

# Academic Underachievement and Delinquent Behavior

Youth &amp; Society

1–28

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DOI: 10.1177/0044118X18767035

journals.sagepub.com/home/yas



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## Abstract

Considerable research has addressed whether various academic factors affect involvement in delinquent behavior among youth. Yet few studies have assessed the association between academic underachievement and delinquency. Academic underachievement is defined as school performance, such as measured by grades, that falls below what is predicted by standardized tests of mental/cognitive ability. Using two waves of longitudinal data ( $n = 11,223$ ), this study aimed to evaluate this association and determine if it is affected by school attachment, family relations, parental education, or self-control. The results of the empirical model suggested a modest association between academic underachievement and delinquent behavior, but it was partially attenuated by attention deficits, an indicator of low self-control. Additional analyses indicated that attention deficits were associated with both underachievement and delinquent behavior.

## Keywords

academic underachievement, delinquent behavior, self-control, attention deficits

Many studies have examined the association between school-related factors and involvement in delinquent behavior among adolescents. Of particular interest to researchers is academic achievement, which is typically measured

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using self-reported or transcript grades. Most studies have shown a negative association between grades and delinquency or related behaviors (e.g., truancy, suspension, expulsion; for example, Hoffmann, Erickson, & Spence, 2013; Lucia, Killias, & Junger-Tas, 2012; van Lier et al., 2012). Similarly, although the research is controversial (e.g., Ellis & Walsh, 2003), recent studies have found that low scores on various types of IQ or cognitive/mental ability tests are associated with a higher risk of delinquent behavior (e.g., Beaver et al., 2013; Schwartz et al., 2015; Ttofi et al., 2016).

Some researchers have posited that higher intelligence or better developed cognitive skills positively affect school performance, which, in turn, is negatively associated with delinquent behavior (McGloin, Pratt, & Maahs, 2004; Möttus, Guljajev, Allik, Laidra, & Pullmann, 2012). An alternative view that has rarely been investigated involves academic underachievement: school performance that falls below what is predicted by standardized tests of mental ability (Smith, 2005; Wong, 2016). In other words, underachievement is conceptualized as scholastic underperformance based on what is expected from a youth's assessed intellectual ability and the grades one receives in school (Barry, Lyman, & Klinger, 2002; Smith, 2005; Wong, 2016). Academic underachievement is a promising concept that, for reasons discussed later, may increase the risk of delinquent behavior.

The purpose of this study was to examine the potential association between underachievement and youth delinquency. As previous research has suggested that the link between academics and delinquency is affected by school, family, and intra-individual factors (Felson & Staff, 2006; Henry, Knight, & Thornberry, 2012; Hirschfield & Gasper, 2011), this study also investigated whether school attachment, family relations, parental education, or self-control affect the association between underachievement and delinquent behavior. The results suggested a modest positive association between underachievement and delinquent behavior, but one that is affected partly by attention deficits among youth.

## Background

There has been considerable interest in the influence of academic factors on delinquent behavior among adolescents. Much of the research on this issue is guided, in large part, by social bond theory (Hirschi, 1969). In general, youth who receive better academic marks, score higher on course examinations, and are more involved in extracurricular activities are presumed to be more closely bonded to schools and to educational pursuits. Thus, they tend to be less involved than others in delinquent behavior (Lucia et al., 2012; Welsh & Harding, 2015). Better academic achievement, in particular, has routinely

been shown to reduce the risk of involvement in delinquent behavior (Hoffmann et al., 2013; Murray & Farrington, 2010; Siennick & Staff, 2008; van Lier et al., 2012). Although some studies have also indicated that delinquency affects subsequent academic achievement, these findings have been inconsistent (cf. Carroll et al., 2009; Hoffmann et al., 2013).

A similar factor that predicts delinquent behavior involves intellectual capabilities, such as those gauged by intelligence, mental ability, or cognitive skills tests. The potential link between measures of intelligence and delinquent behaviors is controversial (e.g., Cullen, Gendreau, Jarjoura, & Wright, 1997; Ellis & Walsh, 2003), especially because a hetereritarian model has often been used to link intellect, ethnicity, and social class (Nisbett, 2009), and due to the dim view that many scholars developed regarding physiological influences on criminal behavior (Rafter, 2008). Nonetheless, youth who score lower on mental ability tests such as the Wechsler Intelligence Scale for Children (WISC) and the Peabody Picture Vocabulary Test–Revised (PPVT-R) stand a greater risk of involvement in delinquent behaviors (Beaver et al., 2013; Loeber et al., 2012; Murray & Farrington, 2010; Schwartz et al., 2015; Ttofi et al., 2016; for contrary findings, though, see Mahler, Simmons, Frick, Steinberg, & Cauffman, 2017; McCartan & Gunnison, 2004).

## **Academic Underachievement and Delinquent Behavior**

An alternative way of viewing the link between academic achievement and delinquency is to consider whether youth who underachieve academically are at risk of delinquent behavior. Briefly, academic underachievement occurs when students' school performance—as gauged by their grades—is lower than what is predicted by standard tests of mental/cognitive abilities (Smith, 2005; Wong, 2016). This concept was well-researched in psychology in the 1970s through the 1990s (Hinshaw, 1992), with studies suggesting that youth who underachieve in academic settings tend to manifest behavioral problems, aggression, low self-esteem, and depressive symptoms (e.g., Frick et al., 1991; Mandel & Marcus, 1988). Underachievement has also been linked to school dropout, poor employment prospects, and lower income in adulthood (Z. Chen & Kaplan, 2003; Eide & Showalter, 2001; Timmermans, van Lier, & Koot, 2009).

Research on the association between academic underachievement and delinquent behavior has been rare. Much of the early psychological research that focused on behavioral problems or delinquent conduct measured underachievement only indirectly by surmising that low academic achievement or low IQ was a sufficient proxy (for a review, see Hinshaw, 1992). Few studies

have been published in the last two decades, though. Those that have assessed underachievement more recently have relied on measures of being held back a grade, school dropout, or teacher ratings of school effort or performance as surrogates (e.g., Tempelaar et al., 2014; van Lier et al., 2012).

