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# Reading Problems and Depressed Mood

Barbara Maughan,<sup>1,3</sup> Richard Rowe,<sup>1</sup> Rolf Loeber,<sup>2</sup> and Magda Stouthamer-Loeber<sup>2</sup>

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Although reading difficulties show well-established overlaps with disruptive behavior disorders in childhood, much less is known about reading-disabled children's vulnerability to emotional difficulties. Using longitudinal data from 6 assessments of boys in the Pittsburgh Youth Study, we found robust links between severe, persistent reading problems and increased risk for depressed mood in a community sample of boys aged 7 and 10 years at initial assessment, though not in those who had already entered their teens. These associations could not be accounted for in terms of selected family risks or comorbid disruptive behaviors; instead, the pattern of the findings pointed to the existence of more direct causal processes whereby reading problems influence younger boys' risk of depressed mood.

**KEY WORDS:** reading problems; depression; longitudinal.

## INTRODUCTION

Reading difficulties show well-established overlaps with disruptive behavior disorders in childhood (Hinshaw, 1992). In addition, ICD-10 (World Health Organization, 1992) lists emotional problems, low self-esteem, and problems in peer relationships as other common associated features of reading disabilities, and DSM-IV (American Psychiatric Association [APA], 1994) points to the possibility of elevated rates of depression and dysthymia. As the DSM-IV guidelines make clear, however, current evidence for these links remains limited; in addition, little is known about the processes that may contribute to comorbidity between reading and emotional problems, or the developmental patterning of their associations with age.

The strongest suggestions of elevated rates of emotional problems among poor readers come from studies of clinic populations and other specially treated groups. Huntington and Bender (1993) reviewed evidence on more widely defined learning-disabled (LD) samples. They con-

cluded that adolescents with LD experience higher levels of trait anxiety than normally achieving peers, and that may also be at increased risk of depression and suicidal behavior. Focusing more specifically on reading disabilities, Casey, Levy, Brown, and Brooks-Gunn (1992) noted that parents of mildly dyslexic children rated them as more anxious and less happy than did parents of normal achievers, and Livingston (1990) found elevated rates of reading disabilities in psychiatric inpatients with diagnoses of depression, and in outpatients with comorbid diagnoses of attention deficit disorder and separation anxiety.

Because rates of comorbidity are elevated in clinical samples (Angold, Costello, & Erkanli, 1999; Caron & Rutter, 1991), these findings may overestimate the extent to which the much larger group of nonreferred children with reading difficulties is vulnerable to emotional problems. To assess this, we need evidence from general population samples. Both the Isle of Wight (Rutter, Tizard, & Whitmore, 1970) and Dunedin (Feehan, McGee, Williams, & Nada-Raja, 1995) epidemiological studies have reported rates of emotional problems among nonreferred children with severe reading difficulties. Although disruptive behaviors were the main correlates of reading retardation in the Isle of Wight studies of 8- and 9-year-olds, poor reading boys were rated as significantly more worried, miserable, and fearful than controls, and findings for the small group of girls followed similar trends. Data from the Dunedin Multidisciplinary Child Development

<sup>1</sup>MRC Social, Genetic and Developmental Psychiatry Research Centre, Institute of Psychiatry, King's College, London, United Kingdom.

<sup>2</sup>Western Psychiatric Institute and Clinic, School of Medicine, University of Pittsburgh, Pennsylvania.

<sup>3</sup>Address all correspondence to Barbara Maughan, Department of Child and Adolescent Psychiatry, Box Number PO46, De Crespigny Park, London SE5 8AF, United Kingdom; e-mail: b.maughan@iop.kcl.ac.uk.

Study are available from a number of ages. Here again, the most marked and persistent behavioral correlates of reading difficulties were identified in the disruptive/inattentive domain. At age 7, an anxious–fearful factor derived from teacher ratings showed no independent association with reading or verbal IQ scores once inattentiveness had been taken into account (McGee, Williams, Share, Anderson, & Silva, 1986), and poor reading boys showed no significant increases in worry–fearfulness relative to controls over the next 4 years. At age 13, however, both boys and girls with severe reading difficulties had higher scores on parent-rated anxiety-withdrawal than controls (McGee, Share, Moffitt, Williams, & Silva, 1988). A UK school-based study documented significant correlations between reading difficulties and emotional problems in 8- to 11-year-olds, which remained when controlled for both verbal and non-verbal IQ (Adams, Snowling, Hennessy, & Kind, 1999). Finally, Boetsch, Green, and Pennington (1996) explored internalizing difficulties in both community and referred samples of poor readers of different ages (children, adolescents, and adults). By contrast with non-RD comparisons, poor readers showed higher scores on parent ratings of internalizing symptoms and on self-reports of depressive symptomatology, but not on an interview measure of over-anxious disorder.

If reading-disabled children are at increased risk of internalizing difficulties, a number of different developmental pathways might be involved. First, shared risk factors such as adverse psychosocial circumstances might contribute to both sets of difficulties. Although relatively little is known about the family backgrounds of children with reading problems, a number of studies have highlighted factors that might also plausibly contribute to emotional difficulties. Richman, Stevenson, and Graham (1982), for example, found that a composite index of preschool home environment including mother's mental state, stressful life events, marital discord between parents, and the quality of parent–child relations contributed significantly to the prediction of later reading problems. Stevenson and Fredman (1990) documented links between maternal criticism and reading levels (in early adolescence) among 13-year-olds. Factors like these might also contribute to risk for emotional disorders; so far as we are aware, these possibilities have not been directly tested to date.

