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## Childhood and adolescent antecedents of drug and alcohol problems: A longitudinal study

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### Abstract

Despite the serious health and economic consequences of drug and alcohol abuse and dependence, few studies have prospectively examined the etiology of this problem in non-clinical populations. This longitudinal study examines childhood and adolescent antecedents of drug and alcohol problems in adulthood among an African American cohort ( $n = 1242$ ; 51% female) from Woodlawn, a neighborhood in Chicago. The participants were followed from age 6 to 32 years, and data were collected in first grade, adolescence, and adulthood. Structural equation modeling showed that, for both males and females, educational attainment was directly associated with a reduced risk for substance use problems. For males, first grade shyness was directly associated with a reduced risk of substance use problems, and adolescent substance use was directly associated with an increased risk. First grade aggression, low family socioeconomic status (SES), and low school bonds were indirectly associated with substance use problems for both males and females. For males, first grade underachievement had an indirect effect, and, for females, first grade shyness and strong parental supervision had indirect effects. This study is among the first to identify life course trajectories to substance use problems among an African American, community-based population. These results help to identify the targets and timing of interventions that may help to reduce the risk of drug and alcohol problems in adulthood.

### Keywords

Drug and alcohol problems; Longitudinal study; African American; Educational attainment; Shyness; Aggression; Socioeconomic status

## 1. Introduction

Substance use disorders are long recognized for seriously undermining the health, safety, and economy of nations worldwide (Adrian, 2002; Caetano and Cunradi, 2002; National Institute on Drug Abuse, 1999; National Research Council, 1993). In the developed world, alcohol use is the leading cause of male disability and the fourth in the developing world (Murray and Lopez, 1996). Although studies in the U.S. indicate an overall decline in use of drugs and alcohol nationwide, a significant proportion of individuals continue to have

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substance use disorders and suffer from their deleterious effects. According to the National Comorbidity Survey, a U.S. survey of a representative sample aged 15–54 years, more than 35% of males and 18% of females reported lifetime abuse or dependence of any substance, including alcohol (Kessler et al., 1994).

Despite the significant negative effects associated with drug and alcohol abuse and dependence, little is known about the etiology of this problem. Most research has focused on substance use, which is distinct from abuse and dependence. According to the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III-R), there are three levels of drug-related behavior and functioning (American Psychiatric Association, 1987): use, which refers to low or infrequent use with few or minor damaging consequences; abuse, which refers to use at doses and/or frequencies lower than dependence with detectable health and functioning outcomes; dependence, which is characterized by high levels of use with severe health and functional consequences and withdrawal symptoms (National Research Council, 1993).

The existing research on substance use disorders is limited by its focus on individuals in clinical and treatment settings and by the use of cross-sectional or retrospective research designs (Morgenstern et al., 1994; Nurco et al., 1998; Woody et al., 1993). In addition, although there is increasing evidence that men and women experience different substance abuse trajectories and consequences (Boyd and Mieczkowski, 1990; Brook et al., 1992; Carlson and Siegal, 1991; Hser et al., 1987), most research on drug and alcohol abuse and dependence has focused on males (Wasilow-Mueller and Erickson, 2001).

Finally, there is a lack of research on substance use disorders among African Americans (Boyd et al., 1993; Crum and Anthony, 2000), despite evidence that substance dependence rises among African Americans in their late 20s, an age when dependence typically decreases among non-Hispanic White Americans (Kandel et al., 1997). Furthermore, African Americans suffer worse consequences from substance use disorders than do Whites (Herd, 1994; Wallace, 1999). For example, Blacks are more likely than Whites to report more problems from their use, including loss of control, symptomatic drinking, binge drinking, health problems, and problems with friends and relatives (Harrison, 1992; Herd, 1994, 1995). Also, Blacks are more likely than Whites (3.9% versus 2.5%) to need treatment for drug and alcohol abuse (Substance Abuse and Mental Health Administration, 1998), and they have twice as many deaths due to drug or alcohol related causes as do Whites (National Institute on Drug Abuse, 2003). Additional research on substance use among African Americans would not only contribute to our understanding of the issue in the U.S., but it could help inform our knowledge about substance use problems among ethnic minorities around the world.

In this study, we prospectively examine the etiology of drug and alcohol problems among an African American cohort of males and females followed from first grade to adulthood. We examine whether childhood and adolescent factors that have been linked to substance use are also directly related to substance use problems (e.g., troubles with work, family, and health). We also investigate potential indirect pathways between childhood behaviors and adult problem use, hypothesizing that certain childhood factors will influence adult problems

through their effects on factors in adolescence. Throughout the paper, we refer to problems related to substance use as “drug and alcohol problems” and “substance use problems.”

Fig. 1 depicts the conceptual framework for the study. This framework was guided by prior research and theory. Specifically, we developed this model based on what has been learned thus far about the development of risk for substance use.

We first examine early childhood behaviors, including aggression and shyness, which have been found to be associated with drug and alcohol use in adolescence and adulthood (Brook et al., 1995; Dobkin et al., 1995; Ensminger et al., 2002; Hawkins et al., 1992; Kellam et al., 1983). Only a small number of studies have examined whether the effects of childhood conduct problems extend to adult substance abuse and dependence (Lewis et al., 1985; Neumark and Anthony, 1997; Ohannessian et al., 1995; Schuckit et al., 1990), and the research on the long-term effects of shyness is not yet conclusive (Caspi et al., 1996; McCord, 1988).

We also consider the role of early school achievement, which also has been associated with substance use in both White and Black populations (Crum et al., 1992, 1998; Jessor and Jessor, 1978; Riala et al., 2003; Robins, 1980; Schulenberg et al., 1994). According to Strain Theory, the frustration that accompanies school failure leads an individual to engage in deviant behaviors (Farnsworth and Leiber, 1989; Schulenberg et al., 1994). What is not yet established is whether achievement problems in childhood are related to substance use problems in adulthood. Prior analyses with the study population found that first grade underachievement increased the risk for alcohol use disorders in adulthood (Crum et al., 1998).

This study also investigates the impact of family socioeconomic status (SES) in childhood on drug and alcohol problems in adulthood. Although national cross-sectional studies have found SES to be correlated with adult substance use disorders (Kandel et al., 1997; Kessler et al., 1994; National Institute on Drug Abuse, 1990), only a few longitudinal studies have examined the long-term impact of childhood economic disadvantage on substance use disorders in adulthood (Brunswick et al., 1992; Farrington, 1989; Poulton et al., 2002). Most existing longitudinal studies have focused on the impact of economic disadvantage on behavioral problems in childhood and adolescence (Duncan and Brooks-Gunn, 1997). Additional research is needed to assess the long-term impact of childhood poverty and explain the mechanisms through which poverty affects development (Corcoran, 2001). One theory is that poverty can indirectly affect developmental outcomes such as substance use problems by increasing parental stress and thereby decreasing the quality of parenting (Conger et al., 1992, 2002; Lempers et al., 1989; McLoyd, 1990).

We also examine adolescents' bonds with parents and schools, as these relationships are widely recognized to play important roles in both discouraging and facilitating risk behaviors, including drug and alcohol use (Bailey and Hubbard, 1990; Baumrind, 1985; Ensminger et al., 1982; Hawkins et al., 1992; Jessor and Jessor, 1977). According to Social Control Theory, strong ties to societal institutions such as family, school, or work decrease the likelihood that individuals will engage in deviant behavior (Hirschi, 1969). Several

studies have found that low parental supervision and low school bonds increase the risk for adolescent and adult drug and alcohol use (Ensminger et al., 2002; Hawkins et al., 1992; Jessor et al., 1991; Kandel et al., 1986; Li et al., 2000; O'Donnell et al., 1995; Patterson and Dishion, 1988), but, again, only a few studies have examined the relationship between these bonds and later substance use disorders (Crum et al., 1998; Nurco et al., 1996).