An exception is Timmermans and colleagues' (2009) study of underachievement and delinquency among a sample of Dutch youth. They assessed academic underachievement as a discrepancy score based on earlier academic advisement by teachers regarding which curriculum track youth should follow (e.g., prevocational vs. preuniversity) and their level of education or degree at age 18. Academic underachievement was operationalized as those who fell below the recommendation because they dropped out, were 2 years behind in school, or followed a lower track than advised. The results of their analysis indicated that property offenses were associated with underachievement, although the temporal order was not clear.

Even though there has been a paucity of research on underachievement in recent years, it may serve a key role in understanding the association between academic performance and delinquent behavior. When ability and skills are present, yet academic achievement is relatively low, as is the case among youth underachievers, this is a direct signal of a weak social bond and, according to social bond theory (Hirschi, 1969), the risk of delinquent behavior increases. Underachievement in this context demonstrates a lack of commitment to conventional educational goals.

Research on academics and delinquency has shown that several factors affect their relationship and thus may also affect the putative association between underachievement and delinquency. These factors include a lack of attachment to schools, family background and relations, and self-control (Felson & Staff, 2006; Henry et al., 2012; Zill, 2013). For instance, among many youth, academic success is influenced by a strong attachment to their schools, which fosters adherence to conventional goals, and, generally, engagement with conventional means of success (Hirschfield & Gasper, 2011). Thus, youth may be more likely to underachieve when they are weakly attached to their schools. And weak attachment to schools has been found to presage delinquent behavior (Dornbusch, Erickson, Laird, & Wong, 2001; Payne, 2008).

Positive family relationships or higher levels of social capital also heighten academic effort and performance (Parcel, Dufur, & Zito, 2010; Woolley & Bowen, 2007) and may discourage underachievement (Howard & Reynolds, 2008) and delinquent behavior (Henry et al., 2012). Low parental education might also bring about underachievement as such parents may not serve as sufficient role models for school success (Zill, 2013); it has also been linked to delinquent behavior (Demuth & Brown, 2004).

In addition, recent studies have suggested that self-control—the ability to delay gratification (Gottfredson & Hirschi, 1990)—may account for the associations among mental/cognitive skills, academic achievement, and delinquency. Low self-control is associated with a higher risk of delinquent behavior (e.g., Benda, 2005; Vazsonyi, Mikuška, & Kelley, 2017) and low academic achievement (e.g., Barriga et al., 2002; Frick et al., 1991), thus serving as a potential confounder of their association. Consider, for example, Felson and Staff's argument about school performance and delinquency. Drawing upon Gottfredson and Hirschi (1990), they observed, "Adolescents are unable to get good grades because they lack the self-restraint necessary to study and pay attention in class. . . . It is not the adolescents' attitudes toward school and parents that cause them to engage in delinquency, but rather their [in]ability to regulate their behavior" (Felson & Staff, 2006, p. 301). To build on their argument, adolescents' underachievement may not result so much from their family background or attachment to schools, but rather from their low self-control, including an inability to self-regulate and attention deficits that make it more difficult to thrive academically even when mental/cognitive skills are sufficiently developed (cf. Barriga et al., 2002; Frick et al., 1991). And the low self-control that affects underachievement also leads to a heightened risk of delinquent behavior.

## Implications and Hypotheses

In sum, there is limited research on whether academic underachievement and delinquent behavior are positively associated among youth. Although some indirect evidence for this relationship was offered by psychology researchers—mostly in the 1980s and 1990s—there has been little attention in recent years. The lack of attention to the association between underachievement and delinquency is unfortunate as the former is an important indicator of commitment to one's education, a key source of social bonding to conventional societal norms and expectations.

Assuming there is an association between underachievement and delinquent conduct (e.g., Timmermans et al., 2009), for reasons described earlier, it may also be affected by parental education, family relations, attachment to schools, or self-control. Thus, this study examined the following hypotheses:

**Hypothesis 1:** There is a positive association between academic underachievement and subsequent delinquent behavior, net the effects of other covariates.

**Hypothesis 2:** The association is attenuated by low parental education.

**Hypothesis 3:** The association is attenuated by parent/family relations and attachment to schools.

**Hypothesis 4:** The association is attenuated by low self-control.

## Method

To test the hypotheses, I used data from the first two waves of the National Longitudinal Study of Adolescent Health (Add Health; <http://www.cpc.unc.edu/projects/addhealth>). Data were initially gathered from students in Grades 7 to 12, parents, and schools during the 1994-1995 academic year. A follow-up survey was administered during the 1995-1996 academic year. These surveys included an in-home component administered to 20,745 students during the first wave and a random subsample of 14,738 students during the second wave. In addition, information was collected from high school transcript data at a later date to develop measures of school grades. Although third and fourth waves of data were also gathered, they covered the years 2001-2002 and 2007-2008. By this point, the respondents were in their early adult years. As this study was concerned with delinquent behavior and academic underachievement among adolescents, I relied on the first and second waves only.

After omitting respondents who were not asked the relevant questions and who dropped out after the initial wave of data collection, the analytic sample was 11,223. As the Add Health study oversampled certain groups (e.g., Hispanics) and was based on a stratified sampling design, all analyses used sampling weights along with correction for the design effects of the survey (P. Chen & Chantala, 2014).

## Measures

Delinquent behavior was measured during Waves 1 and 2 using 12 items that inquired about involvement in vandalism, breaking and entering, assault, car theft, and group fighting. These items have been utilized in earlier delinquency research that relied on data from the Add Health (e.g., Demuth & Brown, 2004; Kort-Butler, 2017). The variables were coded from 0 = *never* to 2 = 3 or more times. The delinquency items were used in a measurement model designed to yield latent constructs from categorical variables. The results of this model are described subsequently.

Measures of mental/cognitive skills and academic achievement were needed to estimate academic underachievement (Smith, 2005). Mental/cognitive skills were measured using the abridged version of the PPVT-R that was

administered during the first wave of Add Health. The PPVT-R was designed to assess verbal intelligence, in particular respondents' receptive vocabulary for Standard American English. Thus, it is presumed to measure their verbal ability and derivative scholastic aptitude (Nigg & Huang-Pollock, 2003). Research has shown that the PPVT-R has good construct, concurrent, and predictive validity relative to similar skills assessments such as the Wechsler intelligence tests (Naglieri & Pfeiffer, 2006). It has also been used in several studies to assess the association between intelligence and delinquency (e.g., Beaver et al., 2013; Yun & Lee, 2013), especially as research has indicated that verbal ability is related more consistently than other forms of intelligence (e.g., spatial, processing speed) to delinquent and similar behaviors (Ayduk, Rodriguez, Mischel, Shoda, & Wright, 2007). The scores were standardized in the Add Health data set to have a mean of 100 and a standard deviation of 15, with higher values indicating greater verbal abilities.