A second model, hinted at in a number of the findings outlined above, is that the association is in some way contingent on the presence of comorbid disruptive behaviors or attentional difficulties. Current evidence is inconsistent here. Smart, Sanson, and Prior (1996) found elevated rates of anxious/fearful behavior in poor readers with comorbid behavior problems, but not in those without. Willcutt

and Pennington (2000), by contrast, found that other disruptive disorders showed no independent links with reading disabilities once associations with ADHD had been taken into account, but that associations with internalizing symptoms—predominantly evident in girls—did remain significant.

Finally, one disorder may act as a risk for the other: anxiety or depression may compromise cognitive functioning, or awareness of reading difficulties may contribute to a lowered sense of emotional well-being. Although depression is undoubtedly associated with some adverse effects on school performance (Kovacs & Goldston, 1991), the epidemiological evidence argues against this as a major contributor to wider patterns of comorbidity. Fleming and Offord (1990), in a review of rates and correlates of child and adolescent depression, found only inconsistent links with school performance, and neither the Isle of Wight (Rutter et al., 1970) nor the Dunedin studies (Anderson, Williams, McGee, & Silva, 1989) found any increased rates of reading or spelling difficulties among young people with emotional disorders. A pathway from reading difficulties to anxiety or depression seems more plausible, possibly mediated by poor readers' well-established vulnerability to problems in academic (and possibly more global) self-esteem (Chapman, 1988). Learning to read is a key developmental task of early childhood; success or failure in that task occurs in the very public setting of the classroom, where a sense of lowered self-confidence can easily be engendered and reinforced. Once established, low self-esteem of this kind could clearly act as a vulnerability factor for depressed mood. Longitudinal evidence is needed to confirm or refute this view. Thus far, however, the few available longitudinal studies have not reported specifically on predictions from earlier reading problems to later emotional disorders. Kellam, Brown, Rubin, and Ensminger (1983) found significant associations between teacher ratings of early learning problems and measures of psychological distress in adolescence, and, for boys only, more specific links with depressive symptoms. In addition, this same research group reported more direct evidence for reading–depression links in early childhood, in the context of a first-grade intervention study: boys whose reading skills improved from fall to spring showed a much reduced stability in depressive symptomatology than their peers who continued to show problems in reading (Kellam, Rebok, Mayer, Ialongo, & Kalodner, 1994).

We set out to explore these issues further using data from the Pittsburgh Youth Study (PYS), a prospective longitudinal study of boys. Although primarily focused on the development of delinquency, the PYS has included repeated assessments of reading achievement and depressed

affect, along with measures of disruptive behaviors and family-based risks. Because reading difficulties are more common in boys than girls, we reasoned that a focus on an all-male sample should be especially informative. In addition, two previous reports from the PYS provided a particular impetus to this study. First, analyses of data from the first two study waves (Loeber, Farrington, Stouthamer-Loeber, & Van Kammen, 1998) highlighted underachievement in reading as among the key correlates of depressed mood in boys. Second, again using data from two assessment waves, Angold et al. (1996) described age-trends in self-reported depressed mood in childhood and adolescence. Using the Short Mood and Feelings Questionnaire (SMFQ; Angold et al., 1995; Mass et al., 1995) that we use here, they found marked changes in reports of depressed mood with age in boys: mean scores were highest in childhood, but dropped sharply in early adolescence. A similar pattern has since been confirmed in two other large-scale epidemiological data-sets (Angold, Erkanli, Silberg, Eaves, & Costello, 2002). These basic developmental trends in self-reports of depressive affect and cognitions clearly need to be borne in mind in assessing associations between depression and other factors.

We used data from the first six PYS assessments to take these findings further. We began by examining age-trends in depressed mood, and family and behavioral correlates of both depressed mood and severe reading problems. Against that background we went on to address four main questions: first, whether reading difficulties were associated with increased risks of depressed mood in boys; second, developmental trends in these associations; third, whether any links between reading and depressed affect were explicable in terms of aspects of family functioning or comorbid disruptive behaviors characteristic of boys with reading difficulties; and fourth, whether there was evidence of any reciprocal effect of depressed mood on the development of reading skills.

## METHOD

### Sample

The sample was taken from the Pittsburgh Youth Study (PYS), a longitudinal survey of the causes and correlates of delinquency (see Loeber et al., 1998, for full details). The PYS used a multistage design to sample boys in grades 1, 4, and 7 for inclusion in the study. Potential participants were randomly selected from lists of all boys enrolled in those grades in the Pittsburgh Public Schools in 1987–88. At the time of the sample selection, 72% of all school children in Pittsburgh attended public schools. Of

those selected, 85% of the boys and their parents agreed to participate. The achievement test profile and racial mix of the study participants did not differ significantly from those of the district-wide male student population in the same grades.