Although use of drugs and alcohol as a teenager has been consistently related to subsequent substance use for both males and females of various ethnic backgrounds (Brook et al., 1995; Johnson et al., 1995; Newcomb, 1997), few studies have examined the association between adolescent substance use and adult substance use disorders (Hawkins et al., 1997; Kandel and Chen, 2000; Nurco et al., 1994). Substance use and other deviant behaviors typically peak in adolescence and then decline with the transition to adulthood (Chen and Kandel, 1995; DeWit et al., 1995; Hirschi and Gottfredson, 1983; Wolfgang et al., 1987), but some individuals continue use and develop use disorders in adulthood. Some evidence suggests that those who continue having behavior problems as adults have distinct childhood characteristics compared to those whose problems are limited to adolescence. Moffitt's Developmental Theory (1993) proposes that there are two primary types of antisocial behavior: behavior that is limited to the adolescent period and behavior that is rooted in childhood neuropsychological problems and tends to last throughout a lifetime. In line with this, as we examine adolescent substance use as a potential risk factor for adult substance use problems, we consider whether early aggression and social withdrawal are among the early risk factors that distinguish those who develop problems in adulthood from those who do not.

We also examine the effects of educational attainment, a well-known risk factor for substance use and abuse. Studies have found educational attainment to be protective against substance use disorders in both Black and White populations (Brunswick et al., 1992; Crum and Anthony, 2000; Kandel et al., 1986; Lewis et al., 1985).

Finally, studies have found that gender plays a role in substance use disorders. In addition to finding higher prevalence of substance use disorders among males than females (Warner et al., 1995), some studies have found that the trajectory to dependence is different for males than it is for females (Blume, 1986; Lex, 1991; Schmidt et al., 1990; Wilsnack and Wilsnack, 1993). In addition, prior Woodlawn studies found that antecedents of drug use differed by gender (Ensminger et al., 1982, 2002).

### 1.1. Research questions

This study addresses the following questions:

1. Are there pathways from early childhood behaviors to adult drug and alcohol problems? Specifically, are those children who have been rated as aggressive or as underachievers in first grade more likely to have later substance use problems? Are those who were rated as shy less likely to have these problems?
2. Are children who grow up in low socioeconomic status households more likely to have substance use problems in adulthood?

3. Are adolescents with weak social ties at an increased risk for substance use problems in adulthood? Specifically, are adolescents with low parental supervision and low school bonds more likely to develop substance use problems in adulthood?
4. Do adolescents who use drugs and alcohol have an increased risk for substance use problems in adulthood?
5. Do individuals with higher educational attainment have a reduced risk for substance use problems in adulthood?
6. Do childhood behaviors and socioeconomic status have indirect effects on adult substance use problems through other factors along the life course (i.e., adolescent social ties, substance use, and educational attainment)?
7. Does the risk for drug and alcohol problems differ for males and females?

## 2. Methods

### 2.1. Study design and population

The data are from the Woodlawn Study, a longitudinal study of an African American cohort from a Chicago community who were followed for more than 25 years (1966–1993). In 1966, Woodlawn ranked among the four most impoverished Chicago neighborhoods (De Vise, 1967). However, there was economic heterogeneity within Woodlawn as some residents had higher incomes and owned their homes (Kellam et al., 1982).

The research reported here is based on data prospectively collected when the cohort was in first grade (ages 6–7 years), in adolescence (ages 15–17 years), and then in early adulthood (ages 32–33 years). In 1966–1967 (Time 1), nearly all first graders ( $n = 1242$ ) in the 9 public and 3 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. Teachers assessed the children three times in first grade, and mothers also provided ratings of their first graders in home interviews.

In 1975–1976 (Time 2), when the children were teenagers (ages 15–17 years), 75% of the mothers or mother surrogates ( $n = 939$ ) were re-interviewed. In addition, roughly 75% of these mothers' teenagers ( $n = 705$ ) were interviewed directly. Adolescents were interviewed with two instruments: the “What’s Happening” questionnaire, a self-report instrument with 60 items, focused on social relationships and behaviors related to family, friends, and society; “How I Feel,” a survey with 102 items related to psychopathology and self-esteem.

In 1992–1993 (Time 3), the cohort, then age 32–33 years, completed the Young Adult Interview. Of the original sample, 1038 (83.5%) were successfully located, and 952 (77% of original cohort) were re-interviewed. Of these, 31 (3.3%) were interviewed in jail or prison.

At each of the two follow-up data collection periods, there was attrition. Tests for attrition bias found that mothers not re-assessed in 1975–1976 were more likely to have been teen parents, to have moved frequently before the child was in first grade, and to have had

children who attended parochial schools in first grade; otherwise, they were not different from the mothers who were assessed. Teenagers who were interviewed did not differ from those not interviewed in terms of aggression, shyness, or underachievement (Ensminger et al., 1982; Kellam et al., 1980). We found no differences between the individuals who were and were not interviewed in young adulthood in terms of their mothers' educational attainment, their first grade teachers' behavior ratings (e.g., aggression), or their own drug and alcohol use in adolescence (Ensminger et al., 1997). However, those in families who were living below the official poverty line in first grade were less likely to be interviewed than those who were not (73% versus 81%), a small but significant difference. This difference could result in an underestimation of the impact of household poverty in 1966. The handling of missing data is discussed in Section 2.3.

## 2.2. Measures

**2.2.1. Adult drug and alcohol problems**—Self-reports of drug and alcohol use were obtained from the young adults in 1992–1993. The Young Adult Interview (YAI) includes modules from the Composite International Diagnostic Interview (CIDI), a structured diagnostic interview developed by the University of Michigan for the National Comorbidity Survey (Kessler et al., 1994). These modules include standardized questions to assess syndromes of alcohol and other drug abuse and dependence according to the criteria of the *Diagnostic and Statistical Manual of Mental Disorders*, Revised Third Edition (American Psychiatric Association, 1987). The CIDI asks about: tobacco, alcohol, cannabis, stimulants, sedatives and hypnotics, tranquilizers, cocaine, phencyclidine, other hallucinogens, heroin, and other opiates.

To represent drug and alcohol problems, we created a latent construct, a variable that is not directly measured but is comprised of multiple observed variables (Swaim et al., 1998). We categorized 22 items according to constructs corresponding to the DSM-III-R criteria: (1) extensive quantity and length of use (e.g., substance use was longer or in larger amounts than intended); (2) negative effects on physical and mental health (e.g., substance use caused psychological problems); (3) negative effects on home and work lives (e.g., substance use interfered with work, school, or parenting); (4) signs of addiction such as tolerance, withdrawal symptoms, and inability to stop use (e.g., tried to stop substance use but could not). Factor analysis of each construct demonstrated that the categorizations of the items were appropriate. For each construct, we created a scale by summing the total number of problems reported. The final latent variable “drug and alcohol problems” includes four scales measuring impairment of functioning (four items,  $\alpha = .75$ ); physical and mental health problems (six items,  $\alpha = .73$ ); signs and symptoms of dependence (eight items,  $\alpha = .84$ ); use that is of greater quantity and duration than intended (four items,  $\alpha = .85$ ).

