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The Academic Consequences of Early Childhood Problem Behaviors

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Abstract

Social/emotional skills in early childhood are associated with education, labor market, and family formation outcomes throughout the life course. One explanation for these associations is that poor social/emotional skills in early childhood interfere with the development of cognitive skills. In this paper, we use data from the Fragile Families and Child Wellbeing Study (N = 2,302) to examine how the timing of social/emotional skills—measured as internalizing, externalizing, and attention problem behaviors in early childhood—is associated with cognitive test scores in middle childhood. Results show that externalizing problems at age 3 and attention problems at age 5, as well as externalizing and attention problems at both ages 3 and 5, are associated with poor cognitive development in middle childhood, net of a wide array of control variables and prior test scores. Surprisingly, maternal engagement at age five does not mediate these associations.

Keywords

early childhood; child school achievement; Fragile Families and Child Wellbeing Study; life course

1. Introduction

Social/emotional skills—such as the ability to get along with peers and to focus on a particular task—play an important role in processes of social mobility and stratification (Bowles and Gintis 1976; Duncan and Magnuson 2011; Farkas 2003). Social/emotional skills in childhood are associated with educational attainment (Alexander, Entwisle, and Dauber 1993; Entwisle, Alexander, and Olson 2005; McLeod and Fettes 2007; McLeod and Kaiser 2004), labor market success (Duncan and Dunifon 1998; Heckman, Stixrud, and Urzua 2006), mental health (Knoester 2003), and social behaviors such as marriage, relationship quality, and delinquency (Heckman et al. 2006; Knoester 2003).

One explanation for this association is that poor social/emotional skills in childhood interfere with the development of cognitive skills in middle childhood (McLeod and Kaiser

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2004). Poor social/emotional skills may impair cognitive development directly, by interfering with children's ability to learn. Poor social/emotional skills may also impair cognitive development indirectly, by making adult-child interactions less rewarding or by lowering parents' and teachers' expectations of children's capabilities, both of which may undermine children's academic performance (Entwisle et al. 2005; McLeod and Fettes 2007; Robinson and Harris 2013). Indeed, a large literature considers the association between social/emotional skills at school entry and later achievement outcomes. Although this literature consistently shows that attention problems are inversely associated with achievement (Claessens and Dowsett 2014; Duncan et al. 2007), the evidence regarding the influence of internalizing or externalizing behaviors on achievement is more mixed, with some studies finding a positive association (DiPrete and Jennings 2012; Jennings and DiPrete 2010; Fergusson and Horwood 1998; Kokko et al. 2006) and others finding a weak or null association (Claessens, Duncan, and Engel 2009; Duncan et al. 2007). Although a life course perspective suggests that the timing of social/emotional skills may be especially important for cognitive development (e.g., Elder 1998), existing studies have rarely considered this possibility, primarily because of data limitations.

In this article, we use data from the Fragile Families and Child Wellbeing Study (FFCWB), a birth cohort study, to address three research questions: (1) Are internalizing, externalizing, and attention problem behaviors (measured using the Child Behavior Checklist [CBCL]) associated with cognitive development in middle childhood (measured by the Woodcock-Johnson (W-J) Passage Comprehension [i.e., reading] and Applied Problems [i.e., math] tests)? (2) Is the timing of internalizing, externalizing, and attention problem behaviors associated with cognitive development in middle childhood? (3) Is the association between internalizing, externalizing, and attention problem behaviors in childhood and cognitive development in middle childhood mediated by children's cognitive development and maternal engagement when they enter school? The first research question is essentially a replication of prior research using a different data source (e.g., Duncan et al. 2007) and we present these analyses to ensure that these earlier studied relationships exist in the FFCWB data. The second and third research questions extend prior research by examining problem behaviors prior to school entry, by comparing problem behaviors at ages 3 and 5, and by examining possible mechanisms linking problem behaviors to cognitive development.

2. Background

2.1. What Are Social/Emotional Skills?

Social/emotional skills in childhood comprise two developmental tasks: the sustainment of positive engagement with peers and the regulation of emotions and expressions (Rose-Krasnor and Denham 2008). Some social/emotional skills, such as cheerfulness or conscientiousness, are considered innate and stable over time (Bowles and Gintis 1976), whereas others, such as shyness or aggressiveness, are considered more malleable and susceptible to social influences. In his review of the literature, Farkas (2003) lists a host of these skills, including, but not limited to, effort, discipline, aggressiveness, self-esteem, sociability, disruptiveness, and a sense of mastery or self-control (also see DiPrete and Jennings 2012). Importantly, unlike cognitive skills that are generally measured by tests of

children's reading and math abilities, social/emotional skills are most commonly measured through parent or teacher reports of children's behaviors (which are considered a manifestation of these skills).

The Child Behavior Checklist (CBCL) (Achenbach 1992; see Duncan et al. 2007; Farmer and Bierman 2002) is often used to measure social/emotional skills. The full CBCL, which is typically administered to children's primary caregivers, includes numerous items that vary depending on children's ages. The most commonly used CBCL subscales are internalizing problem behaviors (such as appearing shy, withdrawn, or nervous) and externalizing problem behaviors (such as breaking rules, destroying things, or fighting). More recently, researchers have considered the importance of attention problems (Claessens et al. 2009; Claessens and Dowsett 2014; Duncan et al. 2007; McClelland, Morrison, and Holmes 2000). In this paper, we measure children's social/emotional skills using three CBCL subscales: internalizing problem behaviors, externalizing problem behaviors, and attention problem behaviors.

2.2. Why Would Social/Emotional Skills in Childhood Affect Cognitive Development?

2.2.1. Theoretical Link Between Social/Emotional Skills and Cognitive Development—

Problem behaviors are expected to impede children's cognitive development both directly and indirectly. With respect to the former, behavior problems may undermine the learning process (Lerner, Lerner, and Zabski 1985). For example, *internalizing problems*, such as being shy and withdrawn, may interfere with a child's ability to interact with and learn from his or her parents, teachers, and other caregivers (e.g., not following along while an adult is reading to him/her). Additionally, children with internalizing problems may cling to adults, making it more difficult for them to interact with and learn from their peers (Mashburn et al. 2009). Children who are anxious may spend substantial time ruminating on their interactions with peers and adults, making it more difficult for these children to master new material or improve upon existing skills (Finn, Pannozzo, and Voelkl 1995).

Similarly, children with *externalizing problems*, which often involve physical (e.g., fighting, hitting others) or emotional (e.g., screaming, anger, aggression) displays, may be distracted from the learning process and/or have less energy than their peers for engaging in learning activities. Easily frustrated, these children may give up on trying to learn or improve their reading or math skills (Hinshaw 1992). Similarly, children with externalizing problem behaviors, such as aggression or rule breaking, may be less engaged in their learning environment than their peers who do not exhibit such behaviors.

Finally, children with *attention problems*, such as problems focusing or hyperactivity, may find it difficult to follow teacher instructions, complete assignments, and focus long enough to learn new skills (Razza, Martin, and Brooks-Gunn 2012).

2.2.2. Empirical Evidence—

A large literature finds that problem behaviors observed at school entry are associated with poor academic performance in middle childhood (Alexander et al. 1993; Entwisle et al. 2005; Farmer and Bierman 2002; Jennings and DiPrete 2010; Lin, Lawrence, and Gorrell 2003; McLeod and Kaiser 2004; Schaefer and

McDermott 1999). This literature includes studies of small homogeneous samples as well as studies of large nationally representative samples. In this review, we focus primarily on the latter.