At initial screening and each subsequent assessment wave each boy and his main caretaker were interviewed using the age-appropriate form of the Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1983), supplemented by additional items from a Self-Report Delinquency Inventory (SRD; Elliott, Huizinga, & Ageton, 1985). Teachers completed an extended version of the Teacher Report Form (TRF; Edelbrock & Achenbach, 1984), complementary to the CBCL. Information from these three sources was combined to create an antisocial behavior risk index. All boys ranked in the top 30% of the index were selected for inclusion in the main study, along with a further 30% randomly selected from the remainder of the screen sample. This provided three stratified samples, each of around 500 boys (youngest sample  $n = 503$ , middle sample  $n = 508$ , oldest sample  $n = 506$ ). Mirroring the composition of the Pittsburgh Public Schools just over half the boys were African American and the remainder Caucasian. Approximately 40% of boys lived with a single parent, and about 40% of parents received public assistance (see Loeber et al., 1998, for further details).

Following the screening, boys and their families have been followed over an extended period. Initially, follow-ups of all three samples took place at 6-month intervals. We focus here on data from the first five of these follow-up assessments (referred to as waves 1–5). Cooperation rates were high throughout this follow-up period, averaging 96% for the youngest sample, 97% for the middle sample, and 94% for the oldest sample.

## Measures

### *Reading Difficulties*

Total reading percentile scores from the California Achievement Test (CAT) were collected from schools at the screening assessment and at follow-up waves 2 and 4. Across the three PYS samples reading levels were slightly below national norms, with mean weighted percentile scores of 46.6, 44.8, and 43.5, respectively, at these three study sweeps. To identify boys with severe and persistent reading problems we selected those with CAT percentile scores of 6 or below at the screening assessment, and who showed continuing reading difficulties (percentile scores at or below the 50th percentile) at wave 2. Of the 1416 boys with test data at the screening assessment, 9.1% ( $n = 134$ )

were designated as poor readers using this definition. As expected, these boys continued to show marked reading difficulties throughout the follow-up period (mean percentile CAT scores of 8.0 ( $SD = 9.0$ ) at wave 2, and 8.6 ( $SD = 11.0$ ) at wave 4). Teacher ratings also confirmed their problems in reading: at the screen assessment 64% of the designated poor readers were rated by teachers as reading far below grade, and a further 30% as below grade.

### *Depressed Mood*

Depressed mood was assessed at waves 1, 3, and 5 using the short version of the Mood and Feelings Questionnaire (SMFQ; Angold et al., 1995; Messer et al., 1995), a self-completion scale for children aged 6 years and above. The SMFQ assesses mood during the past 2 weeks, and includes 13 items reflecting symptoms of major depression covered in DSM-III-R (APA, 1987). SMFQ scores correlate with other self-completion and interview-based measures of depressive symptomatology (Angold et al., 1995), discriminate psychiatrically referred and nonreferred children (Angold et al., 1995), and show a unifactorial structure reflecting the core construct of depression (Messer et al., 1995). Loeber et al. (1998) reported alpha reliabilities of .80–.84 for SMFQ scores in the three PYS samples at wave 1. In the present analyses items were scored 0 (*not true*), 1 (*sometimes true*), and 2 (*true*), giving a total score range of 0–26. Like many measures of psychiatric symptomatology, SMFQ scores show highly skewed, reverse J-shaped distributions in population samples; most participants have low scores, and small groups score highly. To overcome these distributional problems, and to focus on high levels of depressed mood, we used dichotomized SMFQ scores throughout the analyses (see Farrington & Loeber, 2000, for a discussion of the advantages of this approach). We used SMFQ scores of 13 and above (approximately the 93rd percentile for the full sample at wave 1) to identify boys with high levels of depressed mood, though less severe than depressive disorders.

### *Disruptive Behavior Disorders*

Disruptive behavior disorders were assessed from the Revised Diagnostic Interview Schedule for Children (DISC-P; Costello, Edelbrock, & Costello, 1985; Costello, Edelbrock, Kalas, Kessler, & Klaric, 1982), administered to the main caretaker at wave 1. The DISC-P was used to generate diagnoses of Conduct Disorder (CD; weighted prevalence of 6.4%), Oppositional Defiant Disorder (ODD; weighted prevalence of 8.3%), and Attention-Deficit Hyperactivity Disorder (ADHD; weighted prevalence of 11.0%) according to DSM-III-R criteria. A num-

ber of studies (see, e.g., Graetz, Sawyer, Hazell, Arney, & Baghurst, 2001) have now supported the utility of the DSM-IV subtyping of ADHD (APA, 1994) into two dimensions, reflecting symptoms of inattention and motor restlessness/impulsivity. Factor analyses of the ADHD symptoms confirmed a similar structure here. We created subscales from counts of these symptoms (inattentiveness subscale: easily distracted, does not follow instructions, difficulty sustaining attention, doesn't listen, and loses things; restlessness/impulsivity subscale: fidgets, difficulty staying seated, difficulty waiting turn, blurts out answers, shifts activity, difficulty playing quietly, talks excessively, interrupts, and engages in dangerous activities). The reliability of these scales was high (inattentiveness subscale:  $\alpha = .74-.79$  in the three PYS samples; impulsivity subscale:  $\alpha = .76-.77$ ). Raw scores on these subscales are shown in descriptive statistics, whereas standardized scores were used in the analyses.