There are theoretical and empirical justifications for examining alcohol and drug use problems together. Jessor's Problem Behavior Theory (Jessor and Jessor, 1977), which posits that problem behaviors tend to cluster together and can be explained by similar risk factors, suggests that drug and alcohol abuse would share common antecedents. In addition, research findings suggest that the risk for abuse does not appear to be highly drug specific



(Glantz, 1992). Studies have found that the progression from use to abuse typically moves from within one class of drugs to use across multiple types of substances. Exclusive use of one drug is the exception rather than the rule (Tarter and Mezzich, 1992).

**2.2.2. Classroom behaviors, Time 1**—Childhood aggression, shyness, and underachievement were measured according to the Teacher’s Observation of Classroom Adaptation (TOCA). In an interview, first grade teachers rated students in authority acceptance (aggression), social withdrawal (shyness), and achievement on a scale from 0 (fully adapting) to 3 (severely maladapting).

**2.2.3. Socioeconomic status, Time 1**—This latent variable combined the mother’s report of education (continuous) and total family income in 1966 ( $r = -.289, p < .01$ ). Income responses included 10 ordinal categories with 0: <US\$ 2000 and 9: US\$ 10,000 or more.

**2.2.4. Adolescent drug and alcohol use, Time 2 (alpha = .81)**—This latent variable comprised three self-report indicators of adolescent substance use: lifetime use of beer and wine, hard liquor, and marijuana. Frequency categories ranged from never (=0) to more than 40 times (=5).

**2.2.5. Low adolescent school bonds, Time 2 (alpha = .65)**—This latent variable consisted of four observed indicators: “How important is school performance to you?” (0 = very, very much; 5 = not at all), “How does your teacher think you are doing?” (0 = very, very well; 5 = not well at all), “Are you satisfied with your teacher’s opinion of how you are doing?” (0 = very, very much; 5 = not at all), and “How far do you think you really will go in school?” (0 = beyond college to 4 = some high school).

**2.2.6. Low parental supervision, Time 2 (alpha = .64)**—This latent variable comprised five items measuring adolescent reports of parental rules about use of beer and wine, use of drugs, use of cigarettes, and teen’s curfew during the week and on the weekends. Supervision of beer and wine, drugs, and cigarettes were each scaled 0–5, with 0 = absolutely forbid and 5 = completely up to the adolescent. The two curfew items, one weeknight curfew and one about weekend curfew, each had four response options: 0 = cannot go out, 1 = be home by 10, 2 = be home between 10 p.m. and midnight, and 3 = no curfew.

**2.2.7. Education, Time 3**—This item asked respondents to report the number of years of education achieved by young adulthood (YAI). Responses ranged from 4 years to 20 years of education.

### 2.3. Analyses

The multivariate analyses were conducted through structural equation modeling (SEM) with AMOS 4.0 (Arbuckle and Wothke, 1999). SEM is a multivariate statistical method that evaluates both the quality of a set of variables used to measure a latent construct (the measurement model) and the relationships among the latent constructs (the structural model). Primary advantages of structural equation modeling are the ability to determine

pathways along the life course, to identify mediators among the explanatory variables, and to assess direct and indirect effects. These are important considerations given our data were collected at three different time periods over 25 years.

**2.3.1. Missing data**—Data in this study are missing largely because of attrition, most of which was affected by changes in funding at Time 2, which ended data collection efforts prematurely. However, it is possible that some attrition was due to non-random reasons. Some respondents may have skipped particular survey items by mistake, in which case there could be missing information on relevant risk factors or on the outcome. The use of interviewers should have prevented this problem considerably by ensuring items were not accidentally skipped. On the other hand, some participants may have intentionally refused sensitive information.

There are a number of options for handling missing data. Although widely accepted, the traditional ad hoc methods, such as listwise and pairwise deletion, are limited by the loss of important observations, the risk of incorrect standard errors, and possible biased estimates (Arbuckle and Wothke, 1999; Byrne, 2001; Graham et al., 2003). Increasingly recommended is multiple imputation (MI), which creates a new data set for each different imputed value and averages over a predictive distribution for the missing values, resulting in standard errors and estimates that are generally valid (Graham et al., 2003). Like multiple imputation, model-based procedures, such as structural equation modeling, can perform direct maximum likelihood estimation using both complete and incomplete cases. Unlike MI, the model-based procedures deal with the missing data and parameter estimation at the same time (Graham et al., 2003).

By using AMOS 4.0, we were able to compute full-information maximum likelihood (FIML) estimates, which are theoretically based and much more direct than the traditional ad hoc procedures (Arbuckle and Wothke, 1999). FIML uses all available data points to generate the best possible first- and second-order moment estimates. The FIML estimates usually lead to essentially the same results as MI when the sample sizes are reasonably large (Schafer and Graham, 2002). The FIML/ML estimation is advantageous for a number of reasons: (1) it is both consistent and efficient when missing data are “missing completely at random” (missingness may not be related to dependent or independent variables); (2) it is asymptotically unbiased when the missing data are “missing at random” (missingness may be related to independent but not dependent variables) while listwise and pairwise estimates may be biased; (3) ML can yield standard error estimates, while pairwise deletion cannot; (4) when data are “non-ignorable” (not missing at random and therefore related to the independent and dependent variables), ML estimates exhibit less bias than the standard multivariate approaches (Little and Rubin, 1989; Schafer and Graham, 2002).

### 3. Results

In this section, we discuss our descriptive, binary, and multivariate analyses. We first report the prevalence of substance use disorders in the study population (based on DSM-III-R diagnostic criteria) and then describe the characteristics of those who have these disorders. We then discuss the distribution of the study’s dependent and independent variables and



review their correlations with each other. This is followed by a summary of the final models for males and females, including the model fit statistics.

### 3.1. Descriptive analyses

To establish the prevalence of actual substance use disorders in our study population, we ran a frequency of a binary measure of abuse and/or dependence of any substance, including alcohol. This is a different measure from our continuous measure of substance use problems; it identifies those who reported problems that met the DSM-III-R criteria for drug or alcohol abuse or dependence diagnoses. We found that males (26%) were more likely than females (13%) to report lifetime abuse or dependence. To put these rates in context, we compared the Woodlawn prevalence of substance abuse and dependence with that in the total U.S. population as measured by the National Comorbidity Survey (NCS), which also was conducted in the early 1990s and also used the CIDI and DSM-III-R diagnoses (Anthony et al., 1994). To make as precise a comparison as possible, we used reports from the 25–34-year-old respondents from NCS ( $n = 2626$ ), we excluded the incarcerated persons from the Woodlawn sample ( $n = 31$ ), and we examined drugs and alcohol separately. We found the two populations to be fairly similar, with roughly 12% of the total Woodlawn population and 10% of the NCS population reporting drug abuse or dependence, and 12% of Woodlawn and 16% of NCS reporting alcohol abuse or dependence.

In Table 1, we describe the characteristics of those who did and did not meet the criteria for drug or alcohol abuse or dependence to give a profile of substance abusers within a general, non-clinical population. Men and women who reported abuse or dependence were significantly more likely than those not reporting abuse or dependence to live below the poverty line, to be unemployed, to have ever served time in jail/prison, to not own their residences, and to not have children in their households. Men who did not report abuse or dependence were more likely than men who did to have a high school diploma and to be married. Abusers and non-abusers did not differ in terms of having a college degree, having children, or living in Woodlawn.

We next examined the distribution of the dependent and independent variables in the final analyses. The mean scores of the four indicators comprising the latent construct representing drug and alcohol abuse and dependence problems indicated that males were more likely than females to have substance use problems. Roughly 20% of men in the study reported some degree of functional impairment from substance use, compared to 10% of women (chi-square = 20.75,  $p = .000$ ). Men (31%) were more than twice as likely as women (15%) to report health and psychological problems from substance use (chi-square = 37.17,  $p = .000$ ). Men (38%) were also significantly more likely than women (18%) to report symptoms of dependence (chi-square = 56.88,  $p = .000$ ). Finally, 13% of women and 26% of men reported using drugs and alcohol longer and in greater quantities than they intended (chi-square = 25.93,  $p = .000$ ).

