for Standards in Education (OFSTED) is only responsible for English schools, this analysis is restricted to the 8772 children from England.

Measures

Psychiatric disorder and psychopathology

The Development and Well-Being Assessment (DAWBA) consists of a structured interview, administered by lay interviewers who also recorded verbatim accounts of reported problems (Goodman et al. 2000). Experienced clinicians reviewed both the verbatim accounts and the answers to structured questions about symptoms and their impact before assigning diagnoses according to DSM-IV criteria (American Psychiatric Association 1994). Interviews were carried out with parents of 5- to 15-year-olds, and with 11- to 15-year-olds themselves. A shortened version of the DAWBA was mailed to the child's teacher. Younger children were not interviewed as previous studies

suggest that such information is often unreliable (Fallon and Schwab-Stone 1994; Schwab-Stone et al. 1996). Further information on the DAWBA is available from www.dawba.com – including on-line and downloadable versions of the measures and demonstrations of the clinical rating process.

Child factors

5- to 15-year-olds were individually assessed by the lay interviewers using the British Picture Vocabulary Scale as an estimate of verbal intelligence, and the British Ability Scale reading test (Dunn et al. 1997; Elliott et al. 1996). Parents rated their child's general health on a 5-point scale, and children were classified as having a "neurodevelopmental disorder" when reported by their parents to have cerebral palsy, epilepsy, muscle disease or weakness, or co-ordination problems.

Family factors

Socio-demographic details were collected at the parental interview. The 12-item version of the General Health Questionnaire assessed parental anxiety and depression on a dimensional scale (Goldberg et al. 1997), while the general functioning scale of the McMaster Family Assessment Device measured family discord and includes 12 items, scored on a 1–4 scale with a maximum score of 48 (Miller et al. 1985). Parents were asked whether or not ten stressful life events had happened during their child's lifetime, including parental separation or court appearance, bereavement, and serious illness or accident (Goodyer et al. 1990). All three measures have been validated for use in population samples and performed well during the piloting procedure (Meltzer et al. 2000).

School factors

The Office for Standards in Education's (OFSTED) function is to maintain the standards of education in England by inspections, public reporting and advice. OFSTED inspects all state-funded schools (90 % of English schools) and about half the fee-paying schools (5 %), although we only had data from the former for our survey. The data collected by OFSTED contain routine information collected annually, on attendance, exclusions, and the proportion of children with special educational needs, English as a second language, and eligibility for free school meals. We also had access to inspectors' ratings about the following characteristics: staffing, accommodation and learning resources; provision for spiritual, moral and cultural guidance; behavioural management; teaching; pupil welfare; scope for personal development; and school climate. Scores on national academic tests were standardised to give a mean of 0 and a standard deviation of 1 so that we could have a measure of academic attainment which applied to both primary (ages 5–11) and secondary (ages 11–16) schools.

These school characteristics are highly correlated and preliminary analyses showed that none of them was independently associated with psychiatric disorder once adjusted for family and child variables. Since combining related items reduces error variance and may increase predictive power, we developed a combined measure of school function (Ford and Goodman in press). Data from all the OFSTED variables were banded to generate a linear fit with parent and teacher symptom scores. These categories were weighted according to the extent to which the variable predicted emotional and behavioural difficulties. For example, a school with an exclusion rate of more than 1 % would score 4 for this item as opposed to 2 if the exclusion rate was 0.8–0.99 % or 0 if it was less than 0.79 %. The weighted scores for each variable are added together to give a total index of school disadvantage. This extended scale was subsequently simplified to include only four variables (percentage of exclusions, children eligible for free school meals, children with special educational needs and unauthorised absences) in order to make replication by others easier and to maximise the number of children with complete data. The extended scale and the abbreviated 4-item score correlated very highly ($r = 0.86$) and had comparable predictive power in univariate analyses. The prevalence of psychiatric disorder within mainstream schools ranged from 3 % for the lowest score to 12 % for the highest score.

Neighbourhood factors

The Carstair's Index provides an area measure of deprivation based on levels of unemployment, car ownership, overcrowding and percentage of households headed by someone in semi- or unskilled occupations, as recorded in the 1991 census (Carstairs and Morris 1990). As neighbourhoods may have affluent pockets within otherwise deprived areas, we chose enumeration districts, corresponding to approximately 100 households, as the level of analysis.

