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Severity of Emotional and Behavioral Problems Among Poor and Typical Readers

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The purpose of this study was to examine the severity of behavioral and emotional problems among adolescents with poor and typical single word reading ability ($N = 188$) recruited from public schools and followed for a median of 2.4 years. Youth and parents were repeatedly assessed to obtain information regarding the severity and course of symptoms (depression, anxiety, somatic complaints, aggression, delinquent behaviors, inattention), controlling for demographic variables and diagnosis of ADHD. After adjustment for demographic variables and ADHD, poor readers reported higher levels of depression, trait anxiety, and somatic complaints than typical readers, but there were no differences in reported self-reported delinquent or aggressive behaviors. Parent reports indicated no differences in depression, anxiety or aggression between the two groups but indicated more inattention, somatic complaints, and delinquent behaviors for the poor readers. School and health professionals should carefully assess youth with poor reading for behavioral and emotional symptoms and provide services when indicated.

KEY WORDS: poor reading; adolescents; emotional/behavioral problems.

INTRODUCTION

Children and adolescents with poor reading skills face a variety of challenges in their lives, and may be at risk for emotional and behavioral problems. In some cases, behavioral or emotional problems may be triggered by the stress of difficulties in school, or they may be a contributing factor to poor achievement in school or to learning difficulties (Rutter & Yule, 1970). Severity of behavioral and emotional problems also may be associated with the diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) (Connor et al., 2003), which commonly co-occurs with reading problems (Willcutt & Pennington, 2000a). Nevertheless, many of the studies examining these issues have focused on youth in clinical settings, or youth receiving special educational services rather than youth who have been clearly defined as poor readers in non-clinical settings, and have focused on emotional/behavioral problems at only a single point in time, precluding closer examination of the course of symptoms over time. Many studies also have had relatively small sample size or a preponderance of males, have not matched youth with and without reading problems in terms of other relevant characteristics such as sociodemographic factors, or have not considered the presence of comorbid ADHD in contributing to emotional and behavioral problems.

Emotional Problems and Poor Reading

Some cross-sectional studies have found that there are higher than expected rates of learning disabilities among samples of depressed youth (e.g., Fristad, Topolosky, Weller, & Weller, 1992). Conversely, other

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studies of children and adolescents have suggested that youth with learning disabilities (LD) may have higher than expected rates of clinically significant depressive symptoms (defined by cut-offs on scales) (Goldstein, Paul, & Sanfilippo-Cohn, 1985; Maag & Behrens, 1989; Wright-Strawderman & Watson, 1992), and more depressive symptoms than comparison samples of non-LD youth (Hall & Haws, 1989; Rodriguez & Routh, 1989—for peer-nominated ratings of depression but not self-reported depression). Studies of children specifically having reading difficulties have yielded somewhat mixed results. For example, in the Pittsburgh Youth Study, Maughan, Rowe, Loeber, and Stouthamer-Loeber (2003) found that pre-teenage boys with poor reading reported more depressed mood than pre-teenage boys without reading problems; similar differences were not found among adolescent boys. Boetsch, Green, and Pennington (1996) found that children and adolescents with poor reading skills in the community, in a twin study, and in a clinic sample were more depressed than their peers without reading problems. Others have reported that girls with reading disabilities (RD) evidence more depressive symptoms than youth without reading problems, and that depressive symptoms among boys with reading problems are not as pronounced as those for girls (Willcutt & Pennington, 2000b).

Differences in anxiety symptoms likewise have been found among samples of LD youth relative to comparison youth (Margalit & Shulman, 1986; Paget & Reynolds, 1984; Rodriguez & Routh, 1989). Children and adolescents specifically with reading difficulties also have been noted to score higher on measures of anxiety symptoms than youth without reading problems (Casey, Levy, Brown, & Brooks-Gunn, 1992; Willcutt & Pennington, 2000b, particularly for girls).

Somatic complaints have not been well studied among youth with reading problems. Willcutt and Pennington (2000b) found that youth with reading disabilities had more somatic complaints than both their peers in the community and their co-twins without reading problems. They speculated that "some children with RD develop physical symptoms such as headaches or stomachaches in their response to the stress of academic work" (p. 1045). Margalit and Raviv (1984) similarly noted a higher prevalence of teacher-reported minor somatic complaints among children in special schools for learning disabilities relative to children in other schools.

Behavioral Problems and Poor Reading

Behavioral problems are commonly thought to be more prevalent among children and adolescents with poor reading, as well as among those with other types of learning disorders and language problems. For example, longitudinal community research has demonstrated that youth identified at age 5 with pervasive speech and language impairments or auditory comprehension problems evidence higher rates of teacher-rated externalizing behavioral problems at age 12 than youth with speech problems alone (Beitchman et al., 1996). Persistence of such problems was reflected in higher rates of antisocial personality disorder diagnoses at age 19 among males with language impairments relative to males with no speech or language impairment (Beitchman et al., 2001). In addition, LD youth have been described by parents as having more externalizing behaviors than peers in the community (Konstantareas & Homatidis, 1989), and have been reported to engage in violence twice as often as non-LD youth (Svetaz, Ireland, & Blum, 2000). Heiervang, Stevenson, Lund, and Hugdahl (2001) found that children with poor reading ability similarly had more parent and teacher-reported but not self-reported delinquent and aggressive behaviors than children without reading problems; in addition, boys but not girls with reading problems were found to have more teacher-reported externalizing behaviors than youth without reading problems. Willcutt and Pennington (2000b) found that both boys and girls with reading disability had more parent-reported aggressive and delinquent behaviors than youth without reading disability; however, the aggressive behaviors of reading disabled boys were more evident than those of reading disabled girls.

