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The Impact of Early School Behavior and Educational Achievement on Adult Drug Use Disorders: A Prospective Study

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Abstract

Few longitudinal studies have examined the effects of education on drug use disorders among community populations of African Americans. This study explores the impact of multiple early education indicators on later problem drug use in an African American population followed for more than 35 years. The initial cohort comprised all 1st graders (N = 1242, 51% female) living in the Woodlawn community of Chicago in 1966. Follow-up assessments were conducted in adolescence (1975–76), early adulthood (1992–93), and mid adulthood (2002–3). One or both adult interviews were completed by 1053 individuals providing information for identifying lifetime drug use disorders. Logistic regression with multiple imputation revealed several important relationships between early education indicators and DSM-III-R/DSM-IV drug use disorders. Specifically, the risk for adult problem drug use was related to: underachievement in 1st grade; low 7th and 8th grade standardized math scores; both suspension from and skipping school in adolescence; not having a high school diploma (compared to having a college degree), and having a diploma or GED (compared to having a college degree). Also, 1st graders characterized as shy by their teachers were less likely to develop problem drug use in adulthood. Results indicate potential opportunities for targeted intervention at multiple life stages.

Keywords

Drug use disorders; educational attainment; classroom behaviors; school performance; African Americans; longitudinal study

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Contributors

The six authors of this paper worked collaboratively to develop the scope of the research project and determine the contents of the manuscript. All authors contributed to and have approved the final manuscript. Dr. Ensminger is the Principle Investigator of the study. Drs. Ensminger, Green, and Crum contributed primarily to the conceptualization and editing of the manuscript. Dr. Fothergill drafted the manuscript for editing by her coauthors. Drs. Juon and Robertson contributed to the analyses.

Conflict of Interest

None of the authors have any conflict of interest to report.

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1. Introduction

Multiple aspects of education, such as academic performance, educational attainment, and school behaviors, have been associated with drug use and other antisocial behavior in both White and Black populations (Brier, 1995; Brook and Newcomb, 1995; Brook et al., 1998; Brunswick and Messeri, 1984; Jessor and Jessor, 1978; Kandel et al., 1978). For example, school performance has been frequently linked to the initiation of drug use in adolescence (Johnston, 1973) and with drug involvement after graduation (Schulenberg et al., 1994). Educational attainment, as indicated by both years of education and level of education, has had a consistent inverse relationship with drug use and drug use problems (Agrawal et al., 2005; Brunswick and Titus, 1998; Crum and Anthony, 2000; Fothergill and Ensminger, 2006; Green and Ensminger, 2006; Lewis et al., 1985; Mensch and Kandel, 1988; Warner et al., 1995). This inverse relationship has been found for both males and females (Mensch and Kandel, 1988) and for both Whites and Blacks (Obot and Anthony, 1999).

A less studied aspect of the educational experience is school engagement and commitment (Johnson et al., 2001). Lack of engagement is often indicated by maladaptive school behaviors, such as getting suspended and skipping class, which increase the risk for problem behaviors (Farkas et al., 1990; Jenkins, 1995; Newmann et al., 1992). Closely related to school engagement is school attachment, or how the student values education. The importance given to education and expectations for school affect both scholastic achievement and attainment (Johnson et al., 2001; Mickelson, 1990). The research to date suggests that females (Farkas et al., 1990; Finn and Rock, 1997; Johnson et al., 2001; Smerdon, 1999) and those from families with high socioeconomic status (SES) (Ainsworth-Darnell and Downey, 1998; Bryk and Thum, 1989; Lamborn et al., 1992; Smerdon, 1999) are more likely to be engaged in school. More needs to be learned about other subgroup variation and whether or not the effects of poor school engagement persist over time and increase the risk for drug use in adulthood.

Although several researchers have found an association between some aspects of education and drug use, many studies have been cross sectional; therefore, the direction of the relationship is unclear (Kandel et al., 1997; Kessler et al., 1994; Lynskey and Hall, 2000; Warner et al., 1995). Does poor education lead to substance use (social causation), or does drug use lead to poor education (social selection)? Use of prospective data helps to address the issue of social selection versus social causation (Johnson et al., 1999; Miech et al., 1999). The few existing longitudinal studies suggest the relationship is bidirectional. For example, a few studies have shown that drug use can lead to education problems (e.g., dropping out, failure to obtain a university degree) (Fergusson et al., 2003; Kandel et al., 1986; Lynskey and Hall, 2000; MacLeod et al., 2004), and other studies have found that education problems (e.g. poor academic attainment, grade point average) precede drug use (Brunswick et al., 1992; Hawkins et al., 1992; Krohn et al., 1997; Nurco and Lerner, 1999; Schulenberg et al., 1994). Brunswick and colleagues (1998) conducted one of the few prospective studies of drug use among African Americans, and they found that adult heroin users were twice as likely to have dropped out of high school compared to nonusers. In a study of urban men, school performance in adolescence was associated with narcotic addiction in adulthood, but this was based on retrospective reports of performance (Nurco and Lerner, 1999).