Data analysis

The sample was weighted according to non-response by region, age and sex with a correction factor that returned the weighted sample to its original size. We used the Statistics/Data Analysis Program (STATA 6.0) survey program, which adjusts for sampling weights and clustering within strata and primary sampling units in the calculation of test statistics and standard errors (Stata Corporation 1997).

We used chi-squared tests or t-tests to determine the associations between correlates and childhood psychiatric disorder in the bivariate analysis. The second and third stages of the analysis involved logistic regression, initially examining the child and family characteristics separately. While analysing family variables, we performed a nested analysis of children living in two-parent families to examine the effect of marital status. In the final stage of analysis, all child and family variables remaining independently associated with disorder were entered into a model with the measure of school disadvantage and the Carstairs index of neighbourhood deprivation. When investigating each of the five main types of disorder, we adjusted for comorbidity by entering the other disorders as covariates in the model.

Within our sample population, up to 11 children lived in one enumeration district and 19 children attended one school. Multi-level modelling was not feasible since there were crossed random effects as children did not necessarily attend a school in their neighbourhood and there was only one child from the sample in 59 % of enumeration districts and 49 % of schools. As the analysis controlled for the complex design of our sample, the clustering of observations in schools and neighbourhoods which occurred due to the use of supplementary data will not have affected our results (Heeringa and Liu 1999).

Children with missing values for the variables entered into these analyses were excluded in order to have comparable logistic regressions. As logistic regression using the survey package is based on pseudo-maximum likelihoods, we relied on the Wald test to assess the importance of a variable to a model. Although survey statisticians argue that this strategy leads to similar conclusions in most circumstances, we checked our findings against standard logistic regression and the log-likelihood ratio test, which allowed us to weight the data, but not to control for stratification or clustering with postal sectors (Heeringa and Liu 1999). In order to minimise the occurrence of chance findings due to multiple testing, we only accepted those variables that were found to be independently associated with psychiatric disorder using both analytic strategies.

Results

Univariate analysis of the correlates of childhood psychiatric disorder

As Tables 1 and 2 demonstrate, all the variables in the bivariate analysis were associated with childhood psychiatric disorder, with the exception of ethnicity where an Asian heritage was related to a lower prevalence of disorder, while there was no significant difference between the other ethnic minorities and the white majority.

Table 1 Bivariate analysis of categorical variables in relation to psychiatric disorder

Independent variable		Percentage with at least one disorder	Odds ratio	Confidence interval	Number of children
Childhood factors					
Age group/years	5–10	8.3	1.00	Baseline	8772
	11–16	11.3	1.40	1.20–1.64	
Gender	Girls	7.3	1.00	Baseline	8772
	Boys	11.9	1.70	1.47–1.99	
Neurodevelopmental disorder	No	8.7	1.00	Baseline	8772
	Yes	34.3	5.49	4.20–7.07	
Family factors					
Ethnic group	White	9.7	1.00	Baseline	8765
	Black	12.9	1.37	0.93–2.02	
	Asian[1]	5.5	0.55	0.32–0.93	
	Other	9.9	1.02	0.64–1.63	
Family type	Traditional	6.7	1.00	Baseline	8743
	Reconstituted	16.1	2.70	2.32–3.15	
	Lone parent	14.3	2.33	1.89–2.88	
Family structure	Married	9.4	1.00	Baseline	7787
	Cohabiting	12.4	1.36	1.05–1.77	
Number of siblings	2 or fewer	9.4	1.00	Baseline	8772
	3 or more	16.4	1.95	1.39–2.74	
Life events	2 or fewer	7.8	1.00	Baseline	8659
	3 or more	21.1	3.17	2.69–3.74	
Housing tenure	Home owners	6.7	1.00	Baseline	8772
	Rented	16.1	2.69	2.35–3.09	
Economic activity	Working	7.9	1.00	Baseline	8772
	Not working	17.5	2.49	2.15–2.89	
Weekly household income	$800+	6.1	1.00	Baseline	8237
	$576–799	6.0	0.98	0.77–1.27	
	$301–575	11.1	1.93	1.57–2.36	
	$300 or less	15.7	2.87	2.35–3.51	
Social class	Professional	5.8	1.00	Baseline	8518
	Managerial	7.2	1.22	0.87–1.82	
	Skilled non-manual	11.4	2.11	1.41–3.16	
	Skilled manual	9.6	1.74	1.19–2.54	
	Semi-skilled	12.4	2.31	1.62–3.31	
	Unskilled	15.1	2.91	1.89–4.50	
	Never worked	20.0	4.09	2.57–6.53	
Parental qualification/educational level	Degree	6.9	1.00	Baseline	8560
	A-level/GCSE[2]	8.1	1.19	0.95–1.48	
	Other	10.4	1.57	1.21–2.01	
	None	14.9	2.39	1.87–2.95	
Neighbourhood factors					
Carstairs index	Quintile 1	7.0	1.00	Baseline	8772
	Quintile 2	7.4	1.07	0.82–1.40	
	Quintile 3	9.9	1.45	1.13–1.88	
	Quintile 4	12.0	1.81	1.43–2.31	
	Quintile 5	13.1	2.00	1.56–2.57	

