America's Dropout Crisis:

The Unrecognized Connection To Adolescent Substance Use

"There is no problem so bad that alcohol and drugs will not make it worse."

Robert L. DuPont, M.D.[1]

Kimberly M. Caldeira, M.S.[2]

Helen S. DuPont, M.B.A.[1]

Kathryn B. Vincent, M.A.[2]

Corinne L. Shea, M.A.[1]

Amelia M. Arria, Ph.D.[2,3]

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[1] Institute for Behavior and Health, Inc. (IBH), 6191 Executive Boulevard, Rockville, MD, 20852.

[2] Center on Young Adult Health and Development (CYAHD), University of Maryland School of Public Health, 1142 School of Public Health Building, College Park, MD 20742.

[3] Treatment Research Institute (TRI), 600 Public Ledger Building, 150 S. Independence Mall West, Philadelphia, PA 19106.

About the Institute for Behavior and Health, Inc.

Established in 1978 as a nonprofit 501(c)3 organization, the mission of the Institute for Behavior and Health, Inc. (IBH) is to shape drug policy to more effectively reduce illegal drug use. To further this mission, IBH has focused on a small number of specific topics for study, research, and discussion. This report, on the school dropout crisis, reflects years of investigation into teen drug use and school-related outcomes and interventions. More information about IBH can be found at www.ibhinc.org, www.PreventionNotPunishment.org, and www.PreventTeenDrugUse.org.

About the Center on Young Adult Health and Development

In 2009, the Center on Young Adult Health and Development (CYAHD) was established at the School of Public Health on the College Park campus of the University of Maryland. This research center is one of the first such centers in the United States specifically dedicated to understanding the health and development of young adults. More information about CYAHD can be found at www.cyahd.umd.edu.

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EXECUTIVE SUMMARY

High School Dropout in the United States

To remain globally competitive in today's knowledge-based economy, American high schools must improve graduation rates and ensure that graduates have the necessary skills to enter the productive workforce. High school dropout rates have been a concern for more than two decades, and although some progress has been made, the problem still commands the attention of policy makers at state and federal levels. In 2007, 16% of individuals ages 16 to 24, or 6.2 million people, were high school dropouts (Center for Labor Market Studies and Alternative Schools Network in Chicago, 2009). The ten largest public school systems in the U.S. failed to graduate more than 60% of their students (Greene & Winters, 2006). Among the many dire consequences of failing to graduate from high school is the increased risk for unemployment. In the U.S. today, 3.8 million 18- to 24-year-olds, or 15% of young adults, are neither employed nor in school (Annie E. Casey Foundation, 2004); and 35% of men ages 25 to 54 without a high school diploma are unemployed, up from 10% in the 1960s (Economist, 2011).

What Does the Research Show about the Connection Between Substance Use and Dropout?

With its collective expertise in the fields of substance abuse and educational research and policy, experts at the Institute for Behavior and Health, Inc. (IBH) and the Center on Young Adult Health and Development (CYAHD) at the University of Maryland School of Public Health investigated the connection between adolescent substance use and the risk for dropout in the U.S. During the last year, this group conducted a comprehensive review of the empirical research literature and policy-relevant documents, and consulted with clinicians, educators, and policy makers to gain a better understanding of the dropout crisis—its root causes, consequences, and what strategies are being used to address it. These activities covered a variety of disciplines including education, economics, sociology, psychology, and public health.

The following conclusions were made:

- ***School dropout is a complex problem****,* the result of multiple pathways.
- ***Vast resources are being expended to reduce dropout****.*
- ***The social costs of dropout are enormous****,* ranging from the failure of an individual to reach his or her potential, to the economic consequences of a lower skilled workforce, and dependence on the social welfare system, to a decline in the U.S. position in the global marketplace.

- ***The associations between substance use, academic failure, and dropout are strong and well-recognized*** among researchers and educators who study adolescent substance use, but they are rarely acknowledged in educational circles or among state and federal policy makers.

- ***While there is heated debate in the research literature and among policy makers concerning the "chicken-egg" question of which one comes first—academic difficulties or substance use—there is compelling evidence that the association is bidirectional.*** In some individuals, academic difficulties precede the onset of substance use, and in those cases, a vicious cycle can ensue—leading to even more severe academic difficulties and eventual dropout. In other cases, even controlling for individual background characteristics, substance use precedes and contributes to academic failure and dropout, especially when substance use is frequent and severe.

- ***There is general agreement about the biological, social, and environmental mechanisms that explain the link between substance use, academic failure, and dropout.***

- ***Adolescents who are at risk for academic failure or have dropped out of school are likely to have substance use problems in combination with an array of other problem behaviors*** that, if not addressed, place them at extremely high risk for costly long-term adversity, including unemployment, crime, and poor health.