To begin with, data from the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K), a nationally representative sample of kindergarteners, shows that children who exhibit teacher-reported behavior problems in kindergarten (measured by a combination of three scales available in the ECLS-K [Approaches to Learning, Interpersonal Skills, and Self-Control]) have fewer gains in reading and math test scores at the end of third grade than children without such problems (Jennings and DiPrete 2010; also see DiPrete and Jennings 2012). Similarly, using data from the National Longitudinal Survey of Youth 1979 (NLSY79), Lee (2010) finds that behavior problems among 5- and 6-year-old children previously enrolled in Head Start are associated with lower reading scores in middle childhood (ages 11 and 12). Alternatively, a widely cited study that uses six different data sets (including the ECLS-K and the NLSY79) finds that attention problems measured at school entry, but not other problem behaviors, are negatively associated with test score gains (Duncan et al. 2007; also see Hooper et al. 2010). Claessens et al. (2009) report similar findings for kindergarten behavior problems and fifth-grade reading and math test scores (also see Claessens and Dowsett 2014; Morgan et al. 2008; Razza et al. 2012). These conflicting findings may result from differences in the timing of measurement of both problem behaviors and test scores, the use of different control variables, and/or the various ways researchers operationalize problem behaviors. For example, only two of the studies described above—Duncan et al.'s (2007) analyses of data from the NICHD Study of Early Child Care and Youth Development and Farmer and Bierman's (2002) analyses of a nonrandom sample of first-grade children—use the CBCL to measure social/emotional skills.1

Theory, along with some prior research, suggests the following hypothesis:

> Hypothesis 1: Children's internalizing, externalizing, and attention problem behaviors at school entry will be negatively associated with W-J Passage Comprehension and Applied Problems test scores at age 9.

2.3. Does the Timing of Problem Behaviors Matter?

2.3.1. Differential Consequences of Problem Behaviors at Age 3 and Age 5—

Our second research question considers the timing of problem behaviors. The life course perspective, which posits that life experiences may have differential consequences depending on when they occur, suggests that the timing of childhood problem behaviors may be differentially associated with children's cognitive development (Elder 1998).

Perhaps most convincingly, we might expect problem behaviors that exist at approximately age 3 to be more consequential for children's cognitive development than problem behaviors that exist later in childhood (approximately age 5). The life course perspective (Elder 1998)

[1]However, other studies that use different measures of social/emotional skills—such as the Behavior Problems Index (BPI) or the Social Rating Scale—capture similar constructs, including internalizing and externalizing behaviors (Rock and Stenner 2005).

and cumulative disadvantage theory (Dannefur 2003) both stress the importance of early life course events for the development and persistence of inequality later in life. Consistent with these ideas, early problem behaviors—regardless of whether they disappear or persist over time—may have cascading and accumulating consequences for children's cognitive skills.

For one, as described above, children with problem behaviors at age 3 may be unable to master new academic skills or improve upon existing skills and may, in turn, experience cognitive difficulties by the time they enter school. These cognitive difficulties may lead to early placement in a remedial classroom, grade retention, or to later cognitive difficulties (Baumert, Nagy, and Lehmann 2012; Byrd and Weitzman 1994; Duncan et al. 2007); therefore, even if these problem behaviors eventually disappear, they may have lasting consequences for test scores in middle childhood. Additionally, by age 3, parents and children have typically established a pattern of interaction that sets the stage for future parent-child interactions (Egeland and Farber 1984). Consistent with theories of cumulative disadvantage, and the idea that early learning success breeds later learning success, we would expect children with problem behaviors at age 3, compared to children with problem behaviors later in childhood (e.g., at school entry), to have experienced less frequent and less positive adult-child interaction and less cognitive stimulation that, in turn, is associated with lower test scores in middle childhood. Therefore, as disadvantages compound over time, these problem behaviors may continue to be consequential even if behaviors eventually disappear.

It is, of course, possible that problems that exist at school entry (approximately age 5) may be more consequential than problems that appear earlier. This could occur either because problem behaviors at this point are less common than earlier problems, and may be indicative of a more serious problem, or because adults react more negatively to such behaviors when they are less common (e.g., Alink et al. 2006). The latter may be especially true if problem behaviors are disruptive to classroom learning, as opposed to learning at home or in other settings.

2.3.2. Empirical Evidence—As noted earlier, studies that link social-emotional skills and cognitive development are based primarily on school-based samples that do not contain data on behaviors in early childhood. In most other instances, researchers focus exclusively on behaviors after children enter school. Thus we were unable to identify a study that examined whether the association between problem behaviors and cognitive development in middle childhood was sensitive to the timing of problem behaviors.

Theory and prior research suggest the following hypothesis:

> Hypothesis 2A: Children with internalizing, externalizing, and attention problem behaviors at age 3, compared to their counterparts with no internalizing, externalizing, and attention problem behaviors, respectively, will have lower W-J Passage Comprehension and Applied Problems test scores at age 9.
>
> Hypothesis 2B: Children with internalizing, externalizing, and attention problem behaviors at age 5, compared to their counterparts with no internalizing, externalizing,

and attention problem behaviors, respectively, will have lower W-J Passage Comprehension and Applied Problems test scores at age 9.

2.4 Do Test Scores and Maternal Engagement at School Entry Mediate the Association between Problem Behaviors and Cognitive Development?

Our final research question examines potential mediators of the association between early childhood behavior problems and cognitive development in middle childhood. We focus on two mediators: children's test scores and maternal engagement measured when children enter kindergarten.

With regard to the first mediator, we expect test scores at school entry to mediate the association between behavior problems and cognitive development in middle childhood. Problem behaviors in childhood may create a negative dynamic between children and parents that is transferred to the teacher-child relationship when children enter school. Problem behaviors may also lower parents' and teachers' perceptions of a child's ability, leading them to invest less time and money in their child's cognitive development; low expectations may also lead teachers to place a child in a group with lower performing students. Each of these responses is expected to reduce children's development of cognitive skills around school entry and, in turn, reduce children's development of cognitive skills in middle childhood (Campbell et al. 2001).

With regard to the second mediator—maternal engagement—both theory and empirical evidence suggest that mother-child interaction may be an important mechanism in the link between problem behaviors in childhood and cognitive development in elementary school. A child who exhibits problem behaviors may make reading and playing games less rewarding and less frequent (McBride, Schoppe, and Rane 2002), which, in turn, impedes the growth of vocabulary and cognitive skills (Entwisle et al. 2005; McLeod and Fettes 2007; also see Henricsson and Rydell 2004). Thus, assuming that we find an association between problem behaviors and cognitive development in middle childhood, it is reasonable to expect that differences in maternal engagement may account for some of this association.

Existing studies, which find no association between problem behaviors at school entry and test scores in middle childhood once test scores at school entry are included in the model, are consistent with a mediation effect, but these studies do not explicitly test such a model (Duncan et al. 2007). Existing studies, to our knowledge, do not consider maternal engagement as a mediator of the association between problem behaviors and cognitive development. Most importantly, none of these studies examines problem behaviors at age 3, and thus none of them examines factors that mediate the relationship between these early problem behaviors and test scores.

Theory and prior research suggest the following hypothesis:

> Hypothesis 3 (H3): Children's test scores and maternal engagement at age 5 will mediate the relationship between internalizing, externalizing, and attention problems at ages 3 and 5 and Woodcock-Johnson Passage Comprehension and Applied Problems test scores at age 9.