Researchers have often measured academic achievement with self-reports of grades. Studies have shown, though, that self-reports are prone to recall bias and tend to be biased upward, especially among low achievers (Kuncel, Credé, & Thomas, 2005). This bias appears to be larger among delinquent youth (Siennick & Staff, 2008). Fortunately, Add Health also has supplementary transcript grades that were culled from high school records (Muller et al., 2007). Transcript grades were gathered for 11,607 Add Health participants. Using these transcripts, grade point average (GPA) was computed for each school year for each respondent on a standard 4-point scale. Grade level at Wave 1 was then linked to their GPA in that year ( $M = 2.69$ ,  $SD = 0.89$ ). A statistical comparison between those respondents who had valid transcript grades and those who did not revealed few differences (Muller et al., 2007).

There are two common ways to estimate academic underachievement with mental/cognitive skills and GPA. First, some researchers have used difference scores, with underachievement gauged as a score that indicates the adolescent had a lower GPA than the scores from a general skills test. Second, the residual approach regresses GPA on the skills test score and uses the residuals from the model to estimate underachievement (Smith, 2005; Snyder & Linnenbrink-Garcia, 2013). Both approaches were used with the Add Health data to operationalize underachievement. The difference score was calculated after computing  $z$ -scores for the PPVT-R score and GPA to set them on a similar metric and then estimating  $z(\text{PPVT-R}) - z(\text{GPA})$ , with higher scores indicating higher levels of underachievement. The residual approach was based on the regression model  $\text{GPA}_i = \alpha + \beta(\text{PPVT-R}_i)$  followed by computation of the standardized residuals:  $z(\epsilon_i) = z[y_i - \hat{y}_i]$ . These residuals were then reverse coded so that positive values indicate

underachievement. Given their algebraic similarities, it is not surprising that the variables that resulted from these two approaches had a large positive correlation ( $r = .92$ ). The findings of analyses using these two variables yielded quite similar results. Thus, I used the residual scores in subsequent analyses. It has a mean of zero and a standard deviation of 1.14, and ranges from  $-3.56$  to  $2.99$ . The sensitivity analyses described later included variations of these scores to determine if the results are sensitive to the way underachievement is measured.

Examining Hypotheses 2 to 4 required measures of parental education, parent and family relations, school attachment, and self-control. Each was measured during Wave 1. This militates against establishing the temporal order of academic underachievement and these additional variables as they were measured concurrently. It is thus not possible to fully establish whether the variables might simply confound or actually intervene in the association between underachievement and delinquent behavior. Nonetheless, for reasons mentioned earlier, using additional waves of the Add Health data was not feasible.

Parental education was based on two inquiries from the parent interview. The responding parent was asked "How far did you go in school?" and "How far did [he or she] go in school?" The latter question was designed to measure the other parent's level of education. Responses were coded into one of eight categories ranging from less than ninth grade (coded 1) to professional training beyond a 4-year college or university (coded 8). The highest level of education for either parent was utilized in the analyses. This variable has a mean of 5.98 (corresponding to approximately some education beyond high school) and a standard deviation of 2.20.

Similar to the delinquency items, the following variables, from parent and family relations to self-control, were based on latent constructs from the measurement models described later. Parent and family relations (Hypothesis 3) were gauged by eight items that asked respondents how close they felt to their mother or mother figure, how much they felt their mother cared about them, how close they felt to their father or father figure, how much they felt their father cared about them, and whether their family cared about them, understood them, or had fun together (cf. Dornbusch et al., 2001). The items were coded so that all were on a scale from 1 to 5 (*strongly disagree* to *strongly agree*), where a higher score indicated better relations.

To assess school attachment (Hypothesis 3), I utilized seven questions that inquired whether respondents felt close to people at school, felt a part of school, were happy at school, felt safe at school, and had trouble with their teachers (cf. Dornbusch et al., 2001). With two exceptions, each variable was coded from 1 = *strongly disagree* to 5 = *strongly agree*. The other two

variables used a slightly different 5-point scale. Higher values indicated higher reported levels of school attachment.

The Add Health data have been used to measure self-control in various ways (Hypothesis 4). Perrone, Sullivan, Pratt, and Margaryan (2004) and Beaver, DeLisi, Mears, and Stewart (2009), for instance, combined attitudinal and behavioral indicators, such as whether respondents “had problems keeping their mind on what they were doing,” had trouble “getting along with teachers,” or had difficulty “paying attention in school.” Hirschi (2008) argued that self-control is more akin to lacking inhibitions and exhibiting a short-tempered impulsive nature. In addition, there is a risk of tautology by including analogous behavioral measures, such as getting along with teachers, to gauge self-control (cf. Beaver et al., 2009; Tittle, Ward, & Grasmick, 2003). Thus, I considered a range of variables, 16 in total, including those used by other researchers (e.g., Beaver et al., 2009). This included the following inquiries: (a) whether respondents tried to do their school work well; (b) some decision making questions (e.g., “When making decisions, you generally use a systematic method for judging and comparing alternatives”); (c) how adolescents responded to the statement “You never argue with anyone” (response options: *strongly agree* to *strongly disagree*); (d) whether parents thought their child had a bad temper (0 = *no*, 1 = *yes*); and (e) whether parents thought they could “really trust” their child (responses range from “always” [coded 0] to “never” [coded 5]). In general, this set of variables evaluated issues of self-control, impulsivity, decision making, temper, and attention deficit issues. All of these items were considered in the measurement model described later.

As control variables, I included two variables that have been shown to affect delinquency and that may also affect one’s academic performance: parental supervision and delinquent peers (cf. Ahn & Trogon, 2017; Parcel et al., 2010). Parental supervision was assessed at Wave 1 with three questions: (a) a parent was asked how many of their child’s friends’ parents they knew, (b) adolescent respondents were asked if they usually told their mother or father where they went after school, and (c) adolescent respondents were asked if they usually told their mother or father where they went on weekends or evenings. Each variable was coded so that higher values indicated greater parental supervision. These three variables were included in the measurement model discussed later.