In first grade, teachers identified shyness among 32% of females and 35% of males. Males were more likely than females to be rated as aggressive to some degree (30% versus 19%), and females were more likely than males to score well in terms of achievement in first grade (61% versus 48%).

SES was distributed fairly similarly for boys and girls at the time of first grade. The mean education levels for mothers of girls and boys were 10.7 years and 10.6 years, respectively, and roughly two-thirds of mothers of males and females (69% and 62%, respectively) reported living in households with incomes less than US\$ 6000.

In adolescence, males were more likely than females to report high use of marijuana (29% versus 11%), high use of beer and wine (23% versus 11%), and high use of hard alcohol (8% versus 4%).

Male and female adolescents responded similarly to each of the five indicators of school bonds: for example, school performance was very important to 69% males and 77% females, roughly 20% of each sex reported the teacher thought very, very well of their performance, and just over 28% of females and 24% of males were very, very satisfied with their teachers' opinions of them. About 19% of females and 21% of males did not aspire to complete any education beyond high school, while 27% of females and 30% of males reported that they believed they would not get beyond high school.

Female adolescents reported stronger parental supervision than males. For example, females were more likely than males to report having parental rules absolutely forbidding the use of beer or wine (30% versus 20%), and males were more likely than females to report no curfew on weekends (66% versus 46%).

Males and females had fairly equal likelihood of completing 12 years of school (40% and 35%, respectively). However, females were more likely than males to go on to complete 13–20 years of school (46% versus 32%).

Table 2 shows the correlations for all variables included in the final model. For females, the latent dependent variable “drug and alcohol problems” as measured at age 32 years was significantly associated with teen drug and alcohol use, parental supervision, and educational attainment. For males, the outcome was significantly associated with first grade shyness, teen drug and alcohol use, and educational attainment. These are consistent with our hypotheses about the direct effects of the explanatory variables on the dependent variable. The explanatory variables not associated with substance use problems were related to other independent variables, consistent with our hypotheses about indirect effects. For example, although aggression is not significantly correlated with the outcome, it is correlated with adolescent substance use, which is correlated with the outcome. Our decision to keep the independent variables that were not correlated with the outcome was based on recommendations by Shrout and Bolger (2002) to allow inclusion of independent variables that do not have a significant relationship with the dependent variable when a significant portion of the life course is covered by longitudinal data. In this study, 25 years passed between our first and third phases of data collection, and thus we follow Shrout and Bolger's recommendation and retained all of the independent variables in the final model.

### 3.2. Final models

There were three general steps to the SEM analyses. First, we determined whether or not to run separate analyses for males and females because the literature shows that males and

females often follow different life course trajectories to drug and alcohol abuse; furthermore, in our population, the prevalence of substance use disorders was significantly higher among males than females.

Using a multi-group model in AMOS, we compared the full measurement model (including all of the latent variables and their indicators) in which the male and female factor loadings were constrained to be the same to another identical model in which the factor loadings for males and females were allowed to be estimated freely. We found significant measurement invariance between the male and female constructs, suggesting that constraining the measurement models to be equal for both sexes would be inappropriate. Furthermore, the goodness of fit statistic was significantly better for the unconstrained model ( $p = .017$ ), suggesting the analyses would be improved by separating males from females. Therefore, all subsequent analyses were conducted separately for males and females.

The second step was to run confirmatory factor analyses (CFA) to check all of the measurement models for both males and females. The resulting factor loadings indicate the relative influence of each observed indicator per latent variable. A CFA was run for four latent explanatory variables, childhood socioeconomic status, school bonds, parental supervision, and adolescent drug and alcohol use, as well as for the latent outcome variable, drug and alcohol problems. For each factor, the loadings of all indicators were significant, confirming the adequacy of the latent variables.

The final step was to build and analyze the full structural model, which determines the strength and direction of the hypothesized relationships among variables. We developed a series of nested models to compare the direct effects of childhood variables with the direct effects of variables later in development, and then with a full model with both direct and indirect pathways unconstrained. More specifically, we first tested the direct effect of the independent variables from Time 1 (family SES, aggression, shyness, and underachievement) on the outcome, constraining all other pathways in the model to be zero (Model 1). Next, we tested the direct effect of the independent variables at Time 2 and 3 (school bonds, parental supervision, teen drug and alcohol use, and educational attainment) on the outcome, constraining paths from Time 1 constructs to the outcome to be zero (Model 2). We then analyzed a full model in which Time 1, 2, and 3 constructs predicted drug and alcohol problems (Model 3). Comparing the fit of each of the nested models with the full model, results showed the full model was a significant improvement over each of the nested models. Specifically, comparing the full model to Model 1, the chi-square difference was 105.83 with 23 degrees of freedom ( $p < .001$ ), and the chi-square difference between the full model and Model 2 was 82.45 with 24 degrees of freedom ( $p = .003$ ), suggesting that allowing Time 1, 2, and 3 constructs to predict drug and alcohol problems results in a better fitting model.

Using the full model, we assessed the direct pathways from each of the explanatory variables to the outcome as well as the indirect pathways to the outcome from Time 1 variables to Time 2 and 3 variables. Because we wanted to compare identical structural models for males and females, we did not refine the final model to omit those pathways that were not significant. The final models for males and females are discussed below.

The fit of each model was evaluated according to several measures: the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the relative chi-square index, the ratio of the chi-square statistic to the degrees of freedom. The CFI, which adjusts for the degrees of freedom, compares the fit of the model against the null model with values ranging from 0 to 1; scores over .90 represent a good fit (Bentler, 1992), although others recommend using a cutoff of .95 (Hu and Bentler, 1999). The RMSEA takes into account the error of approximation in the population and evaluates how well the model would fit the population covariance matrix with unknown but optimally chosen parameter values. A fit less than .05 is considered a good fit, and a fit less than .08 is acceptable (Browne and Cudeck, 1989; Arbuckle and Wothke, 1999). Finally, for the ratio of the chi-square statistic to the degrees of freedom (Wheaton et al., 1977), values ranging from greater than 1 to less than 5 indicate an acceptable model (Bollen, 1989). One key advantage of AMOS is that it adjusts the chi-square automatically when there is missing data (Arbuckle and Wothke, 1999; Byrne, 2001).

**3.2.1. The female model**—Fig. 2 shows the SEM model fitted to the data for females. The figure shows the significant pathways, their standardized coefficients, and significance values, controlling for the other variables in the model. Table 3 summarizes the direct, indirect, and total effects of each explanatory variable on the outcome. The factor loadings for the latent variables are presented separately in Table 4.

**3.2.1.1. Model fit:** The female model fits the data adequately. For females, the ratio of the chi-square value to the degrees of freedom was 2.6, the RMSEA was .05, and the CFI was .91.

**3.2.1.2. Direct effects:** For females, the two variables having direct effects on the outcome were educational attainment and childhood SES. Females with high levels of education were less likely than those with low levels of education to have drug and alcohol problems ( $-.15$ ,  $p = .028$ ). Females with low SES as children were marginally less likely than those with high SES to have substance use problems in adulthood ( $.16$ ,  $p = .087$ ).