2.5. Contributions of This Study

The current study makes several contributions to the literature. First, and perhaps most importantly, we distinguish between problem behaviors that exist at only age 3, problem behaviors that exist at only age 5, and problem behaviors that exist at both ages 3 and 5. Our approach differs from most of the existing literature, which is based on school samples or samples that begin when children enter school and are therefore unable to consider problem behaviors prior to school entry. An important exception is research by Duncan and colleagues (2007), who control for early problem behaviors in four of the six data sets they analyze. However, this study does not examine differences in how problem behaviors at ages 3 and 5 are associated with cognitive development and instead focuses on whether problem behaviors that exist at school entry are associated with subsequent gains in test scores. The inability of most research to consider problem behaviors prior to school entry is an important limitation insofar as we know that substantial inequalities in these behaviors emerge well before children enter school (Lee and Burkam 2002). The current study makes two additional contributions. We consider two possible mechanisms linking problem behaviors to cognitive skills in middle childhood (cognitive development at school entry and maternal engagement) and use data from the Fragile Families and Child Wellbeing Study (FFCWB), a cohort of children born to mostly unmarried parents in 1998-1999 that allows us to examine a cohort of children born at the turn of the 21st century.

3. Data, Measures, and Analytic Strategy

3.1. Data Source

The Fragile Families and Child Wellbeing Study (FFCWB) is based on a stratified, multi-stage, probability sample of children born in large U.S. cities between September 1998 and September 2000, with an oversample of children born to unmarried parents (Reichman et al. 2001). Mothers completed a 30- to 40-minute in-person interview at the hospital after the birth of their child, between February 1998 and September 2000, and fathers were interviewed as soon as possible after the child's birth. Both parents were interviewed by telephone when their children were approximately 1, 3, 5, and 9 years old. Baseline response rates were relatively high, as about 82% of married and 87% of unmarried mothers participated. Of mothers who responded to the baseline interview, 89%, 96%, 85%, and 74% participated in the 1-, 3-, 5-, and 9-year surveys, respectively.

In addition to the telephone surveys, a subsample of FFCWB respondents participated in an in-home survey when children were 3, 5, and 9 years old. In these in-home surveys, children's caregivers (most often mothers) answered questions about family functioning, the home environment, and child wellbeing. Children were also administered a variety of tests during the in-home surveys. About 67%, 61%, and 69% of families in the baseline sample participated in the 3-, 5-, and 9-year in-home surveys, respectively.

Our analytic sample includes 2,302 observations. Of the 4,898 observations in the FFCWB baseline sample, we first drop the 1,604 (33%) observations with incomplete information on our two dependent variables (e.g., Von Hippel 2007). The majority of these cases are missing due to nonparticipation in the 9-year in-home survey and not item nonresponse. In

addition, we drop the 990 (20%) observations that were missing data on our key explanatory variables, problem behaviors, at both the 3- and 5-year surveys (517 were missing problem behaviors when children were 3 years old, 272 were missing problem behaviors when children were 5 years old, and 201 were missing problem behaviors at both ages 3 and 5). In supplemental analyses, we broaden our analytic sample to include observations with missing data on children's problem behaviors at ages 3 or 5 (and imputed this missing data). The broadened analytic sample is nearly identical to the analytic sample used in this paper, as the only statistically significant difference between the samples is that children were slightly older in the broader analytic sample (112 months at the 9-year survey, compared to 111 months). As expected, results are substantively robust to this alternative imputation strategy.

There are some differences between the full and analytic samples. Compared to mothers in the full sample, mothers in the analytic sample are more likely to be non-Hispanic black, less likely to be Hispanic, and less likely to be foreign-born. They are also less likely to be in a nonresidential romantic relationship with the child's biological father at baseline, have slightly higher levels of education, and have younger focal children ($p < .05$). Relatively few observations in the analytic sample are missing values for our control variables. We preserve these observations by producing 20 multiply imputed data sets in Stata and, in the imputation model, include variables related to the research questions or to the likelihood of being missing (Allison 2002).

3.2. Measures

3.2.1. Test scores—Our two outcome variables are measured when children were 9 years old. Students were administered two subtests of the Woodcock-Johnson III Tests of Achievement (W-J): Passage Comprehension and Applied Problems (Woodcock, McGrew, and Mather 2001). The W-J Passage Comprehension test measures children's skills in understanding what they read. Some items require children to identify pictures that correspond with words, and other items require children to use context clues to identify missing words in a sentence. The W-J Applied Problems test measures children's skills in analyzing and solving math problems. Both tests increase in difficulty as they progress, and both are normed by age (M = 100, S.D. = 15).

3.2.2. Problem behaviors—We examine three indicators of children's problem behaviors at ages 3 and 5: internalizing, externalizing, and attention problem behaviors. These behaviors are measured by the Child Behavior Checklist (CBCL), an established measure of problem behaviors in children (Achenbach 1992). Mothers were asked to rate aspects of their children's behaviors (0 = *not true* to 2 = *very true or often true*), and these responses comprise the internalizing, externalizing, and attention problems measures. For consistency across outcomes, we sum responses for each scale and standardize each to have a mean of 0 and a standard deviation of 1 ($\alpha = .82$ and .77 for internalizing problems at the 3- and 5-year surveys, respectively; $\alpha = .88$ and .86 for externalizing problems; and $\alpha = .72$ and .74 for attention problems; $r = .42$ for 3- and 5-year internalizing problems, $r = .50$ for 3- and 5-year externalizing problems, and $r = .36$ for 3- and 5-year attention problems). Though information on children's problem behaviors is available at age 9, we only consider problem

behaviors prior to the 9-year survey to ensure the indicators are measured prior to our outcome variables.

Our primary multivariate analyses consider two measures of each of the three types of problem behaviors (internalizing, externalizing, and attention). The first measure, consistent with much other research, is a standardized continuous (mean = 0, S.D. = 1) measure of problem behaviors at school entry, when children are about 5 years old. Then, to create the second measure that considers the timing of problem behaviors, we categorize children as having internalizing, externalizing, or attention problem behaviors if their scores for each respective measure falls into the top (worst) quartile of the distribution.2 The second measure includes categorical measures of the timing of problem behaviors: (1) problem behaviors at only age 3; (2) problem behaviors at only age 5; (3) problem behaviors at both ages 3 and 5; and (4) no problem behaviors (reference). Importantly, our labels are driven by the age at which the problem behavior measures in the FFCWB are observed. It is also important that the categorical measures are based on where children fall in the distribution of behavioral problems; therefore, the analyses consider children's positions relative to other children in the sample at both the 3- and 5-year surveys.

3.2.3. Control variables—The multivariate analyses adjust for a host of characteristics associated with both children's problem behaviors and test scores. Mother's race is represented by a series of mutually exclusive dummy variables (non-Hispanic white, non-Hispanic black, Hispanic, non-Hispanic other race). A dummy variable indicates the mother was born outside of the United States. Mother's age at baseline is a continuous variable ranging from 14 to 44. A series of dummy variables indicate the mother's and father's relationship at baseline (married, cohabiting, nonresidential romantic relationship, no relationship), and the number of siblings at baseline is a continuous variable ranging from 0 to 8. We adjust for both mother's and father's educational attainment (less than high school, high school diploma or GED, post-secondary education, college degree). We also adjust for mother's household income at baseline (logged). Dummy variables indicate the mother was employed and the mother received welfare (measured at the 1-year survey, the first time this information was available). A dummy variable indicates maternal depression at the 1-year survey, as measured by the Composite International Diagnostic Instrument-Short Form (CIDI-SF; Kessler et al. 1998), as this is both correlated with children's behaviors (Turney 2011) and because depressed mothers may have negative or distorted beliefs about their children's behaviors (Chi and Hinshaw 2002). Maternal engagement is measured by an average of the number of days per week the mother participated in the following activities with the child at the 1-year survey (0 = *0 days per week* to 7 = *7 days per week*): play games like ‘peek-a-boo’ or ‘gotcha’ with child; sing songs or nursery rhymes to child; read stories to child; tell stories to child; play inside with toys such as blocks or legos with child; take child to visit relatives; hug or show physical affection to child; put child to bed (α = .81). Finally, we adjust for child characteristics: a dummy variable indicating the child is male, a