In longitudinal studies, Williams and McGee (1994) found that reading problems among boys was related to risk of later conduct disorders, but Maughan, Pickles, Hagell, Rutter, and Yule (1996) found that it was girls rather than boys with reading problems who developed later behavioral problems. Similar to cross-sectional findings (Willcutt & Pennington, 2000b), Fergusson and Lynskey (1997) found that the relationship over time between reading problems and behavioral problems was not apparent after controlling for confounding factors such as comorbid ADHD.

Comorbid ADHD and Reading Disabilities

The most common psychiatric disorder seen in reading disabled youth is ADHD. The rates of ADHD among children with RD have been estimated at 6–39% (Semrud-Clikeman et al., 1992; Willcutt & Pennington, 2000a), depending in part on the subtype of ADHD and gender. By contrast, estimates of the prevalence of ADHD from the general population range from approximately 2–5% (Costello et al., 1996; Shaffer et al., 1996). Conversely, the rates of RD found among children diagnosed with ADHD are estimated at 15–45% (August & Garfinkel,

1990; Dykman & Ackerman, 1991; Semrud-Clikeman et al., 1992). Although they often occur together, RD and ADHD are separate diagnostic entities as evidenced by their different patterns of cognitive correlates. Specifically, ADHD is typically associated with impaired executive functioning including inhibition deficits, whereas RD is associated with difficulties with phonological processing or phonemic awareness (Pennington, Groisser, & Welsh, 1993; Schachar, Mota, Logan, Tannock, & Klim, 2000; Willcutt et al., 2001). In a large community-based study, youth with both ADHD and RD appeared to have problems with both phonemic awareness and inhibition (Willcutt et al., 2001).

Despite the common co-occurrence of RD and ADHD, there are some indications that youth with learning disabilities may exhibit "diagnostic-specific deficits" related to attention problems (Tarnowski, Prinz, & Ney, 1986, p. 345). In addition, ADHD has been associated with various psychiatric comorbidities. Therefore, it is possible that emotional and behavioral problems thought to be associated with poor reading may in fact be a function of comorbid ADHD, rather than being a correlate of reading problems per se. Nonetheless, few studies (e.g., Willcutt & Pennington, 2000b) have examined the degree to which emotional/behavioral problems evidenced by poor reading youth are linked to the presence of comorbid ADHD.

With these considerations, the current study was designed to examine the emotional, behavioral, and attention problems from mid- to late adolescence among individuals with and without poor single word reading ability. The majority of previous data regarding the emotional and behavioral correlates of reading ability has emerged primarily from cross-sectional studies, from studies that focused on youth younger than adolescence, or from studies without independent evaluation of reading ability. This study used a longitudinal design to evaluate parent- and self-reported emotional and behavioral symptoms among adolescents with poor and typical single word reading ability as assessed in a screening assessment of non-referred high school students. The reading groups were defined in terms of their single word reading ability because it is a common outcome of a number of reading-related processes such as phonemic awareness and decoding skills, and because prior research has questioned the validity of definitions of reading disabilities based on discrepancies between intellectual functioning and reading performance (Flowers, Meyer, Lovato, Wood, & Felton, 2001; Steubing et al., 2002). Data were collected from both the adolescents and adult informants because previous research has indicated that youth tend to report more internalizing problems and fewer externalizing problems than their parents report about the youth (Kashani, Orvaschel, Burk, & Reid, 1985).

In this study we were particularly interested in the understudied transition period from mid- to late adolescence. For some youth, this may be a particularly stressful developmental period during which adolescents make decisions about whether to continue in school, consider other educational and employment choices, and begin to establish their independence. Thus, this can be a pivotal time in these lives of youth during which important life choices are made that can impact their future.

The specific hypotheses for this study were as follows:

1. Adolescents with poor single word reading ability will evidence more severe symptoms of depression and anxiety and more severe somatic complaints over time as compared to adolescents with typical reading ability.
2. Adolescents with poor single word reading will evidence more severe delinquent and aggressive behaviors over time as compared to adolescents with typical reading.
3. Adolescents with poor single word reading will evidence more severe inattention over time than adolescents with typical reading ability.
4. Differences in emotional, behavioral, and attention problems between poor and typical reading adolescents will continue to be evident after controlling for the presence of comorbid ADHD.

METHODS

Participants and Recruitment

The 188 adolescents participating in this study were screened at the age of 15 from 10th grade classes in six public high schools in the southeastern portion of the United States. Four of the schools served youth in an urban area, and two schools served youth in a rural area. Youth were screened at the age of 15 so they could be identified prior to the age when they could legally drop out of school (i.e., 16) in the state where the study was conducted. In addition to the age requirement for participation in the study, youth had to (1) have at least one living and available parent or legal guardian; (2) have written consent from a parent or legal guardian; (3) not have a sibling who is enrolled in this study; (4) not be in classes for the educable mentally handicapped; and (5) have English as a first language.

A total of 1062 students were screened and found to be eligible for the study: 148 youth were classified as "poor readers" and 914 were classified as "typical readers." We contacted 239 adolescents and families from

this larger sample who were eligible for the study, and 222 (93%) responded to these contacts. Of those who responded, 82% of the poor readers (94 of 114) and 87% of the typical readers (94 of 108) agreed to participate. In choosing which participants to contact, we used the method of frequency distribution matching, i.e., we monitored the gender and race/ethnicity distribution of poor readers recruited from each school, and recruited typical readers from the same gender and race/ethnicity strata in order to achieve a rough balance in demographic characteristics of the poor and typical readers.

