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ARTICLE

The Impact of Early Behavior Disturbances on Academic Achievement in High School

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What's Known on This Subject

Attention problems, but neither internalizing nor externalizing behaviors, at school entry predict low academic achievement at the end of primary school. Low academic achievement has negative consequences for social functioning and health across the life span.

What This Study Adds

Associations between school entry, psychiatric disturbances, and academic achievement in primary school persist through the end of high school. Studies should be performed to examine the impact of interventions to improve academic performance among students with attention problems.

ABSTRACT

BACKGROUND. Previous research has indicated that childhood behavioral disturbances predict lower scores on academic tests and curtail educational attainment. It is unknown which types of childhood behavioral problems are most likely to predict these outcomes.

METHODS. An ethnically diverse cohort was assessed at 6 years of age for behavioral problems and IQ and at 17 years of age for academic achievement in math and reading. Of the original cohort of 823 children, 693 (84%) had complete data. Multiple regressions were used to estimate associations of attention and internalizing and externalizing problems at age 6 and with math and reading achievement at age 17, adjusting for IQ and indicators of family socioeconomic status.

RESULTS. Adjusting for IQ, inner-city community, and maternal education and marital status, teacher ratings of attention, internalizing behavior, and externalizing problems at age 6 significantly predict math and reading achievement at age 17. When types of problems are examined simultaneously, attention problems predict math and reading achievement with little attenuation, whereas the influence of externalizing and internalizing problems is materially reduced and not significant.

CONCLUSIONS. Interventions that target attention problems at school entry should be tested as a potential avenue for improving educational achievement. *Pediatrics* 2009; 123:1472–1476

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Key Words
childhood behavior problems, academic achievement, attention, internalizing behavior, externalizing behavior

Abbreviations
CBCL—Childhood Behavior Checklist
TRF—Teacher Rating Form
WJ-R—Woodcock-Johnson Psycho-Educational Battery-Revised
FSIQ—full-scale IQ
ADHD—attention-deficit/hyperactivity disorder

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Low educational achievement may be both a consequence of poor health in childhood and a cause of poor health in adulthood.[1,2] Health interventions that can improve educational attainment may thus have positive health impacts across the life span.[3] However, little is known about the specific health conditions that predict educational achievement. Evidence from epidemiologic studies suggests that a broad range of psychiatric disorders predict early termination of education.[4,5] For instance, in a recent nationally representative survey, 14 of 17 early onset psychiatric disorders examined were associated with lower probability of completing primary and secondary school, entering college, or completing a 4-year college degree.[6] These associations remained significant after accounting for the impact of parental psychiatric disorders, childhood adversities, and family socioeconomic status on educational attainment. The association between early onset psychiatric disorders and educational attainment, that is, the highest educational qualification completed, may emerge through a variety of developmental pathways. Identifying these pathways is important for mental health interventions that aim to reduce the negative consequences of psychiatric disorders across the life span.

A major pathway that connects early psychiatric disturbances with subsequent curtailment of educational attainment is through children's progress in learning as manifested in academic performance, that is, how well children perform on tests of basic academic skills.[7] Research suggests that poor academic performance in high school predicts lower probability of completing high school, as well as other negative outcomes, including violence, early pregnancy, and substance use.[8–10] Evidence from longitudinal studies, most recently the Monitoring the Future Study, which followed a large cohort of middle school students into early adulthood, suggests that poor academic performance precedes the initiation of substance use and delinquent behavior.[8] Poor performance in school may

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signal to children and their families a reduced potential for success in academic pursuits, lower motivation to achieve academically or remain in school, and fuel interest in proscribed alternatives, including delinquency and substance use.

