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Literacy difficulties and psychiatric disorders: evidence for comorbidity

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Background: Literacy difficulties show high levels of comorbidity with both disruptive and emotional disorders, but questions remain over the nature and specificity of these links. **Method:** Relationships between specific literacy difficulties and psychiatric disorder were investigated in a large-scale national sample of children aged 9 to 15 years. **Results:** Specific literacy difficulties were more common in children from lower socio-economic backgrounds, and were significantly associated with increased risks of Attention-Deficit Hyperactivity Disorder (especially inattentive symptomatology), Conduct Disorder and anxiety disorders in both girls and boys, and with self-reports of depressed mood in boys. Associations between literacy difficulties and diagnoses of both Attention-Deficit Hyperactivity Disorder (ADHD) and Conduct Disorder (CD) were mediated by inattentiveness, as were links with low mood. Links between specific literacy difficulties and anxiety were of a different nature, suggestive of a direct impact of literacy problems on risk for anxiety disorders. **Conclusions:** Literacy difficulties are significantly associated with externalising disorders via inattention, but may constitute a more immediate risk factor for naturally anxious children to develop clinically significant levels of anxiety.
Keywords: Comorbidity, reading difficulties, ADHD, conduct disorder, anxiety, depression.
Abbreviations: ADHD: Attention deficit hyperactivity disorder; CD: Conduct disorder; SDQ: Strengths and Difficulties Questionnaire; DAWBA: Development and Well-Being Assessment; SMFQ: Short Moods and Feelings Questionnaire; B-CAMHS99: British Child and Mental Health Survey 1999.

Children with reading disabilities are at increased risk for other psychiatric disorders. This excess risk has been reported in both referred and epidemiological samples (Beitchman & Young, 1997), and is documented for a range of diagnoses: although the most extensive evidence relates to comorbidity with disruptive disorders, and in particular Attention Deficit Hyperactivity Disorder (ADHD) and Conduct Disorder (CD) (see Hinshaw, 1992, for a review), studies have also reported increased rates of anxiety disorders (Casey, Levy, Brown, & Brooks-Gunn, 1992; Willcutt & Pennington, 2000) and of depression/depressed mood (Boetsch, Green, & Pennington, 1996; Willcutt & Pennington, 2000; Maughan, Rowe, Loeber, & Stouthamer-Loeber, 2003) in reading disabled samples. Some reports suggest that these associations vary by gender, such that increased risks of ADHD are more marked in boys with reading problems, while elevated rates of internalising symptoms and somatic complaints are more common in reading disabled girls (Willcutt & Pennington, 2000).

These findings raise important questions about the bases for the increased vulnerability of children with reading problems to psychiatric disorder. As with psychiatric comorbidity more generally (see Caron & Rutter, 1991; Angold, Costello, & Erkanli, 1999, for reviews), several different mechanisms have been proposed. The first centre on the possibility of shared risks, either genetic or environmental. Shared genetic risks have been examined most extensively in relation to ADHD; twin studies have demonstrated significant bivariate heritability between ADHD and reading disabilities (Willcutt, Pennington, & DeFries, 2000), and molecular genetic findings are beginning to highlight the particular susceptibility loci involved (Willcutt et al., 2002). So far as we are aware, the possibility of shared genetic effects has received less attention in relation to other disorders, although Stevenson and Graham (1993) concluded that the comorbidity between spelling difficulties and conduct problems was not attributable to common genes, and Willcutt and Pennington (2000) found that increased risks of internalising symptoms in children with reading problems were not attributable to general familial influences. Shared environmental risks have been little explored, in part at least because much less is known about the environmental correlates of reading difficulties. From the limited data currently available, however, this seems a perhaps less plausible route for comorbidity with psychiatric problems: where psychiatric disorders tend to be associated with psychopathology in parents, and with difficulties and disruptions in family relationships and functioning (see e.g., Meltzer, Gatward, Goodman, & Ford, 2000), the prime correlates of reading disabilities appear to centre on more straightforwardly 'demographic' indicators such as social class and parental education.