In terms of reading skills, typical readers who enrolled in the study had slightly better performance in single word reading ability as measured with the Woodcock–Johnson Letter Word Identification test than typical readers who declined to participate in the study (M(enrolled) = 50.3, M(declined) = 48.4; t = 2.90, p = .005). However, they did not differ from typical readers in the remainder of the subject pool in this regard ($t < 1.00$, $p > .10$). The poor readers enrolled in the study did not differ from poor readers who declined to participate nor did they differ from poor readers in the remainder of the screening sample in terms of single word reading ability (as measured with the Woodcock–Johnson Letter Word Identification test; $t < 1.00$, $p > .10$).

The final sample consisted of 82 girls and 106 boys, of which 51% ($n = 96$) were African-American, 45% ($n = 83$) were White and non-Hispanic, and the remainder were either Hispanic ($n = 2$, 1%) or self-identified as biracial ($n = 5$, 3%). As classified by the Hollingshead Index (Hollingshead, 1957), the socioeconomic status of youth at the index psychiatric interview was distributed as: I (highest), 5%; II, 8%; III, 37%; IV, 36%; and V (lowest), 15%. A description of the demographic characteristics of participants by group is provided in Table I.

This is an ongoing study, and participants are still being followed. The current paper focuses on the first three assessments with this cohort through November 2, 2003; by this cut-off, participants had been followed for a maximum of 3.7 years (median of 2.4 years). Thus far, four participants (three female, one male) have dropped out of the study—three from the poor reading group and one from the typical reading group.

Table I. Description of Poor and Typical Single Word Readers at the Initial Assessment (n (%))

Variable	Poor readers ($N = 94$)	Typical readers ($N = 94$)
Gender		
Male	52 (55)	54 (56)
Female	42 (45)	40 (44)
Race/ethnicity		
Black non-Hispanic	47 (50)	49 (52)
White non-Hispanic	44 (47)	41 (44)
Hispanic	1 (1)	1 (1)
Biracial	2 (2)	3 (3)
SES		
1 = highest	1 (1)	8 (9)
2	7 (7)	8 (9)
3	33 (35)	36 (38)
4	35 (38)	32 (34)
5 = lowest	18 (19)	10 (10)

Overview of Procedures

After the initial reading screening and enrolling in the study, youth and their primary caretakers participated in the initial study assessment. The assessment instruments used in the initial assessment are described later and were repeated at follow-up interviews with the following two exceptions: (1) the CBCL was not used after youth turned 18 or started living independently; and (2) different sets of cognitive or reading measures were administered at each of the follow-up interviews. For the purposes of study interviews, the "primary caretaker" was defined as the adult who spent the most time with the adolescent and was responsible for the adolescent's supervision and well-being. We did not interview participants' primary caretakers when youth moved out of their parents' homes, when they became married or moved in to the home of a "significant other," or after they reached their 18th birthday. The initial assessments and the follow-up interviews took place at the medical center where the study was conducted, at participants' homes, or at an agreed upon locale in the participants' communities (e.g., a room in a local library). Participants and their families were compensated monetarily for the time and travel expenses involved in participating in the initial and the follow-up assessments.

Participants in the study were re-assessed annually following their index assessment for a total of three interviews for the majority (92%, $n = 179$ of 194) of participants (median time between interviews = 12.0 months). However, the actual amount of time between assessments sometimes varied between and within participants due to subject preferences, difficulty locating participants, and staff shortages. Ten percent of the follow-up assessments were conducted at 18 months or longer since the preceding assessments. As described later, the statistical methods used in this study are capable of using all available data, regardless of differing amounts of data among participants or varying assessment intervals.

Assessment of Poor Single Word Reading Ability

For classification into the groups of "poor readers" and "typical readers" at the time of screening, we administered the Letter Word Identification (LWID) subtest of the Woodcock–Johnson Psychoeducational Battery-Revised (Woodcock & Johnson, 1990). This is a single-word test of reading that contains words through the college level. Participants with a raw score at or below 44 (the 18th percentile for age 16 according to national norms) were classified as poor readers; those with scores of 45 and higher were considered typical readers. This cut-off corresponds approximately to the proportion of individuals identified in genetic studies of dyslexia with the "single word phenotype," i.e., significant difficulties with single word reading (e.g., Grigorenko, Wood, Meyer, & Pauls, 2000). This percentile cut-off is more conservative than the 25th–30th percentile suggested by Lyon, Fletcher, Torgeson, Shaywitz, and Chhabra (2004) to indicate "below average" performance. In addition, in a study of sex differences and RD, Rutter et al. (2004) used a cut-off of 15% on reading tests as one of the alternative methods for defining the presence of reading disabilities in four large epidemiologic samples. We used the cut-off on the LWID test rather than discrepancy criteria for defining reading problems because the validity of discrepancy criteria has been questioned (Flowers et al., 2001; Steubing et al., 2002).

In addition to the LWID, several other cognitive measures were administered over the course of the study. The Decoding Skills Real Words Test (Richardson & DiBenedetto, 1985) was administered at screening along with the LWID. The Woodcock–Johnson Word Attack Subtest (Woodcock & Johnson, 1990) and the Test of Auditory Analysis Skills (Rosner, 1979) were administered in conjunction with the index psychiatric assessment. The Decoding Skills Non-Words test (Richardson & DiBenedetto, 1985) and the Rapid Automized Naming (Digits and Letters) tasks (Denckla & Rudel, 1976) were administered at the first follow-up assessment. The Lindamood Auditory Conceptualization task (Lindamood & Lindamood, 1971) was administered at the second follow-up assessment. Providing validity for our classifications or poor versus typical reading ability, as can be seen in Table II, the adolescents with poor and typical single word reading ability differed on each of the other reading-related measures.