One of the reasons poor school performance may lead to problem behaviors is because it represents a failure to meet social role expectations (Jessor and Jessor, 1977; Kellam and Ensminger, 1980). Drug use is one way to cope with the frustration and disappointment of not meeting social role expectations. According to the Life Course Social Field Theory, an individual's success at performing key social roles (e.g., family member, student, employee) is related to later social adaptation (Cicchetti and Schneider-Rosen, 1984; Kellam et al., 1975; Kellam and Ensminger, 1980). Several empirical and intervention findings support the

theory's predictions, including the relationship of early social adaptation to later psychological well-being, drug use, delinquency, and educational attainment (Compton et al., 2005; Kellam and Anthony, 1998).

The goal of this study is to examine whether education during childhood, adolescence, and early adulthood affects later drug use disorders among African American males and females. Using data from the Woodlawn Project, which prospectively follows a cohort of African Americans from age 6 to 42, this study examines the impact of education from early childhood into mid adulthood. While most studies have focused on the relationship between education and drug use, this study examines drug use disorders. In addition, much of the research has considered the role of educational performance or attainment in isolation; few studies have examined a wide array of educational indicators, including grades, test scores, classroom and school behaviors, educational expectations, and educational attainment. Here we examine a number of understudied aspects of education to learn more about their influence on later drug use disorders. Finally, few studies have examined the long-term relationship between education and drug use disorders within an African American population. This study follows an African American cohort for more than 35 years to assess the effects of education on later drug use disorders.

This study builds upon recent Woodlawn research on the relationship between education and alcohol disorders in early and mid adulthood (Crum et al., 2006). In that work we found that first grade shy behavior and math achievement, adolescent school truancy, and completion of high school were related to later alcohol use disorders. Because alcohol is a legal substance, its normative status is quite different from that of illicit drugs; therefore, the risk factors for alcohol use disorders might differ from those for drug use. This study aims to identify educational risk factors specific to drug use disorders in adulthood. Given that drug involvement is neither legal nor normative, we hypothesize that it will be strongly related to early maladaptive behaviors such as poor educational performance and school behavior. We expect a particularly strong relationship between drug use disorders and educational behaviors that are indicative of deviance (e.g., aggression, truancy, and getting suspended).

2. Methods

2.1 Sample

The original cohort consisted of 1,242 first-grade male and female students in 1966–1967 residing in Woodlawn, a low-income community on the south side of Chicago, Illinois. Follow-up interviews were completed during adolescence (1975–1976), young adulthood (1992–1993), and midlife (2002–2003). Mothers of the cohort members were also interviewed in 1966, 1975, and in 1997. Other data sources include teachers, school records, and police arrest records.

In 1966–67 (Time 1), nearly all first graders ($n = 1242$) in the nine public and three parochial schools in the Chicago neighborhood of Woodlawn were enrolled in the study; only 13 families (1%) did not consent for their child to be included in the project. Full details on the study design and methods have been described earlier (Kellam et al., 1983; Kellam et al., 1975). Teachers assessed the children three times in first grade, and mothers also provided ratings of their first graders in home interviews. In 1975–76 (Time 2), when the children were teenagers (ages 15–17), 75 percent of the mothers or mother surrogates ($n = 939$) were reinterviewed. In addition, roughly 75 percent of these mothers' teenagers ($n = 705$) were assessed using audiovisual questionnaires (Ensminger, 1990).

In 1992–3 (Time 3), when the cohort was in early adulthood, we re-interviewed a total of 952 cohort members. Forty-four were deceased, three were incapacitated, 39 refused to participate,

and 204 were not located (Ensminger, Anthony and McCord, 1997). In the recent mid adult (2002–2003) interview, we assessed 833 (72.2% of those who survived and were not incapacitated) (See Figure 1) (Crum et al. 2006). A total of 135 refused or otherwise could not be interviewed. The remainder (n = 185) could not be located. Since the study began, 91 individuals have died or have become incapacitated. Written informed consent was obtained for study participation.