[1] Indian, Pakistani, Bangladeshi and Chinese; [2] GCSE exams are usually taken aged 16 and A levels at age 18

Logistic regression analysis of characteristics of the child in relation to childhood psychiatric disorder

The sample for the logistic regression included 7755 children (88.4 % of the original sample). Excluded children were more likely to have at least one psychiatric disorder (12.2 % vs. 9.3 %, χ^2 9.4, p = 0.001), an anxiety disorder (4.8 % vs. 3.5 %, χ^2 3.5, p = 0.05) or a conduct disorder (2.2 % vs. 1.3 %, χ^2 4.1, p = 0.04).

Table 3 shows the adjusted odds ratios for the child-related variables in relation to psychiatric disorder. Poor general health and neurodevelopmental disorders confounded each other, as did lower intelligence and reading quotients, but the standard errors of estimates did

Table 2 Bivariate analysis of continuous variables in relation to psychiatric disorder

Independent variable	Mean (SD) of independent variable		Odds ratio	Odds ratio – 95% Confidence Interval	Number of children
	No disorder	Any disorder			
Childhood factors					
Poor general health (1 = very good, 5 = very bad)	1.36 (0.84)	1.74 (0.60)	2.49	2.23–2.79	8661
Poor reading ability[1, 3]	104.9 (20.3)	93.6 (17.6)	1.83	1.70–1.98	7833
Poor verbal ability[2, 3]	102.1 (17.2)	94. 6 (15.1)	1.55	1.44–1.67	8316
Family factors					
Poor parental mental health[4]	1.6 (3. 7)	3.4 (2.6)	1.27	1.23–130	7718
Age of mother when child born	27.8 (5.4)	26.3 (5.2)	1.06	1.05–1.08	7472
Poor family function[5]	24.6 (3.0)	25.5 (1.7)	1.33	1.28–1.39	7687
School factors					
Disadvantaged school	6.3 (2.9)	7.0 (2.8)	1.10	1.07–1.13	7767

[1] British Ability Scales reading subscale; [2] British Picture Vocabulary Scale; [3] odds ratio represents the increase in prevalence per standard deviation or 15 points; [4] General Health Questionnaire; [5] McMasters Family Assessment Device

Table 3 Adjusted odds ratios for characteristics of the child that were independently associated with psychiatric disorder

Characteristics	Any disorder	Anxiety disorder[1]	Depression[1]	ADHD[1]	ODD[1]	Conduct disorder[1]
Older age	**1.43** **1.20–1.69**	**1.38** **1.03–1.85**	**7.35** **3.75–14.40**	0.87 0.62–1.22	**0.64** **0.49–0.90**	**2.87** **1.78–4.62**
Male gender	**1.65** **1.40–1.95**	0.87 0.68–1.12	0.69 0.40–1.19	**3.07** **2.07–4.56**	**1.76** **1.24–2.49**	**3.39** **2.13–5.40**
Poorer general health	**1.69** **1.51–1.89**	**1.85** **1.53–2.23**	**2.07** **1.53–2.79**	1.16 0.92–1.46	**1.32** **1.07–1.64**	**1.50** **1.15–1.96**
Neurodevelopmental disorders	**3.36** **3.33–4.78**	**2.33** **1.42–3.82**	1.60 0.72–3.52	**2.73** **1.50–4.98**	1.82 0.98–3.37	1.07 0.40–2.87
Lower intelligence quotient	**1.23** **1.10–1.37**	1.09 0.99–1.32	0.90 0.65–1.24	0.94 0.75–1.19	**1.47** **1.22–1.79**	**1.59** **1.23–2.04**
Lower reading quotient	**1.51** **1.37–1.67**	**1.27** **1.11–1.47**	1.08 0.83–1.39	**1.61** **1.35–1.87**	**1.21** **1.02–1.44**	**1.67** **1.28–2.13**