Table II. Differences in Cognitive Test Performance Between Adolescents With Poor and Typical Single Word Reading Ability

	Poor readers		Typical readers		
Cognitive tests[a]	Mean	*SD*	Mean	*SD*	*t*-Statistic[b]
Single word reading					
W-J LWID	41.2	2.8	50.3	2.4	24.11
DST–Real Words	51.3	6.5	58.9	1.5	11.13
Decoding skills					
W-J Word Attack	14.0	4.4	23.7	3.5	16.66
DST–Non-words	36.2	9.7	52.0	5.3	13.44
Phonemic awareness					
TAAS	9.0	2.6	11.3	2.1	6.56
LAC	70.4	15.4	87.6	14.3	7.26
Fluency					
RAN Digits	22.2	4.5	19.0	3.3	5.40
RAN Letters	21.9	4.3	18.4	4.1	5.56

[a] W-J LWID: Woodcock–Johnson Psychoeducational Battery-Revised Letter Word Identification subtest; DST–Real Words: Decoding Skills Test–Real Words Test; W-J Word Attack: Woodcock–Johnson Psychoeducational Battery-Word Attack subtest; DST–Non-words: Decoding Skills Test–Non-words subtest; TAAS: Test of Auditory Analysis Skills; LAC: Lindamood Auditory Comprehension Test; RAN Digits: Rapid Automized Naming Test Digits; RAN Letters: Rapid Automized Naming Test Letters.

[b] $p < .001$ for all contrasts using *t*-tests with unequal variances; sample sizes for the contrasts range from $n = 188$ for the LWID and DST–Real Words administered at the initial screening assessment to $n = 157$ for the LAC which is still being administered in the most recent assessments.

Assessment of Severity of Behavioral, Emotional, and Attention Problems

To assess severity of behavioral, emotional, and attention problems, participants and their parents completed several self-report questionnaires. These questionnaires were administered by research clinicians (masters-level mental health professionals who received extensive training in the use of all measures prior to data collection) at the initial assessment and at each follow-up assessment. In instances when participants needed help in completing the questionnaires (by their own report, or as assessed via a brief reading sample at the beginning of each assessment), staff orally administered the questionnaires.

Youth Self-Report Inventory (YSR)

The YSR (Achenbach, 1991a, 1991c) was used to assess participants' behaviors and emotions (Achenbach, 1991c). For the purpose of this paper, the somatic complaints, attention, aggressive, and delinquent subscales of the YSR were used in our analyses. The YSR is a widely used, empirically based, factor-analytic derived, reliable and valid, and normed self-report measure intended for use with youth aged 11–18 (Achenbach, 1991c). Because the norms only extend to age 18 and we followed adolescents beyond this age, we used the raw scores from the YSR scales in our longitudinal analyses.

Beck Depression Inventory (BDI)

To assess severity of depressive symptoms, participants completed the BDI (Beck, Steer, & Garbin, 1988; Steer & Beck, 1988.) The BDI is a widely used self-report inventory for the assessment of depressed mood, for which the reliability and validity have been demonstrated with adolescents (Ambrosini, Metz, Bianchi, Rabinovich, & Undie, 1991; Carter & Dacey, 1996).

State–Trait Anxiety Inventory (STAI)

The Trait Anxiety portion of the STAI was used to measure trait anxiety symptoms (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The STAI has strong internal consistency and good reliability and has been used extensively in research and clinical practice (Spielberger et al., 1983).

Child Behavior Checklist (CBCL)

To assess internalizing and externalizing behaviors from the perspective of participants' parent or guardian, the 118-item CBCL (Achenbach, 1991a, 1991b) was administered. The CBCL is a reliable and valid, empirically derived, and normed behavior checklist (Achenbach, 1991b) designed to be used in conjunction with the YSR. For the purpose of this analysis, we were primarily interested in the anxious/depression, somatic complaints, attention, delinquent behavior, and aggression subscales.

Assessment of ADHD

Lifetime diagnoses and current diagnoses of ADHD for youth in this sample were assessed in part with the semi-structured diagnostic interview, the Schedule for Affective Disorders and Schizophrenia for School-Age Children—Epidemiologic Version, 5th edition (K-SADS-E; Orvaschel & Puig-Antich, 1994). The K-SADS-E was administered by masters-level mental health professionals who received extensive training and were closely supervised in the administration of the interview. The K-SADS-E includes inquiries about symptoms of current psychiatric disorder as well as history of psychiatric symptoms. Symptoms are operationally defined in the K-SADS-E as "clinically significant" (i.e., above diagnostic threshold) on the basis of their frequency, duration, and severity. Both adolescents and their parent or guardian were interviewed. Consistent with procedures used by Kovacs and colleagues (Kovacs, Feinberg, Crouse-Novak, Paulauskas, & Finkelstein, 1984; Kovacs, Feinberg, Crouse-Novak, Paulauskas, & Pollock, et al., 1984) and others, the validity of different sources of information in the interviews was not weighted a priori. When the information provided by adolescents and adults were inconsistent, additional questions were asked and a judgment was made as to the most reliable report. When both informants were judged to be reliable but the symptom was reported by one but not the other, the symptom was assumed to be present. Bird, Gould, and Staghezza (1993) demonstrated that a strategy of assuming symptoms as present when they are reported by either the parent or youth informants was related to clinical diagnoses no less often than computer-based or statistical weighting strategies, which selectively weight information from "optimal" informants. Different studies have indicated good to very good inter-rater reliability ($\kappa = .77$; Ambrosini, 2000; $\kappa = 1.00$; Faraone, Biederman, & Friedman, 2000; $\kappa = .99$; Wilens et al., 2002) and very good 1-year test–retest reliability ($\kappa = .95$; Faraone, Biederman, & Milberger, 1995) of K-SADS-E–derived ADHD diagnoses.