Successful academic performance results in part from developmental processes that begin in early childhood. In a recent analysis of 6 large-scale longitudinal studies, Duncan et al[11] examined whether behavioral assessments, including assessments for attention problems, internalizing behaviors (ie, emotional problems, primarily anxious-depressive symptoms), and externalizing behaviors (ie, aggressive and/or disruptive behavior), conducted at school entry (ages 5–6), predict school performance at the end of primary school (ages 11–12), after accounting for academic ability (ie, school readiness or IQ) and family socioeconomic status. The 6 studies consistently found that, among the early childhood behavior assessments, attention problems predicted academic achievement at the end of primary school, whereas emotional problems and disruptive behavior (subsumed under internalizing and externalizing behaviors) did not. These findings strongly suggest that attention problems (problems characteristic of ADHD) detected at school entry signal a risk for low future school performance, relative to expectation on the basis of cognitive potential. The implications of these results are limited by the fact that the data come from studies that followed children only for 5 years, to the end of primary school. The long-term impact of mental health problems detected at the start of schooling remains to be documented. It is not known whether attention problems at the start of schooling predict performance beyond the first few years of school.

The goal of this study was to address this gap in knowledge. Does the adverse influence of attention problems persist through the entire period of school attendance, up to the end of high school? We examined the contributions of attention and internalizing and externalizing problems at school entry to academic achievement at the end of high school (ages 17–18) in a longitudinally followed, ethnically and socioeconomically diverse sample. Assessments of behavior problems at school entry were based on teacher ratings, using a standardized and empirically supported measure, the Teacher Rating Form (TRF). Academic achievement at age 17 was assessed by using the Woodcock-Johnson Psycho-Educational Battery-Revised (WJ-R), a standardized academic achievement test that assesses math and reading achievement independent of teacher assessments conveyed in grades or school evaluations. The contribution of early behavior problems to later academic achievement was evaluated taking into account children's early cognitive abilities, as measured by IQ tests. In addition, we tested whether attention problems at age 6 uniquely predicted achievement in math and reading at age 17, when its correlation with other behavioral problems was taken into account.

METHODS

Data came from a Detroit-area longitudinal study of low birth weight and normal birth weight children followed from age 6 through age 17. Full descriptions of the study are provided elsewhere[12] and briefly summarized here. Random samples of children born with low and normal birth weights between 1983 and 1985 were drawn from the birth records of 2 large hospitals, 1 urban and 1 suburban. Children with severe neurologic impairment, mental retardation, or blindness were excluded. Children were initially assessed as they passed their sixth birthday, in 1990–1992. Of the 1095 children selected, 823 (75%) participated in the initial assessment.

Follow-up assessments were conducted when the children reached ages 11 and 17. In this analysis, we used information from the initial assessment at age 6 and the final assessment at age 17. Assessments at age 17 were conducted on 713 children, 86.6% of the original sample. Full data from ages 6 and 17 were available for 693 children, 84.2% of the original sample.

Initial assessments at age 6 included the Wechsler Intelligence Scale for Children-Revised[13] and the TRF[14] rated by teachers. The Wechsler Intelligence Scale for Children-Revised is age-standardized and has a mean of 100 and a SD of 15 in the general population. Children were assessed individually under the same standardized laboratory conditions. Psychometricians were trained to a uniform standard, and all test files were scored by 2 independent testers. Full-scale IQ (FSIQ) was used in this analysis to measure cognitive ability at age 6. In this analysis, we focused on 3 behavior problem scales from the TRF, the attention problems subscale and the internalizing and externalizing behavior composite scales. The attention subscale has 20 items, which include the cardinal symptoms of attention-deficit/hyperactivity disorder (ADHD) (eg, fails to finish things he or she starts, can't concentrate or pay attention for long, can't sit still, fails to carry out assigned tasks). The internalizing scale is the sum of 3 subscales: withdrawn, somatic complaints, and anxious/depressed. The externalizing scale is the sum of 2 subscales: delinquent and aggressive. *T* scores on the basis of age and gender distributions of normative samples were used. Methodologic studies have found excellent test-retest reliability for the internalizing ($\rho = 0.91$), externalizing ($\rho = 0.93$), and attention ($\rho = 0.96$) scales.[14]

Academic achievement at age 17 was measured by the WJ-R.[15] Broad math achievement was assessed by the calculation and applied problems tests and basic reading was assessed by the word identification and word attack tests. The WJ-R tests are standardized to have a mean of 100 and a SD of 15 in the general population.