### *Delinquency Seriousness*

Data on delinquency were collected from parent reports (CBCL, Lifetime Scale; Achenbach & Edelbrock, 1983), teacher reports (TRF; Edelbrock & Achenbach, 1984), and self-reports (Self-Reported Antisocial Behavior Scale; Loeber, Stouthamer-Loeber, Van Kammen, & Farrington, 1989; SRD; Elliott, Huizinga, & Ageton, 1985) at each study contact. These measures were combined, and classified into a number of levels of delinquency seriousness at each phase (see Loeber et al., 1998, for details). We dichotomized this measure to contrast no or minor delinquency with moderate or severe delinquent acts (any theft of \$5 or over, gang fighting, carrying weapons, joyriding, and more serious theft and violence). At a combined assessment from the screen and first follow-up phases 25% of the youngest sample, 42% of the middle sample, and 54% of the oldest sample were classified as showing moderate or severe delinquency on this measure.

### *Family Socioeconomic Status (SES)*

Family SES was classified using the Hollingshead (1975) index of social status, drawing on indicators of parents' occupational prestige and educational level. In two parent families the higher of the two individual parent scores was used.

### *Family Atmosphere and Parenting*

Loeber et al. (1998) explored a wide range of family and behavioral factors as possible correlates of depressed mood in wave 1 of the PYS. We focused on the subset

of indicators that showed significant associations with depression in at least one sample in those prior analyses, and were available for all three samples. All measures were dichotomized as closely as possible to the 75th percentile in the full sample.

- (i) Poor caretaker–child communication: This construct was based on caretaker reports (30 items) of how frequently they communicated with their child about emotions, disagreements, and problems ( $\alpha = .86-.90$  in the three samples).
- (ii) Physical punishment: Combined caretaker and child reports of the frequency with which the parent slapped, spanked, or hit the boy; correlations between parent and child reports ranged from  $r = .12$  to  $r = .17$  in the three samples.
- (iii) Poor supervision: Combined caretaker (4 items) and child (4 items) reports of parental knowledge and supervision of the child’s activities ( $\alpha = .63-.75$  across the three samples).
- (iv) Caretaker stress: 14-item caretaker report (covering the previous month) of perceived stress and ability to handle problems ( $\alpha = .83$  in all three samples).

**Attrition**

CAT reading scores were available for 1416/1517 boys (93%) at the screening assessment. Boys without reading test data were of lower family SES than those with test data (mean SES = 29.0 vs. 33.7,  $p = .003$ ). Taking account of these SES variations, boys without test score data were also more likely to have been selected as high risk (48.2% vs. 35.4%,  $p = .049$ ), and somewhat more likely to be of African American origin (69.8% vs. 55.2%,  $p = .071$ ). Teacher ratings of reading ability were available for 93 of the 101 boys with missing test data. These suggested an increased rate of reading problems in this group: 42% were rated as reading far below grade by their teachers at the screen assessment, by contrast with only 16% of boys with test data. To provide some assessment of the effects of these losses we repeated key analyses with cases rated as reading far below grade reassigned to the poor reader category, and all other cases without CAT scores but with teacher ratings treated as adequate readers.

**Analyses**

Except where indicated we combined data from all three samples to maximize statistical power, and included age as a covariate throughout. Logistic regression analyses were used to test for group differences on dichotomous

outcomes and ordinary regressions for analyses of continuous reading scores. Initial tests of psychosocial and behavioral correlates of depression and reading problems were undertaken separately, to assess the differing developmental pathways hypothesized as contributing to links between the two disorders. A conservative significance level of  $p = .1$  was then used to identify potentially important correlates for inclusion in subsequent multivariate models. The analyses were undertaken in STATA (Stata-Corp, 1999), weighted as appropriate to take account of the stratified sample design.

**RESULTS**

**Age Trends and Correlates of Depressed Mood**

We began by examining age trends and correlates of depressed mood in this male sample. As outlined earlier, Angold et al. (1996) found marked age-variations in mean levels of self-reported depressed mood in the first two SMFQ assessments in the PYS, with rates dropping sharply with age. The same pattern was evident here. In the youngest sample (mean age 7.4 years at wave 1), 13.4% of boys were rated as depressed on our selected cut-point. That figure fell to 7.1% in the middle sample (mean age 10.7 years), then dropped further in the oldest sample (13.8 years), to just 2.5%.

Table I shows rates of selected demographic and family risks for depressed mood at wave 1 in the full combined sample, along with odds ratios (ORs) and 95% confidence intervals (CIs) from age-adjusted logistic regression analyses assessing bivariate links between each factor and depressed mood. Adjusted for age, depressed mood was more common in boys of African American origin, from

**Table I.** Demographic and Family Correlates of Depressed Mood, Full Sample, Wave 1

Correlates	Depressed mood		Age adjusted OR <sup>a</sup> (CI)
	No (n = 1382)	Yes (n = 127) <sup>b</sup>	
Race (% African American)	55	67	<b>1.7</b> (1.2–2.6)
% Low family SES	24	34	<b>1.7</b> (1.2–2.6)
% Poor family communication	22	24	1.3 (0.8–1.9)
% Frequent physical punishment	34	60	<b>2.1</b> (1.4–3.3)
% Poor supervision	21	35	<b>1.9</b> (1.3–2.9)
% Parental stress	27	31	1.2 (0.8–1.9)

<sup>a</sup>Bold ORs indicate  $p < .05$ .