**3.2.1.3. Indirect effects:** First grade aggression, shyness, and SES had indirect pathways to the outcome through their relationships with variables in adolescence and adulthood. Girls rated as shy in first grade were more likely to report strong parental supervision in adolescence, which in turn related to higher educational attainment in adulthood. Girls who were rated as aggressive in first grade were marginally more likely to have low school bonds in adolescence, and girls with low school bonds had lower educational attainment in adulthood. Girls with low family SES in first grade were more likely to have low educational attainment.

**3.2.1.4. Total effects:** The AMOS analyses with missing data do not provide significance levels for total effects. We highlight total effect sizes greater than .10 as noteworthy since many of the direct effect sizes greater than .10 were significant at  $p$ -value  $< .10$ . For females, three variables had total effects greater than .10. Low parental supervision had the largest standardized effect size (.156). Since the direct effect of supervision was not significant, the total effect indicates strong indirect effects. This underscores the importance of identifying

indirect pathways through multiple variables over time. The second largest total effect among females was for education level (−.149), which was the equivalent of its direct effect. Finally, the third largest total effect was from first grade family SES (.108). This effect included the marginally significant direct effect as well as the indirect effects through other variables in the model.

**3.2.2. The male model**—The data for males were fit in a separate model, as shown in Fig. 3, which includes all significant pathways and their standardized coefficients. The factor loadings for the latent variables are reported separately in Table 4. Table 5 presents the standardized estimates for direct, indirect, and total effects on drug and alcohol problems for males.

**3.2.2.1. Model fit:** The fit statistics indicate the male model fit the data reasonably well. The ratio of chi-square to degrees of freedom was 2.2, the RMSEA was .04, and the CFI was .92.

**3.2.2.2. Direct effects:** For males, there were three variables to have a significant direct effect on drug and alcohol problems: first grade shyness, adolescent substance use, and educational attainment. First grade boys who were shy were less likely to have substance use problems in adulthood (−.13,  $p = .020$ ). Adolescent males who used drugs and alcohol had a higher risk of drug and alcohol problems in adulthood (.19,  $p = .045$ ). Males with high levels of education were less likely than those with low levels of education to have drug and alcohol problems in adulthood (−.19,  $p = .000$ ).

**3.2.2.3. Indirect effects:** Two first grade variables had indirect effects on drug and alcohol problems through their relationships with other variables over the life course. First, aggressive boys were more likely to use drugs and alcohol as adolescents, which in turn increased the risk for substance use problems in adulthood. Males with low SES in childhood and males with low first grade achievement were more likely to have low educational attainment, which increased the risk for substance use problems.

**3.2.2.4. Total effects:** For males, three variables had total effects greater than .10. Adolescent substance use had the largest total effect (.199), which captured its significant direct effect as well its indirect impact through other variables. Education level had the second largest total effect (−.190), which included only its direct effect and no indirect effects. The third largest total effect was for first grade shyness (−.126), representing both its significant direct effect and its indirect effects through other variables.

## 4. Discussion

This is one of few studies to use data collected prospectively from a general population to examine developmental pathways from childhood to substance use problems in adulthood. We used structural equation modeling to examine the relationships between childhood and adolescent factors and drug and alcohol problems in adulthood.

Our first goal was to assess whether or not factors reported in early childhood have a direct impact on drug and alcohol problems 25 years later. We found that males who were shy in

first grade had a significant decreased risk of substance use problems in adulthood. Although this finding builds upon prior Woodlawn study findings showing that first grade shyness protects against the use of drugs and alcohol in adulthood (Ensminger et al., 2002) and other findings that shyness protects against alcohol use disorders (Eggleston et al., 2004; McCord, 1988), the findings on shyness have not been consistent. Some studies have found that inhibition increases the risk for illicit substance use in adolescence (Page, 1990) and for alcohol problems in adulthood (Caspi et al., 1996; Crum and Pratt, 2001; Hartman, 1986).

One reason for the inconsistent research on shyness may have to do with the measures being used. Social inhibition, withdrawal, and shyness have often been used interchangeably in social science research. In this study, “shyness” refers to being shy, timid, alone too much, friendless, or aloof. Caspi et al. (1996) defined social inhibition as being shy, fearful, and easily upset. Other studies have defined shyness as being uncomfortable and inhibited in interpersonal situations (Henderson and Zimbardo, 1998). To understand the discrepant findings on the effects of shyness, Kerr et al. (1997) tested different conceptualizations of shyness. They define inhibition as reacting fearfully to strange people, objects, or situations (Kagan et al., 1988) or to the threat of punishment or non-reward (Gray, 1990). In contrast, social withdrawal was defined as “a non-anxious preference for solitary activity” (Rubin and Mills, 1988) or a “failure to be rewarded by social interaction or others’ approval” (Kerr et al., 1997). Tests of their effects found that inhibition protected boys against delinquency, but withdrawal was not protective. Based on this, we speculate that our finding that shyness is protective may be because our measure of shyness captures more inhibition than withdrawal. Future research should examine if those who are inhibited as children have a different risk for later substance use problems compared to those who are withdrawn. Nevertheless, it is noteworthy that a teacher rating of shy behavior made in first grade directly relates to substance use problems 25 years later.

The other first grade classroom variables, aggression and achievement, were not directly related to the outcome for either males or females. Both, however, are related to important variables in the pathways to substance use problems. The effect of a childhood factor may be important because of its impact on the developmental course of behavior.

The findings regarding socioeconomic status in childhood deserve special mention. For females, childhood SES had a marginal direct effect ( $p = .087$ ), with female first graders who lived in lower SES households less likely to have substance use problems 25 years later. Although our hypothesis was that lower SES would increase the risk of substance use problems, this finding for females is consistent with our earlier finding that lower SES in childhood protected against cocaine use for females (Ensminger et al., 2002). What is interesting to note is that although childhood poverty shows marginal protection against later substance use problems, concurrent poverty does not, as both male and female abusers were more likely to be poor in adulthood than non-abusers (see Table 1). Thus, there may be something specific about living in poverty as a child that is protective against adult substance use problems for females. Also noteworthy, the indirect effects of SES were not protective, as those who lived in poverty as children were likely to attain fewer years of education, which in turn increased the risk for substance use problems. These two different



findings regarding SES indicate a need for further study on how childhood poverty influences the developmental course of substance use disorders.

Another primary goal of the study was to examine the effects of factors occurring in adolescence and early adulthood on the development of later substance use problems. Adolescent males who used drugs or alcohol were significantly more likely to report substance use problems in adulthood. This suggests that drug and alcohol use by adolescent males is a risk for later problems and should not be dismissed as normative experimentation as some have suggested (Baumrind, 1985; Bruns and Geist, 1984). We also found that males and females who reported high levels of educational attainment were less likely to report substance use problems in adulthood. It is important to note that this finding is controlling for adolescent substance use, so the importance of educational attainment is not a result of its association with earlier drug use. Numerous findings have shown a relationship between education and substance abuse (Brunswick and Titus, 1998; Crum and Anthony, 2000; Obot et al., 1999; Warner et al., 1995), and our findings extend this work, showing the importance of education in a developmental trajectory to drug and alcohol problems.

We did not find that school bonds or parental supervision had direct effects on substance use problems for either males or females. The weak effects could be due to the 16-year time lapse between Time 2 and 3 (Shrout and Bolger, 2002). Another possibility is that the measures were not reliable enough to have predictive power (the alpha scores for each measure were less than .70). It is also important to note the strong association of both low school bonds and low parental supervision with adolescent substance use. This may have limited the direct effect of these variables on adult substance use problems since their influence could be through their relationship to adolescent drug use.