Associations of teacher-rated behavior problems at age 6 with math and reading achievement scores at age 17, adjusted for IQ at age 6, family factors, and study sample design were estimated by using ordinary least squares multiple regression analysis. All regression models included statistical controls for IQ at age 6, family factors, and the study sampling design. The family factors were maternal education (< high school, high

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TABLE 1 Characteristics of the Initial Sample at Age 6 and the 17-Year-Old Follow-up Sample

	Initial Sample ($N = 823$), %	Age 17 ($N = 713$), %	Total Attrition ($N = 130$), %[a]	Sample Used in Regression ($N = 693$), %
Urban	49.8	48.9	45.00	50.7
Low birth weight	57.5	56.8	61.76	56.7
Education of mother				
<High school	16.9	15.6	24.36	15.5
High school	27.4	26.8	30.07	26.9
Some college	37.3	38.0	33.57	38.0
College	18.3	19.6	11.37	19.6
Single mother	32.9	31.7	38.23	31.9
Male	48.6	47.1	55.53	47.3
Black	42.9	44.3	36.50	44.1

[a] Includes all respondents in the original sample who were not included in the analysis sample because of loss to follow-up or missing data on study variables.

TABLE 3 Regressions of WJ-R Math and Reading Scores on TRF Subscales at Age 6

Model	Subscale	Math Achievement		Reading Achievement	
		Standardized Coefficient	*P*	Standardized Coefficient	*P*
1	Attention	−0.12	<.001	−0.10	.002
	FSIQ	0.55	<.001	0.48	<.001
2	Externalizing	−0.09	<.001	−0.06	.063
	FSIQ	0.58	<.001	0.51	<.001
3	Internalizing	−0.07	.009	−0.07	.018
	FSIQ	0.59	<.001	0.51	<.001
4	Attention	−0.09	.013	−0.10	.012
	Externalizing	−0.05	.153	−0.01	.966
	FSIQ	0.55	<.001	0.48	<.001
5	Attention	−0.10	.001	−0.09	.021
	Internalizing	−0.02	.389	−0.04	.290
	FSIQ	0.55	<.001	0.48	<.001

All regressions were adjusted for low birth weight, urban versus suburban residence, maternal education, and mother's marital status at birth.

school graduate, some college, college graduate) and maternal marital status at the time of the child's birth (single versus married). The study design variables were low versus normal birth weight and urban versus suburban sample. The urban subsample was an inner-city community and mostly black (80.4%); the suburban subsample was middle-class and mostly white (94.9%).

Five regression models are presented for each of the 2 outcomes, math and reading achievement at age 17. Coefficients for IQ at age 6 and the childhood behavior problem scales, adjusted for the main effects of the other covariates listed above, are presented for each model. In models 1 to 3, each of the behavior problem scales were examined individually. In models 4 and 5, 2 behavior problem scales were examined simultaneously: (1) attention plus externalizing and (2) attention plus internalizing.

RESULTS

Complete data from assessments at ages 6 and 17 was available for analysis on 693 of the original 823 (84%) subjects (Table 1). Attrition from the sample because of loss to follow-up or missing data on study variables was more common among people with lower maternal education, those born to single mothers, males, and black subjects. Because of the low absolute level of attrition, the analysis sample remained representative of the entire age-17 sample ($N = 713$) and the initial age-6 sample ($N = 823$).

Table 2 shows the zero-order Pearson correlations among the key variables. As expected, the 3 TRF behavior scales (attention, internalizing, and externalizing) were substantially correlated with each other, ranging from 0.37 between internalizing and externalizing to 0.62 between attention and externalizing. The FSIQ was correlated modestly with the internalizing (−0.20) and externalizing (−0.28) scales and moderately (−0.44) with the attention scale.