<sup>b</sup>ns vary slightly in individual analyses as a result of occasional missing data.

**Table II.** Behavioral Correlates of Depressed Mood, Full Sample, Wave 1

Correlates	Depressed mood		Age adjusted <i>OR</i> <sup>a</sup> (CI)
	No ( <i>n</i> = 1382)	Yes ( <i>n</i> = 127) <sup>b</sup>	
% CD	5.8	14.6	<b>3.5</b> (2.0–5.9)
% ODD	8.3	7.9	1.1 (0.6–2.3)
% ADHD	10.2	21.7	<b>2.1</b> (1.3–3.4)
Mean inattentiveness symptoms	1.5	1.9	<b>1.3</b> (1.1–1.6)
Mean restless/impulsive symptoms	1.9	2.7	<b>1.3</b> (1.1–1.5)
% Moderate/severe delinquency	39.6	47.5	<b>2.0</b> (1.3–3.1)

<sup>a</sup>Bold *OR*s indicate *p* < .05.

<sup>b</sup>*n*s vary slightly in individual analyses as a result of occasional missing data.

low SES families, and in families where parents more frequently reported using physical punishment and exercised poor supervision over their son's activities. In a multivariate analysis including all potential demographic and family risks only these latter two factors (physical punishment, *OR* = 1.9, 95% CI = 1.3–3.0, *p* = .002; and poor supervision, *OR* = 1.6, 95% CI = 1.0–2.4, *p* = .033) remained independently associated with depressed mood, whereas low SES was of borderline significance (*OR* = 1.4, 95% CI = 0.9–2.2, *p* = .098).

Table II shows behavioral correlates of depressed mood, and confirms the high levels of comorbidity between internalizing and externalizing problems noted in many previous studies. Rates of CD and ADHD diagnoses were both elevated among boys with high depression scores, as were mean scores on the inattentive and restless/impulsive ADHD symptom scales and levels of moderate–severe delinquency. In a multivariate analysis including all of these behavioral factors only CD (*OR* = 2.2, 95% CI = 1.1–4.2, *p* = .020) and delinquency (*OR* = 1.6, 95% CI = 1.0–2.6, *p* = .038) continued to show independent associations with depressed mood. The inattentiveness and impulsivity subscales were highly correlated (*r* = .60). We thus reran the multivariate analyses including each of these predictors individually in turn. The inattentive subscale was predictive of depressed mood independently of the delinquency, CD, and ODD measures (*OR* = 1.2, 95% CI = 1.0–1.5, *p* = .036).

**Demographic, Family, and Behavioral Correlates of Reading Problems**

Tables III and IV report parallel findings on correlates of reading difficulties. Beginning with demographic

**Table III.** Demographic and Family Correlates of Reading Problems, Full Sample, Wave 1

Correlates	Reading problems		Age adjusted <i>OR</i> <sup>a</sup> (CI)
	No ( <i>n</i> = 1282)	Yes ( <i>n</i> = 134) <sup>b</sup>	
Race (% African American)	53.3	75.1	<b>2.5</b> (1.7–3.9)
% Low family SES	22.6	39.9	<b>2.2</b> (1.5–3.3)
% Poor family communication	21.0	28.8	1.4 (0.9–2.1)
% Frequent physical punishment	36.7	32.0	1.2 (0.8–1.8)
% Poor supervision	21.5	24.1	1.2 (0.8–1.8)
% Parental stress	27.0	28.4	1.1 (0.7–1.6)

<sup>a</sup>Bold *OR*s indicate *p* < .05.

<sup>b</sup>*n*s vary slightly in individual analyses as a result of occasional missing data.

indicators, African American boys were overrepresented among the poorest readers, as were boys from low SES families (Table III); both of these factors continued to show significant links with reading problems in a multivariate analysis (race: *OR* = 2.3, 95% CI = 1.5–3.6, *p* < .001; SES: *OR* = 2.0, 95% CI = 1.3–3.0, *p* = .001). In other respects, however, reading difficulties showed few associations with the other family and parenting factors associated with depressed mood. Families of boys with severe reading problems were no more likely than others to use physical punishments with their sons, nor to exercise poor supervision, and levels of parental stress were closely similar in both groups. The one possible exception was in terms of poor family communication, which was reported somewhat more commonly in families of boys

**Table IV.** Behavioral Correlates of Reading Problems, Full Sample, Wave 1

Correlates	Reading problems		Age adjusted <i>OR</i> <sup>a</sup> (CI)
	No ( <i>n</i> = 1282)	Yes ( <i>n</i> = 134) <sup>b</sup>	
% CD	5.3	11.0	<b>2.0</b> (1.2–3.6)
% ODD	7.9	10.6	1.2 (0.7–2.3)
% ADHD	10.4	16.2	<b>2.0</b> (1.2–3.3)
Mean inattentiveness symptoms	1.5	2.1	<b>1.4</b> (1.2–1.7)
Mean restless/impulsive symptoms	1.9	2.3	<b>1.3</b> (1.1–1.5)
% Moderate/severe delinquency	37.8	53.7	<b>1.5</b> (1.0–2.3)

<sup>a</sup>Bold *OR*s indicate *p* < .05.