(Results in bold type significant using both analytical strategies at $p < 0.05$)
[1] The other types of disorder were included covariates in these models in order to adjust for comorbidity

not increase on the addition of variables to the model in a way that suggested that collinearity was a major problem. All the variables were associated with having at least one psychiatric disorder, but the relationship with the individual types of disorder was more specific.

Logistic regression analysis of characteristics of the family in relation to childhood psychiatric disorder

The sample consisted of 7747 children representing 88.3 % of the original sample and those included and excluded did not vary with respect to the prevalence of psychiatric disorders. As expected, there was confounding among many of the family variables, but the standard errors of estimates did not increase on the addition of variables to the model in a way that suggested that collinearity was a major problem (Table 4).

The following family characteristics were not independently associated with childhood psychiatric disorder and were omitted from further analysis: marital status, parental employment, family size, social class and family income. There were relatively small numbers in each ethnic minority group (White 91.3 %, Asian 4.2 %, African-Caribbean 2.4 % and other 2.1 %), so we may have lacked power to detect associations with ethnicity. However, these proportions were representative of the British population according to the 1991 census.

Cross-domain analysis

The sample for the final cross-domain logistic regression model contained 6685 children (76.2 % of the original sample) and by comparison with the excluded children contained a lower proportion of children with at

Table 4 Adjusted odds ratios for characteristics of the family that were independently associated with psychiatric disorder

Characteristics		Any disorder	Anxiety disorder[1]	Depression[1]	ADHD[1]	ODD[1]	Conduct disorder[1]
Ethnicity	Black	0.83 0.51–1.37	0.74 0.31–1.74	0 children	1.02# 0.65–1.60	1.66 0.86–3.19	0.38 0.06–2.50
	Asian	0.72 0.39–1.37	1.13 0.51–2.53	1.81# 0.70–4.70	0 children	0.91 0.32–2.59	1.03 0.30–3.55
	Other	0.88 0.50–1.54	1.22 0.59–2.54	0.56# 0.08–4.18	0.40# 0.09–1.82	1.34 0.55–3.25	1.37 0.44–4.31
Family type	Step	**1.55** **1.26–1.89**	1.17 0.79–1.72	1.13 0.78–1.64	1.03 0.60–1.75	1.23 0.84–1.80	**2.02** **1.20–3.38**
	Lone parent	**1.62** **1.26–2.10**	1.09 0.68–1.74	1.07 0.67–1.71	1.14 0.69–1.89	1.41 0.92–2.16	**2.41** **1.31–4.41**
Social class	Managerial	0.91 0.62–1.35	1.07 0.57–2.01	1.06 0.56–2.00	0.69 0.33–1.43	0.51 0.27–0.98	1.33 0.31–5.69
	Skilled non-manual	1.05 0.66–1.68	1.28 0.60–2.71	1.27 0.60–2.69	0.98 0.46–2.06	0.46 0.22–0.93	1.35 0.29–6.32
	Skilled manual	1.00 0.66–1.53	1.36 0.69–2.66	1.35 0.69–2.74	1.07 0.55–2.07	0.47 0.24–0.91	1.12 0.26–4.83
	Semi-skilled	0.94 0.63–1.42	1.01 0.51–2.00	1.00 0.51–1.99	1.15 0.55–2.41	0.36 0.18–0.73	1.11 0.22–5.37
	Unskilled	1.11 0.63–1.84	1.38 0.60–3.17	1.37 0.60–3.15	0.53 0.19–1.46	0.45 0.18–1.08	2.35 0.50–11.07
	Never worked	1.04 0.60–1.80	1.34 0.52–3.50	1.32 0.52–3.37	0.69 0.22–2.07	0.60 0.22–1.59	0.74 0.12–4.30
Cohabiting vs. married[2]		0.93 0.57–1.51	0.95 0.46–2.00	0.54 0.07–4.12	0.63 0.20–1.96	0.80 0.31–2.02	1.33 0.40–4.39
More than 3 siblings vs. 2 or fewer		1.05 0.67–1.65	1.32 0.71–2.44	1.25 0.33–6.12	0.41 0.14–1.17	0.96 0.45–2.05	1.46 0.54–3.95
Three or more life events vs. two or fewer		**1.92** **1.58–2.94**	**2.59** **1.97–3.41**	**2.59** **1.97–3.41**	**1.51** **1.05–2.17**	**1.61** **1.08–2.38**	0.76 0.45–1.29
Rented housing vs. home ownership		**1.53** **1.27–1.84**	1.27 0.95–1.76	1.21 0.87–1.68	1.3 0.95–1.94	**1.97** **1.43–2.72**	1.66* 0.99–2.79
No parent employed vs. at least one parent employed		1.25 0.99–1.57	1.22 0.88–1.69	1.32 0.97–1.80	0.89 0.57–1.38	1.04 0.66–1.63	1.20 0.61–2.37
Low weekly household income		0.99 0.92–1.07	1.00 0.89–1.13	1.02 0.91–1.15	0.97 0.83–1.12	1.01 0.88–1.16	0.99 0.78–1.25
Few maternal educational qualifications		**1.15** **1.06–1.25**	**1.22** **1.09–1.37**	1.05* 1.09–1.37	0.87 0.73–1.04	**1.20** **1.03–1.41**	**1.49** **1.20–1.85**
Young mother when child born		1.01 0.99–1.03	1.00 0.98–1.03	1.07* 0.78–1.29	1.01 0.97–1.04	1.01 0.98–1.04	**1.08** **1.03–1.13**
Poor maternal mental health		**1.13** **1.10–1.16**	**1.14** **1.09–1.18**	**1.13** **1.05–1.21**	1.01 0.96–1.06	**1.08** **1.03–1.14**	**1.10** **1.02–1.17**
Poor family functioning		**1.11** **1.07–1.15**	**1.05** **1.00–1.11**	**0.90** **0.90–1.08**	1.00 0.96–1.06	**1.11** **1.05–1.17**	**1.16** **1.09–1.24**