To test for attrition biases, comparisons were made between those who were interviewed in at least one of the adult interviews (1992/3 and/or 2002/3) and those who were not interviewed. High school dropouts were less likely to be interviewed compared to those with a graduate equivalency degree (GED) or regular high school diploma. Those who were in poverty in first grade and/or adolescence were less likely to be interviewed during adulthood. Attrition was not associated with frequency of use of beer, wine, hard alcohol, or marijuana use during adolescence. There were no differences in sex, first grade reports of shy and aggressive behavior, or mother's educational level between those who were re-interviewed and those who were not.

The current analyses are based on an overall sample size of 1053, which includes those who completed the early adulthood and/or the mid adulthood interview and provided information to assess the presence of a lifetime drug use disorder. Because our goal was to assess the impact of education occurring before the onset of drug use disorders, we excluded the 62 participants who reported an age of onset of drug or alcohol use disorders before age 18 for all analyses of information gathered from the adolescent and adult interviews. Age of onset was defined as the age at which the first symptom of a drug or alcohol use disorder occurred. Five individuals were missing information on drug disorders in adulthood and thus excluded from the analysis, leaving us with a sample of 1048 with childhood predictor information and a sample of 986 with adolescent predictor information.

In addition to testing for attrition biases, we use multiple imputation to take into account missingness, which is largely due to attrition. In rare instances, respondents skipped or refused to answer particular survey items. In this study, both types of missingness are assumed to be missing at random (MAR) (Arbuckle and Wothke, 1999), and thus can be handled with innovative missing data techniques. The traditional way to handle missing data is to delete observations with any missing values using listwise deletion. The disadvantage of this approach is that by deleting an entire observation, there is a loss of important information, and this, in turn, reduces statistical power and increases the risk of incorrect standard errors. Another option is multiple imputation, which allows for analysis with the full data set by making calculated estimates of the missing values using other variables in the model (e.g., marginal mean imputation or conditional mean imputation) (Allison, 2002). Increasingly recommended is multiple imputation (MI), which creates a new data set for each different imputed value (Allison, 2002). These new data sets are then analyzed, and the parameter estimates and standard errors for each are saved. Ultimately, the parameter estimates and standard errors from each analysis are combined to create a single set of parameter estimates and corresponding standard errors. In essence, MI averages over a predictive distribution for the missing values, and the standard errors and estimates are generally valid (Graham et al., 2003).

In this study a multiple imputation procedure was implemented by using PROC MI and PROC MIANLYZE in SAS 9.1 (SAS Institute Inc, Cary, NC). Imputation models included the outcome and all covariates from childhood, adolescence, and young adulthood that were related to the missing mechanism and were associated with drug use disorders. We created two completed imputed datasets for sample of 986 and a sample of 1048. Based on a mixture of dichotomous and ordinal variables, we imputed under an assumption of normality and rounded off the continuous imputes to the nearest categories (Schafer 1997). We compared the results

of the multiple imputation ($n = 1053$) with that of listwise deletion ($n = 634$) and found the results were comparable; however, the imputed data had lower standard errors, resulting in larger coefficients and smaller p -values.

2.2 Research Question

Our primary research question was whether or not poor educational achievement and school behaviors increase the risk for drug use disorders in adulthood. Specifically, we examined the effects of the following on adult drug use disorders: 1) first grade school behaviors (shy behavior, aggressive behavior, achievement), 2) school performance (first grade readiness to learn, math and reading scores in 1st grade and in 7th/8th grade), 3) adolescent school behaviors (skipping school and getting suspended), 4) educational expectations of mother and adolescent; and 5) overall educational attainment.

2.3 Measures

Readiness to learn scores—This variable was based on scores from the Metropolitan Readiness Test (MRT), a standardized test used to measure a child's readiness for school learning by scoring the child's initial responses to the cognitive tasks of the classroom (Anastasi, 1968). It was administered by either the first grade teachers or school staff in the public schools. The MRT scores range from 2 (not ready) to 98 (superior).

First grade math and reading grades—First grade teachers assessed the child's performance in math and reading during the first and second semester; for this study we used the second semester assessments. Performance was rated on a 4-point scale from 1 = unsatisfactory to 4 = excellent.

First grade behaviors (teacher and mother ratings)—Childhood aggressive behavior, shy behavior, and underachievement were measured according to the Teacher's Observation of Classroom Adaptation (TOCA). First grade teachers rated students in authority acceptance (aggressive behavior), social withdrawal (shy behavior), and achievement on a scale from 0 (fully adapting) to 3 (severely maladapting). Children rated as high achievers (3) were compared to those who were rated as low achievers (0–2). Children rated as aggressive, shy, or both shy and aggressive were compared with those rated as neither shy nor aggressive. TOCA reliability was demonstrated using the test-retest method, and the validity of TOCA was demonstrated through assorted tests of criterion, construct, and content validity (Kellam et al., 1975). The mothers' interview included similar descriptions of these five maladaptive types of behavior; and mothers were asked to indicate whether their child was not at all that way (0), just a little that way (1), quite a bit that way (2), or very much that way (3). In this study we use the mothers' ratings of high achievement (3) compared to low (0–2).