We focused on both lifetime and current ADHD diagnoses in this study. In DSM-IV (American Psychiatric Association, 1994), it is acknowledged that adolescents and adults may evidence significant symptoms of ADHD, but may no longer meet full diagnostic criteria for the ADHD syndrome. When individuals evidence residual symptoms of ADHD, but no longer meet full ADHD diagnostic criteria, they are referred to as having ADHD "in partial remission." For purposes of this study, we classified adolescents as having ADHD in partial remission when they had a lifetime history of ADHD, and still evidenced two or more "clinically significant" ADHD symptoms that were not explainable by other psychiatric disorders. This procedure is similar to that used in previous longitudinal studies of developmental psychopathology (e.g., Kovacs, Feinberg, Crouse-Novak, Paulauskas, & Finkelstein, 1984; Kovacs, Feinberg, Crouse-Novak, Paulauskas, & Pollock, et al., 1984). Adolescents were considered to have a current ADHD diagnosis if they met either full diagnostic criteria for current ADHD, or if they had a past history of ADHD and currently evidenced enough residual symptoms to be classified as "in partial remission." Following precedent from other longitudinal studies (e.g., Goldston et al., 1999; Kovacs, Feinberg, Crouse-Novak, Paulauskas, & Finkelstein, 1984; Kovacs, Feinberg, Crouse-Novak, Paulauskas, & Pollock, et al., 1984), best-estimate diagnoses were made on the basis of all available information, including the K-SADS-E symptom ratings and psychiatric treatment records, which were independently reviewed (by the PI of the study and research clinicians who did not conduct the interview in

question), and were arrived at by a process of consensus judgment.

Assessment of Sociodemographic Variables

Sociodemographic variables, such as socioeconomic status (SES), race, gender, and family composition, were recorded onto structured coding sheets at each follow-up interview. These Follow-Up Information Sheets are modifications of similar instruments developed by Kovacs (M. Kovacs, unpublished manuscript, University of Pittsburgh, 1982) for use in longitudinal studies. SES was coded using Hollingshead Index (Hollingshead, 1957).

STATISTICAL METHODS

A linear mixed effects model analysis (Laird & Ware, 1982) was used to examine differences in behavior scores between youth with poor reading and those with typical reading. The linear mixed effects model is a linear regression model that accounts for the correlation exhibited among repeated measurements (i.e., assessments at different interview times) for the same participants. These models are capable of accommodating varying numbers of interviews taken at unequally spaced intervals. In order to satisfy the normality and homogeneity of variance assumptions of the linear model, the positively skewed symptom severity scores were transformed to the logarithmic scale. The log-transformed values were then included as the dependent variables in the regression models. The independent variable in each model was a binary classification indicating whether youth were poor readers or did not have difficulties with reading. The dependent variables were youth self-report measures of (1) depression, (2) anxiety, (3) somatic complaints, (4) delinquency, (5) aggression, and (6) attention. In a second series of models, the dependent variables were parent report measures of (1) anxiety and depression, (2) somatic complaints, (3) delinquent behaviors, (4) aggression, and (5) attention, which were all assessed with the CBCL. Models were adjusted for age, gender, race/ethnicity, and SES. We additionally explored whether differences between poor readers and typical readers persisted after controlling for lifetime history of ADHD or current diagnoses of ADHD in addition to the demographic characteristics. Interactions between reading status and ADHD were tested to examine whether differences in outcomes were primarily apparent for youth with both ADHD and poor single word reading ability. Interactions between age and reading status, and between gender and reading status, were included to test whether differences in emotional and behavioral problems vary with age or gender.

Multivariate Models Controlling for Demographic Variables

In Table III, the unadjusted means, ranges, and standard deviations for the parent and youth scales at the baseline assessment for the two reading groups are presented. As can be seen, there were generally larger ranges of scores (and therein standard deviations) for youth with poor reading than for youth with typical reading ability.

Table III. Unadjusted Means, Standard Deviations, and Ranges of Emotional and Behavioral Symptom Ratings for the Reading Groups at Baseline Assessment[a]

	Poor single word reading				Typical single word reading			
Outcome variable	Mean	*SD*	Minimum	Maximum	Mean	*SD*	Minimum	Maximum
BDI	8.2	8.6	0	47	4.7	4.5	0	22
STAI Trait Anxiety	38.0	9.9	22	68	32.4	8.3	20	58
YSR somatic	3.7	3.1	0	15	2.6	2.4	0	10
YSR delinquency	3.6	2.6	0	13	1.1	1.7	0	7
YSR aggression	8.3	5.8	0	26	7.3	4.2	0	19
YSR inattention	5.5	3.3	0	16	4.1	2.4	0	12
CBCL anxiety/depression[b]	2.2	3.7	0	19	1.6	2.3	0	12
CBCL somatic	1.9	2.8	0	12	1.1	2.0	0	14
CBCL delinquency	2.0	2.8	0	14	1.1	1.7	0	7
CBCL aggression	4.0	4.9	0	25	3.2	3.8	0	16
CBCL inattention	2.6	3.4	0	17	1.3	2.2	0	12

[a] Total *n* for each group is 94. However, due to missing data at the index assessment, the *n* for each outcome measure for each group ranged from 89 to 93.

[b] Mothers were the sole or joint informant for 85% of Achenbach CBCLs for adolescents with poor single word reading and for 90% of CBCLs for adolescents with typical reading.