not directly comparable as children from ethnic minority group with no disorder dropped from the analysis; * only significant using one method of analysis; [1] The other types of disorder were included covariates in these models in order to adjust for comorbidity; [2] Nested analysis of 6937 two-parent families
(Results in bold type significant using both analytical strategies at $p < 0.05$)

least one psychiatric disorder (9.1% vs. 12.4%, χ^2 15.1, $p = 0.001$), anxiety disorder (3.5% vs. 4.6%, χ^2 4.8, $p = 0.04$) and conduct disorder (1.3% vs. 2%, χ^2 3.9, $p = 0.05$). Collinearity was not a serious problem as assessed by the change in standard errors on addition of variables to the model. Table 5 shows the results of the final analysis.

Neighbourhood deprivation and school disadvantage were not associated with any type of disorder, although it is notable that the relationship of neighbourhood and conduct disorder approaches significance and runs in the opposite direction to the results for neighbourhood and the other disorders. No variable was associated with every type of disorder. The failure to detect an excess of depression among girls may also relate to a lack of power as there were only 79 cases, or the relative youth of the sample. There was no interaction between age and gender for any of the types of disorder. Forty associations were detected by both analytic strategies, as compared with just four instances where a result that was significant with one approach was not detected by the other.

Table 5 Adjusted odds ratios for the characteristics of the child, family, school and neighbourhood in relation to childhood psychiatric disorder