- ***Little is being done to screen for substance use in pediatric and educational settings,*** and even less is being done to address escalating substance use problems among adolescents at risk for dropout or those who have already dropped out of high school.

- ***Of all the problems that contribute to dropping out, substance use is one of the easiest to identify and one of the most easily stopped*** by interventions including treatment.

- ***Research evidence shows that when adolescents stop substance use, academic performance improves.*** This is consonant with long standing clinical anecdotal accounts.

Why Has So Little Action Been Taken to Identify Substance Use in Schools and Among Dropouts if there is a Recognized Connection Between Substance Use and Academic Failure?

While no one doubts that an association exists between substance use and dropout, a major stumbling block to taking steps to address the problem is the lack of agreement on the nature of the association. Two alternative views predominate: substance use is either the result of earlier academic difficulties, or it is a contributory factor to academic difficulties. A third explanation is that substance use and failing academic performance are the result of shared factors, such as a general propensity for deviance. This debate about the directionality of the association and which direction is predominant has resulted in an impasse among researchers and policy makers.

Beyond the disagreement among experts of the causal directionality of dropout, there are other reasons why efforts have not been organized to address substance use among students in high school, starting with a lack of resources and leadership as well as the perception that there are few or no effective solutions. Educators and policy makers must take action, shifting the focus from theoretical debates to solutions to help students get back on track.

What Research Findings Show that the Association Between Substance Use and Academic Failure is Bidirectional?

While it is generally acknowledged that academic performance problems can lead to substance use, equal acknowledgement is lacking that adolescent substance use plays a substantial role in academic failure. In fact, the association between substance use and academic failure is *bidirectional.* The resistance to believing that substance use can lead to academic performance problems is surprising given the many known negative consequences of substance use and addiction, for example those that are health- and safety-related. Perhaps part of the resistance stems from the general notion that substance use is normative and perhaps is even an accepted rite of passage during adolescence.

Research on the association between substance use and academic performance using different samples and different methodologies yield the following conclusions:

- ***Substance-using students, compared with non-users, are at increased risk for academic failure, including dropout, especially when their substance use is frequent and severe.*** Studies utilizing longitudinal designs have shown that even after statistical adjustment for problem behaviors and other important co-factors, substance use plays a role in increasing the risk for dropping out of high school.
- ***Marijuana use has a stronger negative relationship to academic outcomes such as grade point average (GPA) and risk for dropout than alcohol use.*** Lighter, less frequent alcohol use does not always have a statistically strong relationship with academic outcomes, while marijuana use does. This might be due to differences in the patterns of consumption between alcohol (which is typically consumed sporadically) and marijuana (which might be consumed more regularly) among adolescents. In the studies that showed weak associations with alcohol, the students investigated were, on average, very low level drinkers. Some researchers observed that the heavier drinking adolescents dropped out of school and thus were not available to participate in follow-up research interviews.
- ***The more severe the substance use, the more likely the impact on academic performance and risk for dropout.***

- ***Some studies provide evidence that substance use precedes academic failure; other studies provide evidence that early academic failure precedes substance use.*** The most sensible interpretation of these seemingly conflicting findings is that the two scenarios are not mutually exclusive. Clinical experience clearly supports a multitude of pathways leading to different types of adverse outcomes during adolescence.
- ***Cessation of substance use following treatment is associated with improvements in academic performance.*** Although only a few studies could be located that assessed adolescent academic functioning after treatment, this type of evidence strongly supports the contributory role of substance use in academic failure.
- ***High school dropouts, compared with non-dropouts, have dramatically higher rates of substance use.*** Individuals who have dropped out of high school are at high risk for exhibiting a constellation of behavioral problems that are amenable to early intervention.

It is Time to Act

Several questions are policy relevant. Does adolescent use of alcohol and drugs promote dropping out? Are adolescents that stop using alcohol and drugs less likely to drop out? Once dropout has occurred, does stopping alcohol and drug use encourage school reentry? Since the answer to these questions is "yes", the policy challenge is to identify best practices to reduce adolescent alcohol and drug use in general. However it is particularly important to identify alcohol and drug use among students that are at high risk for dropping out—the students with low academic performance and high levels of truancy—and to intervene to help them become alcohol- and drug-free.