In Table IV, the results of reading status on the self-report outcome variables after controlling for age, gender, race/ethnicity, and SES are presented. As can be seen, self-reported depression, anxiety, somatic complaints, and inattention scores were higher for participants with poor single word reading than for participants with typical reading ability. There also was a trend for more delinquent behaviors to be reported by adolescents with poor reading than by adolescents with typical reading ability. In terms of the effects of covariates in these models, all of the self-report scores with the exception of delinquent behaviors decreased over time; depression, anxiety, and somatic complaint scores were higher for adolescent females than adolescent males; and, depression scores were higher for minority than for white, non-Hispanic participants ($p < .05$).

The effects of reading status on parent-reported outcome variables after controlling for demographic variables also are presented in Table IV. Somatic complaints, delinquent behaviors, and inattention were higher for the adolescents with poor single word reading ability than for adolescents with typical reading ability. As for the effects of covariates, parent-reported somatic complaints and anxiety/depression also were more severe among adolescent girls than boys, and parent-reported aggressive behaviors decreased as youth got older ($p < .05$)

Table IV. Effects of Reading Status on Emotional and Behavioral Indices in Multivariate Models

Variable	*b*	*SE*	*p*	95%	CI
Controlling for Demographic Variables Only					
BDI	.47	.14	.001	.19	.74
STAI Trait Anxiety	.16	.03	<.001	.10	.22
YSR somatic	.45	.11	<.001	.24	.67
YSR delinquency	.17	.10	.093	−.03	.38
YSR aggression	.12	.11	.278	−.10	.35
YSR inattention	.39	.11	<.001	.18	.61
CBCL anxiety/depression	.04	.13	.766	−.22	.29
CBCL somatic	.26	.11	.016	.05	.46
CBCL delinquency	.33	.12	.004	.10	.56
CBCL aggression	.15	.16	.364	−.17	.46
CBCL inattention	.38	.13	.003	.13	.63
Controlling for demographic variables and current ADHD					
BDI	.42	.14	.003	.14	.69
STAI Trait Anxiety	.14	.03	<.001	.08	.20
YSR somatic	.43	.11	<.001	.22	.64
YSR delinquency	.11	.10	.280	−.09	.31
YSR aggression	.07	.11	.533	−.15	.29
YSR inattention	.35	.11	.001	.14	.56
CBCL anxiety/depression	.01	.13	.947	−.25	.27
CBCL somatic	.20	.11	.055	−.06	.41
CBCL delinquency	.27	.12	.022	.04	.49
CBCL aggression	.05	.16	.771	−.26	.35
CBCL inattention	.26	.12	.035	.02	.50
Controlling for demographic variables and lifetime ADHD					
BDI	.47	.14	.001	.19	.75
STAI Trait Anxiety	.15	.03	<.001	.09	.21
YSR somatic	.46	.11	<.001	.24	.68
YSR delinquency	.16	.11	.142	−.05	.37
YSR aggression	.14	.12	.226	−.09	.37
YSR inattention	.35	.11	.002	.13	.56
CBCL anxiety/depression	.01	.13	.922	−.25	.28
CBCL somatic	.23	.11	.038	.01	.44
CBCL delinquency	.29	.12	.017	.05	.52
CBCL aggression	.10	.17	.534	−.22	.43
CBCL inattention	.28	.13	.033	.02	.54

Examination of Whether the Effects of Reading are Attributable to ADHD

To examine whether any differences in self-reported or parent-reported outcomes as assessed with questionnaires were attributable to comorbid ADHD, current ADHD was entered as a covariate in multivariate models. Youth with poor single word reading and with typical reading ability differed in rates of current ADHD (17 of 94 of adolescents with poor reading versus 6 of 94 of adolescents with typical reading ability at index psychiatric assessment). As can be seen in Table IV, after considering the presence of current ADHD, reading status was still related to self-reported depression, trait anxiety, somatic complaints, and inattention. Reading status also was still related to parent-reported somatic complaints, delinquency, and inattention after controlling for current ADHD. As a covariate in the same model with demographic variables and reading status, current ADHD was a significant covariate of self-report anxiety, somatic complaints, and inattention scores, and parent-reported somatic complaints, delinquent behaviors, and inattention scores ($p < .05$).

Lifetime history of ADHD also was examined as a covariate in multivariate models. Adolescents with poor single word reading and with typical reading differed in overall rates of lifetime history of ADHD (27 of 94 for adolescents with poor reading ability versus 10 of 94 for adolescents with typical reading ability; Fisher Exact test, $p = .003$). The results of reading status on the outcomes, after considering the presence of lifetime ADHD, are presented in last panel of Table IV. In the multivariate model with lifetime history of ADHD, reading status was still significantly related to self-reported depression, anxiety, somatic complaints, and inattention scores. Reading status also was still related to parent-reported somatic complaints, delinquent behaviors, and inattention scores. As for the covariates in these models, lifetime history of

ADHD remained a significant covariate of parent-reported attention scores ($p = .003$) after considering the effects of demographic variables and reading status.

Examination of Adolescents with Comorbid ADHD and Poor Single Word Reading

The main effects models described earlier provided information about whether the effects of reading status on outcomes were attributable to the presence of comorbid ADHD. However, the main effects models do not provide information about whether emotional or behavioral difficulties were primarily apparent among youth with both poor reading and comorbid ADHD. To explore this latter possibility, the interaction terms between ADHD (current and lifetime ADHD in separate models) and reading status were examined in multivariate models containing ADHD, reading status, and demographic variables. In modeling parent- and child-reported outcomes, the current ADHD by reading status interactions were not significant ($p > .10$). The lifetime ADHD by reading status interaction was significant only as a predictor of parent-reported delinquency scores ($b = -.64$, $SE = .31$, $p = .042$). Follow-up analyses revealed that reading status was a predictor of parent-reported delinquency scores only in the absence of lifetime ADHD.