Characteristics		Any disorder	Anxiety disorder[1]	Depression[1]	ADHD[1]	ODD[1]	Conduct disorder[1]
Of the child							
Older age		**1.27** **1.04–1.54**	1.28 0.92–1.79	**7.53** **3.59–15.81**	0.81 0.56–1.20	**0.62** **0.42–0.92**	**2.63** **1.48–4.68**
Male Gender		**1.67** **1.35–2.03**	1.07 0.80–1.42	1.45 0.79–2.65	**2.86** **1.89–4.35**	**1.89** **1.26–2.78**	**2.77** **1.59–4.54**
Poorer general health		**1.45** **1.28–1.64**	**1.48** **1.21–1.82**	**1.96** **1.42–2.71**	1.25 0.97–1.61	1.22 0.96–1.56	1.21 0.89–1.66
Neurodevelopmental disorder		**3.32** **2.20–5.01**	**2.16** **1.25–3.75**	1.57 0.64–3.87	**2.41** **1.27–4.58**	**2.40** **1.28–4.49**	0.96 0.27–3.55
Low intelligence quotient		1.13* 0.99–1.28	1.01 0.81–1.26	1.19 0.80–1.75	1.12 0.87–1.43	**1.49** **1.23–1.78**	**1.67** **1.20–2.27**
Low reading quotient		**1.58** **1.43–1.73**	**1.27** **1.08–1.27**	0.94 0.69–1.26	**1.43** **1.28–1.78**	1.19 0.99–1.45	1.30 0.98–1.72
Of the family							
Family type	Lone parent	**1.40** **1.12–1.73**	**1.47** **1.07–2.02**	1.26 0.53–3.00	0.89 0.55–1.41	1.39 0.92–2.10	1.21 0.65–2.21
	Reconstituted	**1.53** **1.17–2.01**	1.34 0.85–2.10	0.91 0.37–2.23	1.13 0.66–1.92	1.57 0.97–2.52	**2.15** **1.16–3.97**
Rented housing vs. home ownership		**1.45** **1.17–1.79**	1.16 0.81–1.68	0.70 0.31–1.60	1.19 0.75–1.89	**2.13** **1.54–2.94**	**1.89** **1.06–3.45**
Three or more life events vs. two or fewer		**1.70** **1.35–2.14**	**2.22** **1.61–3.07**	**2.15** **1.16–3.98**	1.49 0.98–2.27	1.19 0.77–1.84	0.58 0.32–1.04
Poor family functioning		**1.09** **1.05–1.14**	1.05 0.99–1.11	1.01 0.92–1.12	1.04 0.97–1.11	**1.07** **1.01–1.14**	**1.17** **1.09–1.27**
Poor parental mental health		**1.13** **1.10–1.16**	**1.14** **1.09–1.19**	1.06 0.97–1.16	1.02 0.96–1.08	**1.09** **1.03–1.15**	**1.09** **1.00–1.18**
Younger mother when child born		0.98 0.96–1.00	1.01 0.97–1.04	0.96 0.90–1.02	0.98 0.94–1.01	1.01 0.97–1.04	**1.09** **1.02–1.12**
Fewer maternal qualifications		1.05 0.95–1.17	**1.16** **1.01–1.32**	0.97 0.69–1.37	0.87 0.73–1.08	1.15 0.93–1.43	**1.33** **1.01–1.76**
Of the school							
Disadvantaged school		1.01 0.98–1.05	0.99 0.93–1.06	0.97 0.86–1.10	0.97 0.90–1.04	1.04 0.98–1.11	1.02 0.93–1.11
Of the neighbourhood							
Increasing deprivation		0.93* 0.86–1.00	0.94 0.84–1.06	0.86 0.70–1.07	0.88 0.77–1.01	0.91 0.78–1.05	1.15 0.91–1.45

* Statistically significant with only one of the analytic strategies; [1] The other types of disorders were included as covariates in order to adjust for comorbidity
(Results in bold type were significant at $p < 0.05$ using both analytic strategies, but results given are adjusted for survey design)

Discussion

Substantive findings

Our findings suggest that different disorders have separate correlates, and that it is not appropriate to study the correlates of all disorders grouped together. ADHD stands out as being related only to neurodevelopmental disorders and difficulty in reading, both of which may indicate a biological aetiology. By contrast, conduct disorder had the strongest association with socioeconomic and family characteristics. Though anxiety and depressive disorders were both strongly linked to life events and poor general health, they also differed in several of their associations: depression was strongly linked to age, while anxiety was more strongly linked to neurodevelopmental disorders, poor reading skills, living with a lone parent, poorer parental mental health, and fewer maternal qualifications.

Given the debate about the classification of behaviour disorders, it is relevant that conduct disorder and oppositional defiant disorder had similar associations with male gender, lower intelligence, poorer family func-

tioning and more parental mental health problems. Although only conduct disorder was significantly associated with fewer maternal qualifications and living in a reconstituted family, the findings for oppositional defiant disorder were similar though not quite significant. The correlates of the two sorts of behavioural disorders only differed markedly in two respects. First, children with conduct disorder were older. Secondly, neurodevelopmental disorders substantially raised the likelihood of oppositional defiant disorder but not conduct disorder, corroborating clinical accounts of increased irritable and oppositional but not antisocial behaviours among children with neurological disorders (Goodman and Yude 2000).