2The cutoff points of the standardized measures are as follows: 0.572 and 0.622 for internalizing problem behaviors at the three- and five-year surveys, respectively; 0.673 and 0.613 for externalizing problem behaviors, and 0.836 and 0.502 for attention problem behaviors. In supplemental analyses, we consider different thresholds (tertiles and quintiles) and the results remain substantively similar.

dummy variable indicating the child was born low birth weight (fewer than 2,500 grams), a dummy variable indicating the mother reported breastfeeding the child, and a continuous variable indicating the child's age (in months) at the 9-year survey. We also adjust for children's Peabody Picture Vocabulary Test-Third Edition (PPVT) score, a measure of children's age-standardized verbal skills at age 3 (Dunn and Dunn 1997), to estimate the relationship between problem behaviors and test scores in middle childhood net of previous test scores and omitted variables correlated with PPVT scores at age 3.

3.2.4. Mechanisms

The analyses consider two mechanisms, both measured at the 5-year survey. First, the Woodcock-Johnson Letter-Word Recognition Test, a standardized measure that assesses children's symbolic learning and reading skills, indicates test scores at school entry. Second, a continuous variable indicates the frequency of maternal engagement (measured similarly to maternal engagement at the 1-year survey).3

3.3. Analytic Strategy

We first present means of children's test scores at age 9 by the timing of problem behaviors in early childhood. We use t-tests to compare differences between children with problems at only age 3, problems at only age 5, problems at both ages 3 and 5 to children with no problems. These descriptive statistics correspond with our main multivariate analyses.

To answer our first research question—are childhood problem behaviors associated with cognitive development in middle childhood?—we conduct a series of multivariate analyses. These analyses are similar to those conducted by others (e.g., Claessens et al. 2009; Duncan et al. 2007) and we present them to ensure that the associations found in our sample are similar to those found in samples from other data sources. We use ordinary least squares (OLS) regression models to estimate children's test scores at age 9 as a function of problem behaviors at age 5. We include all three measures of problem behaviors—internalizing, externalizing, and attention—in the same multivariate model, as we are interested in the independent influence of each and because this approach is common in other research on this topic (e.g., Duncan et al. 2007). The different measures of problem behaviors are highly correlated (at the 5-year survey, $r = .58$ for attention and internalizing problems, $r = .59$ for attention and externalizing problems, and $r = .50$ for internalizing and externalizing problems), but diagnostic tests suggest that collinearity does not bias the results. We first present the unadjusted results (Model 1), then adjust for the demographic and other control variables described above (Model 2), and then adjust for children's PPVT scores at the 3-year survey (Model 3). This final model adjusts for underlying differences in children's cognitive ability, which might affect both problem behaviors and cognitive development.

To address our second research question—is the age at which problem behaviors are observed associated with cognitive development in middle childhood?—we use OLS regression models to estimate test scores as a function of problem behaviors, measured as a

3Paternal engagement may also mediate the relationship between problem behaviors and cognitive development. We focus on *maternal* engagement here, as nearly all children live with their mothers, but supplemental analyses considering paternal engagement reach similar conclusions.

series of mutually exclusive categories: problem behaviors at only age 3, problem behaviors at only age 5, problem behaviors at both ages 3 and 5, and no problem behaviors (reference category). Again, we include all three measures of problem behaviors in the same multivariate model, and the models progress in a similar fashion as the multivariate analyses described above.

To answer our third research question—is the association between problem behaviors in childhood and cognitive development in middle childhood mediated by children's test scores and maternal engagement at the time they enter school?—we conduct a test of mediation. In accordance with Baron and Kenny (1986), we consider the following: (1) the relationship between problem behaviors and each proposed mediator, (2) the relationship between each proposed mediator and children's cognitive test scores, (3) the relationship between problem behaviors and children's cognitive test scores without the mediator(s), (4) the relationship between problem behaviors and children's cognitive test scores with the mediator(s) (and the difference in the relationship with and without the mediator(s)). These models adjust for all covariates considered in previous models and the proposed mediators include children's test scores at school entry and maternal engagement, both measured at the 5-year survey.4

The analyses are unweighted, and all models include robust standard errors to account for the clustering of observations in cities. Across all analyses, we calculate effect sizes by dividing the coefficient by the standard error of the outcome (Cohen 1992).

3.4. Sample Characteristics

Table 1 presents descriptive statistics of all variables. The test scores at age 9 show that the children in the sample, on average, have lower scores than the normed scores of 100. For all three types of problem behaviors, about two-thirds of children never fall into the top quartile of problem behaviors (67% of children have no internalizing problems at ages 3 or 5, 66% have no externalizing problems, and 62% have no attention problems). Also across all three types of problem behaviors, about one-tenth of children have problem behaviors at both age 3 and age 5. About 10% of children have internalizing problems at both ages, 12% have externalizing problems at both ages, and 10% have attention problems at both ages. Additionally, problem behaviors at only age 3 are slightly more frequently reported than problem behaviors at only age 5. For example, about 12% of children have internalizing problems at only age 3 and 11% who have internalizing problems at only age 5.

More than half of mothers (52%) are non-Hispanic Black and nearly one-fourth (23%) are Hispanic. Mothers were, on average, 25 years old when their children were born. Nearly three-fifths (59%) of mothers were in marital or cohabiting relationships with their child's father at baseline, and children had, on average, one sibling at birth. The majority of children's parents (63% of mothers and 68% of fathers) had no education beyond high school. More than half (55%) of mothers were employed and 27% received welfare at the one-year survey.

[4]In supplemental analyses, we considered mediation without adjusting for PPVT scores at age 3. In additional supplemental analyses, we considered maternal engagement at age 3 as a mediator. In both instances, results were nearly identical to those presented.

4. Results

4.1. Bivariate Association Between Early Childhood Problem Behaviors and Test Scores

Table 2 presents means of children's tests scores at the 9-year survey, by the timing of children's problem behaviors. Turning first to internalizing behavior problems, children with problems at age 3 have lower test scores than their counterparts with no internalizing problem behaviors. These differences are statistically significant across both outcomes. For example, children with problem behaviors at age 3 score about 6 points lower on the W-J Passage Comprehension test than children with no problem behaviors (88.39 compared to 94.87, $p < .001$). These children also score about 5 points lower on the W-J Applied Problems test (95.59, compared to 99.71, $p < .001$). In addition, compared to children with no problem behaviors, children with internalizing behaviors at age 5 score lower on the W-J Passage Comprehension test ($p < .01$) and children with internalizing behaviors age ages 3 and 5 score lower on the W-J Passage Comprehension test ($p < .001$) and the W-J Applied Problems test ($p < .001$).

Similar descriptive patterns appear with respect to the association between externalizing problem behaviors and test scores. Children with externalizing problems at age 3, compared to their counterparts with no externalizing problems, score about 6 points lower on the W-J Passage Comprehension test ($p < .001$) and about 5 points lower on the W-J Applied Problems test ($p < .001$). These patterns also exist for differences between children with problems at age 5 (compared to those with no problems) and for children with problems at ages 3 and 5 (compared to those with no problems). Finally, the bivariate association between attention problems and test scores shows that children who experience attention problems at age 3, at age 5, or at ages 3 and 5 have lower test scores than their counterparts with no attention problems ($p < .001$ across both outcomes).