Peer delinquency was measured at Wave 1 using a combination of peer network and self-report data (Haynie & Osgood, 2005). In the in-school Add Health survey, respondents nominated up to five male and five female friends. As the survey was given to all students at the participating schools, all within-school nominations may be linked to self-report data. Respondents were

asked, “During the past 12 months, how often did you. . .” (a) smoke cigarettes and (b) get drunk. The responses ranged from 0 = *never* to 6 = *nearly every day*. A similar item asked, “In the past year, how often have you gotten into a physical fight?” The responses ranged from 0 = *never* to 4 = *more than 7 times*. The mean score of all the nominated friends who were part of the Add Health sample was included for each peer delinquency item: smoking, getting drunk, and fighting. These three variables were included in the measurement model discussed subsequently.

Based on previous research (e.g., Demuth & Brown, 2004; Felson & Staff, 2006; Langenkamp, 2016; Murray & Farrington, 2010), I included several additional control variables in the model, each measured at Wave 1. These were sex, grade in school, family residential move, family income, family structure, race/ethnicity, region of residence, and college aspirations. Sex was an indicator variable coded as 0 = female and 1 = male. It is designated as *male* in the tables. Grade in school was measured from 7 through 12 during the first wave. Family move was an indicator variable coded as 0 = did not move between Waves 1 and 2 and 1 = moved to a new home between waves. Family income was measured in thousands of dollars, but the natural logarithm of this variable was used to normalize its distribution as it manifested sizable skew.

Family structure was measured by a set of indicator variables (single parent family, stepparent family, other family arrangement), with two biological parent family as the reference category. The race/ethnicity categories included White, African American, Hispanic, Asian/Pacific Islander, Native American, and Other. White comprised the reference group. Region was divided into four areas of residence: Northeast, Midwest, South, and West; with Northeast as the reference category. Finally, I included a variable that was based on the following inquiry: “On a scale of 1 to 5, where 1 is low and 5 is high, how much do you want to go to college?” The variable was recoded so that zero is the lower bound and 4 is the upper bound. This was included because it is feasible that those who wished to attend college may have been less likely to underachieve. Descriptive statistics for all the variables in the model are provided after estimating the measurement model to identify the latent constructs.

### **Analysis Strategy**

As an initial analysis step, I imputed missing data using multiple imputation. In general, the variables used in the analysis had modest proportions of missing data (median = 3%). About half of the observed variables had less than 0.5% missing values. Eleven percent of the family income observations were missing. Thus, I constructed 25 multiply imputed data sets using a chained equations method of multiple multivariate data imputation to improve power

and efficiency in the estimates (Graham, Olchowski, & Gilreath, 2007). A set of auxiliary variables was included in the imputation model to reduce potential bias in missing value estimates (Graham, 2009). Each imputed data set was separated by 100 iterations because graphical diagnostics indicated that the imputation model converged well before that point (Enders, 2010). The models were estimated separately on each of the imputed data sets and Rubin's (1987) formulas were used to combine parameter estimates and standard errors into a single set of results.

Following the imputation stage, I estimated a measurement model with the statistical package MPlus 7.4 that utilized all the observed categorical explanatory variables and the outcome variable. This was designed to estimate latent constructs, based on factor scores, for delinquent behavior, family relations, school attachment, self-control, supervision, and peer delinquency. The model used a robust weighted least squares approach that was appropriate for categorical indicators (Finney & DiStefano, 2006). Once a satisfactory model was obtained (see the "Results" section), I fit structural equation models (SEMs) to estimate the effects of the latent constructs and the control variables on delinquent behavior. The models were adjusted for the complex sampling design of the Add Health data and used sampling weights.

The SEMs were fit in two stages. The first model regressed Wave 2 delinquent behavior on Wave 1 delinquent behavior, academic underachievement, and several of the control variables described earlier. This was designed to test Hypothesis 1. The second model added the proposed explanatory variables: school attachment, family/parent relations, and self-control, as well as parental supervision and peer delinquency. This was designed to test Hypotheses 2 to 4. As two waves of longitudinal data were used, the regression model estimated the effects of these variables on changes in delinquent behavior from Wave 1 to Wave 2 (Greenberg, 2008).

## Results

### *Measurement Model*

The initial measurement model was fit in MPlus using all the observed indicators for each of the proposed latent variables described earlier. As common method effects were likely to affect adjacent questionnaire items (Lance, Dawson, Birkelbach, & Hoffman, 2010), the residuals from adjacent items were allowed to covary (e.g., physical fight at Time 1 and hurt someone at Time 1 as these were adjacent items in the survey instrument; family understands me and family has fun together, which were also adjacent questionnaire items).

The initial measurement model with each latent variable specified resulted in a poor fit (comparative fit index [CFI] = 0.85; root mean square error of approximation [RMSEA] = 0.09). According to this model, there appeared to be four problems that involved (a) some of the delinquency items, (b) the school attachment item concerning trouble with teachers, (c) one of the supervision items (the parent question), and (d) the lack of fit of the self-control items. Contrary to some previous studies (e.g., Perrone et al., 2004), the self-control items loaded on two separate latent constructs: attention deficit issues and whether parents thought their child had a bad temper and could not be trusted. The attention deficit latent construct appeared to be similar to the construct Thoughtfully Reflective Decision Making (TRDM), which has been found to be related to subsequent criminal behavior (Paternoster, Pogarsky, & Zimmerman, 2011). It may thus be closer to a measure of cognitive processing rather than to a strict self-control measure.

After removing the observed items that did not load well and permitting two latent self-control constructs, I estimated a final measurement model. Its properties are shown in Table 1. All of the standardized loadings for the observed items exceeded 0.50 for their particular latent constructs. Model fit was adequate, with a CFI of .966 and an RMSEA of .015 (95% confidence intervals [CIs] = [.010, .020]), well below most recommended thresholds. The percentages of variance explained by each latent variable, based on polychoric principal components analyses (Kolenikov & Angeles, 2009), were at or above about 56%. Table 2 furnishes descriptive statistics for each of the single item variables and latent constructs.