The child and family factors associated with childhood psychiatric disorder are familiar and will surprise few readers. It is more striking to note the factors that were *not* independently associated with childhood psychiatric disorder in this sample, namely school and neighbourhood disadvantage, social class, household income, parental employment, marital status, and family size. Many of these variables may be more distal in the causal pathway, but it is possible that some of them may be harmless markers of other variables. Further studies using techniques such as path analysis or structural equation modelling could begin to address these issues.

Methodological issues

The cross-sectional nature of the data prevents us from judging the direction of causality. Many of the independent family factors associated with childhood psychiatric disorder could be accounted for by reverse causality. For instance, children's problems could undermine parental mental health or interfere with family functioning. There are plans to follow a sample of these children up and longitudinal evidence of predictive power will provide stronger evidence that we have identified risk factors. Cross-sectional data may also lead to an oversimplified picture of some family variables, particularly family structure. Recent work demonstrates that periods of single-parenthood and remarriage are often brief and that movement between them impacts on children through changes in school, neighbourhood and socioeconomic circumstances in addition to changes in family relationships (Dunn 2001).

The study utilised a very large sample, with accepted diagnostic criteria and measures, and had the advantage of combining information from informants in a manner that emulated clinical assessment and was, therefore, unlikely to inflate or underestimate the presence of psychopathology. However, even with a sample size of over 10 000, some of the subgroup analyses, particularly those involving depression, were running out of power.

Our measures of schools and neighbourhoods were based on aggregated data, and this may have missed important school and neighbourhood influences that are relatively specific to a given child. For example, the fact that a child is attending an 'average' school as far as school-wide indicators are concerned does not mean that the child's mental health will not be severely affected if he or she is bullied or associates with antisocial peers. Consequently, aggregated measures of a school or a neighbourhood as a whole may well miss important risk factors that would only be evident if children were asked about their individual experience of their school and neighbourhood. Similarly, we were constrained in this analysis by the measures used within the original survey, and, thus, there were some important correlates, such as parental substance abuse and social capital, that we could not examine.

Due to inaccuracies in the child benefit register, the sampling frame was estimated not to cover 10 % of British children. These children, together with the families that opted out or refused to take part may well differ from participants in their exposure to risk factors. Past experience suggests that the under-privileged and those living in inner cities are less likely to participate in research and have higher rates of psychiatric illness, hence the decision to adjust for non-response according to age, gender and region in the sampling weights (Cox et al. 1977; Market Research Society 1981). Importantly, the survey obtained a high response rate (83 %). The children with missing data excluded from the multivariate analysis differed from those included, but these differences were not large.

The correlates of childhood psychiatric disorder are likely to be inter-related in a complex manner. For instance, when a woman starts her family young, this may lead her to cut short her education and affect her subsequent earning power or mental health. In this study, however, there was no evidence for marked collinearity, where the effects of one variable are so bound up with another that they cannot be separated.

Conclusions

The child and family factors that remained as independent correlates are potential determinants of childhood psychiatric disorder through which more distal factors act and are, thus, potential targets for intervention or prevention. Our findings suggest that parents with common mental disorder will be more likely to have children with anxiety or behavioural problems that need treatment. Similarly, children with physical illness, low intelligence quotients or difficulty in reading are more likely to have a psychiatric disorder. These findings emphasise the importance of child mental health professionals working closely with adult mental health specialists, paediatricians and education-based professionals.

The associations that we detected are robust, given that each variable was corroborated by two analytic strategies. Several well-known "risk factors" – school and neighbourhood disadvantage, social class, household income, parental employment, marital status, and family size – had strong univariate associations with

child psychiatric disorders that disappeared in multivariate analyses.

Given the cross-sectional nature of the observations, the significant multivariate associations are not necessarily causal, and many of the exposures measured are likely to be highly interrelated and act together in a complicated manner. Both longitudinal studies and latent variable analysis would help to establish the complex transactional processes involved. In the meantime, the correlates we have identified could alert professionals to children who may be at greater risk of psychiatric disorder.

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