TABLE 2 Correlations Between TRF CBCL Subscales and FSIQ at Age 6

	Internal	External	Attention
Internal	1		
External	0.37	1	
Attention	0.49	0.62	1
FSIQ	−0.20	−0.28	−0.44

[a] Shown are Pearson correlation coefficients.

In preliminary analyses, we regressed WJ-R math and reading achievement scores at age 17 on each TRF behavior problem rating scale, adjusting only for sample design variables. Math and reading achievement scores were significantly (all P values $< .001$) associated with attention (standardized β: −.34 and −.31, respectively), externalizing (standardized β: −.21 and −.17, respectively), and internalizing (standardized β: −.15 and −.14, respectively) scales.

Table 3 presents standardized regression coefficients from a sequence of ordinary least squares regressions of WJ-R math and reading achievement scores at age 17 on the 3 TRF behavior problems scales and FSIQ at age 6, adjusted for gender, maternal education, maternal marital status at time of birth, and the 2 design variables. In the first 3 models, each of the 3 TRF scales (attention, externalizing, internalizing) was examined separately from the other 2 scales. The results show that each of the behavioral problem areas was significantly associated with the math and reading achievement tests, with 1 marginal exception (the P value for the coefficient relating externalizing behavior with reading achievement was .06). The standardized coefficients for the TRF scales in the first 3 models, adjusted for IQ, maternal education, and marital status, were attenuated compared with the unadjusted associations noted above, ranging from 0.06 to 0.12. The standardized coefficients for attention problems were larger than those for externalizing and internalizing problems.

Models 4 and 5 examined whether the associations of internalizing or externalizing behavior problems with math and reading achievement were sustained, after statistical control for attention problems. For both math

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and reading, the standardized coefficients for internalizing behavior problems (model 4) and for externalizing behavior problems (model 5) were reduced by one-half or more and were uniformly not statistically significant. In contrast, the standardized coefficients for attention problems remained statistically significant, when either internalizing problems or externalizing problems were controlled statistically.

In all 5 models, the standardized coefficients for IQ were statistically significant and in a narrow range, between 0.55 and 0.59 for math achievement and 0.48 and 0.51 for reading achievement. Maternal education was significantly associated with both math and reading achievement in all the models, and maternal marital status was significantly associated with math (but not reading) achievement in models 1 and 2 only (data not shown).

A number of supplementary analyses were conducted to assess whether the results were sensitive to the model specification. First, the sequence of models was repeated by using dichotomous indicators for TRF scores above standard cut points indicative of clinically significant disturbance.[16] The pattern of results in the models with dichotomous indicators was identical to that reported above for the continuous indicators.

Second, models were estimated with attention entered as a continuous measure and each of the other TRF scales entered as a dichotomous indicator, by using the established cutoffs for clinically significant disturbance. This model was specified to test whether extreme values of internalizing or externalizing behavior were predictive of achievement over and above the continuous attention score. Neither of the dichotomous indicators was significantly associated with achievement in any of the models containing the continuous attention scale.

Third, the analyses were repeated by using parent ratings on the parallel assessment instrument administered to parents, the Child Behavior Checklist (CBCL) at age 6, rather than the teacher ratings. The associations of the 3 CBCL scales (attention, internalizing, externalizing) with math and reading achievement tests were slightly weaker than those reported above between the corresponding TRF scales and achievement, but the pattern of associations across the 5 models was the same.

DISCUSSION

This prospective study offers the opportunity to examine potential long-term consequences of attention problems, internalizing behaviors, and externalizing behaviors at school-entry for academic achievement at the end of high school. Additional strengths of the study include the diverse sample, the use of independently administered standardized tests as measures of academic achievement rather than teacher grades and evaluations, and the inclusion of assessments of IQ at school entry. When the influence of IQ was statistically controlled (together with other covariates listed above) and the 3 behavioral assessments were examined separately, each significantly inversely predicted academic achievement at age 17. However, correlations among the 3 behavioral assessments must be taken into account. When examined simultaneously, only attention problems significantly predicted academic achievement at age 17. This finding adds to a growing body of evidence supporting the conclusion that among a variety of childhood behavior problems, attention problems are the principal predictor of diminished achievement relative to expectations on the basis of a child's cognitive ability. This finding also strengthens the suggestion that the association between early onset psychiatric disorders and diminished educational attainment at the high school level originates in part in early childhood.