Other pathways to comorbidity arise from the possibility that one disorder directly increases risk for a second. In relation to reading difficulties, accounts of this kind are intuitively appealing: it is not

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difficult to envisage, for example, how a primary problem with reading might contribute to inattentiveness or disruptiveness in the classroom, or how an already anxious child might have his or her worries exacerbated by repeated exposure to experiences of failure at school. Perhaps surprisingly, few direct tests of such possibilities have been made. There is, however, some longitudinal evidence that poorer early reading achievement is associated with increased risk for conduct problems in middle childhood (Bennett, Brown, Boyle, Racine, & Offord, 2003), and that boys whose reading skills improved in first grade showed less stability in depressive symptoms than their peers who continued to show problems in reading (Kellam, Rebok, Mayer, Ialongo, & Kalodner, 1994). In addition, as noted earlier, Willcutt and Pennington (2000) found that elevated rates of internalising symptoms in children with reading disabilities were not attributable to shared familial risks, pointing again to the possibility of a direct effect of reading difficulties.

Given the broad spectrum of psychiatric risks identified in reading disabled samples, it is also important to exclude a third possibility, namely that associations with some disorders may reflect what Angold et al. (1999) have termed *epiphenomenal* comorbidity: that a statistical association between disorders A and B arises largely because both share substantive associations with disorder C. In the reading disabilities field this possibility has been tested most fully in relation to disruptive behaviour disorders. Studied individually, both ADHD (Gilger, Pennington, & DeFries, 1992; McGee, Prior, Williams, Smart, & Sanson, 2002; Semrud-Clikeman et al., 1992; Shaywitz, Fletcher, & Shaywitz, 1995) and CD (Maughan, Pickles, Hagell, Rutter, & Yule, 1996; Rutter, Tizard, & Whitmore, 1970) show higher than expected rates of comorbidity with reading problems. Given the well-established comorbidity between ADHD and CD (see Angold et al., 1999), however, it is clearly possible that one or other of these associations might primarily be of this epiphenomenal kind. The multivariate analyses reported to date have borne this out: Frick et al. (1991), Maughan et al. (1996) and Willcutt and Pennington (2000) all found that bivariate associations between conduct/oppositional behaviours and reading difficulties were reduced to non-significance when comorbid hyperactivity/ADHD were controlled. These studies used overall ADHD diagnoses or related rating scales for these tests. More recently, however, Willcutt et al. (2000) have shown that reading difficulties are most strongly associated with the inattentive sub-type of ADHD, and less strongly so with the hyperactive sub-type. Evidence on the impact of controls for this more focused aspect of ADHD symptoms on the comorbidity between reading problems and CD is still limited. In a representative sample of boys, however, Maughan et al. (2003) found that inattentiveness symptoms alone did mediate links between CD/delinquency and reading difficulties.

Fewer studies have used this strategy to examine associations between reading problems and internalising disorders. Where this has been done, however, findings have been somewhat different. First, in a twin sample, Willcutt and Pennington (2000) found that reading disabilities remained significantly associated with elevated rates of depressive symptoms and somatic complaints in girls after controlling for symptoms of ADHD and other disruptive behaviours. Second, in a community sample of boys, Maughan et al. (2003) found that associations between reading difficulties and depressed mood were also robust to controls for comorbid externalising disorders and ADHD symptomatology. If replicated, these findings suggest that – by contrast with the pattern for CD – associations between reading difficulties and some aspects of internalising symptoms are not simply a by-product of comorbidity with disruptive disorders, but may be more specific correlates of reading disabilities.

We take up these issues here, using data from a large-scale, nationally representative sample of 9–15-year-olds. The data are drawn from the 1999 British Child and Adolescent Mental Health Survey (B-CAMHS99; Meltzer et al., 2000), which assessed rates of psychiatric disorder and associated family risks in children of school age. In addition, the study children were invited to complete reading, spelling and vocabulary tests, allowing for the identification of a group with specific literacy difficulties. We use these cross-sectional data to address a series of questions. First, as a background to the main analyses, we report on the family and demographic correlates of literacy difficulties, and associations between literacy problems and both psychiatric disorders and dimensional measures of emotional/behavioural problems in this national sample. Second, we explore the specificity of associations with the main categories of psychiatric disorder, considering in turn links between literacy disabilities and ADHD and its constituent sub-types; conduct disorder; depressive disorders and self-reports of depressed mood; and anxiety disorders.