4.2. Estimating Test Scores as a Function of Problem Behaviors at School Entry

Our first research question is as follows: Are childhood problem behaviors associated with cognitive development in middle childhood? This research question essentially replicates existing research with a new data source. To examine this question, we present results from OLS regression models that estimate children's test scores at age 9 as a function of problem behaviors at approximately age 5. We first examine models estimating W-J Passage Comprehension scores.

Model 1, which only includes the three measures of problem behaviors, shows that internalizing problems and externalizing problems at school entry are not associated with lower W-J Passage Comprehension scores at age 9. In contrast, attention problems at age 5 are negatively associated with W-J Passage Comprehension scores at age 9 ($b = -1.61$, $p < .001$).

These results persist in Model 2, which adjusts for an array of demographic and socioeconomic characteristics, and in Model 3, which further adjusts for PPVT scores at age 3. The coefficient for attention problem behaviors remains statistically significant. This final model shows that a one-unit increase in attention problem behaviors is associated with a

1.43-point decrease in W-J Passage Comprehension scores ($p < .01$). This translates into a relatively small effect size of .10.

The next sets of models present results for W-J Applied Problems. Across Models 1, 2, and 3, attention problem behaviors are negatively associated with W-J Applied Problems scores. In Model 3, the model that adjusts for all control variables and PPVT scores at age 3, a one-unit increase in attention problem behaviors is associated with a 2.29-point decrease in W-J Applied Problems scores ($p < .001$; effect size = .15). Taken together, these results are consistent with prior research that finds that attention problems (but not internalizing or externalizing problems) at school entry are independently associated with poor future academic outcomes (Claessens et al. 2009; Duncan et al. 2007; Morgan et al. 2008).

4.3. Estimating Test Scores as a Function of Timing of Problem Behaviors

4.3.1. Main Analyses—To examine the second research question—does the timing of problem behaviors matter?—we estimate a new set of models that distinguishes between children who have problem behaviors at only age 3, children who have problem behaviors at only age 5, and children who have problem behaviors at both ages 3 and 5. Table 4 reports these findings. Turning first to W-J Passage Comprehension, the unadjusted model (Model 1) shows that internalizing problems at age 3 ($b = -3.67$, $p < .001$), internalizing problems at ages 3 and 5 ($b = -3.28$, $p < .05$), externalizing problems at age 3 ($b = -3.27$, $p < .091$), and attention problems at ages 3 and 5 ($b = -3.06$, $p < .01$) are negatively associated with scores. These differences are smaller in magnitude than the findings presented in Table 2 because all measures of problem behaviors are considered simultaneously.

In Model 2, which adjusts for an array of control variables, children with internalizing problems at age 3, compared to those with no problems, have lower W-J Passage Comprehension scores ($b = -1.81$, $p < .05$). Additionally, children with externalizing problems at age 3 ($b = -2.67$, $p < .001$) and children with attention problems at age 5 ($b = -3.14$, $p < .01$) have lower W-J Passage Comprehension scores than those with no problems. In the final model, which is a conservative estimate because it adjusts for PPVT scores at age 3, the coefficients for externalizing problems at age 3 ($b = -2.78$, $p < .001$) and attention problems at age 5 ($b = -2.81$, $p < .01$) remain statistically significant, and translate into about one-fifth of a standard deviation (effect size = .20 and .21, respectively). In this final model, the coefficients for attention problems at age 3 ($F = 6.13$, $p = .023$) and attention problems at age 5 ($F = 18.54$, $p = .000$) are statistically different from the coefficient for attention problems at ages 3 and 5. In other words, attention problems that exist at both ages 3 and 5 are especially consequential.

We turn next to estimates of W-J Applied Problems scores. Model 1 shows that externalizing problems at age 3 ($b = -2.51$, $p < .05$), attention problems at age 5 ($b = -2.83$, $p < .05$), and internalizing $b = -2.63$, $p < .05$), externalizing ($b = -3.21$, $p < .05$), or attention problems at ages 3 and 5 ($b = -3.86$, $p < .01$) are associated with lower W-J Applied Problems scores. With the exception of internalizing behaviors, these associations persist in Model 2, which adjusts for control variables, and in Model 3, which adjusts for PPVT scores. These coefficients translate into small to moderate effect sizes (ranging between .13 and .24).

Across both W-J Passage Comprehension and Applied Problems scores, the magnitude of the coefficients for problem behaviors at age 3, problem behaviors at age 5, and problem behaviors at ages 3 and 5 decrease from Model 1 to Model 2. In additional analyses, we found that socioeconomic characteristics (mother's education, father's education, income) independently explain much of this decrease in magnitude. For example, including mother's education to Model 1 estimating W-J Passage Comprehension explains 40% of the age 3 internalizing problems coefficient, 25% of the age 3 externalizing problems coefficient, and 70% of the age 3 attention problems coefficient. Including father's education explains 19%, 19%, and 81%, respectively.

4.4. Considering Mechanisms Linking Problem Behaviors and Test Scores at Age 9

Our final research question is as follows: Do test scores and maternal engagement at age 5 mediate the association between childhood problem behaviors and cognitive development at age 9? We focus our discussion on the associations that remained statistically significant in Model 3 of Table 4.

First, we consider the relationship between problem behaviors (externalizing at age 3, externalizing at ages 3 and 5, attention at age 5, and attention at ages 3 and 5), and each proposed mediator. These results (not presented for parsimony) suggest that externalizing behaviors at age 3 and at ages 3 and 5, but not attention behaviors, are associated with test scores at age 5. These results also show that attention problems at age 5 and at ages 3 and 5, but not externalizing problems, are associated with maternal engagement at age 5. Second, we consider the relationship between each proposed mediator and children's test scores at age 5. We find a relationship between test scores at age 5 and test scores at age 9 but no relationship between maternal engagement at age 5 and test scores at age 9.

Taken together, these results suggest that only test scores at age 5 can mediate the relationship between problem behaviors and test scores at age 9. Table 5 considers this possibility. Model 1 presents the baseline association between problem behaviors and test scores, the equivalent of the models in Table 4, for comparison. In Model 2, which adjusts for test scores at age 5, the coefficient for externalizing problems at age 3 is reduced by 16% for W-J Passage Comprehension (from $b = -2.78$ in Model 1 to $b = -2.34$ in Model 2) and by 29% (and to statistical insignificance) for W-J Applied Problems (from $b = -2.09$ in Model 1 to $b = 1.49$ in Model 2). Though we do not present the coefficients for school entry test scores, they are positively and significantly associated with test scores at age 9 ($p < .001$ across both outcomes). This mediation is confirmed with formal Sobel-Goodman tests.

5. Discussion

5.1. Linking Problem Behaviors to Cognitive Skills

Social/emotional skills have been linked to a host of outcomes, including educational attainment, labor market success, and social behaviors such as marriage and childbearing and thus play an important role in intra-generational processes of stratification (Bowles and Gintis 1976; Duncan and Magnuson 2011; Farkas 2003). Yet, despite the voluminous literature demonstrating the importance of these skills for later life outcomes, we know

much less about the pathways through which these skills affect cognitive development in middle childhood. Indeed, recent studies have suggested that social/emotional skills, such as internalizing and externalizing behaviors at school entry, may *not* directly influence cognitive development after children enter school (e.g., Claessens and Dowsett 2014; Duncan et al. 2007). In this article, we extend this research by examining how the timing of social/emotional skills—measured as internalizing, externalizing, and attention problem behaviors in childhood—is associated with cognitive development in middle childhood.