Mother's educational expectations of child in first grade—The mothers of first graders were asked how far their children "really will go (in school) the way it looks now?" Responses were (1) some high school, (2) finish high school, (3) some college, (4) finish college, (5) beyond college.

Standardized math and reading scores in 7th and 8th grades—Because correlation of 7th and 8th grade scores were high ($r = 0.61$, $p < 0.001$, for math scores; $r = 0.69$, $p < 0.001$, for reading scores), we used a mean score of the two grades to represent scores during adolescence. Results from each of the tests distributed normally, so that continuous measures of the test scores were included in the regression models. High scores indicate good test results.

Adolescent behaviors (adolescent and mother reports)—Items from the adolescent interview included self-reports of skipping school and being suspended: "Please tell me how

many times you've [skipped a day at school without a real excuse/been suspended from school] in the last 3 years?" [(1) never, (2) once, (3) twice, (4) 3 or 4 times, (5) 5 or more times]. Mothers were asked similar questions about their children's behaviors.

Expectations for education (adolescent's and mother's)—Items from the adolescent interview included self-reports of educational expectations: "How far do you think you really will go the way it looks now?" Responses were (1) some high school, (2) finish high school, (3) some college, (4) finish college, (5) beyond college. Mothers were asked a similar question about educational expectations for their adolescents. The items were included as continuous variables in the analyses.

Educational attainment—Information on the highest level of schooling achieved was based on self-report information gathered in the adult interviews. In addition, this data was supplemented by assessments of school records and mothers' reports (1997–98 interview). The final measure included mutually exclusive categories for individuals who: 1) did not have a high school diploma, 2) obtained a GED (graduate equivalency diploma), 3) completed high school with a regular diploma, 4) had some college experience, or 5) achieved a college degree.

Drug use disorder—Both the early (age 32–33) and mid adult (age 42–43) interviews assessed drug use disorders (abuse and dependence) using computer algorithms of data gathered with the Michigan version of the Composite International Diagnostic Interview (CIDI) (Kessler et al., 1994; Robins et al., 1988). In the early adult interview (1992–93), the diagnoses were based on DSM-III-R criteria (American Psychiatric Association, 1987), and in the mid adult interview, the survey questions reflected the new DSM-IV criteria (American Psychiatric Association, 1994). Concordance between DSM-III-R and DSM-IV diagnoses of current and lifetime abuse and dependence was reported to be good to excellent among a large representative sample of the United States population (Grant, 1996). The reliability and validity of these measures were assessed for consistency of self reports of marijuana use from adolescence and adulthood and what characterizes inconsistent reporters in the cohort (Ensminger, Juon, and Green, 2007). In the current study, a lifetime diagnosis of drug use disorder from the young adult interview and/or the mid-life interview was used as the dependent variable.

2.4 Analyses

In bivariate analyses of the relationships between drug use disorders in adulthood and known risk factors, including gender, socioeconomic indicators (family poverty, mother's education) and family history of drug use (mother's ever use of drugs or regular alcohol use during the year prior to the adolescent interview), to determine which, if any, should be controlled for in the final analyses. We found that mother's drug or alcohol use was significantly related to drug use disorders in adulthood (odds ratio [OR] = 1.71, 95% confidence interval [CI]: 1.06–2.73, $p = .027$), and males were more likely than females to have drug use disorders (OR = 1.96, CI: 1.41–2.70). Neither family poverty nor mother's education was significantly related to drug use disorders in adulthood. We then ran a multiple logistic regression for each education variable, controlling for gender and mother's earlier drug or alcohol use. We also tested for gender interactions to see if the relationships between the education variables and drug use disorders differed for males and females.

3. Results

We identified 189 adults (18%) with drug use disorders at either age 32, age 42 or both ages. About 23% of males and 13% of females reported drug use disorders at either or both of these times. Table 1 compares the descriptive characteristics of those with and without drug use

disorders. Compared to those without drug use disorders, those with disorders were more likely to be male (61% vs. 39%) and to have mothers with a history of substance use (19% vs. 12%). Those with drug disorders were also more likely to be rated by their mothers as poor achievers in first grade (10% vs. 5%) and to receive low math and reading scores in 7th and 8th grades. Finally, those without drug use disorders completed more education than those with disorders.