Method

Population

The data were derived from a national survey of child mental health carried out by the UK Office for National Statistics in 1999. The sample was selected to be representative of the UK population of children aged 5 to 15, and full details of the survey design and measures are available in Meltzer et al. (2000). Briefly, the Child Benefit Register was used as a sampling frame to identify children aged 5–15 in England, Scotland, and Wales. Child benefit is a financial allowance available to all families with children in the UK; the Register should

thus provide a relatively complete basis for sampling the child population. After exclusions because of missing address details and records that were undergoing revision, a total of 6,422,202 children were in the sampling frame. This frame was stratified by Regional Health Authority, and within that by socio-demographic groupings. Four hundred and seventy-five postal sectors (400 in England, 50 in Scotland and 25 in Wales) were selected from the 8,265 that cover Great Britain. Families of 30 children from each selected postal area were invited to participate in the study by letter. From this total of 14,250 families, 931 (6.5%) opted out at this stage and 790 (5.5%) were found to have incorrect address information. Information from up to three informants was collected on 10,438 children (83%) from the remaining target sample of 12,529. There were 1,774 (15%) refusals and 317 (2%) failures to make contact. The investigators created a weight to take account of the unequal probability of postal sector selection, and to correct for non-response bias associated with region, age and gender (see Meltzer et al., 2000, for details).

Measures

Cognitive abilities. The children were invited to complete tasks measuring verbal abilities and attainments. Verbal skills were measured by the British Picture Vocabulary Scales II (BPVSII; Dunn, Dunn, Whetton, & Burley, 1997). Single word reading and spelling were measured on the British Ability Scales II (BAS II; Elliot, Murray, & Pearson, 1996). From these measures, standard scores were obtained for each child. Reading and spelling data were missing for around 12% of the sample. Children with missing reading/spelling data were more likely to come from older age groups (mean age 12.2 years versus 11.8 years, OR = 1.10, CI = 1.06–1.14, $p < .001$), and more likely to have a psychiatric diagnosis (16.1% versus 11.1%, OR = 1.50, CI = 1.20–1.87, $p < .001$). These factors were used to create a cognitive test response weight, which was used in addition to the main study weight in all analyses.

Specific literacy difficulties. Specific literacy difficulties are normally diagnosed when a child is reading at a level significantly below his or her general intellectual ability. In the present study a regression equation was calculated to predict children's reading and spelling scores on the basis of their vocabulary scores (see Meltzer et al., 2000 for details). The 5% of children with reading or spelling scores furthest below their predicted scores were classified as showing specific literacy difficulties. The group selection was stratified by age to ensure that a similar proportion of children was selected from each age group. The present analyses were restricted to children aged nine years and older to ensure adequate reliability of the discrepancy-based definitions of specific literacy problems. This resulted in final samples of $n = 5,752$ with parental interview and questionnaire data, $n = 4,585$ with teacher questionnaire data, and $n = 3,904$ 11–15-year-olds with self-report data on depressed mood (see below). Given the relatively large proportion of children with missing teacher report data, analyses were carried out to assess whether children without teacher data varied systematically from the group as a whole. Children without teacher data were slightly more likely to be older, and to come from lower socio-economic classes, and slightly less likely to have a psychiatric diagnosis than those with complete data. However, there was no association between teacher data availability and a diagnosis of literacy difficulties.

From the sample of 5,752 children, 68 girls (2.4%) and 221 boys (7.6%) were classified as showing specific literacy difficulties, a gender ratio of 3.25:1 (OR = 3.42, CI = 2.59–4.51, $p < .001$). Examination of the characteristics of this group of children showed that they had an average mean vocabulary score ($m = 101.11$, $sd = 18.18$), with poorer reading and spelling ($m = 73.72$, $sd = 12.47$, $m = 72.45$, $sd = 10.36$ respectively).

Behavioural and emotional problems and psychiatric disorder. All of the children in the full sample were also assessed for the presence or absence of psychiatric, emotional or behavioural difficulties. Dimensional measures of emotional and behavioural problems were collected through parent and teacher ratings on the Strengths and Difficulties Questionnaire (SDQ; Goodman, 2001). The SDQ is a widely used behavioural screening questionnaire of known reliability and validity. Individual behaviours are rated on 3-point scales, and items are summed to create 5-item sub-scales; the conduct, emotional and hyperactivity sub-scales were used in the present analyses. In addition, children aged 11 years and older completed the Short Mood and Feelings Questionnaire (SMFQ; Angold, Costello, Messer, & Pickles, 1995). The SMFQ is a 13-item inventory for children aged 6 years and above assessing mood during the past two weeks, with items reflecting the symptoms of major depression covered in DSM-III-R (American Psychiatric Association, 1987).