<sup>b</sup>*n*s vary slightly in individual analyses as a result of occasional missing data.

with reading problems; controlled for family SES, however, these differences were reduced to nonsignificance ( $p = .3$ ). As measured here, the family and parenting factors associated with depressed mood in the PYS were not especial characteristic of families of poor readers.

As expected, however, severe reading problems were strongly comorbid with disruptive behavior disorders and delinquency (Table IV). In a multivariate analysis both ADHD and CD showed potentially important links with reading difficulties (ADHD:  $OR = 1.8$ , 95% CI = 1.0–3.1,  $p = .04$ ; CD:  $OR = 1.7$ , 95% CI = 0.9–3.2,  $p = .078$ ). Confirming previous findings, more detailed tests using the ADHD symptom scales showed that associations with ADHD primarily reflected high rates of inattentive symptoms among poor readers. In a multivariate analysis of the two ADHD symptom subscales inattentive symptoms remained significantly associated with reading difficulties ( $OR = 1.3$ , 95% CI = 1.1–1.7,  $p = .009$ ) whereas restlessness/impulsivity did not ( $OR = 1.1$ , 95% CI = 0.8–1.3,  $p = 0.6$ ). In their turn, these elevated rates of inattentiveness seemed a key mediator of associations between reading problems and delinquency. Controlled for levels of inattentiveness, delinquency risk was no longer associated with reading group status ( $OR = 1.4$ , 95% CI = 0.9–2.1,  $p = .15$ ).

## Reading Problems and Depressed Mood

### Short-Term Longitudinal Prediction of Depressed Mood

As outlined earlier, reading difficulties were defined on the basis of achievement scores collected at the screening assessment. Our first test of associations between reading difficulties and depressed mood focused on short-term prediction to SMFQ scores collected 6 months later, at wave 1. Figure 1 shows rates of depressed mood among poor and more skilled readers in each sample at that stage. Levels of depressed mood were elevated in poor readers in both the youngest and middle samples (ages 6.9 and 10.2 years, respectively); not surprisingly, the sharp drop in overall levels of depressed mood in the oldest sample obviated the possibility of group differences at that point. In the light of these developmental trends, the remaining analyses focused on boys in the youngest and middle samples only. Across these two groups, poor readers showed significantly higher rates of categorically defined depressed mood than boys without marked reading difficulties (good readers: 9.6%, poor readers: 23%;  $OR = 3.0$ , 95% CI: 1.6–5.4,  $p < .001$ , adjusted for age), with no significant differences in these effects between the two samples.

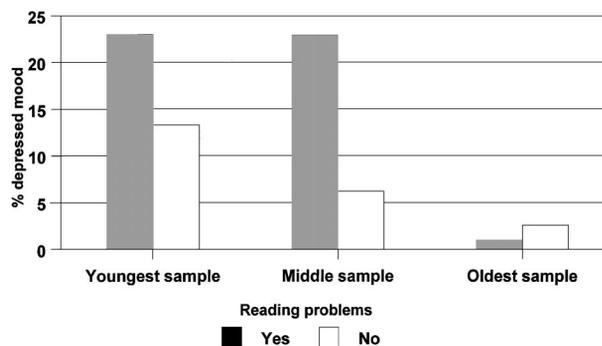


Fig. 1. Reading problems and depressed mood, wave 1.

We then carried out a series of multivariate analyses to examine the extent to which these associations were robust to controls first for family correlates of depressed mood, and second, comorbid disruptive behavior problems and delinquency. Table V shows the results. Including the potentially important family-based correlates identified earlier (physical punishment, poor supervision, and low SES), age-adjusted estimates of the effects of reading difficulties on depressed mood remained very similar (Model 2 vs. Model 1). Including significant effects of delinquency seriousness, CD, and the inattentiveness subscale alongside reading difficulties (Model 3) the effects of reading problems were somewhat reduced, but remained highly significant ( $p = .007$ ). Finally, in a multivariate model including the effects of all previously significant confounds (Model 4), reading problems continued to show strong associations with increased risk of depressed mood ( $p = .007$ ).

As outlined earlier, reading test data were missing for a small subsample of boys. We repeated the analyses with these cases reassigned to reading problem groups on the basis of teacher ratings of reading (see Methods section). The pattern of the findings remained unchanged, although estimates of the effects of reading difficulties were slightly reduced; in the final multivariate analysis, for example, controlling for effects of physical punishment, CD, and delinquency seriousness, the age-adjusted odds ratio for effects of reading difficulties on depressed mood was 2.0 (95% CI 1.1–3.6,  $p = .025$ ).

### Longer-Term Prediction

These findings suggested that in the short-term, reading difficulties were frequently followed by increased risks of depressed mood. The repeated assessments of SMFQ scores at waves 3 and 5 (1 and 2 years, respectively, after the initial SMFQ assessments) enabled us to examine

**Table V.** Predictors of Depressed Mood, Wave 1, Youngest and Middle Samples ( $n = 954$ )<sup>a</sup>

Predictors	OR (CI)			
	Model 1 <sup>b</sup>	Model 2 <sup>b</sup>	Model 3 <sup>b</sup>	Model 4 <sup>b</sup>
Reading problems	3.0 (1.6–5.4)***	2.7 (1.4–4.9)**	2.3 (1.3–4.3)**	2.3 (1.3–4.3)**
Physical punishment	—	2.0 (1.2–3.1)**	—	1.8 (1.1–2.9)*
Poor supervision	—	1.5 (0.9–2.3)	—	1.4 (0.8–2.2)
Low SES	—	1.5 (1.0–2.4)	—	1.4 (0.9–2.3)
Delinquency seriousness	—	—	1.7 (1.1–2.7)*	1.6 (1.0–2.5)
CD	—	—	2.2 (1.1–4.5)*	2.1 (1.1–4.3)*
Inattentiveness	—	—	1.1 (0.9–1.4)	—

<sup>a</sup>*n*s vary slightly in individual analyses as a result of occasional missing data.