In multivariate models controlling for gender and mother's self reports of drug use or regular alcohol use, we found that several, but not all, of the educational indicators were associated with drug use disorders in adulthood. In regard to the first grade behaviors, those who were shy behaving in first grade were less likely to develop a subsequent drug use disorder compared to those who were neither shy nor aggressive ($OR = 0.66, p = 0.04$). (See Table 2). Mother's report of underachievement in first grade was positively related to later drug use such that those with low achievement were at higher risk for later drug use disorders ($OR = 2.15, p = 0.009$).

As for adolescence, 7th and 8th graders who did well on the standardized math tests were less likely to report drug use disorders in adulthood ($OR = .98, p = .004$). (See Table 3). The analyses of adolescent behaviors found that those who reported skipping school during adolescence were at an increased risk for drug use disorders in adulthood ($OR = 1.31, p < .01$). Similarly, adolescents who reported getting suspended were significantly more likely to report drug use disorders in adulthood ($OR = 1.28, p < .01$).

Mother's educational expectations for her child as reported when her child was in first grade (Table 2) and then again in adolescence (Table 3) were not significantly related to drug use disorders. Adolescents' expectations were marginally related to later drug use disorders such that those with higher expectations were less likely to have drug use disorders in adulthood ($OR = .82, p = .06$) (Table 3).

As shown in Table 4, educational attainment was significantly related to adult drug use disorders. Those who dropped out of high school were significantly more likely to report drug use disorders compared to those who obtained a college degree ($OR = 3.50, p < .001$). In addition, those who had a high school degree or a GED were more likely than those with a college degree to have a drug use disorder in adulthood ($OR = 2.63, p = .04$). Those who spent some time in college or obtaining an associates degree were not more likely to report drug use disorders compared to those with a college degree. It is important to remember that we excluded those few who reported disorders before the age of 18 so as to better understand the association between education and drug use disorders.

Our tests for gender interaction found no significant interaction terms. Gender did not moderate the relationship between any of the education variables and drug use disorders, and thus gender interaction terms were not included in the results shown in Tables 2–4.

4. Discussion

The goal of this study was to assess prospectively the impact of education on subsequent drug use disorders in adulthood. According to the Life Course Social Field Perspective, a child's successful performance in key social fields, one of which is school, will affect the development of later problems. Accordingly, we hypothesized that success or failure in education would have an effect on later drug use disorders. We examined the impact of a wide variety of educational factors, including school performance, school behaviors, educational expectations, and educational attainment on drug use disorders in early and mid adulthood. We found that educational success at specific time periods was significantly related to later drug use disorders. Specifically, controlling for gender and mother's drug and alcohol use, we found the risk for drug use disorders was significantly affected by: underachievement in first grade (mother's rating); low 7th and 8th grade standardized math scores; suspension from school in adolescence

(adolescent's report); skipping school in adolescence (adolescent's report); not having a high school diploma (compared to having a college degree), and having a high school diploma or GED (compared to having a college degree). We also found that shy behaving first graders were less likely to develop drug use disorders in adulthood.

Perhaps the most striking findings are those that link first grade education-related variables to drug use disorders more than 25 years later. For example, first graders whose behaviors were rated as shy by their teachers were less likely to report drug use disorders in adulthood. This corresponds with prior research finding an inverse relationship between inhibition and substance use (Farrington, 1989; Sieber and Angst, 1990) and with previous Woodlawn analyses finding shy behavior to be protective against adult drug use (Ensminger et al., 2002; Fothergill and Ensminger, 2006) and alcohol disorders (Crum et al., 2006). However, other studies have found that inhibition increases the risk for alcohol problems (Caspi et al, 1996). Much more needs to be learned about the mechanisms through which shy behavior affects deviance.

The study also found that children's underachievement in first grade, according to mothers' reports, was significantly related to later drug use disorders. Research has consistently demonstrated an association between poor academic achievement and substance use (Brook et al., 1998; Jessor and Jessor, 1978; Kandel et al., 1978), and now it is evident that first grade achievement is related to drug use disorders more than 25 years later in adulthood. It is interesting to note that the finding differs from a recent Woodlawn study of alcohol disorders that did not find either mother's or teacher's rating of first grade achievement to be a significant risk factor (Crum et al., 2006). This suggests the trajectories to drug and alcohol disorders may be different and should be examined separately. It also points to the need to explore ways to intervene with students, parents, and teachers to improve school achievement early on.