Dropout is costly. Adolescence (or even earlier) is the right time to intervene. If substance use during adolescence is not addressed, problems escalate, become more difficult to solve, and the subsequent consequences can be severe. Too much is at stake to delay action. On a practical level, all that is important to know is that drug and alcohol use is sometimes the first sign of problematic behavior, and that it is more often part of a broader constellation of maladaptive behaviors that reduce academic performance and contribute to dropping out. Spending more time and discussion on the complexity of these issues is unnecessary. It is time to shift our national energy and resources to the design and implementation of scalable, cost-effective solutions for students at risk for dropout and those who have dropped out already that address their substance use and other problem behaviors. Such solutions hold promise for getting these students back on track. The review of the literature included in this report shows evidence that with modest intervention or, in the most severe cases, successful treatment, academic performance improves.

The strong evidence from scientific peer-reviewed studies is bolstered by views from clinicians and educators who deal directly with at-risk youth. These professionals conclude that substance use causes and/or worsens academic failure and that when youth stop using drugs and/or alcohol, their academic performance improves and their school attendance increases.

One particularly powerful source of information is the recovery community. Among young people in recovery, stories abound of the connection between early substance use, poor academic performance, and dropping out. Clinicians report that their patients say such things as "I didn't care about my academics… I skipped some days of school to use." On a positive note, there are just as many stories from youth in sustained recovery of the unmistakable connection between abstinence from the use of drugs and alcohol and dramatic improvements both in academic performance and school attendance.

In the words of a recovering 17-year-old female high school student, "I was able to do assignments, study, and focus because I wasn't high. I was able to learn. I actually cared about school and would go so I didn't have to make up work. I wouldn't be tired from the night before and wouldn't have to call in sick." And in the words of another, "I actually cared about where my life was going."

What Actions Should be Taken to Reduce the Dropout Crisis?

At the root of the dropout issue lies a variety of sociodemographic and community-level risk factors for dropout. Dropout rates are not uniformly distributed; rather, there are clear racial, ethnic, and regional disparities. Many have described the process of "disengagement" that eventually leads students to lose interest in academic pursuits. Others have focused on individual learning difficulties that are present early in a child's life, which if unaddressed because of socioeconomic disadvantage or other reasons, can later contribute to dropout risk. Advocates seeking to reduce dropout rates have called for increased resources to create better learning environments, improve the quality of teaching, decrease class sizes, personalize learning, and improve student-teacher relationships. All of these approaches aim to improve school bonding, and thereby boost academic performance. There is no doubt that these reforms will enhance learning environments.

Substance use and other problematic behaviors do commonly occur together. There is a great need for new ways of thinking about the interconnected problems of substance use and poor academic performance. Currently available scientific evidence, clinical experiences, and common sense all support a series of steps to reduce students' use of drugs and alcohol, both to improve their academic performance and to prevent them from dropping out of school. The following recommended actions reflect these major themes:

1. Place more attention on at-risk students. To this end, it is critical to act early to identify and address the variety of problem behaviors including truancy, drug and alcohol use, delinquency, and academic "disengagement." All students with early signs of academic difficulties should be comprehensively assessed and carefully and specifically screened for drug and alcohol use. Steps should be taken to ensure that these at-risk students become and stay drug- and alcohol-free. By extrapolating from clinical experiences, the heterogeneity can be seen in the pathways by which substance use and academic problems become intertwined. In some cases, early signs of problematic behavior preceded the substance use. In other cases, affiliation with substance-using peers provided opportunities for substance involvement and led to escalation of use, which then led to skipping class, poor grades, and eventually to dropping out. A phrase from the recovery community about the role of substance use states, "There is no problem so bad that alcohol and drugs will not make it worse!" That wisdom, borne of the experience of thousands of individuals recovering from alcohol and other drug abuse, applies to the problems of failing academic performance and dropping out of school.

Because academic difficulty in a student is often a marker for substance use, assessment and intervention should become routine in such cases. This is especially relevant where there is a precipitous drop in academic performance in a student who was previously performing well.

2. Focus resources on empowering parents. Common sense and numerous research studies underscore the importance of parents and other adults in the lives of students, in terms of their role in preventing the onset and escalation of substance use, and setting high parental expectations for their child's achievement to reduce the likelihood of dropout. A concerted effort to educate parents about their critical role during the adolescent years, and how they can be effective within the context of the larger community support system—which, of course, includes the school—will do much to reduce dropout rates. Because dropout is an extreme result of a complex and interacting set of risk factors, prevention strategies must identify risk-promoting factors that can be reduced and identify change agents who are willing to act and intervene. Empowering parents with the knowledge and tools to be more effective parents is a cost-effective and feasible strategy.