Examination of Differential Change Over Time and Gender Differences in Outcomes

A set of models was conducted to examine whether these patterns of relationships changed significantly over time (e.g., whether or not there was an increase or decrease in symptoms as adolescents got older) or whether these patterns differed by gender. These models were run separately with current ADHD entered as a covariate. For each of the measures of emotional and behavioral difficulties except inattention, the interactions between age and reading status were not statistically significant ($p > .10$), reflecting no developmental trends in the patterns of symptoms over time. For self-reported inattention, there was a significant age by reading status interaction ($b = .13$, $SE = .05$, $p = .013$). Namely, youth with poor single word reading ability reported a slower rate of decline in attention difficulties as they grew older than youth with typical reading. In all cases, the interactions between gender and reading status were not significant, indicating that no differences associated with reading status were primarily attributable to or evident among either males or females.

DISCUSSION

The findings of this longitudinal study highlight the greater internalizing behaviors, externalizing behaviors, and inattention among youth with poor reading ability relative to their peers with typical reading ability during the period of mid- to late adolescence. As such, these findings complement and extend previous findings of the emotional and behavioral correlates of mostly younger youth with reading and learning problems, and shed light on an important developmental period. Mid- to late adolescence may be particularly stressful for many adolescents with poor reading, as they deal with the continuing frustration of school demands requiring reading, and ponder a more limited range of choices following secondary school. Not all youth with poor reading during mid- to late adolescence experience problems, but these results underscore the need for identification and intervention with youth experiencing difficulties.

The findings regarding internalizing symptoms were consistent with our hypotheses that youth with poor reading would report higher rates of both depression and anxiety than those with typical reading. No differences in anxiety and depression among poor and typical reading adolescents were described by parents, but adults are not always aware of their children's internalizing symptoms and often report fewer such symptoms than the youth themselves (Kashani et al., 1985). Our findings are consistent with those of cross-sectional studies that have documented higher self-reported rates of anxiety and depression among RD youth (Willcutt & Pennington, 2000b) as compared to those without such disabilities. Willcutt and Pennington (2000b) found no parent-reported differences in anxiety/depression for boys, but did find that girls with RD were described as having more anxiety/depression than girls without reading problems. The findings regarding greater somatic complaints among youth with reading problems also replicates findings with younger children (Willcutt & Pennington, 2000b). Somatic complaints may be related to other internalizing problems such as the increased anxiety, or may be related to the stress of academic work experienced by poor readers (Willcutt & Pennington, 2000b). The association between poor reading and internalizing symptoms was not mediated by comorbid ADHD in the current study, similar to the findings regarding depression described by Willcutt and Pennington (2000b) for girls. Hence, poor reading during mid- to late adolescence appears to be associated with increased risk for internalizing behaviors, and such risk does not appear to be simply artifactual (i.e., associated with the other psychiatric disorders such as ADHD that are comorbid with reading disability more often than expected by chance).

The fact that many internalizing symptoms are not recognized by parents underscores the need for school-based efforts to identify and intervene with youth experiencing such problems.

Parents of youth with poor reading reported higher rates of delinquent behaviors than did parents of typical reading youth; there was a trend for youth with poor reading to also report higher levels of delinquent behaviors relative to typical reading youth. There were no differences in aggression, however, according to either parents or youth reports. These findings dovetail with other reports of concurrent and subsequent delinquent or antisocial behavior problems among some youth identified as having reading or language impairments (Beitchman et al., 2001; Maughan et al., 1996; Willcutt & Pennington, 2000b). Based on findings from at least two studies (Maughan et al., 1996; Willcutt & Pennington, 2000b), there have been suggestions that the relationship between reading problems and externalizing behaviors may be mediated by ADHD. Inconsistencies across studies raise questions about the role of ADHD in the behavioral problems of poor reading youth across different samples or in different settings. The findings from the current study of course should not be interpreted as meaning that ADHD does not affect academic skills or school functioning. Indeed, there is some evidence that ADHD is associated with as many problems as reading disabilities (Wood & Felton, 1994). Rather, these results suggest that behavioral and emotional problems experienced by poor and typical reading youth in this sample do not appear to be explained by the ADHD diagnosis. In this regard, it is notable that some researchers have suggested that ADHD and poor reading are unique problems that often co-occur but have different developmental paths (Pisecco, Baker, Silva, & Brooke, 2001). Although we did not find evidence that the difficulties associated with poor reading in this study were attributable to ADHD, it is still possible that ADHD affects the long-term prognosis and adult outcomes of youth with poor reading ability.

Externalizing problems are often more easily observed by parents than internalizing symptoms because they are disruptive and intrusive to their environment. For poor reading youth, who appear to be engaging in delinquent behavior, thorough assessment and appropriate intervention for the specific behaviors are important. Cornwall and Bawden (1992) have suggested that treatment of reading problems may not be sufficient to reduce externalizing problems, but it remains an empirical question whether successful remediation of reading problems is associated with significant reduction in risk for behavioral and emotional difficulties.

Even after accounting for the presence of lifetime or current ADHD, youth with significant reading problems had more difficulties with attention, and greater persistence of attention problems over time than their peers without reading problems. These findings highlight the fact that attention problems characterize a greater proportion of adolescents with poor reading than simply those youth meeting formal criteria for an ADHD diagnosis. They also complement laboratory findings that indicate that children with ADHD and learning problems both have attention problems, albeit different patterns of attention difficulties (Tarnowski et al., 1986). Although it is unclear why some youth with reading problems might manifest attentional deficits, the combination of reading problems and attentional problems may make it especially difficult for some to succeed in academic and vocational arenas.