Poor school engagement in adolescence, as indicated by self reports of skipping school and being suspended, was also related to later drug use disorders. This is an important finding given the dearth of research on the long-term impact of school engagement. A few studies using cross sectional data have linked school engagement to problem behaviors (Farkas et al., 1990; Jenkins, 1995; Newmann et al., 1992), but no known studies have prospectively examined the effects of school engagement on drug use disorders occurring in adulthood. The recent Woodlawn study of alcohol disorders found that skipping school (mother's report) was a risk factor for males (Crum et al., 2006). Future research should further examine the etiologic pathways from school engagement to later drug and alcohol disorders and how these pathways may differ by gender. Improved understanding of these pathways will help inform the design of interventions (e.g., school programming, student counseling) to improve school bonds.

Finally, as hypothesized, educational attainment was a key factor in the development of risk for later drug use disorders. The influence of educational attainment on substance use and disorders has been well established (Agrawal et al., 2005; Brunswick and Titus, 1998; Crum and Anthony, 2000; Crum et al., 1998; Jarjoura, 1993; Lewis et al., 1985; Mensch and Kandel, 1988; Warner et al., 1995). Here we found that obtaining less than a high school education significantly increased the risk for later drug use disorders (3–4 fold increase) when compared to obtaining a college degree. While the order of the relationship may be in question (i.e., those with drug disorders may be more likely to drop out of school), we tried to control for order by excluding those who reported disorders before the age of 18. The finding may be an underestimation of the risk given that study attrition was related to dropping out of school. We also found that those with a high school diploma or Graduate Equivalency Diploma (GED) were at an increased risk for drug use disorders compared to those who finish college. While prior studies have shown that completion of high school reduces the risk of later disorders

(Crum and Anthony, 2000; Green and Ensminger, 2006; Warner et al, 1995), this finding suggests that completing high school or getting a GED is not enough to reduce the risk.

Much more needs to be learned about the mechanisms through which education affects later drug use disorders. How academic achievement, school performance, and educational attainment affect later problems has not been examined. According to Strain Theory, when youth get frustrated at their inability to succeed in school, they often turn to delinquency, including drug use (Jarjoura, 1993; Schulenberg et al., 1994). These students, therefore, may be more likely to use drugs or drop out of school, both of which may lead to drug use and drug use problems later in adulthood. Alternatively, doing well in school may strengthen the student's bond with school, thereby decreasing the risk for deviant behaviors. This is line with Social Control Theory, which suggests that having healthy ties to social institutions (e.g., school) prevents problem behavior by instilling social norms and sanctioning deviance (Hirschi, 1969). The Primary Socialization Theory suggests that weak school bonds increases the likelihood of affiliations with deviant peers, which in turn increases the risk of drug use and other problem behaviors (Oetting and Donnermeyer, 1998). Another explanation might be that youth who do not do well in school and who use drugs as adults have a general tendency toward problem behavior (Jessor and Jessor, 1977). This is often attributed to a general lack of attachment to conventional values (Elliott et al, 1985; Jessor and Jessor, 1977). In addition, there may be common etiologic traits that may lead to both poor educational outcomes and drug use disorders. These analyses are beyond the scope of this study, but future research should explore these potential theoretical mechanisms.

Not all of the research hypotheses were supported by the results. For example, there was no significant relationship between classroom aggressive behavior and later drug use disorders. The relationship between early aggressive behavior and later drug use is well documented in prior literature (Brook et al., 1995; Dobkin et al., 1995; Farrington, 1991; Hawkins et al., 1992; McCord, 1988; Neumark and Anthony, 1997; Ohannessian et al., 1995; Shedler and Block, 1990), and prior Woodlawn analyses found aggressive behavior to be predictive of drug use in adolescence (Kellam et al., 1983) and in mid adulthood (Fothergill et al., revise and resubmit). Perhaps the pathway from aggressive behavior to drug use disorders is different from the pathway to drug use.

In addition, the study found no significant relationship between drug use disorders and readiness to learn in first grade, first grade reading and math scores, mother's educational expectations, or adolescents' educational expectations. This could be due to the nature of the educational factors, the timing of their occurrence, or unidentified methodological issues. Additional research is needed to further examine the impact of these factors on later drug use disorders.