We also examined the indirect relationships among variables along the pathway from early childhood to adult substance use problems. According to The Social Development Model (Catalano and Hawkins, 2000; Guo et al., 2001), there are two general pathways in development: prosocial and antisocial. These pathways result from sequential and cumulative influences over the life-course; therefore, having prosocial bonds and behaviors during childhood and adolescence should increase the chance of later prosocial bonds and behaviors, while antisocial bonds are more likely to lead to later antisocial behaviors. For example, this study found that males who were aggressive in first grade were more likely to use drugs and alcohol in adolescence, which in turn increased the risk for substance use problems in adulthood. It also shows males rated as high achievers in first grade were more likely to have high levels of educational attainment, which decreased their risk of substance use problems in adulthood. Among females, those who were shy in first grade were more likely to report strong parental supervision in adolescence, which in turn increased the likelihood of higher educational attainment, which reduced the risk for substance use problems in adulthood. Also, females with low school bonds were less likely to attain high levels of education, thereby increasing the risk for later substance use problems. For both males and females, having higher SES in childhood increased the likelihood of high levels of educational attainment, which in turn decreased the risk for substance use problems. These findings underscore the value of early intervention to steer young children on a prosocial

pathway as well as interventions in adolescence to re-direct those youth who may already be on an antisocial pathway.

Our final goal was to determine if males and females followed different pathways to drug and alcohol problems in adulthood. The results clearly indicate that males and females have similar as well as different trajectories to substance use problems. This finding suggests that some interventions be tailored specifically for males and females. Future research on substance use disorders should examine males and females separately to learn more about their respective risk trajectories over the life course.

Overall, this study gives a rare picture of the development of substance use problems over a 25-year time period. However, there are study limitations to be acknowledged. First, the generalizability is limited due to the focus on an all African American population from a specific community in Chicago. Whether these findings are applicable to other populations can only be determined by replication in other population groups. Second, although the tests for attrition bias found no differences regarding key risk factors between those interviewed and those who were not, it is possible that general attrition could have affected the findings. If so, some significant relationships may not have been detected, or those that have been detected may be an underestimation of the relationships between variables. In addition, the assessment periods were widely spaced, limiting our ability to identify other factors along the life course contributing to the development of substance use problems. This may also help explain why the effect sizes are not large. The omission of other important influences might explain why the fit indicators of the final models were only “reasonable” and not “good.”

Another issue is that the data are more than 10 years old; additional research should confirm the findings with data collected more recently. Also, although most abuse and dependence does not occur until adulthood (Warner et al., 1995), a few individuals may have had substance use problems prior to adulthood; since the study did not control for these early problems, the effects of adolescent substance use may be overestimated. Additional research is necessary to better understand the role of these developmental risk factors. Finally, the validity of self-reports of drug and alcohol use is often questioned because of the possible reporting of “social desirable” responses (e.g., underreporting, exaggeration, and denial) (Schwartz (1999). However, various studies have shown self-reports of drug and alcohol use to be reliable and valid (Babor et al., 2000; Darke, 1998; Gold, 1970), and previous tests of validity with the Woodlawn data indicate there is not a significant amount of bias in the responses (Ensminger et al., 1997).

Despite these caveats, this study makes important contributions to the field. First, the findings identify life course trajectories to drug and alcohol use problems for both males and females. The Woodlawn population was followed for over 25 years, providing rare insight into if and how various factors at different stages of development influence the risk for substance use problems. Second, the findings are among the first to identify risk factors for drug and alcohol problems among a general population. Most prior studies of substance use disorders have focused on individuals in clinical and treatment settings (Woody et al., 1993;

Morgenstern et al., 1994). Third, the use of multiple sources of information, including the focal participants, the mothers, and teachers, lends strength to the validity of the findings.

The study also provides a rare picture of the development of risk among an African American population. Most of what is known about drug and alcohol use and abuse pertains to White populations; very little is understood about how the risk for drug and alcohol problems differs within race categories (Jones-Webb et al., 1995). Given that African Americans suffer disproportionately from the consequences of drug and alcohol abuse and dependence (Wallace, 1999), these findings are important for interventions targeting African Americans. Similarly, this study found distinct gender differences in the trajectories to drug and alcohol problems. It also identified those risk factors that played a significant role for both males and females.

The findings indicate that the etiology of substance use problems is an extension of the risk for substance use, but further research is needed to confirm this and to identify additional risk factors. In particular, further research on life course pathways is critical for prevention efforts. In this study, childhood risk factors affected adult substance use problems through their relationships with parental supervision, teen drug and alcohol use, and educational attainment. The identification of prosocial points of intervention in early in the life course would help inform efforts aiming to redirect youth away from antisocial pathways to adulthood.

There are several potential implications for prevention programs and research. First, the finding that first grade males who are aggressive are indirectly at risk for later drug and alcohol problems highlights the importance of targeting these boys early on to help them modify their behaviors or help them thrive despite these behavioral problems. This points to the value of expanding or replicating several existing school-based prevention programs that target these behaviors, such as the Fast Track program (Conduct Problems Prevention Research Group, 1992, 1996) and the Baltimore Prevention Research Center (Kellam and Anthony, 1998; Kellam et al., 1998).

Second, the study also highlights the strong role of childhood SES in shaping the trajectory from childhood to adulthood for both males and females. Thus, there is a critical need to continue and enhance policies supporting low-income families and community programs that offer educational and recreational opportunities for all youth.

In addition, educational attainment had a significant impact on drug and alcohol problems for both males and females. This implies that not only do economically disadvantaged youth need supports to stay in school and perform well academically, but all youth need access to good schools that will foster an interest in education and help them aspire to complete high school and pursue additional education after graduation.

For females, the findings underscore the importance of parental supervision for increased educational achievement, which is associated with reduced risk for drug and alcohol problems. This indicates a need for improved guidance and support for parents, particularly those of adolescent girls. In addition, other possible interventions include after-school programs for girls or other programming to engage teenage girls while their parents work.

For males, the finding that teen drug and alcohol use increases the risk for adult drug and alcohol problems affirms the value of substance use prevention programs for adolescent males. Youth who could benefit from being engaged in prosocial activities should have access to after-school programs either at school or in the community. Such programs keep youth busy and reduce opportunities to use drugs and alcohol, facilitate the development of prosocial skills such as sportsmanship, and enhance males' ties to community institutions such as schools, community centers, or churches.

Finally, the study's finding of different pathways to substance use problems for males and females highlights a critical need for further research on gender differences in substance abuse risk, prevalence, and consequences. Future research should also explore the mechanisms behind these gender differences. Much more needs to be learned about the corresponding roles of biology, socialization, gender roles, and other contextual factors in the experience of drug and alcohol abuse and its consequences (Clayton et al., 1986; Lex, 1991).