Our analyses also revealed that differences between poor and typical readers in terms of behavioral and emotional problems were generally not related to sociodemographic factors (age, gender, race, or SES). There were some decreases in youth-reported depression, anxiety, somatic complaints, and inattention, and both parent- and youth-reported aggression over time. However, only in the case of self-reported attention did these developmental differences vary as a function of reading status, with attention problems decreasing more rapidly over time for typical than poor readers. Thus, the differences between poor and typical readers in emotional, behavioral, and attention problems do not appear to dissipate over time during mid- to late adolescence. This finding may suggest that the problems reported by these youth and their caregivers continued to persist as they approach adulthood despite whatever efforts at intervention might have taken place.

We also did not find that differences between poor and typical readers in behavioral and emotional problems, whether reported by the adolescents themselves or by parents, varied by gender. In a sample that was on average younger than the current sample, Willcutt and Pennington (2000b) found significant gender differences with RD girls, but not RD boys evidencing higher rates of internalizing problems, and RD boys evidencing more aggressive behavior. In a longitudinal study, Maughan et al. (1996) found in contrast that girls but not boys with IQ-discrepant reading problems evidenced greater externalizing behaviors than youth without reading problems. Findings regarding patterns of gender differences (or lack thereof) associated with reading or learning disabilities have been inconsistent in other studies as well (e.g., Svetaz et al., 2000; Casey et al., 1992). The issue of possible gender differences in behavioral or emotional problems

associated with poor reading at different developmental periods and/or across time is important for understanding different developmental trajectories, needs, and outcomes of youth, and is deserving of further careful delineation and clarification. Gender differences in behavior and emotional problems may be reflective of different ways of coping or different expressions of frustration by boys and girls with poor reading at various stages of development.

The differences between adolescents with poor and typical reading ability underscore the need for identification of youth experiencing such difficulties, and intervention to help them navigate this, sometimes difficult, developmental transition period. Although clearly not all youth with poor reading have diagnosable psychiatric or behavioral difficulties, Angold, Costello, Farmer, Burns, and Erkanli (1999) have found that even symptoms not meeting threshold for psychiatric diagnoses may be associated with significant functional impairment or burden. To the degree that emotional and behavioral problems can further interfere with academic success, interventions focused on improving the psychosocial well-being of youth with reading problems during this transition period may not only improve emotional well-being, but may also increase chances of success in school. The interrelationship between poor reading and emotional and behavioral difficulties found in this study also underscores the possibility that among youth who present with psychiatric problems, clinicians should be alert to the possibility of unsuspected language impairments (Cohen, Davine, Horodezky, Lipsettm, & Isaacson, 1993).

In this study, we aimed to fill the gap in the existing research on severity of emotional and behavioral problems among poor readers as compared to typical reading youth. In contrast to many other studies, our sample included comparable numbers of males and females rather than primarily males and included approximately 50% minority adolescents. On one level, this limits the comparability of the current findings to previous studies; however, it also allowed us to demonstrate that the emotional and behavioral correlates of poor reading ability were evidenced in both genders, and across different ethnic and racial groups. This study also included youth screened from public schools as opposed to youth selected from clinical settings. To understand the prognosis of poor reading youth, Maughan (1995) has noted that we need studies with representative samples of youth who are selected through screenings of entire schools. Our design also accounted for changes in functioning over a period of time that has not been widely studied and included multiple data collection points.

Despite the contributions of this study, several limitations must be noted. In this study, youth were ascertained based on their single word reading ability, and we did not assess changes in reading-related abilities over the course of the study. Despite the fact that single word reading is the common outcome of a number of reading-related processes, it is possible that youth selected on other reading-related bases may have different outcomes. It also is unclear from this study how changes in reading over time may be related to changes in severity of behavioral and emotional problems. In addition, although we attempted to match samples on gender, race and ethnicity, and the proportion of adolescents with poor and with typical reading from each school, this study did not utilize population-based probability sampling strategies. The findings therefore may not be generalizable to other samples. In this study, we began following youth when they were in middle adolescence. Hence, we have limited information about the lifetime trajectories or the precedence of reading problems and emotional and behavioral problems. Although we were interested in examining whether differences as a function of reading status were attributable to ADHD, the study was limited by the fact that the number of youth with ADHD, particularly in the typical reading group, was not large. Lastly, it is probable that differences in the severity of behavioral and emotional problems of poor and typical reading youth are affected by a host of risk and protective factors not examined in this research. For example, among LD youth, others have documented the protective influence of religious identity and family connectedness for this population (Svetaz et al., 2000).

In summary, our results suggest that youth with poor reading ability experience greater emotional and behavioral symptoms relative to their typical reading peers. Given these findings, it is important that school staff and other health professionals screen youth with poor reading for problems, such as anxiety and depression, which may not always be obvious to the observer. This is particularly important, given that there is typically little emphasis on affective problems in LD programs (Rodriguez & Routh, 1989). In addition, it is possible that behavioral and emotional problems may manifest themselves differently among this population. For example, the dimensions of anxiety for LD children may be different than for children without such difficulties (Paget & Reynolds, 1984). For children who read poorly, anxiety may be related to school performance, such as reading in public or completion of other reading-related tasks.

Given the long-term problems potentially associated with poor reading, it is important that these youth are given the opportunity to address their difficulties and problems in order to maximize the likelihood of success later in life. Without appropriate assessment and intervention when indicated, it is likely that the youth, particularly those with internalizing symptoms that are not as easily observable

as externalizing behaviors, will not receive needed services. Little is known about the effectiveness of specific interventions for youth with both poor reading and other behavioral and emotional problems, but future research must examine this issue to better understand what methods of intervention work best with this group of youth.

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