The presence of common childhood psychiatric disorders was assessed using the Development and Well-Being Assessment (DAWBA; Goodman, Ford, Richards, Gatward, & Meltzer, 2000). The DAWBA consists of a parental interview (available for 99.7% of cooperating families), a child interview for children aged 11 years and over (available for 95.3% of age-appropriate children), and a teacher questionnaire (available for 80.3%). Data on symptoms and related psychosocial impairment are probed through a structured, computer-assisted interview. In addition, interviewers record participants' verbatim descriptions of symptomatic behaviours in response to open-ended questions. Preliminary DSM-IV diagnoses (American Psychiatric Association, 1994) are made by computer algorithm on the basis of symptom and impairment data, using evidence from all available informants. Experienced clinicians then review a computer-generated case summary including both the symptom and impairment data and the verbatim transcripts, and either accept or amend the computer-generated diagnoses. A reliability study (see Heyman et al., 2001) in which two clinicians rated disorder in five hundred children showed that the chance-corrected reliability for the presence of any diagnosis was .86 (95% Confidence Interval [CI] = .78–.95). The measures used here included DSM-IV hyperactive type, inattentive type and combined type attention deficit hyperactivity disorder (ADHD),

conduct/oppositional defiant disorder, depression, and anxiety disorders (separation anxiety, generalised anxiety disorder, social phobias, specific phobias, panic, agoraphobia and other anxiety disorders).

Family and social background. A range of measures of family and social background were collected in the course of the parental interviews. These included indicators of family size (one, two, three, four or five or more children), family type (traditional, single parent or reconstituted categories), family social class (coded according to Registrar General's classifications), household income (weekly income divided into brackets of 100, with the highest category being over ≤700) and maternal education (degree, teaching qualification, A-levels or equivalent, O-level grades A–C or CSE/GCSE equivalents, lower graded O-levels/CSEs/GCSEs, other qualifications, no qualifications). In addition, maternal distress was assessed using the 12-item General Health Questionnaire (GHQ-12; Goldberg & Williams, 1988), and the MacMaster Family Activity Device (Miller, Epstein, Bishop, & Keitner, 1985) was used to assess family functioning.

Statistical analyses

The survey models of STAT6 (StataCorp, 1999) were used for all analyses. These models allowed for the use of the standard study weights and the additional weights created to take account of non-response on the cognitive tests. Logistic regression was used for the analysis of binary outcomes, and ANOVAs and ordinary regression for comparison of group means on continuous scales.

Results

Literacy problems and family background

Preliminary analyses were carried out to examine associations between children's literacy problems and family background characteristics. Specific literacy difficulties showed significant associations with a range of indicators of family socio-economic and educational characteristics: family social class (OR = 1.21, CI = 1.12–1.31, $p < .001$); household income (OR = 1.10, CI = 1.05–1.17, $p < .001$) and maternal education (OR = 1.13, CI = 1.06–1.20, $p < .001$). By contrast, well-established correlates of behavioural and emotional problems such as maternal psychological well-being (OR = 1.03, CI = .99–1.07, p = ns); family size (OR = 1.03, CI = .90–1.16, p = ns); family type (OR = 1.05, CI = .89–1.25, p = ns) and family functioning (OR = 1.00, CI = .97–1.02, p = ns) were not related to literacy problems. In a multivariate logistic regression analysis in which the three significantly associated variables were included only family socio-economic status (OR = 1.17, CI = 1.06–1.29, $p < .01$) showed an independent association with specific literacy difficulties. Family social class and the child's sex were included as covariates in all the logistic regression analyses that follow.

Literacy difficulties, psychiatric disorder and emotional and behavioural problems

Table 1 shows rates of any psychiatric disorder, and of each of the major disorder categories (ADHD, CD/ODD, any anxiety disorder, and depression), in children with and without specific reading problems. Controlling for the child's sex, and for effects of family social class, reading problems showed significant associations with each of the main disorder categories except depression, with odds ratios ranging from 2 (any anxiety disorder) to 4 (ADHD). Further tests for possible sex differences in these associations revealed no significant effects (ADHD $p = .722$, CD $p = .833$, anxiety $p = .228$).

As Table 1 also illustrates, however, despite these markedly increased risks it was still only a minority of children with reading problems that met formal criteria for psychiatric disorder. Table 2 shows associations with dimensional measures of emotional and behavioural difficulties: mean parent and teacher ratings on the SDQ sub-scales, and, for 11–15-year-olds, mean SMFQ scores from the young people themselves. Regression analyses were used to test for group differences on these measures after adjusting for the effects of sex and family socio-economic status. These showed significant associations between the presence of literacy difficulties and scores on all of the SDQ sub-scales except parent and teacher ratings of prosocial behaviour, and also on the self-reports of depressed mood completed by 11–15-year-olds. As with the diagnostic measures, none of these associations varied significantly by gender.