The study limitations should be noted. First, since all study participants were African American and living in the same inner city neighborhood in first grade, the findings may not be generalizable to other populations. These relationships need to be confirmed in other studies. Second, there was significant attrition during the adolescent data collection period. To take into account information from those who did not complete all four waves of data collection, we used multiple imputation, and the results were comparable to those obtained using listwise deletion. Third, there is general concern about the validity of self reports of substance use (Schwartz, 1999); however, previous tests of validity with the Woodlawn and other data indicate there is not a significant amount of bias in the responses (Babor, et al., 2000; Darke, 1998; Ensminger et al. 1997, Gold, 1970). Another issue is that due to the large number of analyses that were performed, it is possible that some associations were due to chance. Therefore, results should be interpreted with caution until they have been replicated. Finally, we were not able to examine specific drug use disorders (e.g., marijuana, heroin, etc). It is

possible that there are substance-specific relationships with education that we would not have been able to identify.

The strength of the present study lies in its focus on an epidemiologically defined community population of African American males and females using a prospective longitudinal design which allowed for examination of long-term effects of multiple aspects of education on adult substance use disorders. The findings build upon the extensive research showing an association between education and drug use and support the conclusion that education is a risk factor for later drug use disorders. This does not suggest that early drug use disorders do not affect educational outcomes, but it does support the social causation hypothesis. Future research should explore the mechanisms through which education affects health behaviors, as well as the factors related to both failures in education and drug use disorders. Once these mechanisms are better understood, interventions with various targets (e.g., schools, teachers, parents) at different points in time along the life course can be designed and tested.

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Figure 1.
Woodlawn Study Data Collection, 1966–2003

Table 1Characteristics of those with adult drug use disorder and those without ($N = 1048$)

	Disorder $n = 189$ (18.0%)	No disorder $n = 859$ (82.0%)	t or chi-square, df, p -value
Men	116 (61.4%)	385 (44.8%)	$\chi^2 = 17.02$, 1 df $p < .001$
African-American	188 (99.5%)	847 (99.2%)	$\chi^2 = 0.17$, 1 df $p = .559$
Mother's education level (mean years, SD)	10.8, $sd = 2.00$	10.6, $sd = 2.39$	$t = -0.94$, 1033 df, $p = .349$
Mother's self-reported drug use or regular use of alcohol	28 (18.8%)	81 (11.9%)	$\chi^2 = 5.00$, 1 df $p = .025$
1 st Grade:			
Mean Metropolitan Readiness Test Score (range 2–98, 98 = superior)	58.0, 18.58	58.1, 18.94	$t = 0.07$, 871df $p = .941$
Math grade excellent	9 (5.1%)	73 (9.2%)	$\chi^2 = 3.00$, 1 df $p = .083$
Reading grade excellent	11 (6.4%)	84 (10.6%)	$\chi^2 = 2.83$, 1 df $p = .093$
Shy/Aggressive Behavior:			
Neither	97 (51.3%)	453 (53.0%)	$\chi^2 = 6.10$, 3 df $p = .107$
Shy only	22 (11.6%)	148 (17.3%)	
Aggressive only	39 (20.6%)	133 (15.6%)	$\chi^2 = 7.95$, 1 df $p = .005$
Both shy and aggressive	31 (16.4%)	121 (14.2%)	
Mother's rating of classroom underachievement = high	19 (10.1%)	41 (4.8%)	$\chi^2 = 0.68$, 1 df $p = .409$
Teacher's rating of classroom underachievement = high	18 (9.5%)	66 (7.7%)	$\chi^2 = 2.04$, 1 df $p = .153$
Mother's expectation: child will go beyond college	4 (2.2%)	37 (4.5%)	
Adolescence: (excluding those with onset of abuse/dependence symptoms before age 18) ($N = 986$)			
Mean standardized Math scores –7th/8th grade (higher is better)	83.8, 11.38	88.1, 12.15	$t = 3.25$, 725df $p = .001$
Mean standardized Reading scores –7th/8th grade (higher is better)	82.4, 13.80	85.4, 14.29	$t = 1.96$, 730df $p = .050$
Mother's report: suspension from school = often	1 (7.7%)	12 (1.8%)	$\chi^2 = 0.36$, 1 df $p = .548$
Mother's report: skipping school = often	10 (9.7%)	45 (6.6%)	$\chi^2 = 1.28$, 1 df $p = .258$
Adolescent's report: suspension from school = often	11 (13.3%)	41 (7.9%)	$\chi^2 = 2.58$, 1 df $p = .108$
Adolescent's report: skipping school = often	19 (22.9%)	65 (12.6%)	$\chi^2 = 6.32$, 1 df $p = .012$
Mother expectations: child will go beyond college	4 (7.7%)	48 (7.2%)	$\chi^2 = 1.54$, 1 df $p = .215$
Adolescent expects to go beyond college	9 (11.0%)	60 (11.6%)	$\chi^2 = 0.29$, 1 df $p = .864$
Adulthood: (excluding those with onset of abuse/dependence symptoms before age 18)			
Educational level:			
High school dropout	35 (27.6%)	150 (17.5%)	$\chi^2 = 18.44$, 3 df $p < .001$
High school degree/GED	56 (41.1%)	326 (38.1%)	
Some college/associates degree	32 (25.2%)	257 (30.1%)	
College degree +	4 (3.1%)	122 (14.3%)	