## SEMs

The results of the SEMs are provided in Table 3. The first model included Wave 1 delinquent behavior, academic underachievement, and most of the control variables. The second model added key explanatory variables, as well as parental supervision and delinquent peers. Model 1 suggested a modest positive association between academic underachievement and changes in delinquent behavior from the first to the second year of the survey. Each one standardized unit increase in underachievement was associated with about a 0.06 standardized unit increase in delinquent behavior, thus suggesting a modest association. It is interesting to note that this coefficient was one of only a few that were statistically significant in the first model. Consistent with previous studies, males tended to be involved in more delinquent behavior than females ( $\beta = 0.012, p < .05$ ). Those living with single parents or stepparents also tended to be more involved in delinquent behavior than those in two parent families. There was also a modest positive association between

**Table 1.** Loadings and Fit Information From Final Measurement Model, National Longitudinal Study of Adolescent Health (Add Health), 1994-1995.

| Variable                      | Factor loading <sup>a</sup> | SE   | Standardized loading | % of variance explained <sup>b</sup> |
|-------------------------------|-----------------------------|------|----------------------|--------------------------------------|
| Delinquent behavior—Wave 1    |                             |      |                      | 55.9                                 |
| Graffiti                      | 1.000                       | —    | .744                 |                                      |
| Damage property               | 0.981                       | .031 | .727                 |                                      |
| Stolen from store             | 0.945                       | .032 | .699                 |                                      |
| Physical fight                | 0.823                       | .035 | .604                 |                                      |
| Hurt someone                  | 0.998                       | .039 | .751                 |                                      |
| Stole car                     | 0.942                       | .063 | .702                 |                                      |
| Burglary                      | 0.913                       | .059 | .679                 |                                      |
| Strong armed                  | 0.966                       | .032 | .697                 |                                      |
| Sold drugs                    | —                           | —    | —                    |                                      |
| Stole >US\$50                 | 0.787                       | .030 | .560                 |                                      |
| Group fight                   | 0.840                       | .026 | .655                 |                                      |
| Rowdy/public nuisance         | —                           | —    | —                    |                                      |
| Delinquent behavior—Wave 2    |                             |      |                      | 56.4                                 |
| Graffiti                      | 1.000                       | —    | .653                 |                                      |
| Damage property               | 1.041                       | .050 | .706                 |                                      |
| Stolen from store             | 1.024                       | .052 | .694                 |                                      |
| Physical fight                | 0.905                       | .045 | .607                 |                                      |
| Hurt someone                  | 1.119                       | .066 | .780                 |                                      |
| Stole car                     | 1.233                       | .052 | .783                 |                                      |
| Burglary                      | 1.020                       | .070 | .659                 |                                      |
| Strong armed                  | 1.113                       | .048 | .723                 |                                      |
| Sold drugs                    | —                           | —    | —                    |                                      |
| Stole >US\$50                 | 0.965                       | .057 | .640                 |                                      |
| Group fight                   | 0.842                       | .053 | .578                 |                                      |
| Rowdy                         | —                           | —    | —                    |                                      |
| School attachment             |                             |      |                      | 60.9                                 |
| Teachers care                 | 1.000                       | —    | .668                 |                                      |
| Close to people               | 0.777                       | .022 | .543                 |                                      |
| Part of school                | 0.891                       | .020 | .600                 |                                      |
| Happy at school               | 1.003                       | .025 | .669                 |                                      |
| Teachers fair                 | 0.952                       | .020 | .638                 |                                      |
| Feel safe                     | 0.776                       | .021 | .519                 |                                      |
| Trouble with teachers         | —                           | —    | —                    |                                      |
| Parent-child/family relations |                             |      |                      | 57.9                                 |
| Family understands            | 1.000                       | —    | .756                 |                                      |
| Family has fun                | 1.018                       | .018 | .761                 |                                      |

(continued)

**Table 1. (continued)**

| Variable                   | Factor loading <sup>a</sup> | SE   | Standardized loading | % of variance explained <sup>b</sup> |
|----------------------------|-----------------------------|------|----------------------|--------------------------------------|
| Family pays attention      | 1.005                       | .016 | .756                 |                                      |
| Close to mom               | 0.903                       | .020 | .704                 |                                      |
| Close to dad               | 0.855                       | .021 | .665                 |                                      |
| Mom warm                   | 0.888                       | .023 | .681                 |                                      |
| Dad warm                   | 0.929                       | .020 | .722                 |                                      |
| Parents care               | 0.895                       | .019 | .699                 |                                      |
| Parental supervision       |                             |      |                      | 83.7                                 |
| Parents know friends       | —                           | —    | —                    |                                      |
| After school               | 1.000                       | —    | .803                 |                                      |
| On weekends                | 1.112                       | .029 | .825                 |                                      |
| Delinquent peers           |                             |      |                      | 69.2                                 |
| Friends smoke              | 1.000                       | —    | .919                 |                                      |
| Friends gotten drunk       | 0.744                       | .030 | .829                 |                                      |
| Friends physical fighting  | 0.591                       | .013 | .590                 |                                      |
| Self-control               |                             |      |                      |                                      |
| Attention                  |                             |      |                      | 63.2                                 |
| Mind wanders               | 1.000                       | —    | .581                 |                                      |
| Attention in school        | 1.213                       | .038 | .665                 |                                      |
| Trouble with homework      | 1.009                       | .037 | .662                 |                                      |
| Try to do school work well | 0.891                       | .042 | .508                 |                                      |
| Temper                     |                             |      |                      | 68.3                                 |
| Bad temper                 | 1.000                       | —    | .525                 |                                      |
| Parents don't trust        | 1.268                       | .094 | .665                 |                                      |
| Model fit                  |                             |      |                      |                                      |
| CFI                        | .966                        |      |                      |                                      |
| RMSEA                      | .015                        |      |                      |                                      |

Note. The results are from a CFA designed for categorical indicators. The analysis used a robust WLS estimator and 25 multiply imputed data sets to adjust for missing data in the observed indicators. The coefficients and standard errors were adjusted for the complex sample design of the Add Health data set. All of the *p* values for the factor loadings were less than .001 (two-tailed test). *N* = 11,223. CFI = comparative fit index; RMSEA = root mean square error of approximation; CFA = confirmatory factor analysis; WLS = weighted least squares.

<sup>a</sup>A factor loading of 1.000 indicates that the scale for the observed indicator was used to fix the scale for the latent variable.

<sup>b</sup>The percentage of variance explained by the latent variable was based on a polychoric principal components analysis.