These findings confirmed the broad spectrum of vulnerability to psychiatric disorder and emotional/

Table 1 Prevalence of psychiatric diagnoses in children with and without literacy difficulties

	Specific literacy difficulties		
Disorder	No	Yes	Odds Ratio, 95% CI*
ADHD	(107 / 5,463) 2.0%	(25 / 289) 9.0%	OR = 3.82, CI = 2.37–6.14
Conduct	(247 / 5,463) 4.8%	(28 / 289) 13.8%	OR = 2.40, CI = 1.63–3.52
Anxiety	(201 / 5,463) 3.9%	(27 / 289) 9.9%	OR = 2.74, CI = 1.75–4.28
Depression	(73 / 5,463) 1.4%	(6 / 289) 2.3%	OR = 1.04, CI = .38–2.85

*All analyses adjusted for the effects of child sex and family social class.

Table 2 Mean scores on the SDQ and MFQ scales in children with and without literacy difficulties

	Specific literacy difficulties		
Sub-scales	No	Yes	Odds Ratio, 95% CI*
Par-hyper	3.21 (2.56)	5.09 (2.87)	OR = 1.22, CI = 1.17–1.28, $p < .001$
Teach-hyper	2.60 (2.66)	4.78 (3.11)	OR = 1.21, CI = 1.16–1.27, $p < .001$
Par-conduct	1.48 (1.67)	2.05 (2.11)	OR = 1.14, CI = 1.07–1.21, $p < .001$
Teach-conduct	.90 (1.67)	1.46 (2.16)	OR = 1.08, CI = 1.01–1.16, $p < .05$
Par-emotion	1.90 (1.99)	2.57 (2.36)	OR = 1.16, CI = 1.10–1.23, $p < .001$
Teach-emotion	1.30 (1.88)	2.28 (2.50)	OR = 1.21, CI = 1.14–1.28, $p < .001$
Par-peer	1.47 (1.66)	2.34 (2.12)	OR = 1.24, CI = 1.17–1.32, $p < .001$
Teach-peer	1.33 (1.74)	2.13 (2.16)	OR = 1.17, CI = 1.10–1.25, $p < .001$
Par-prosocial	8.65 (1.56)	8.56 (1.75)	OR = 1.04, CI = .95–1.13, p = ns
Teach-prosocial	7.27 (2.38)	6.65 (2.55)	OR = .97, CI = .92–1.03, p = ns
MFQ	3.83 (4.38)	4.44 (4.28)	OR = 1.03, CI = 1.00–1.06, $p < .05$

*All analyses adjusted for the effects of child sex and family social class.

behavioural problems among children with literacy difficulties identified in previous research. The next stage of the analyses involved more detailed tests of the nature of that relationship in each specific areas.

Literacy difficulties and attention deficit/ hyperactivity disorder

As outlined earlier, previous research has suggested that literacy difficulties are more highly associated with inattentive type ADHD than with hyperactive type ADHD. The prevalence of each subtype of ADHD in the general population and in children with literacy difficulties is shown in Figure 1. Logistic regression analyses confirmed that both the inattentive and combined sub-types of ADHD were significantly associated with literacy difficulties (inattentive, OR = 5.57, CI = 2.71–11.42; combined, OR = 2.63, CI = 1.35–5.13), while the hyperactive-impulsive sub-type was not (OR = 3.46, CI = .72–16.56). However, the odds ratios for linear comparisons between sub-types were not significant (inattentive vs. combined: OR = 2.08, CI = .80–5.43, p = ns and hyperactive-impulsive vs. combined: OR = 1.35, CI = .25–7.31, p = ns, respectively), leaving it uncertain whether there were differential associations between reading difficulties and specific subtypes of ADHD.

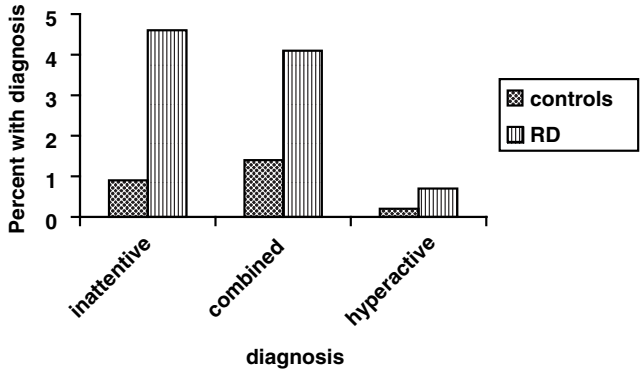

Figure 1 Association of ADHD subtypes with literacy difficulties

In part these inconclusive findings seemed likely to reflect a lack of statistical power, as only a very small subgroup of children showed hyperactive symptoms in the absence of inattention. A more sensitive analysis would examine the effects of the number and severity of inattentive or overactive symptoms. To facilitate this, scores on the parent- and teacher-rated SDQ hyperactivity scales were divided into two sub-categories, according to whether they concerned over-activity or inattention.