Table 2

The association of first grade educational indicators with drug use disorder: school performance, behaviors, and expectations ($N = 1048$)

	Unadjusted OR (95% CI, p -value)	Adjusted OR ^I (95% CI, p -value)
Metropolitan Readiness Test (2–98)	0.99 (0.98, 1.02), $p = .84$	0.99 (0.98, 1.01), $p = .99$
Math – 1st grade (1–4, 4 = high)	0.85 (0.70, 1.04), $p = .11$	0.86 (0.70, 1.06), $p = .16$
Reading – 1st grade (1–4)	0.89 (0.72, 1.09), $p = .26$	0.93 (0.75, 1.16), $p = .53$
Shy and aggressive behavior		
Neither	1.00	1.00
Shy only	0.69 (0.42, 0.97), $p = .02$	0.66 (0.40, 0.98), $p = .04$
Aggressive only	1.36 (0.89, 2.06), $p = .07$	1.20 (0.79, 1.84), $p = .07$
Both shy and aggressive	1.19 (0.76, 1.86), $p = .39$	1.04 (0.66, 1.65), $p = .58$
Underachievement		
Mother's rating on underachievement		
0–2 (low)	1.00	1.00
3 (high)	2.22 (1.26, 3.92), $p = .006$	2.15 (1.21, 3.83), $p = .009$
Teacher's rating on underachievement		
0–2 (low)	1.00	1.00
3 (high)	1.26 (0.73, 2.17), $p = .41$	1.21 (0.69, 2.10), $p = .51$
Mother's expectations (1 st grade) (1–5, 5 = high)	0.91 (0.78, 1.06), $p = .22$	0.95 (0.81, 1.10), $p = .47$

^I Multivariate models adjust for gender and mother's self-report of drug use or regular alcohol use.

Table 3

The association of adolescent educational indicators and drug use disorder: school performance, behaviors, and expectations ($N = 986$)

	Unadjusted OR (95% CI, p -value)	Adjusted OR ¹ (95% CI, p -value)
Standardized Math scores – 7th/8th grade ² (high = better score)	0.97 (0.95, 0.99), $p = .002$	0.98 (0.96, 0.99), $p = .004$
Standardized Reading scores – 7th/8th grade	0.98 (0.97, 1.01), $p = .11$	0.98 (0.97, 1.01), $p = .16$
Mother's report: suspension from school (1–5, 5 = often)	1.09 (0.87, 1.35), $p = .46$	1.04 (0.83, 1.30), $p = .73$
Mother's report: of skipping school (1–5, 5 = often)	1.12 (0.95, 1.32), $p = .16$	1.11 (0.95, 1.31), $p = .19$
Adolescent's report of suspension from school (1–5; 5 = often)	1.31 (1.11, 1.56), $p < .001$	1.28 (1.07, 1.52), $p < .01$
Adolescent's report of skipping school (1–5, 5 = often)	1.32 (1.15, 1.52), $p < .01$	1.31 (1.14, 1.52), $p < .01$
Mother's expectations reported during adolescence (1–5; 5 = high)	0.89 (0.74, 1.08), $p = .22$	0.90 (0.74, 1.09), $p = .27$
Adolescent's expectations (1–5, 5 = high)	0.81 (0.66, 1.01), $p = .051$	0.82 (0.67, 1.01), $p = .061$

¹ Multivariate models adjust for gender and mother's self-report of drug use or regular alcohol use.

Table 4Adult educational level and drug use disorder ($N = 986$)

	Unadjusted OR (95% CI, p -value)	Adjusted OR ^{<i>I</i>} (95% CI, p -value)
High school dropout	3.78 (1.85, 7.69), $p < .001$	3.50 (1.71, 7.17), $p < .001$
High school degree/GED/training	2.75 (1.41, 5.39), $p = .02$	2.63 (1.34, 5.17), $p = .04$
Some college or associates degree	2.00 (0.96, 4.19), $p = .73$	2.00 (0.92, 4.18), $p = .81$
College degree +	1.00	1.00

^{*I*} Multivariate models adjust for gender and mother's self-report of drug use or regular alcohol use.