Our analyses provide mixed support for Hypothesis 1. We find that after adjusting for a host of demographic and socioeconomic characteristics, attention problems at school entry—but not internalizing problems or externalizing problems at school entry—are significantly associated with children's cognitive development, measured by their W-J Passage Comprehension and W-J Applied Problems test scores. These findings, though inconsistent with theoretical expectations, are consistent with existing literature that finds attention problems at school entry are more important predictors of cognitive development than internalizing or externalizing problems at school entry (e.g., Claessens et al. 2009; Duncan et al. 2007).

Additionally, our analyses provide mixed support for Hypothesis 2. We extend existing research by showing that the pattern of associations differs when we consider the timing of problem behaviors. Our results point to the following three conclusions: (1) internalizing problems at age 3, at age 5, or at ages 3 and 5 are not associated with the development of children's cognitive skills during early elementary school; (2) externalizing problems at age 3 (and at both ages 3 and 5) are negatively associated with the development of children's cognitive skills during these years, and attention problems at age 5 (and at both ages 3 and 5) are associated with the development of children's cognitive skills; and (3) part, but not all, of the association between externalizing problems at age 3 and test scores at age 9 is mediated by children's cognitive development when they enter kindergarten. Broadly, our analyses also indicate that both the presence and persistence of problem behaviors can be deleterious for children's cognitive development (Alink et al. 2006).

The fact that internalizing problems—regardless of when they occur—do not independently impede children's cognitive skill development is inconsistent with our expectations that children with internalizing problems may withdraw from interactions with others and/or may be disengaged from the learning process (Finn et al. 1995). This finding, however, is consistent with the findings of other studies using different data (e.g., Duncan et al. 2007). One explanation may be that internalizing behaviors are less consequential for disruptions in learning. These children may withdraw from their interactions with peers and adults while they are processing material. It is also possible that internalizing behaviors are less likely than externalizing and attention problems to negatively affect adults' perceptions of children's abilities or their willingness to engage with their child.

The fact that externalizing behaviors observed at age 3 are consequential for children's cognitive development, while externalizing problems observed at age 5 but not age 3 are not consequential, suggests that parents and the home environment (or adults in childcare centers) play a key role in the process through which these behaviors interfere with learning.

In contrast, the fact that attention problems observed at age 5 but not age 3 are consequential suggests that that teachers and school settings play a key role in the link between these problems and learning. Given that the coefficients observed at age 3 and age 5 for externalizing and attention problem behaviors are not statistically different from one another, we should be cautious in drawing strong conclusions about the timing of problem behaviors. However, the findings are suggestive and should be explored in future research. Specifically, future studies should consider how externalizing behaviors are associated with other behaviors in childhood and the processes through which they are linked to cognitive development.

Finally, our results provide mixed, and somewhat puzzling, support for Hypothesis 3. With regard to cognitive development at school entry, we find that test scores in kindergarten mediate about 20 percent of the negative association between externalizing problems at age 3 and cognitive development in middle childhood, confirming a direct link between early social/emotional problems and cognitive skills. Unfortunately, we cannot identify the precise process though which this link occurs. As noted earlier, problem behaviors may interfere with children's learning directly, or they may operate indirectly by affecting parents' and teachers' evaluations and expectations of children. Parents and teachers who witness a child struggle with problem behaviors may reduce their expectations of and investments in these children, which in turn may cause children to reduce their expectations of themselves and impede future success (Karp 2002; Miech, Essex, and Goldsmith 2001). If the latter explanation were true, however, we would expect maternal engagement—our second mediator—to play a significant role in the association between externalizing problems at age 3 and children's cognitive development. Yet our findings suggest that maternal engagement at age 5 does little to mediate the association. This is puzzling and suggests that our measures of engagement may be inadequate, either because they do not capture the right behaviors, there is relatively little variation in maternal engagement, or because mothers' reports of engagement are inaccurate. It is also possible that parents' expectations and other aspects of the home environment are more important than mother-child interactions in shaping children's cognitive development. In any case, theses issue merit further attention.

5.2. Limitations

Our study also has limitations. To begin with, although we use longitudinal data, we cannot make causal conclusions about the associations between children's problem behaviors and cognitive skills, as omitted variables may bias our results. However, the rich nature of the FFCWB data, which makes it possible to control for many potential confounders and to employ the appropriate time order of variables reduces the likelihood of omitted variable bias. Most of our models adjust for cognitive skills at age 3, which help reduce omitted variable bias.

A second limitation is that our measures of children's problem behaviors are based on mothers' reports. We control for mothers' depression, as depressed mothers may have distorted perceptions of their children's behaviors (Chi and Hinshaw 2002), but other limitations may exist. When evaluating children's behaviors, mothers may reference other children in their family or neighborhood, whereas teachers would be likely to reference other

children in their classroom. Additionally, children may act differently in home and school settings. If measurement error exists, due to the reliance on mother-reported problem behaviors, this could bias our estimates of the association between problem behaviors and cognitive skills. Future research should investigate how mother- and teacher-reported behaviors are differentially associated with behavior problems and cognitive outcomes (Hinshaw et al. 1992). Relatedly, the CBCL only measures some types of problem behaviors, and future research should consider additional measures.

Third, the FFCWB is not representative of all children in the United States. Rather, the study samples children born in large U.S. cities and includes an oversample of children born to unmarried parents who are disproportionately Hispanic and African American. Although our analyses are not representative of all children or even all disadvantaged children, they are based on a sample of children for whom problem behaviors and poor cognitive development are important issues (McLanahan 2009).

Finally, although we can glean some insight into the mechanisms linking problem behaviors and test scores in middle childhood, the data preclude us from measuring all possible mechanisms. Unobserved mechanisms include children's learning in the home and in childcare settings, children's motivational factors in the classroom setting, children's participation in the classroom environment, and parents' and teachers' expectations for children. Future research, ideally qualitative research that can observe children across home, school, and childcare settings, should carefully shed light on such processes.

6. Conclusion

Taken together, this research contributes to a large literature that considers the links between social/emotional skills and cognitive development in childhood and extends this literature in several ways. Most importantly, we find that externalizing problem behaviors in early childhood, along with attention problem behaviors that exist when children enter elementary school, have important consequences for cognitive development. Because children's cognitive skills in middle childhood have long-lasting implications for later life advantages and disadvantages, it is imperative that children with problem behaviors receive appropriate learning opportunities from their parents and teachers. Both parents and teachers should recognize that children with problem behaviors, especially externalizing behaviors at an early age, may be susceptible to cognitive impairments. Schools may also consider implementing interventions to aid learning among these children. The fact that externalizing problem behaviors are most detrimental when they exist prior to school entry highlights the importance of the family environment in shaping children's academic success.