**Table 2.** Means, Standard Errors, Minimum, and Maximum Values of Outcome and Explanatory Variables, National Longitudinal Study of Adolescent Health (Add Health), 1994-1995.

| Variable                                 | M    | SE   | Minimum | Maximum |
|--|------|------|---------|---------|
| Delinquent behavior—Wave 1 <sup>a</sup>  | 0.00 | 0.04 | -0.86   | 7.01    |
| Delinquent behavior—Wave 2 <sup>a</sup>  | 0.00 | 0.05 | -0.70   | 7.30    |
| Academic underachievement (standardized) | 0.00 | 0.03 | -3.56   | 2.99    |
| Male                                     | 0.48 | 0.01 | 0       | 1       |
| Grade in school                          | 9.43 | 0.12 | 7       | 12      |
| Family moved                             | 0.43 | 0.01 | 0       | 1       |
| Family income (logged)                   | 3.58 | 0.03 | 0       | 6.91    |
| Want to attend college                   | 3.49 | 0.02 | 0       | 4       |
| Race/ethnicity                           |      |      |         |         |
| Caucasian                                | 0.69 | 0.03 | 0       | 1       |
| African American                         | 0.13 | 0.02 | 0       | 1       |
| Hispanic                                 | 0.04 | 0.01 | 0       | 1       |
| Asian/Pacific Islander                   | 0.04 | 0.01 | 0       | 1       |
| Native American                          | 0.03 | 0.01 | 0       | 1       |
| Other ethnic                             | 0.06 | 0.01 | 0       | 1       |
| Family structure                         |      |      |         |         |
| Two parent                               | 0.56 | 0.03 | 0       | 1       |
| Single parent                            | 0.24 | 0.02 | 0       | 1       |
| Stepparent                               | 0.14 | 0.02 | 0       | 1       |
| Other                                    | 0.06 | 0.01 | 0       | 1       |
| Region                                   |      |      |         |         |
| Northeast                                | 0.17 | 0.02 | 0       | 1       |
| Midwest                                  | 0.35 | 0.01 | 0       | 1       |
| South                                    | 0.37 | 0.01 | 0       | 1       |
| West                                     | 0.12 | 0.02 | 0       | 1       |
| Supervision <sup>a</sup>                 | 0.00 | 0.04 | -3.48   | 2.43    |
| Delinquent peers <sup>a</sup>            | 0.00 | 0.05 | -5.59   | 6.59    |
| Parental education                       | 5.98 | 0.09 | 1       | 9.80    |
| School attachment <sup>a</sup>           | 0.00 | 0.02 | -4.20   | 5.25    |
| Parent/family relations <sup>a</sup>     | 0.00 | 0.02 | -6.17   | 5.40    |
| Temper <sup>a</sup>                      | 0.00 | 0.04 | -2.90   | 2.10    |
| Attention deficits <sup>a</sup>          | 0.00 | 0.03 | -3.96   | 2.54    |

Note. The results are based on 25 multiply imputed data sets to adjust for missing data in the variables. The means were weighted and the standard errors were adjusted for the complex sample design of the Add Health data set.  $N = 11,223$ .

<sup>a</sup>Variable is based on a confirmatory factor model. The constituent variables and their factor loadings are provided in Table 1.

**Table 3.** Structural Equation Models of Academic Underachievement and Delinquent Behavior, National Longitudinal Study of Adolescent Health (Add Health), 1994-1995.

| Variable                                 | Model 1     |       | Model 2     |       |
|--|-------------|-------|-------------|-------|
|  | Coefficient | SE    | Coefficient | SE    |
| Delinquent behavior—Wave 1               | 0.519**     | 0.024 | 0.486**     | 0.024 |
| Academic underachievement (standardized) | 0.057**     | 0.013 | 0.034*      | 0.015 |
| Male                                     | 0.012*      | 0.005 | 0.005       | 0.008 |
| Grade in school                          | -0.100**    | 0.013 | -0.126**    | 0.015 |
| Family moved                             | 0.002       | 0.013 | 0.001       | 0.013 |
| Family income (logged)                   | 0.031*      | 0.015 | 0.023       | 0.020 |
| Want to attend college                   | -0.017      | 0.014 | -0.015      | 0.014 |
| Race/ethnicity                           |             |       |             |       |
| Caucasian <sup>a</sup>                   |             |       |             |       |
| African American                         | -0.030*     | 0.011 | -0.023*     | 0.011 |
| Hispanic                                 | 0.015       | 0.014 | 0.020       | 0.014 |
| Asian/Pacific Islander                   | -0.011      | 0.012 | -0.013      | 0.012 |
| Native American                          | 0.001       | 0.021 | 0.002       | 0.021 |
| Other ethnic                             | 0.006       | 0.011 | 0.008       | 0.011 |
| Family structure                         |             |       |             |       |
| Two parent <sup>a</sup>                  |             |       |             |       |
| Single parent                            | 0.090**     | 0.030 | 0.088*      | 0.035 |
| Stepparent                               | 0.059*      | 0.026 | 0.052       | 0.028 |
| Other                                    | 0.039       | 0.033 | 0.038       | 0.034 |
| Region                                   |             |       |             |       |
| Northeast <sup>a</sup>                   |             |       |             |       |
| Midwest                                  | 0.011       | 0.025 | 0.010       | 0.025 |
| South                                    | 0.050*      | 0.024 | 0.049       | 0.025 |
| West                                     | 0.033       | 0.039 | 0.032       | 0.040 |
| Supervision                              |             |       | -0.085**    | 0.015 |
| Delinquent peers                         |             |       | 0.019**     | 0.007 |
| Parental education                       |             |       | 0.012       | 0.014 |
| School attachment                        |             |       | -0.009      | 0.012 |
| Parent/family relations                  |             |       | -0.080**    | 0.015 |
| Temper                                   |             |       | 0.013       | 0.014 |
| Attention deficits                       |             |       | 0.056**     | 0.018 |
| R <sup>2</sup>                           | .302        |       | .313        |       |

Note. The results are from structural equation models that regressed delinquency at Wave 2 on the covariates at Wave 1 using restricted maximum likelihood. The analysis used 25 multiply imputed data sets to adjust for missing data in the variables. The coefficients and standard errors were adjusted for the complex sample design of the Add Health data set. Standardized coefficients are provided for the continuous covariates and semistandardized (*y* standardized) coefficients are provided for categorical covariates. Table 1 provides the confirmatory factor model from which several of the variables were constructed. *N* = 11,223.