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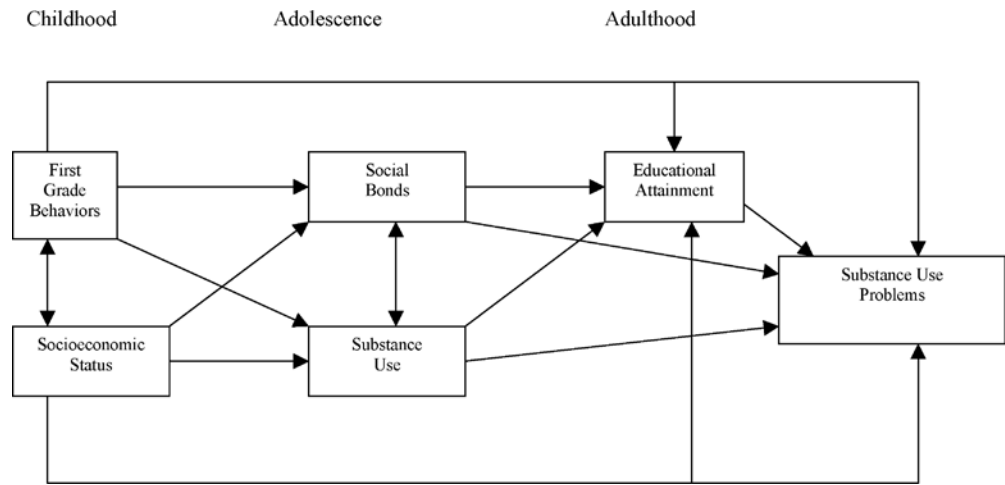
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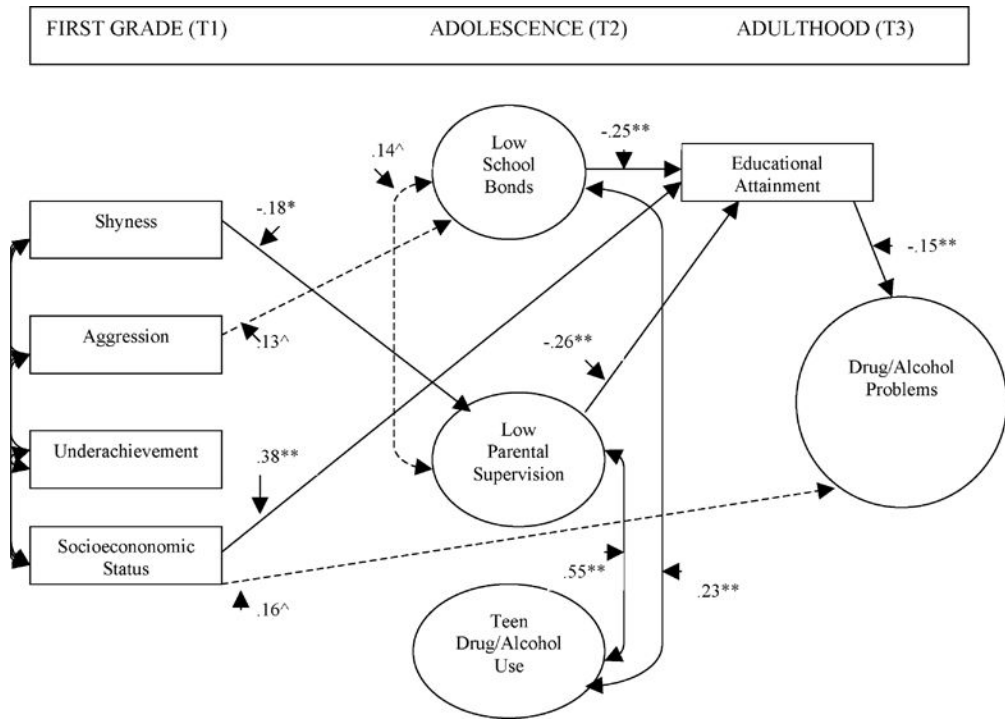
**Fig. 1.**  
Conceptual framework.

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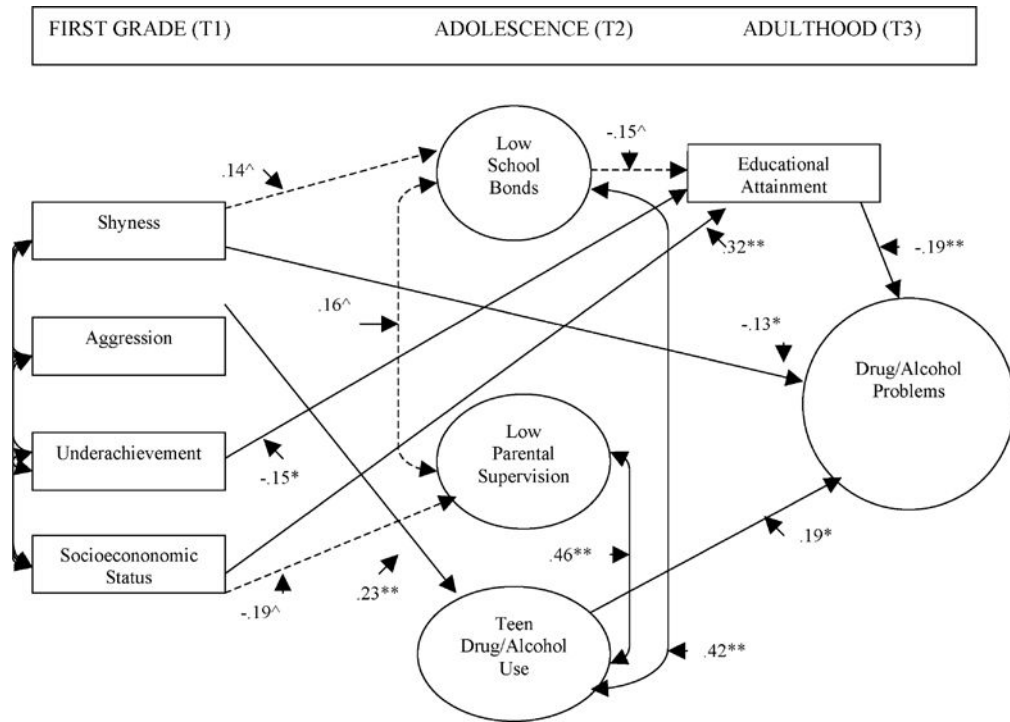
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**Fig. 2.** Female model with full-information maximum likelihood standardized estimates ( $\hat{p} < .10$ ;  $*p < .05$ ;  $**p < .01$ ). The rectangles represent observed variables; the circles represent latent variables. The factor loadings for the indicators of each latent variable are listed in Table 4. Arrows represent significant pathways. The correlation lines drawn between the Time 1 variables are all significant with  $p < .05$  (estimates not included to reduce the complexity of the figure). Fit: chi-square/d.f. = 2.6; CFI = .91; RMSEA = .05.



**Fig. 3.** Male model with full-information maximum likelihood standardized estimates ( $\hat{p} < .10$ ; \* $p < .05$ ; \*\* $p < .01$ ). The rectangles represent observed variables; the circles represent latent variables. The factor loadings for the indicators of each latent variable are listed in Table 4. Arrows represent significant pathways. The correlation lines drawn between the Time 1 variables are all significant with  $p < .05$  (estimates not included to reduce the complexity of the figure). Fit: chi-square/d.f. = 2.2; CFI = .92; RMSEA = .04.



**Table 1**

Characteristics of adults who meet the DSM-III-R criteria for drug or alcohol abuse or dependence, 1993 (females = 496; males = 456)

	Females		Males		Chi-square
	Abusers (n = 64) (%)	Non-abusers (n = 432) (%)	Abusers (n = 120) (%)	Non-abusers (n = 336) (%)	
Income below poverty line	50	38	54	33	15.60**
Education					
H.S. diploma/GED	78	82	68	81	7.60**
College degree	33	41	30	43	1.70
Currently unemployed	61	36	53	30	19.90**
Marital status					
Married	17	26	18	37	
Separated	13	14	12	6	
Divorced	8	10	9	7	
Widowed	2	1	2	0	
Living with partner	8	6	15	8	
Never married	53	44	45	42	24.90**
Has children	78	79	28	31	.23
Has children in household	59	77	23	39	12.80**
Living in Woodlawn	13	10	10	8	.46
Owner of residence	3	18	7	24	13.50**
Ever served time in jail/prison	28	4	59	18	69.60**

Note: "DSM-III-R": revised third edition of the *Diagnostic and Statistical Manual of Mental Disorders*; "abusers": those who meet the DSM-III-R criteria for abuse or dependence; "GED": Graduate Equivalent Degree. Percentages are rounded to the nearest whole number. Characteristics that are significantly different for males compared to females are in bold text. The sample size is 952, based on the adult interview and not including imputed data.