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Table 1
Unweighted Descriptive Statistics of Variables Used in Analysis

Variables	Mean	(SD)
Woodcock-Johnson Passage Comprehension (y9)	93.28	(13.63)
Woodcock-Johnson Applied Problems (y9)	98.36	(15.64)
Internalizing problems (y3)	0.39	(0.24)
Internalizing problems (y5)	0.24	(0.21)
Externalizing problems (y3)	0.61	(0.35)
Externalizing problems (y5)	0.44	(0.27)
Attention problems (y3)	0.92	(0.49)
Attention problems (y5)	0.26	(0.27)
Timing and chronicity of internalizing problems (y3, y5)		
Problems at age 3	12.3%	
Problems at age 5	11.2%	
Problems at ages 3 and 5	10.0%	
No problems	66.5%	
Timing and chronicity of externalizing problems (y3, y5)		
Problems at age 3	12.0%	
Problems at age 5	10.3%	
Problems at ages 3 and 5	12.1%	
No problems	65.6%	
Timing and chronicity of attention problems (y3, y5)		
Problems at age 3	14.6%	
Problems at age 5	13.2%	
Problems at ages 3 and 5	10.3%	
No problems	61.8%	
Mother's race (b)		
White	21.7%	
Black	52.2%	
Hispanic	22.6%	
Other race	3.4%	
Mother foreign-born (b)	11.4%	
Mother's age (b)	25.10	(6.01)
Parent's marital status (b)		
Married	23.8%	
Cohabiting	35.4%	
Nonresidential romantic relationship	28.5%	
Separated	12.3%	
Number of siblings (b)	1.28	(1.32)
Mother's education (b)		
Less than high school	31.7%	
High school diploma or GED	31.1%	

Variables	Mean	(SD)
Some college	26.2%	
College degree	11.0%	
Father's education (b)		
Less than high school	30.8%	
High school diploma or GED	37.5%	
Some college	21.3%	
College degree	10.1%	
Mother's household income (log) (b)	9.87	(1.38)
Mother employed (y1)	54.8%	
Mother receives welfare (y1)	27.0%	
Mother depressed (y1)	16.4%	
Mother engagement (y1)	5.13	(1.26)
Child is male (b)	52.0%	
Child born low birth weight (b)	9.6%	
Child breastfed (b)	55.6%	
Child age, in months (y9)	111.72	(3.96)
PPVT score (y3)	86.07	(16.40)
Woodcock-Johnson Letter Recognition (y5)	99.90	(15.04)
Mother engagement (y5)	4.63	(1.18)
N	2,302	

Note: b: measured at baseline; y1: measured at 1-year survey; y3: measured at 3-year survey; y5: measured at 5-year survey; y9: measured at 9-year survey.

Table 2
Unweighted Means of Test Scores at Age Nine, by Timing of Problem Behaviors

	W-J Passage Comprehension	W-J Applied Problems
Internalizing problem behaviors		
Problems at age 3 (n = 282)	89.39 ***	95.69 ***
Problems at age 5 (n = 258)	92.37 **	97.81
Problems at ages 3 and 5 (n = 231)	88.50 ***	93.29 ***
No problems (n = 1,531)	94.87	99.71
Externalizing problem behaviors		
Problems at age 3 (n = 277)	89.38 ***	95.41 ***
Problems at age 5 (n = 236)	92.34 **	96.68 **
Problems at ages 3 and 5 (n = 279)	89.08 ***	93.50 ***
No problems (n = 1,510)	94.92	100.07
Attention problem behaviors		
Problems at age 3 (n = 238)	91.62 ***	96.73 ***
Problems at age 5 (n = 304)	92.01 ***	96.03 ***
Problems at ages 3 and 5 (n = 337)	88.06 ***	92.87 ***
No problems (n = 1,423)	94.82	100.17

Note: Asterisks indicate test scores are statistically different from test scores of children with no problems.

** $p < .01$.

*** $p < .001$.

Table 3

Unweighted OLS Regression Models Estimating Test Scores at Age Nine as a Function of Problem Behaviors at School Entry

	W-J Passage Comprehension			W-J Applied Problems		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Internalizing problem behaviors	-0.56 (0.34)	0.05 (0.27)	0.21 (0.29)	-0.38 (0.44)	0.20 (0.41)	0.36 (0.39)
Externalizing problem behaviors	-0.19 (0.38)	0.32 (0.33)	0.24 (0.32)	-0.25 (0.50)	0.51 (0.40)	0.43 (0.38)
Attention problem behaviors	-1.61 (0.36) ***	-1.63 (0.37) ***	-1.43 (0.35) **	-2.29 (0.58) **	-2.49 (0.55) ***	-2.29 (0.50) ***
Mother's race (reference = White)						
Black		-2.84 (0.89) **	-1.48 (0.90)		-5.00 (1.32) **	-3.61 (1.35) *
Hispanic		-3.61 (0.71) ***	-2.37 (0.74) **		-4.39 (0.89) ***	-3.13 (0.89) **
Other race		-0.02 (1.25)	0.43 (1.15)		-0.84 (1.39)	-0.37 (1.37)
Mother foreign-born		0.45 (0.77)	1.67 (0.86)		2.26 (0.87) *	3.49 (0.95) **
Mother's age		-0.05 (0.08)	-0.06 (0.08)		-0.05 (0.07)	-0.05 (0.08)
Parent's marital status (reference = married)						
Cohabiting		0.34 (0.87)	0.34 (0.85)		0.45 (1.00)	0.46 (1.01)
Nonresidential romantic relationship		-1.07 (0.98)	-1.07 (0.89)		-0.85 (0.96)	-0.85 (1.02)
Separated		-0.39 (0.93)	-0.57 (0.85)		-0.40 (1.32)	-0.57 (1.28)
Number of siblings		-0.49 (0.28)	-0.40 (0.27)		-0.15 (0.23)	-0.06 (0.23)
Mother's education (reference = less than HS)						
High school diploma or GED		0.87 (0.53)	1.18 (0.47) *		1.30 (0.77)	1.61 (0.74) *
Some college		2.33 (0.79) **	1.86 (0.82) *		3.42 (0.98) **	2.93 (0.90) **
College degree		7.13 (0.87) ***	5.57 (1.04) ***		7.32 (1.59) ***	5.73 (1.56) **
Father's education (reference = less than HS)						
High school diploma or GED		0.13 (0.51)	-0.01 (0.50)		-1.20 (0.67)	-1.33 (0.69)
Some college		2.52 (0.71) **	2.27 (0.71) **		2.41 (0.79) **	2.16 (0.80) *
College degree		1.74 (0.96)	1.43 (0.99)		2.59 (1.06) *	2.27 (1.13)
Mother's household income (log)		0.80 (0.27) **	0.71 (0.27) *		0.73 (0.25) **	0.64 (0.26) *
Mother employed		1.35 (0.59) *	1.42 (0.59) *		0.93 (0.56)	1.00 (0.54)
Mother receives welfare		-0.77 (0.63)	-0.57 (0.66)		-1.28 (0.57) *	-1.09 (0.57)

	W-J Passage Comprehension			W-J Applied Problems		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Mother depressed		1.77 (0.67) *	1.87 (0.69) *		0.22 (0.75)	0.31 (0.75)
Mother engagement		0.54 (0.17) **	0.40 (0.17) *		0.27 (0.31)	0.12 (0.30)
Child is male		-3.44 (0.52) ***	-3.14 (0.50) ***		-0.58 (0.47)	-0.28 (0.44)
Child born low birth weight		-2.79 (0.98) *	-2.27 (0.92) *		-4.20 (0.95) ***	-3.66 (0.90) **
Child breastfed		0.46 (0.44)	0.22 (0.46)		1.12 (0.70)	0.87 (0.68)
Child age, in months		-0.23 (0.06) **	-0.22 (0.06) **		-0.24 (0.06) ***	-0.23 (0.05) ***
PPVT score			0.17 (0.02) ***			0.18 (0.02) ***
Constant	93.28	110.92	95.91	98.36	118.99	103.79
R-squared	0.02	0.18	0.21	0.03	0.18	0.20
N	2,302	2,302	2,302	2,302	2,302	2,302

Note: Robust standard errors in parentheses.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

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Table 4

Unweighted OLS Regression Models Estimating Test Scores at Age Nine as a Function of Timing of Problem Behaviors