When analysed jointly, both the parent (OR = 1.26, CI = 1.12–1.42, $p < .001$) and teacher (OR = 1.43, CI = 1.25–1.64, $p < .001$) inattention scores accounted for significant independent variance, as did parent overactivity scores (OR = 1.12, CI = 1.00–1.26). Once scores on both the parent and teacher inattention subscales had been entered into the analysis, ADHD diagnosis was no longer significantly associated with literacy difficulties (OR = 1.40, CI = .80–2.43). It appeared, therefore, that the association between literacy problems and ADHD at the diagnostic level was part of a broader pattern of high and pervasive levels of inattention shown by many children with literacy problems, and that inattention constituted a key behavioural correlate of literacy difficulties.

Literacy difficulties and conduct disorder

Turning to overlaps between literacy difficulties and CD, one central debate in previous studies has been the extent to which this association may be an epiphenomenon of comorbidity between CD and ADHD, and in particular of the reduced attentiveness often shown by children with conduct disorder. As expected, CD and ADHD were strongly associated in the present sample (OR = 28.91, CI = 19.94–41.91, $p < .001$), and children and adolescents with CD had elevated scores on both the parent SDQ inattentiveness sub-scales (non-CD: mean = 1.21 (sd = 1.30), CD: mean = 2.86 (sd = 1.23), $F(1,5668)$ = 354.35,

$p < .001$) and the equivalent teacher scales (non-CD: mean = 1.21 ($sd = 1.31$), CD: mean = 2.95 ($sd = 1.23$), $F(1,4566) = 425.69$, $p < .001$). Literacy problems retained significant links with CD with ADHD diagnosis controlled (OR = 1.95, CI = 1.27–2.99, $p < .01$). A logistic regression analysis including scores on the inattention subscales, however, suggested that overlaps with inattentiveness did indeed mediate CD–reading problem links: with inattentiveness controlled, the association between literacy difficulties and conduct disorder dropped to non-significance (OR = 1.15, CI = .74–1.78, p = ns).

Literacy difficulties, depression and depressed mood

In the initial analyses, literacy difficulties were not significantly associated with depression at the diagnostic level, but were associated with 11–15-year-olds' self-reports of depressed mood on the SMFQ. Previous research has suggested that developmental trends in SMFQ scores differ for girls and boys across early adolescence, rising in girls while falling in boys (Angold, Erkanli, Silberg, Eaves, & Costello, 2002). For this reason, the associations between literacy difficulties, SMFQ scores and age were analysed separately for boys and girls, and the possibility of an interaction between depressed mood and age was examined. For girls, depressed mood was not significantly associated with literacy difficulties (OR = 1.02, CI = .96–1.07, p = ns) and there was no evidence of any interaction with age. With respect to boys, there was a significant effect of depressed mood (OR = 1.04, CI = 1.00–1.08, $p < .05$), and tests of an interaction with age fell short of statistical significance ($p = .19$), though examination of the mean scores suggested that boys with literacy difficulties showed increased levels of depressed mood only in the younger age group. Inclusion of parental ratings of inattentiveness, however, reduced the association of depressed mood with literacy problems to non-significance ($p = .53$).

Literacy difficulties and anxiety

A different picture emerged in relation to anxiety disorders. Although children with anxiety diagnoses also showed increased levels of inattention on both the parent (not anxious: mean = 1.46, $sd = 1.32$, anxious: mean = 2.18, $sd = 1.42$, $F(1, 5668) = 67.45$, $p < .001$) and the teacher (not anxious: mean = 1.28, $sd = 1.35$, anxious: mean = 1.95, $sd = 1.46$, $F(1, 4566) = 43.68$, $p < .001$) ratings, the comorbidity between literacy difficulties and anxiety disorders did not seem entirely mediated in this way: the combined measure of anxiety diagnoses remained significantly associated with literacy difficulties after inattention scores had been controlled (OR = 2.15, CI = 1.31–3.52).

