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

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Abstract

Background—Previous research has documented 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 age 6 for behavioral problems and IQ, and at age 17 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, internalizing and externalizing problems at age 6 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, while the influence of externalizing and internalizing problems is materially reduced and not significant. Standardized coefficients representing the adjusted associations of attention problems and IQ at age 6 with achievement scores at age 17 were -0.12 ($p < .001$) and 0.55 ($p < .001$) respectively for math and -0.10 ($p = .002$) and 0.48 ($p < .001$) respectively for reading.

Conclusion—Interventions targeting attention problems at school entry should be tested as a potential avenue for improving educational achievement.

Keywords

Childhood Behavior Problems; Academic Achievement; Attention; Internalizing Behavior; Externalizing Behavior

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 lifespan³. However, little is known about the specific health conditions that predict educational achievement. Evidence from

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epidemiological 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 out of 17 early-onset psychiatric disorders examined were associated with lower probability of completing primary and secondary school, entering college, or completing a four year college degree⁶. 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 lifespan.

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 skills⁷. 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 behavior⁸. Poor performance in school may 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 six large-scale longitudinal studies, Duncan et al examined whether behavioral assessments, including attention problems, internalizing behaviors (i.e. emotional problems, primarily anxious-depressive symptoms) and externalizing behaviors (i.e. aggressive and/or disruptive behavior), conducted at school entry (age 5–6), predict school performance at the end of primary school (age 11–12), after accounting for academic ability (i.e. school readiness or IQ) and family socioeconomic status¹¹. The six 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 based on 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 is 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 examine the contributions of attention, internalizing and externalizing problems at school entry to academic achievement at the end of high school (age 17–18) in a longitudinally followed ethnically and socioeconomically diverse sample. Assessments of behavior problems at school entry are based on teacher ratings, using a standardized and empirically supported measure, the Teacher Rating Form (TRF). Academic achievement at age 17 was assessed using the Woodcock-Johnson Educational Battery, a standardized academic achievement test, which 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 is evaluated taking into account children's early cognitive abilities, as measured by IQ tests. Additionally, we test whether attention problems at age 6 *uniquely* predict achievement in math and reading at age 17, when its correlation with other behavioral problems is taken into account.

METHODS

Data come 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 elsewhere¹² and briefly summarized here. Random samples of children born with low and normal birth weights in 1983–85 were drawn from the birth records of two large hospitals, one urban and one suburban. Children with severe neurological impairment, mental retardation or blindness were excluded. Children were initially assessed as they passed their sixth birthday, in 1990–92. Of the 1095 children selected, 823 (75%) participated in the initial assessment.

Follow-up assessments were conducted when the children reached age 11 and age 17. In this analysis we use 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 are available for 693 children, 84.2% of the original sample.

Initial assessments at age 6 included the Wechsler Intelligence Scale for Children-Revised (WISC-R)¹³ and the Teacher Report Form (TRF)¹⁴ rated by teachers. The WISC-R is age-standardized and has a mean of 100 and standard deviation 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 two independent testers. Full scale IQ (FSIQ) is used in this analysis to measure cognitive ability at age 6. We focus in this analysis on three behavior problems 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) (e.g. fails to finish things he/she starts; can't concentrate, pay attention for long; can't sit still; fails to carry out assigned tasks). The internalizing scale is the sum of three subscales: withdrawn, somatic complaints, and anxious/depressed. The externalizing scale is the sum of two subscales: delinquent and aggressive. *T* scores based on age and sex distributions of normative samples were used. Methodological studies have found excellent test-retest reliability for the internalizing ($p=0.91$), externalizing ($p=0.93$) and attention ($p=0.96$) scales¹⁴.

Academic achievement at age 17 was measured by the Woodcock-Johnson Psycho-Educational Battery-Revised (WJ-R)¹⁵. Broad Math achievement is assessed by the Calculation and Applied Problems tests and basic reading is assessed by the Word Identification and Word Attack tests. The WJ-R tests are standardized to have a mean of 100 and standard deviation 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 using OLS multiple regression analysis. All regression models include statistical controls for IQ at age 6, family factors, and the study sampling design. The family factors were maternal education (Less than High School, High School Graduate, Some College, College Graduate) and maternal marital status at the time of the child's birth (Single vs. Married). The study design variables were low vs. normal birth weight and urban vs. suburban sample. The urban subsample is an inner-city community and mostly Black (80.4%); the suburban subsample is middle-class and mostly White (94.9%).

The regression results are displayed in Table 3. Five models are presented for each of the two 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 1–3 each of the behavior problem scales are examined individually. In models 4 and 5 two behavior problem scales are examined simultaneously: 1) attention plus externalizing and 2) attention plus internalizing.

RESULTS

Complete data from assessments at age 6 and 17 is available for analysis on 693 of the original 823 subjects (84%) (Table 1). Attrition from the sample due to loss to follow-up or missing data on study variables is more common among people with lower maternal education, those born to single mothers, males and Blacks. Due to the low absolute level of attrition the analysis sample remains 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 three TRF behavior scales, attention, internalizing and externalizing, are substantially correlated with each other, ranging from .37 between internalizing and externalizing to .62 between attention and externalizing. FSIQ is correlated modestly (–.20, –.28) with the internalizing and externalizing scales and moderately (–.44) with the attention scale.