<sup>a</sup>The reference category.

\**p* < .05. \*\**p* < .01 (two-tailed test).

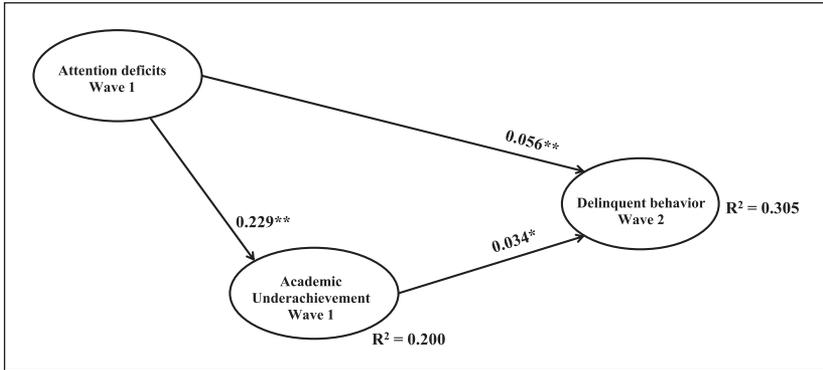
delinquent behavior and family income (cf. Demuth & Brown, 2004; Murray & Farrington, 2010).

Model 2 added the variables purported to account for the association between academic underachievement and delinquent behavior. Note that the association between underachievement and delinquency was reduced by about 40%, but remained statistically significant. Thus, the analysis offered evidence in favor of Hypothesis 1. Among the variables added to Model 2, four had statistically significant associations with delinquent behavior: parental supervision ( $\beta = -0.085$ ), delinquent peers ( $\beta = 0.019$ ), parent/family relations ( $\beta = -0.080$ ), and attention deficits ( $\beta = 0.056$ ).

Given Hypotheses 2 to 4, the next issue was to determine whether some particular variable, or set of variables, attenuated the association between underachievement and delinquent behavior. Auxiliary analyses demonstrated clearly that attention deficits were key to this attenuated effect. A model that simply added the attention deficits variable resulted in a reduction of the academic underachievement coefficient by about 34%. On the contrary, the addition of parental education, parent/family relations, or school attachment did not affect the association. Thus, whereas there was no evidence to support Hypothesis 2 or 3, Hypothesis 4 was partially supported. A modest association between delinquent behavior and underachievement ( $\beta = 0.034$ ,  $p < .05$ ) remained once attention deficits were included in the model.

As an extension, I modified the SEM to estimate two simultaneous equations to determine more clearly the impact of attention deficits. These equations were identified to determine (a) the association between attention deficits and academic underachievement, and (b) the associations among attention deficits, academic underachievement, and delinquent behavior. In both equations, I included the other variables shown in Table 3. This allowed adjustment for potential selection effects that may account for academic underachievement. The key results of this modeling exercise are provided in Figure 1.

Although the temporal order between attention deficits and underachievement is indeterminate as they were both measured during Wave 1, the results suggested that attention deficits affected delinquent behavior in two ways. First, consistent with self-control theory (Hirschi, 2008), there was a direct, albeit modest, effect on delinquent behavior. Second, there was an indirect effect that was channeled through academic underachievement and accounted for at least part of the association between this latter variable and delinquent behavior. In general, then, one of the reasons that academic underachievement influenced delinquent behavior was because it was affected by attention deficits among adolescents. Results not provided indicated that, as expected, academic underachievement tended to be more common among males and



**Figure 1.** Simultaneous equations of attention deficits, academic underachievement, and delinquent behavior.

Source. National Longitudinal Study of Adolescent Health (Add Health), 1994-1995.

Note. Standardized coefficients are provided on the paths. Stability effects from the model are not shown. The analysis uses 25 multiply imputed data sets to adjust for missing data in the variables. The coefficients and standard errors are based on weighted data and adjusted for the complex sample design of the Add Health data set. Table 1 provides the confirmatory factor model from which attention deficits and delinquent behavior are constructed.  $N = 11,223$ .

\* $p < .05$ . \*\* $p < .01$  (two-tailed test).

certain ethnic groups (African Americans, Hispanics, and Native Americans), at relatively lower levels of parental education and school attachment, and among those who had little interest in attending college (Ford & Moore, 2013; Wong, 2016).

### Sensitivity Analyses

Several additional models were estimated to determine if the associations shown in the analyses were due to particular analytic decisions or nuances of the measures. First, I used a difference score to operationalize academic underachievement and re-estimated all the models presented in Table 3 and Figure 1. This resulted in a larger effect for academic underachievement on delinquency. I also considered underachievement along a continuum (less than the 25th percentile, overachievement; between the 25th and 75th percentile, normal achievement; and above the 75th percentile, underachievement). Underachievement remained as a statistically significant predictor of delinquent behavior at Wave 2 and it was affected by attention deficits (cf. Figure 1).

Second, it is feasible to contend that it may not have been academic underachievement that affected delinquent behavior, but rather simply low grades

or low cognitive skills that predicted this outcome. When each model was estimated to include GPA or the PPVT-R scores, the effects of underachievement were magnified. It is also interesting to note that GPA ( $\beta = -0.022$ ) and the PPVT-R scores ( $\beta = -0.027$ ) had similar effect sizes.

Finally, I considered alternative regression models (e.g., negative binomial regression, zero-inflated models, multivariate regression models that assumed a joint distribution of delinquency and underachievement). None of these models suggested that the general results presented earlier should be modified. In general, then, academic underachievement was positively associated with delinquent behavior and was affected by attention deficits under several modeling conditions.

## Discussion

A long line of studies drawing on social bond theory have examined whether youth who perform better in school or on standard tests of intelligence are less involved in delinquency (e.g., Henry et al., 2012; Lucia et al., 2012; Murray & Farrington, 2010; Schwartz et al., 2015; Ttofi et al., 2016). Yet, they have tended to consider these two predictors separately or as part of a temporal chain that results in delinquency. Another way to conceptualize the link between mental or cognitive skills and academic achievement—and thus expand our understanding of how academics are associated to delinquent behavior—is to focus on academic underachievement. Although psychological studies at one time regularly addressed the association between underachievement and negative youth outcomes (Frick et al., 1991; Hinshaw, 1992), recent research has rarely addressed this issue (Timmermans et al., 2009). This is unfortunate as underachievement serves as a direct indicator of the social bond of commitment, one that does not require self-reports of school commitment from youth that may be affected by various reporting biases (Mesmer-Magnus, Viswesvaran, Deshpande, & Joseph, 2006).