To examine this association in more detail we explored links between literacy difficulties and specific anxiety diagnoses. Prevalence rates for each anxiety subtype are shown in Table 3. To ensure adequate statistical power, logistic regression analyses were only carried out for diagnoses with prevalence rates in the comparison group of above .5%. Results suggested that literacy difficulties were closely related to both separation anxiety and to generalised anxiety disorder (see Table 3), and that these associations remained significant when controlled for effects of parent-rated inattentiveness (separation anxiety: OR = 3.02, CI = 1.51–6.04, $p < .01$; generalised anxiety disorder: OR = 2.60, CI = 1.12–6.00, $p < .05$). Reading difficulties were not associated with increased levels of specific phobias (OR = 1.74, CI = .59–5.11, p = ns). Less common anxiety diagnoses (social phobias, PTSD, OCD, panic, agoraphobia and anxiety disorders not otherwise specified) were combined into an 'other anxieties' category. Literacy difficulties showed a bivariate association with this combined anxiety measure (OR = 2.04, CI = 1.05–3.99, $p = .04$), but this dropped to non-significance once parent-rated inattention was included in the model (OR = 1.43, CI = .73–2.81, ns).

Table 3 Prevalence of specific anxiety disorders in children with and without literacy difficulties

	Specific literacy difficulties		
Disorder	No	Yes	Odds Ratio, 95% CI*
Generalised anxiety	.81%	2.94%	OR = 3.52, CI = 1.52–8.11, $p < .01$
Separation anxiety	.85%	3.52%	OR = 4.18, CI = 2.06–8.47, $p < .001$
Specific phobias	.90%	1.50%	OR = 1.74, CI = .59–5.11, ns
Social phobias**	.31%	1.42%	–
Panic disorder**	.25%	.32%	–
Agoraphobia**	.10%	.32%	–
PTSD**	.22%	.0%	–
Obsessive- compulsive**	.42%	.41%	–
Anxiety NOS	1.14%	2.18%	–

*All analyses adjusted for the effects of child sex and family social class.
**Disorders with prevalence rates below .5% in the non-literacy problems sample not tested – see text.

Discussion

This study capitalised on data from a large-scale, nationally representative study of 9–15-year-olds to explore patterns of comorbidity between literacy difficulties and psychiatric disorders, and some of the mechanisms that might give rise to them. The results replicated previous findings in several respects, and also provided some novel insights.

Firstly, in terms of family and demographic correlates, it was found that specific literacy difficulties were associated with social class and parental education, but not with measures of the family's emotional well-being. The links between literacy difficulties and social background factors have received only limited attention in the past, yet showed striking variations here: children in the lowest social class were almost ten times more likely to have specific literacy problems than children from the highest social class. In addition, mothers' educational level was also associated with literacy problems, with one-third of children with literacy difficulties having mothers with no qualifications, in contrast to one-quarter of the children without literacy difficulties. Given the strong heritability of literacy problems, the most straightforward explanation for these associations is likely to involve genetic effects: children with literacy difficulties often come from families where parents have literacy difficulties, and parents with literacy difficulties are more likely to have lower-paid jobs and lower levels of education than average (Boetsch et al., 1996).

In contrast, families of children with literacy difficulties were not more likely than average to show emotional strain or distress, as indicated by the measures of family functioning and the mother's emotional well-being. This suggests that – in contrast to the findings on psychiatric disorders (Meltzer et al., 2000) – literacy difficulties are not generally associated with familial stress. This separation of family correlates in turn suggests some likely separation in environmentally based risks for literacy and psychiatric problems, such that the roots of poor readers' increased vulnerability to psychiatric disorder are unlikely to lie in family stressors. The cross-sectional design of B-CAMHS99 did not allow us to test this possibility directly, but our findings suggest that it would be valuable to explore in more detail in the context of studies with longitudinal and genetically sensitive designs.

Secondly, literacy difficulties were associated with each of the major psychiatric diagnoses, with the exception of depression. In contrast to some previous reports (e.g., Willcutt & Pennington, 2000), we found no gender differences in the strength of these associations: girls with literacy problems were as likely as boys to face a relative increase in risk of ADHD and CD, and boys were as likely to show increased rates of anxiety as girls. Importantly, the findings also showed that these associations were not solely confined to the relatively small groups of children who met diagnostic criteria for psychiatric disorders: literacy problems were associated with higher scores on both parent and teacher ratings on all the main 'problem' sub-scales of the Strengths and Difficulties Questionnaire (Goodman, 2001), and also on self-report measures of depressed mood.