In preliminary analyses we regressed Woodcock-Johnson 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 = –0.34, –0.31 respectively), externalizing (standardized β = –0.21, –0.17 respectively) and internalizing (standardized β = –0.15, –0.14 respectively) scales.

Table 3 presents standardized regression coefficients from a sequence of OLS regressions of Woodcock-Johnson math and reading achievement scores at age 17 on the three TRF behavior problems scales and full scale IQ at age 6, adjusted for sex, maternal education, maternal marital status at time of birth and the two design variables. In the first three models each of the three TRF scales, attention, externalizing, internalizing, is examined separately from the other two scales. The results show that each of the behavioral problem areas is significantly associated with the math and reading achievement tests, with one marginal exception (the p-value for the coefficient relating externalizing behavior with reading achievement is 0.06). The standardized coefficients for the TRF scales in the first three models, adjusted for IQ, maternal education and marital status, are attenuated compared with the unadjusted associations noted above, ranging from 0.06 to 0.12. The standardized coefficients for attention problems are larger than those for externalizing and internalizing problems.

Models 4 and 5 examine whether the associations of internalizing or externalizing behavior problems with math and reading achievement are sustained, after statistical control for attention problems. For both math and reading, the standardized coefficients for internalizing behavior problems (Model 4) and for externalizing behavior problems (Model 5) are reduced by one half or more and are uniformly not statistically significant. In contrast, the standardized coefficients for attention problems remain statistically significant, when either internalizing problems or externalizing problems are controlled statistically.

In all five models the standardized coefficients for IQ are statistically significant and in a narrow range, between 0.55 and 0.59 for math achievement and .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 (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 using dichotomous indicators for TRF scores above standard cut-points indicative of clinically significant disturbance¹⁶. 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, using the established cut-offs for clinically significant disturbance. This model was specified in order 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 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 three 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 five 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 is statistically controlled (together with other covariates listed above) and the three behavioral assessments are examined separately, each significantly inversely predicted academic achievement at age 17. However, correlations among the three 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 based on 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 in their analysis of data from six longitudinal studies that assessed behaviors at school entry and academic achievement at the end of primary school¹¹. 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 two complementary questions. Why do attention problems at school entry predict poor school performance after controlling for IQ? 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 problems¹⁷. 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 teacher's expectations as well as those of students and their families. Ultimately, students who do poorly may lose motivation to invest effort in academic work, 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 DSM criteria. Previous studies have found that the association between attention problems and academic achievement is not limited to the extremes of attention scores¹⁸. In addition, the use of empirically based disturbance constructs is warranted, given the current lack of definitive diagnostic assessment procedures¹⁹.

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 than ADHD, including conduct disorder and substance use disorders, are associated with poor school performance and higher risk for dropping out of the high school⁶. This apparent contradiction cannot be resolved in this study, but two 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 due to 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 prior attention problems. This would be the case, for instance, if substance use disorders are caused by poor academic performance, as has been suggested⁸.

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. Non-clinical 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 consequential²².

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.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Abbreviations

CBCL, Childhood Behavior Checklist; TRF, Teacher Rating Form; FSIQ, Full Scale Intelligence Quotient; WJ-R, Woodcock-Johnson Psycho-Educational Battery-Revised; ADHD, Attention Deficit Hyperactivity Disorder.

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Table 1

Characteristics of the initial sample at age 6 and the 17 year follow-up sample

	Initial sample	Age 17	Total Attrition*	Sample used in Regression
	(n=823)	(n=713)	(n=130)	(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 %

* Includes all respondents in the original sample who were not included in the analysis sample due to loss to follow-up or missing data on study variables.

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

* Pearson correlation coefficients.

Table 3

Regressions of Woodcock-Johnson Math and Reading Scores on TRF Subscales at age 6

Model	Subscale	Math Achievement		Reading Achievement	
		Standardized Coefficient	P-Value	Standardized Coefficient	P-Value
1	Attention FSIQ	-0.12 0.55	<0.001 <0.001	-0.10 0.48	0.002 <0.001
2	Externalizing FSIQ	-0.09 0.58	<0.001 <0.001	-0.06 0.51	0.063 <0.001
3	Internalizing FSIQ	-0.07 0.59	0.009 <0.001	-0.07 0.51	0.018 <0.001
4	Attention Externalizing FSIQ	-0.09 -0.05 0.55	0.013 0.153 <0.001	-0.10 -0.01 0.48	0.012 0.966 <0.001
5	Attention Internalizing FSIQ	-0.10 -0.02 0.55	0.001 0.389 <0.001	-0.09 -0.04 0.48	0.021 0.290 <0.001

* All regressions adjust for low birth weight, urban vs suburban residence, maternal education, and mother's marital status at birth.

Slopes of Math and Reading at age 17 and attention at age 6 in 4 strata of the sample

	Math			Reading		
	Coefficient	(se)	p=	Coefficient	(se)	p=
NBW, urban	-.89	(.16)	.000	-1.29	(.21)	.000
NBW, suburban	-.95	(.22)	.000	-.25	(.20)	.200
LBW, urban	-.58	(.08)	.000	-.64	(.12)	.000
LBW, suburban	-.95	(.18)	.000	-.78	(.17)	.000

NBW= normal birth weight, LBW= normal birth weight