^ Chi-square significance:  $p < .10$ .

\*\* Chi-square significance:  $p < .01$ .

Correlations of dependent and independent variables, by gender ( $N = 1242$ : 636 females, 606 males)

Table 2

	1	2	3	4	5	6	7	8	9
1. Socioeconomic status, T1	-	-.174*	-.255*	-.203*	.038	-.010	.170 <sup>^</sup>	.408*	.096
2. Aggression, T1	-.069	-	.172*	.446*	.118 <sup>^</sup>	.025	-.035	-.151*	.055
3. Shyness, T1	-.126*	.239*	-	.476*	-.044	-.132*	-.176*	-.125*	-.015
4. Underachievement, T1	-.119*	.498*	.429*	-	.035	.011	-.158*	-.172*	.015
5. Low school bonds, T2	-.056	.108 <sup>^</sup>	.178*	.150*	-	.136 <sup>^</sup>	.228*	-.256*	.043
6. Weak supervision, T2	-.126	.057	.059	.079	.068	-	.518*	-.218*	.187*
7. Drug/alcohol use, T2	-.027	.192*	.054	.045	.415*	.405*	-	-.031	.159*
8. Educational attainment, T3	.361*	-.037	-.082 <sup>^</sup>	-.163*	-.200*	-.045	-.124 <sup>^</sup>	-	-.115*
9. T3 drug/alcohol problems	-.090	.032	-.092 <sup>^</sup>	.005	.065	.105	.221*	-.217*	-

Note: Figures for males are in the bottom left, figures for females are in upper right. All figures derived with AMOS 4.0. T1: Time 1 (1967); T2: Time 2 (1975); T3: Time 3 (1993).

<sup>^</sup>  $p < .10$ .

\*  $p < .05$ .

**Table 3**

Female model—standardized direct, indirect, and total effects

Predictor	Dependent variable	Direct effect (S.E.)	Indirect effect	Total effect
Family SES	Low school bonds	.049 (.04)	–	.049
	Low supervision	–.030 (.09)	–	–.030
	Teen drug/Alc. use	.133 (.09)	–	.133
	Education level	.382 ** (.16)	.007	.389
	Drug/Alc. problems	.162 ^ (.04)	–.053	.108
Aggression	Low school bonds	.129 ^ (.04)	–	.129
	Low supervision	.029 (.10)	–	.029
	Teen drug/Alc. use	.052 (.10)	–	.052
	Educational level	–.017 (.14)	–.035	–.052
	Drug/Alc. problems	.062 (.04)	.010	.071
Shyness	Low school bonds	–.066 (.04)	–	–.061
	Low supervision	–.179 * (.10)	–	–.179
	Teen drug/Alc. use	–.101 (.10)	–	–.101
	Educational level	–.032 (.14)	.053	.020
	Drug/Alc. problems	.027 (.04)	–.029	–.003
Underachievement	Low school bonds	.017 (.04)	–	.017
	Low supervision	.075 (.10)	–	.075
	Teen drug/Alc. use	–.106 (.04)	–	–.106
	Educational level	–.046 (.13)	–.032	–.079
	Drug/Alc. problems	–.005 (.03)	.011	.006
Low school bonds	Educational level	–.250 ** (.30)	–	–.250
	Drug/Alc. problems	–.043 (.08)	.037	–.006
Low supervision	Educational level	–.256 ** (.15)	–	–.256
	Drug/Alc. problems	.118 (.04)	.038	.156
Teen drug/Alc. use	Educational level	.086 (.14)	–	.086
	Drug/Alc. problems	.079 (.04)	–.013	.066
Educational level	Drug/Alc. problems	–.149 * (.02)	–	–.149

Note: When AMOS uses maximum likelihood estimation with missing data, it does not provide significance levels for indirect or total effects. “SES”: socioeconomic status; “Alc.”: alcohol.

^  
p < .10.

\*  
p < .05.

\*\*  
p < .01.

**Table 4**

AMOS factor loadings for the measurement models within the final structural models for males and females

	<b>Males (<i>n</i> = 606)</b>	<b>Females (<i>n</i> = 636)</b>
Independent variables		
Socioeconomic status, Time 1		
Mother's education (no. of years)	.70	.54
Income 1966, before taxes	.39	.53
School bonds		
How important is school performance to you?	.44	.34
How does your teacher think you are doing?	.78	.72
Are you satisfied with your teacher's opinion?	.61	.75
How far do you think you will go in school?	.41	.47
Parental supervision		
Parental rules about beer/wine	.52	.68
Parental rules about drugs	.38	.38
Parental rules about cigarettes	.47	.70
Weekday curfew	.64	.47
Weekend curfew	.60	.46
Adolescent drug and alcohol use		
Ever use marijuana	.76	.68
Ever use hard liquor	.73	.74
Ever use beer or wine	.81	.90
Dependent variable		
Drug and alcohol problems		
Functional impairment	.88	.84
Physical and psychological health problems	.87	.83
Signs of dependence	.89	.89
Length and quantity of use	.84	.89

*Note:* All factor loadings are significant with  $p < .001$ .

**Table 5**

Male model—standardized direct, indirect, and total effects

Predictor	Dependent variable	Direct effect (S.E.)	Indirect effect	Total effect
Family SES	Low school bonds	-.033 (.03)	–	-.033
	Low supervision	-.192 <sup>^</sup> (.06)	–	-.192
	Teen drug/Alc. use	-.011 (.08)	–	-.011
	Education level	.322 <sup>**</sup> (.14)	–	.342
	Drug/Alc. problems	-.015 (.03)	-.082	-.097
Aggression	Low school bonds	.040 (.04)	–	-.040
	Low supervision	.098 (.07)	–	.098
	Teen drug/Alc. use	.225 <sup>**</sup> (.12)	–	.225
	Educational level	.082 (.12)	-.021	.062
	Drug/Alc. problems	.006 (.05)	.036	.042
Shyness	Low school bonds	.136 <sup>^</sup> (.04)	–	.136
	Low supervision	.031 (.07)	–	.031
	Teen drug/Alc. use	.034 (.12)	–	.034
	Educational level	.038 (.10)	-.023	.015
	Drug/Alc. problems	-.125 <sup>*</sup> (.05)	.000	-.126
Underachievement	Low school bonds	.070 (.04)	–	.070
	Low supervision	.078 (.08)	–	.078
	Teen drug/Alc use	-.081 (.13)	–	-.081
	Educational level	-.145 <sup>*</sup> (.13)	-.014	-.159
	Drug/Alc. problems	.007 (.05)	.018	.026
Low school bonds	Educational level	-.148 <sup>^</sup> (.33)	–	-.148
	Drug/Alc. problems	-.048 (.12)	.028	-.020
Low supervision	Educational level	-.077 (.20)	–	-.077
	Drug/Alc. problems	.085 (.08)	.015	.100
Teen drug/Alc. use	Educational level	-.031 (.11)	–	-.031
	Drug/Alc. problems	.185 <sup>*</sup> (.04)	.006	.199
Educational level	Drug/Alc. problems	-.190 <sup>**</sup> (.02)	–	-.190

Note: When AMOS uses maximum likelihood estimation with missing data, it does not provide significance levels for indirect or total effects. “SES”: socioeconomic status; “Alc.”: alcohol.

<sup>^</sup>  $p < .10$ .

<sup>\*</sup>  $p < .05$ .

<sup>\*\*</sup>  $p < .01$ .