Exploring these associations in more detail, previous findings were replicated in that both ADHD and conduct disorder were closely associated with literacy difficulties. This has been found repeatedly in past studies (Maughan et al., 1996; McGee et al., 2002; McGee, Williams, Share, Anderson, & Silva, 1986; Rutter et al., 1970; Willcutt & Pennington, 2000). Within this study, the links between both of these externalising diagnoses and literacy difficulties seemed mediated by levels of inattentive behaviour. This suggests, in line with Willcutt and Pennington (2000), that the links between conduct disorder and literacy difficulties are mediated by associated ADHD symptomatology, and in line with Willcutt et al. (2000) that the prime reason for links between ADHD and literacy difficulties also lies in the inattentiveness domain. Once again, the cross-sectional design of B-CAMHS99 means that we were unable to test whether inattention is a result of literacy difficulties or vice versa, or whether both are caused by a third variable such as a genetic link. However, previous research has suggested that there is a genetic basis to the link between ADHD and literacy difficulties (Stevenson, Pennington, Gilger, DeFries, & Gillis, 1993; Willcutt et al., 2000), and that one disorder cannot be explained entirely as a consequence of the other (Adams & Snowling, 2001).

In contrast to some previous reports (Boetsch et al., 1996), we found no links between diagnoses of depression and literacy difficulties in the present study, although literacy problems were associated with higher scores on the continuous measures of depressed mood completed by 11–15-year-olds. More detailed tests showed that these associations primarily related to boys, and possibly predominantly to younger boys (11- and 12-year-olds) rather than to those in the mid-teens. We identified links between reading problems and low mood in a previous study of boys (Maughan et al., 2003), where we also found some evidence that this association declined with age. In that sample, however, reading problem–depression links were robust to controls for inattentiveness, while in the present study parent-rated inattentiveness appeared to mediate links between literacy difficulties and boys' mood. Willcutt and Pennington (2000) reported yet a different pattern, where links with depressed affect were most salient for girls with reading disabilities, but only those without comorbid ADHD. These inconsistencies might reflect a variety of methodological factors: definitional differences in the assessment of reading problems, other differences in sample characteristics, and – perhaps most plausibly – age/

developmental variations: Willcutt and Pennington's (2000) reading disabled samples had a mean age of 10.5 years, while boys in our previous study ranged from 7 to 16 years, and SMFQ data for B-CAMHS99 participants was available for 11–15-year-olds. Given the marked age-variations in levels of depressed mood across childhood and adolescence (Angold et al., 2002), related variations in comorbidity with other disorders should not perhaps be unexpected. To provide accurate guidance for practitioners, families, and young people with literacy problems, however, it seems important that future studies attempt to clarify the developmental patterning of associations between literacy disabilities and depressed mood, and explore the factors that may underlie them.

Finally, the present study found that literacy difficulties were significantly associated with anxiety diagnoses, and that these links were not entirely accounted for by inattention. Closer examination of the sub-types of anxiety disorder suggested that literacy difficulties were associated with both separation anxiety and generalised anxiety disorder after background variables and inattentive behaviour were accounted for. In contrast, simple phobias were not associated with literacy difficulties, and the link between a combined measure of other anxiety diagnoses and literacy problems was attributable to increased levels of inattention.

Separation anxiety was once known as 'school phobia', and this may provide a possible explanation for the association with literacy difficulties; perhaps having literacy problems can make school an unpleasant place to be for children, so that, over time, some children with a naturally anxious disposition will develop more incapacitating fears of going to school or leaving their parents.

The present study has provided the opportunity to examine associations between literacy problems and psychiatric disorders in a large-scale, representative sample of British school-aged children. Although the cross-sectional nature of B-CAMHS99 limited our capacity to test some key hypotheses about the basis for these associations, the availability of a broad range of psychiatric measures nonetheless allowed for a number of important tests. As suggested in the introduction, some associations between psychiatric diagnoses and literacy difficulties proved to be epiphenomenal, in the sense that raised levels of inattention accounted for the association between literacy difficulties and CD, depressed mood, and some anxiety diagnoses. There was also, however, a link between anxiety and literacy difficulties that was not accounted for by attention levels. Instead, it seemed more likely that literacy difficulties might act as a risk factor for increased levels of both generalised and school-related anxiety. Longitudinal studies, tracking the emotional development of children with literacy problems over the early years of schooling, are needed to test this out. At this stage, however, our findings suggest that practitioners should be alert to signs of anxiety and depression, as well as the perhaps more obvious evidence of inattentive and disruptive behaviours, in their assessments and planning for children with reading disabilities.

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