3. Identify and study currently available policies and programs that deliver on the goal of helping youth sustain long-term abstinence. The Achilles' heel of existing efforts to reduce substance use among high-risk youth is the paucity of cost-effective, scalable, and comprehensive programs that systematically identify and intervene with youth who are using drugs and alcohol, with the goal of helping them sustain long-term abstinence. We should learn from the successes of existing programs and policies, and encourage model building on the basis of their experiences. Moreover, evaluations of substance use prevention and intervention programs should include not only substance use as a measurable outcome, but academic achievement as well.

4. Develop and evaluate new personalized approaches to intervening with students at risk for dropout. Despite the success of many existing programs, we believe there remain important opportunities to explore novel, research-based approaches to reducing substance use and dropout risk in high schools. Specifically, we advocate an intervention involving

comprehensive, confidential assessment and continued monitoring of student behaviors and academic performance. An important first step will be to conduct a small-scale pilot demonstration project within a public school system to identify and intervene with high school students who are at risk for dropout. As with any novel approach, the program must be evaluated to quantify the cost-benefit ratio of such an approach.

Conclusion

Substance use remains at high levels among high school students in the U.S. Given troubling statistics regarding high dropout rates and poor readiness skills among our nation's high school students, it is urgent that we recognize the contribution of substance use to these problems. High schools must implement innovative solutions, which should include reducing substance use by students as an important part of a comprehensive plan to enhance social and emotional development and to promote skill acquisition. This approach will ensure that students are well prepared for the challenges they will face after graduation and as they become young adults.

While substance use is only one of many problems related to dropout, addressing it is one essential component of a comprehensive solution to the dropout crisis. Such complex problems demand complex solutions. It is commonly accepted that if early educational difficulties are present in a third-grade child, then educational systems and families must act to detect and intervene to improve that child's chances of educational success. If early onset alcohol or drug use is present in a seventh-grade or any other age child, then similarly, educational systems and families must detect and intervene to improve that child's chances of educational success and reduce the likelihood of all outcomes typically associated with adolescent substance use. And for those who have already dropped out, because they are at enormous risk, there must be mechanisms in place to assess and address their drug, alcohol, and mental health issues and to help them get back on track.

SECTION 1.
THE SCOPE OF THE PROBLEM

1.1. Substance Use among Adolescents in the United States

Substance use, including underage drinking (see ***Box A***) has long been recognized as a widespread problem among adolescents. In 2011, 12.7% of eighth graders reported having an alcoholic drink during the past month, and 6.4% met criteria for "binge drinking" during the past two weeks, defined as having five or more drinks in a row (Johnston, O'Malley, Bachman, & Schulenberg, 2012). Also among eighth graders, more than one in ten (12.5%) have smoked marijuana during the past year, with moderate differences observed between males (14.0%) and females (10.6%). Most forms of substance use become much more common as adolescents grow older. By their senior year, 25.5% of males and 17.6% of females have engaged in binge drinking during the past two weeks, and 36.4% have smoked marijuana during the past year (Johnston et al., 2012). Recent increases in marijuana use have been observed among youth, sparking concern among public health professionals, prevention and treatment practitioners, and educators (see ***Box B***). Moreover, 24.9% of high school seniors have tried an illicit drug other than marijuana during their lifetime, including using a prescription drug nonmedically (Johnston et al., 2012). The reader is referred to many publicly available data sources (see ***Table 1***), all of which show the magnitude of the substance use problem among American youth over time as well as variation by socioeconomic characteristics and gender. With respect to more severe manifestations of substance use, 6.9% of 12- to 17-year-olds in the U.S. meet standard psychiatric criteria for substance use disorders, with 3.8% meeting criteria for abuse or dependence on alcohol and 4.6% for abuse or dependence on other drugs (Substance Abuse and Mental Health Services Administration, 2012).

1.2. High School Dropout among Adolescents in the United States

National attention has been focused on the "dropout crisis" in America for decades (Rumberger & Lim, 2008; Tyler & Lofstrom, 2009). Trend lines in the proportion of the population who have earned a traditional high school diploma after four years of high school have been relatively flat during the last few decades (Heckman & LaFontaine, 2010). Not only are school dropout rates unacceptably high, but they are costly for states and the federal government (Belfield & Levin, 2007). The following grim statistics come at a time when the need for a more educated workforce has never been greater, as the American workforce must now compete in a global economy.

- 7,000 students drop out of high school every day, totaling more than one million students per year (Alliance for Excellent Education, 2010; Tyler & Lofstrom, 2009).