Examining four hypotheses regarding the association between underachievement and delinquency, the empirical results supported the basic proposition that academic underachievement was positively, albeit modestly, associated with increases in delinquent behavior. Once attention deficits were included in the model, the association between underachievement and delinquent behavior was reduced by about two fifths. Simultaneous equations (see Figure 1) also suggested that those who reported attention deficits were at risk of both underachievement and delinquent behavior. This result is consistent with studies showing, for instance, that self-control and self-regulation issues are associated with academic underachievement and that low self-control helps account for the association between academic

factors and delinquency (cf. Barriga et al., 2002; Felson & Staff, 2006; Gardner, Dishion, & Connell, 2008; Hoffmann et al., 2013). It is also consistent with Hirschi's (2008) claim that low self-control leads to attenuated social bonds among youth. Nonetheless, as attention deficits and underachievement were both measured at Wave 1, whether the latter is a true mediator, as intimated by Figure 1, cannot be fully determined.

Academic underachievement remained a moderate predictor of increased delinquent behavior even after accounting for attention deficits and several other variables. Thus, it does appear that the academic underachievement is a promising measure of one form of social bonding—educational commitment—that affects delinquency.

### *Limitations*

There are other variables that were not available in this study but may also affect the association between underachievement and delinquency. For instance, in addition to low self-control, other candidates include commitment to educational success, low expectations of occupational success, a lack of motivation to do school work, emotional and impulse control issues, school strain or other forms of stress, or a lack of belief in the utility of school effort or achievement (Hinshaw, 1992; Mahler et al., 2017; Snyder & Linnenbrink-Garcia, 2013; Vogel & Barton, 2013). Future research on academic underachievement and delinquency should consider these potential influences.

Another type of variable that may have affected these associations involves individual differences that are due to human genetic variation (Connolly & Beaver, 2014; Sniekers et al., 2017). It is reasonable to presume, for instance, that there is a genetic component to academic underachievement that may affect its association with self-control and delinquent behavior. How this genetic component might affect these associations is unclear, however. Perhaps genetic risk factors lead to low self-control in the form of attention deficits (Middeldorp et al., 2016), which, in turn, increase the probability of underachievement. Hence, the pathway shown in Figure 1 may still be valid, yet incomplete as it does not include predisposing genetic influences. On the contrary, genetic factors may affect underachievement in other ways, such as through their influence on intellectual capabilities or academic motivation (Sniekers et al., 2017). In general, then, future studies should attend to the role of genetic and other physiologically relevant factors in the pathway from attention deficits through academic problems to delinquent behavior.

There are additional limitations that should also be addressed. First, even though self-control has been linked to genetic factors, it has also been found—contrary to its originators' view (Gottfredson & Hirschi, 1990)—to be malleable throughout adolescence and into emerging adulthood (Piquero, Jennings, & Farrington, 2010). Yet, this malleability was not measured in the empirical models presented herein. One consequence is that greater commitment to one's education may diminish attention deficits.

Second, longitudinal data were used to assess the hypotheses, but the results may not be considered causal due to the nature of the observational data used in the analysis. As already acknowledged, there are several variables that do not appear in the model yet may affect the associations shown in the analyses. These include not only genetic factors but also differences in physiological functioning (e.g., neurochemical processes, neurological functions), early childhood socialization or adversity, labeling processes, autism, learning disabilities, school-level factors, neighborhood influences on individuals and schools, and others (e.g., Kavish, Mullins, & Soto, 2016; Keppens & Spruyt, 2017; McDermott, Westerlund, Zeanah, Nelson, & Fox, 2012; Welsh & Harding, 2015). Future studies should evaluate both conceptually and empirically a broader scope of potential influences than have heretofore been considered.

Third, the measure of cognitive/mental skills addressed verbal ability, but there might be other dimensions, such as performance IQ, that may also be associated with academic success and delinquent behavior. The results presented in this research may be misspecified if they are affected by different measures of cognitive or mental abilities. As other measures of these skills were not available in the data, future studies should consider them to determine if they affect the results.

Fourth, future research may also wish to examine whether underachievement is more germane for specific types of delinquent offending. Although a single latent construct underlies the manifest delinquency items used in the analysis, there may be stronger effects on, say, property offending than on personal or violent offending.

Finally, there is the potential for reciprocal influences inherent in models of academic underachievement and delinquency (cf. Hoffmann et al., 2013). For instance, underachievement at one point may influence subsequent family relations, school attachment, academic aspirations, or other aspects of adolescent life. These influences have not been investigated in extant studies. It may be time to do so to not only appreciate the association between underachievement and delinquent behavior better, but also to improve our understanding of academic underachievement and educational commitment in

general. If there are reciprocal effects, the true effect of underachievement on delinquency may be misspecified in this study.

In sum, the results demonstrated a modest association between academic underachievement and an increased risk of delinquent behavior. This association was partially, but not wholly, determined by differences in attention deficits among youth. Hence, in addition to future attention to the effects of academic achievement or intelligence on delinquency, researchers should also consider how a disjunction between intellectual potential and academic realization affects involvement in delinquent behaviors. This is an important theoretical issue, for it shows how a direct measure of commitment affects delinquent behavior. Moreover, the findings have important policy implications as youth who manifest both attention deficits and underachievement can be targeted by programs designed to reduce future involvement in delinquent and other maladaptive behaviors.

### **Author's Note**

All uses of the data, analytic decisions, and interpretations of results are my own. Persons interested in obtaining data files from Add Health should contact the Carolina Population Center ([addhealth@unc.edu](mailto:addhealth@unc.edu)).

### **Acknowledgments**

I appreciate the advice and assistance provided by Scott Wolfe, Mike Leiber, Wade Jacobsen, Kristie Rowley, Carter Rees, Lance Erickson, and Dallin Everett. Special acknowledgment is due to Ronald R. Rindfuss and Barbara Entwisle for assistance with the original design of the Add Health project.

### **Declaration of Conflicting Interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### **Funding**

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research uses data from Add Health, a project designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris and funded by Grant P01–HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 17 other agencies. No direct support was received from grant P01–HD31921 or any other funding agency for this analysis.

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