	W-J Passage Comprehension			W-J Applied Problems		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Internalizing problem behaviors (reference = no problems)						
Problems at age 3	-3.67 (0.93) **	-1.81 (0.71) *	-1.25 (0.77)	-1.96 (1.19)	-0.01 (1.17)	0.58 (1.15)
Problems at age 5	-1.38 (1.09)	-1.08 (1.07)	-0.50 (1.08)	-0.20 (1.29)	0.01 (1.18)	0.62 (1.17)
Problems at ages 3 and 5[a]	-3.28 (1.25) *	-0.56 (1.37)	-0.01 (1.42)	-2.63 (1.23) *	0.19 (1.53)	0.77 (1.62)
Externalizing problem behaviors (reference = no problems)						
Problems at age 3	-3.27 (0.75) ***	-2.67 (0.51) ***	-2.78 (0.49) ***	-2.51 (1.01) *	-1.97 (0.97) *	-2.09 (1.00) *
Problems at age 5	-1.41 (1.05)	-0.23 (0.83)	-0.29 (0.85)	-2.04 (1.23)	-0.44 (1.03)	-0.50 (1.06)
Problems at ages 3 and 5[b]	-2.45 (1.27)	-1.36 (1.09)	-1.64 (1.07)	-3.21 (1.15) *	-1.74 (0.97) *	-2.04 (0.96) *
Attention problem behaviors (reference = no problems)						
Problems at age 3	-0.67 (0.84)	0.02 (0.87)	0.34 (0.87)	-1.37 (0.97)	-0.51 (0.86)	-0.17 (0.87)
Problems at age 5	-1.34 (0.75)	-1.16 (0.70)	-0.80 (0.67)	-2.83 (1.00) *	-2.91 (0.97) **	-2.52 (0.96) *
Problems at ages 3 and 5[c]	-3.06 (0.94) **	-3.14 (0.91) **	-2.81 (0.85) **	-3.86 (1.07) **	-4.03 (1.11) **	-3.69 (1.12) **
Mother's race (reference = White)						
Black		-2.65 (0.88) **	-1.37 (0.88)		-4.75 (1.30) **	-3.40 (1.33) *
Hispanic		-3.54 (0.71) ***	-2.39 (0.75) **		-4.38 (0.85) ***	-3.17 (0.84) **
Other race		0.60 (1.31)	1.03 (1.23)		-0.36 (1.34)	0.09 (1.31)
Mother foreign-born		0.37 (0.75)	1.49 (0.84)		2.18 (0.86) *	3.38 (0.98) **
Mother's age		-0.05 (0.08)	-0.06 (0.09)		-0.04 (0.08)	-0.05 (0.08)
Parent's marital status (reference = married)						
Cohabiting		0.51 (0.86)	0.43 (0.85)		0.64 (1.00)	0.56 (1.02)
Nonresidential romantic relationship		-0.93 (0.94)	-1.02 (0.88)		-0.64 (0.98)	-0.73 (1.04)
Separated		0.04 (0.94)	-0.23 (0.87)		-0.06 (1.37)	-0.35 (1.33)
Number of siblings		-0.45 (0.28)	-0.36 (0.28)		-0.13 (0.22)	-0.03 (0.22)
Mother's education (reference = less than HS)						
High school diploma or GED		0.90 (0.57)	1.21 (0.53) *		1.32 (0.85)	1.65 (0.83)

	W-J Passage Comprehension			W-J Applied Problems		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Some college		2.24 (0.82) *	1.76 (0.89)		3.48 (1.03) **	2.97 (0.96) **
College degree		6.95 (1.00) ***	5.44 (1.20) ***		7.26 (1.66) ***	5.66 (1.65) **
Father's education (reference = less than HS)						
High school diploma or GED		0.02 (0.48)	-0.15 (0.48)		-1.18 (0.63)	-1.36 (0.66)
Some college		2.50 (0.66) **	2.23 (0.65) **		2.47 (0.81) **	2.18 (0.81) *
College degree		1.88 (0.96)	1.49 (0.98)		2.81 (1.08) *	2.40 (1.15)
Mother's household income (log)		0.77 (0.26) **	0.68 (0.27) *		0.72 (0.25) *	0.62 (0.26) *
Mother employed		1.29 (0.60) *	1.38 (0.60) *		0.85 (0.54)	0.94 (0.51)
Mother receives welfare		-0.52 (0.61)	-0.37 (0.64)		-1.11 (0.58)	-0.95 (0.58)
Mother depressed		1.79 (0.70) *	1.90 (0.70) *		0.13 (0.74)	0.25 (0.74)
Mother engagement		0.42 (0.18) *	0.29 (0.18)		0.15 (0.32)	0.02 (0.32)
Child is male		-3.41 (0.49) ***	-3.12 (0.47) ***		-0.66 (0.49)	-0.35 (0.47)
Child born low birth weight		-2.86 (0.99) *	-2.29 (0.94) *		-4.28 (0.97) ***	-3.68 (0.91) ***
Child breastfed		0.43 (0.47)	0.23 (0.49)		1.08 (0.72)	0.87 (0.70)
Child age, in months		-0.23 (0.06) **	-0.22 (0.06) **		-0.24 (0.06) ***	-0.23 (0.05) ***
PPVT score			0.17 (0.02) ***			0.18 (0.02) ***
Constant	95.64	113.18	98.40	100.76	120.68	105.06
R-squared	0.05	0.19	0.22	0.03	0.17	0.20
N	2,302	2,302	2,302	2,302	2,302	2,302

Note: Robust standard errors in parentheses.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

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Table 5

Unweighted OLS Regression Models Estimating Test Scores at Age Nine as a Function of Timing of Problem Behaviors, with Mechanisms

	W-J Passage Comprehension		W-J Applied Problems	
	Model 1 *baseline model*	**Model 2** *+ school readiness*	**Model 1** *baseline model*	**Model 2** *+ school readiness*
Internalizing problem behaviors (reference = no problems)				
Problems at age 3	-1.25 (0.77)	-1.07 (0.71)	0.58 (1.15)	0.83 (1.07)
Problems at age 5	-0.50 (1.08)	-0.56 (1.01)	0.62 (1.17)	0.54 (1.10)
Problems at ages 3 and 5	-0.01 (1.42)	0.05 (1.37)	0.77 (1.62)	0.86 (1.59)
Externalizing problem behaviors (reference = no problems)				
Problems at age 3	-2.78 (0.49) ***	-2.34 (0.51) ***	-2.09 (1.00) *	-1.49 (0.95)
Problems at age 5	-0.29 (0.85)	0.02 (0.79)	-0.50 (1.06)	-0.07 (1.01)
Problems at ages 3 and 5	-1.64 (1.07)	-1.15 (1.07)	-2.04 (0.96) *	-1.38 (1.04)
Attention problem behaviors (reference = no problems)				
Problems at age 3	0.34 (0.87)	0.15 (0.88)	-0.17 (0.87)	-0.42 (0.84)
Problems at age 5	-0.80 (0.67)	-0.78 (0.68)	-2.52 (0.96) *	-2.50 (0.96) *
Problems at ages 3 and 5	-2.81 (0.85) **	-2.80 (0.86) **	-3.69 (1.12) **	-3.67 (1.16) **
Constant	98.40	80.05	105.06	80.04
R-squared	0.22	0.26	0.20	0.25
N	2,302	2,302	2,302	2,302

Note: All models adjust for variables in Table 4. Robust standard errors in parentheses.

* $p < .05$.

** $p < .01$.

*** $p < .001$.