<sup>b</sup>All analyses adjusted for age.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

the extent to which reading problems contributed to any longer-term risk for depressed mood at later study contacts, once an initial association had been established. Reading difficulties were of borderline significance in predicting depressed mood at wave 3 ( $OR = 2.1$ , 95% CI = 1.0–4.5,  $p = .058$ ); including depressed mood at wave 1, this effect was further reduced ( $OR = 1.6$ , 95% CI = 0.7–3.8,  $p = .261$ ). Prediction to depression at wave 5 followed a similar pattern. Reading problems significantly predicted wave 5 depression ( $OR = 2.4$ , 95% CI = 1.0–5.7,  $p = .048$ ) after accounting for age trends, but this effect was again reduced once depression at wave 3 was included in the model ( $OR = 2.23$ , 95% CI = 0.8–6.0,  $p = .113$ ). Although reading difficulties were associated with increased risk of depressed mood at all three study waves, these findings provided no strong statistical support for any marked exacerbation of risk for depression once an initial association had been established.

#### *Depressed Mood and Reading Achievement*

Finally we explored whether depressed mood might show reciprocal effects with reading achievement, using continuous reading scores in the full sample as the dependent measure. As expected, individual differences in reading achievement were highly stable across annual assessments (screen–wave 2,  $r = .76$ , wave 2–wave 4,  $r = .83$ ). In regression analyses of reading at wave 2, prior reading scores accounted for 58.5% of the variance, and family SES, race, a diagnosis of CD and delinquency seriousness each showed significant additional effects, accounting for a further 3.0% of the variance. Added to this model, continuous SMFQ scores at wave 1 had a significant ( $p = .017$ ) but extremely modest additional effect on reading achievement, accounting for only 0.17% of variance. Parallel analyses of reading at wave 4 failed to show any signifi-

cant effects of SMFQ scores once prior reading levels had been taken into account.

## DISCUSSION

We used longitudinal data from six assessments of boys in the PYS to examine the extent to which, in addition to their known risks of ADHD and disruptive behavior problems, reading-disordered children might also face elevated levels of depressed mood. We found robust links between severe, persistent reading problems and increased risk for depressed mood in a community sample of boys aged between 7 and 10 years at initial assessment, though not in those who had already entered their teens. The effects involved were substantial: younger boys with reading problems were three times more likely to report high levels of depressed mood than their peers at the first study contact.

We explored a number of pathways whereby poor readers' increased vulnerability to depressed mood might have come about, beginning with the possibility that both sets of difficulties shared common roots in other risks. In principle, shared risks of this kind might arise in a variety of ways: through shared genes, common environmental risks, or through comorbidities with disruptive behavior disorders. Our data did not allow for tests of genetic hypotheses, but did permit some evaluation of the latter two possibilities. First, we assessed the extent to which poor readers' vulnerability to depressed mood might derive from shared psychosocial adversities, and in particular from exposure to "depressogenic" conditions within the family. We found little evidence to support this view on the measures examined here. Although poor readers were more likely to come from low SES backgrounds, their families were not marked by other family-based correlates of depressed mood—in particular, frequent physical

punishment and poor parental supervision—identified within the PYS, and estimates of the effects of reading difficulties on subsequent depression were very little affected by the inclusion of these family factors in joint analyses. Although it remains possible that other family-based correlates of depression might function as shared environmental risks for reading problems, it seems more likely that the key processes run through other routes.

A second model, especially plausible given the strong overlaps that both reading problems and depression show with disruptive behavior disorders, is that any associations reflect artefacts—or possibly products—of those other comorbidities. Once again, however, our analyses failed to support a model of this kind. Although statistical controls for comorbid externalizing problems slightly reduced the estimated effects of reading difficulties on depression, reading problems remained strongly and significantly associated with depressed mood after taking comorbid disruptive behaviors into account.

The third model we evaluated was of a more direct (and possibly causal) association between reading difficulties and depressed mood. Though not entirely consistent, previous evidence was available to support the possibility of influences in each direction, boys' mood states affecting their academic performance and their school progress contributing to influence their mood. Our findings more strongly favoured the second view. Although we found some evidence for effects of prior depressed mood on reading progress, the effects involved were small, and not consistently replicated in tests across repeated assessment waves. By contrast, reading difficulties assessed at the start of the study were associated with increased risk for depressed mood at three subsequent assessment waves, and these links were robust to controls for a range of potential confounds. Although the experience of depression clearly had some impact on boys' reading progress, the findings suggested that the more probable source of the comorbidity between reading difficulties and depressive effect ran through processes whereby reading problems influenced boys' risk of depressed mood.