Our findings extend those reported by Duncan et al[11] in their analysis of data from 6 longitudinal studies that assessed behaviors at school entry and academic achievement at the end of primary school. In that study, attention problems but neither internalizing nor externalizing behaviors at school entry were associated with later academic achievement. Our findings suggest that the pattern of association between these domains of behavior and academic achievement remain stable through to the end of high school. These findings raise 2 complementary questions: why do attention problems at school entry predict poor school performance after controlling for IQ, and why are internalizing and externalizing behaviors at school entry unrelated to academic achievement after control for IQ and attention problems?

Attention problems are likely to negatively influence children's academic achievement beginning in the early grades, and these early direct effects may be compounded by the added indirect consequences of poor academic performance as they advance to the higher curricular demands of the later grades. Students who have difficulties focusing on classroom activities or completing homework assignments because of their attention problems are likely to be less efficient learners compared with their similarly able classmates without attention problems.[17] Inefficient learning in the early grades may limit students' ability to acquire basic skills that are necessary for developing higher level math and reading skills. Consequent poor performance may reduce teachers' expectations as well as those of students and their families. Ultimately, students who do poorly may lose motivation to invest effort in academic work and become more open to competing interests including substance use and more likely to drop out of school.

A limitation of this study with respect to the analysis of attention problems is the use of the TRF attention scale rather than a structured diagnostic interview that would provide psychiatric diagnoses according to the *Diagnostic and Statistical Manual of Mental Disorders* criteria. Previous studies have found that the association between attention problems and academic achievement is not limited to the extremes of attention scores.[18] In addition, the use of empirically based disturbance constructs is warranted given the current lack of definitive diagnostic assessment procedures.[19]

Equally of interest is the finding that after accounting for IQ and attention problems, there is no association between internalizing and externalizing behaviors and later academic achievement.[20,21] This finding is in apparent contradiction with reports that some early internalizing (anxiety and mood) disorders and externalizing disorders other

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than ADHD, including conduct disorder and substance use disorders, are associated with poor school performance and higher risk for dropping out of the high school.[6] This apparent contradiction cannot be resolved in this study, but 2 potential explanations may be considered.

First, many psychiatric disorders are characterized by symptoms that are similar to attention problems. For instance, concentration problems and difficulties making decisions are symptoms of depressive disorders that involve difficulties in attention. The association of other disorders with poor academic performance and dropout may be caused by the attention-related components of those disorders. Second, it may be the case that the associations of disorders with poor academic achievement and dropout are explained by the causal effects of previous attention problems. This would be the case, for instance, if substance use disorders are caused by poor academic performance, as has been suggested.[8]

Converging evidence regarding the importance of early childhood attention problems in predicting later school performance suggests that these problems should be a focus of concern across the multiple disciplines that address child health. At present, there is no consensus among pediatricians, child psychiatrists, and educators regarding the appropriate thresholds of attention problems that warrant expenditure of scarce resources and risk of negative consequences associated with clinical interventions. Nonclinical education or skill-based interventions may be most appropriate for the majority of children with attention problems, particularly because these interventions more directly address attention problems in the school settings where their impact is most consequential.[22]

Achieving consensus on evidence-based indications for educational and clinical services for children with attention problems will require multidisciplinary translational research. On the one hand, research is needed to build intervention strategies that bridge the gap between clinical assessments and learning behaviors that can be targeted through educational interventions in schools. On the other hand, clinical practice should also be informed by neuroscience research on attention, behavior regulation, and hyperactivity that may help tailor interventions to match an individual child's learning difficulties.

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