Before discussing the implications of these results we should note both the strengths and the limitations of our study and design. The PYS had a number of advantages for the analyses. First, as outlined earlier, because all types of comorbidity are known to occur at increased rates in referred samples (Angold et al., 1999; Caron & Rutter, 1991), community-based studies such as the PYS are essential for tests of this kind. Second, the prospective design and wide range of assessment instruments included in the PYS enabled us to test a variety of different hypotheses. Third, the assessments of depressed mood were based on self-reports by the boys themselves. Many previous stud-

ies of links between internalizing problems and reading disabilities have relied on parent or teacher reports. Although these undoubtedly provide an important perspective on children's emotional difficulties, agreement between reporters is modest at best, and there is considerable evidence that youth report higher levels of internalizing problems than their teachers or caregivers (Youngstrom, Loeber, & Stouthamer-Loeber, 2000). Child self-reports are clearly key tools in assessing phenomena that essentially concern "internal," subjective states; the PYS dataset was valuable in enabling us to extend the evidence on links between reading and emotional problems, using measures of this kind.

Set against these strengths three main limitations of our design must also be borne in mind. First, diagnostic criteria for reading disabilities focus on IQ-discrepant reading problems, identifying as reading disabled those children whose reading skills fall markedly below expectation not only for their age, but also for their general cognitive abilities (APA, 1994; World Health Organization, 1992). This requirement has given rise to considerable debate: several studies (see, e.g., Pennington, Gilger, Olsen, & DeFries, 1992) have shown that the same neurocognitive factors are associated with both age- and IQ-discrepant reading problems, but a recent twin study reported evidence that the etiology of reading disabilities does vary as a function of IQ (Wadsworth, Olsen, Pennington, & DeFries, 2000). Because the PYS did not include assessments of IQ we focused on boys with persistently low levels of reading for their age/grade, scoring at or below the 6th percentile at initial assessment judged on national norms, well within the 4–7% estimates for the prevalence of severe reading problems reported in recent studies (Snowling, 2002). Although a proportion of these boys would undoubtedly have met criteria for IQ-discrepant reading disabilities, for others, problems in reading may well have formed part of a more global cognitive deficit. As a result, our findings must be interpreted as relating to low reading achievement rather than to reading disabilities per se; in addition, poor cognitive skills may have contributed to some of the associations with depressed mood that we observed. Second, reading test data—collected from the public school system—were not available for a small proportion of the PYS sample. Although we have no precise means of assessing the effects of these losses, reassignment of missing cases on the basis of teacher ratings resulted in a closely similar pattern of findings to those reported above, though estimates of the effects of reading difficulties on depressed mood were slightly reduced. Finally, because the PYS focused only on boys, we must await further studies to evaluate the extent to which our findings are mirrored in results for girls.

Given these limitations, our results suggest that boys with severe reading difficulties are at a considerably increased risk of depressed mood in childhood. Although the main focus of previous research on reading-behavioral comorbidities has been on disruptive behavior problems, our findings are generally consistent with the few previous reports that have assessed internalizing symptomatology. In addition, the pattern of our findings suggested that this increased risk was not attributable to shared family or behavioral correlates, but might reflect some more direct impact of poor reading on boys' mood. Willcutt and Pennington (2000), using a twin sample, also found that increased rates of internalizing symptomatology among poor readers (most evident among girls in their study) were not attributable to shared family factors, but seemed more specific to reading problems. We can only speculate on the processes involved here. One plausible model would appear to run through the effects of poor school performance on self-esteem. Children with reading difficulties are known to show low self-esteem (Chapman, 1988), likely reflecting their awareness of their difficulties with a core aspect of the school curriculum. Although our study did not include direct assessments of self-esteem, the SMFQ items are weighted towards symptoms of depression that reflect self-deprecatory ideation (Messer et al., 1995), lending further support to this view. If it is correct, our findings suggest that processes of this kind are evident quite early in boys' school careers, that they persist throughout the main years of childhood, and that they contribute to considerable distress in a substantial minority of severely reading-disabled boys. This in turn suggests that interventions designed to prevent reading failure may have the additional benefit of reducing these risks. Evidence for short-term effects of this kind is already available (Kellam et al., 1994); monitoring the longer-term impact of reading interventions for children's mood states would clearly be of value.

Probably the most challenging aspect of our findings was that, using the relatively severe cut-points for depressed mood that we adopted in this study, no similar effects were evident once boys had entered their teens. Once again, we can only speculate on the processes involved here. As outlined earlier, data from other studies (Angold et al., 2002) have now confirmed that mean SMFQ scores fall markedly with age across the years of childhood, suggesting that our findings must be seen against the background of more general developmental changes taking place in boys' reports of depressive mood and cognitions at these ages. Using a less stringent cut-point for depression, however, Loeber et al. (1998) also found more limited evidence of links between reading achievement and SMFQ scores in early adolescents than in younger

boys in the early PYS assessment waves. This suggests that two rather different processes may be involved. First, there is clearly a general reduction in the levels of depressed mood reported by boys on measures such as the SMFQ between childhood and adolescence. Second, it seems possible that reading difficulties are highly salient to boys' self-perceptions early in their school careers (when the school system inevitably places much emphasis on reading acquisition), but that, with the advent of a wider range of influences on self-perceptions in the teens, literacy skills become less central to self-esteem at that stage. We must await further evidence to clarify the extent to which these or other processes contribute to the patterns we observed.

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