- 25% of students who are currently in school will eventually drop out (Stillwell, Stable, & Plotts, 2011).
- The ten largest public school systems in the U.S., which enroll 8% of the nation's students, failed to graduate more than 60% of their students (Greene & Winters, 2006).
- In 2007, 16% of individuals ages 16 to 24, or 6.2 million people, were high school dropouts (Center for Labor Market Studies and Alternative Schools Network in Chicago, 2009).
- 3.8 million 18- to 24-year-olds, or 15% of young adults, are neither employed nor in school (Annie E. Casey Foundation, 2004).
- Among 25- to 54-year-old males with no high school diploma, approximately 35% have no job, up from about 10% in the 1960s. Among African-Americans, almost 70% of high school dropouts have no job (Economist, 2011).
- The lost income tax revenue associated with high school dropouts exceeds $50 billion annually (Rouse, 2005).

As will be discussed in more detail in ***Section 1.2.4.***, dropout is the end-stage manifestation of a wide variety of inter-connected issues, the pathways of which differ across individuals. The multiple causal pathways to dropout involve influences at the individual, community, and family levels. Although some controversy exists regarding how high school dropout is defined and measured by school systems (Tyler & Lofstrom, 2009), there is unanimous agreement about the seriousness of the issue and the social and economic consequences of the current situation.

Box A: Terminology

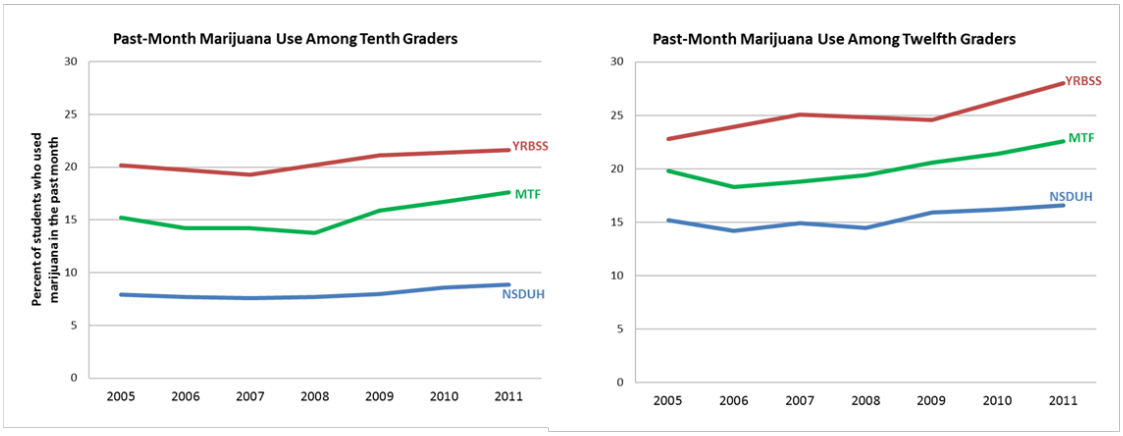
Researchers have used many different terms in drug and alcohol studies, which can be confusing because the terms and their definitions vary from one study to the next. In this report we use the general term "substance" to refer to alcohol, drugs, and prescription drugs being used nonmedically. Similarly, we use the general term "use" to encompass the full range of substance use patterns, from the lightest use to the most chronic and problematic levels of use, such as dependence or addiction. However, when we discuss findings from a research study, we repeat the specific terms used by that study's authors. This is necessary to ensure that we avoid misleading readers as to the true scope of a particular set of findings. Thus, readers should note that terms such as misuse, abuse, binge drinking, and chronic use all have specific definitions in the context of various research studies, but are subsumed here under the broader term "substance use."

There are many ways to describe and measure substance use, and some of the standard measures have changed over time. In this report, quantity refers to the amount of substance consumed (e.g., number of drinks), frequency refers to how often the substance was used (e.g., number of days), and duration refers to the length of time over which use continued (e.g., number of months).

Additional confusion can arise from the term "illicit," especially since some legal substances are often used in an illicit manner. For instance, many adolescents drink alcohol despite not having reached the minimum legal drinking age, and prescription drugs can be used nonmedically by people for whom the drug was not prescribed. Thus, we avoid this term except when describing specific studies.

Box B: Recent increases in adolescent marijuana use

National data from tenth and twelfth grade students suggest that marijuana use has been gradually increasing during the past few years. (YRBSS=Youth Risk Behavior Surveillance System; MTF=Monitoring the Future; NSDUH=National Survey on Drug Use and Health)



Note: Because NSDUH data are not available by grade, results for are depicted for 15- and 17-year-olds as a rough approximation of tenth and twelfth graders, respectively.

1.2.1. Variation in dropout rates by sociodemographic characteristics

Certain segments of the population are less likely to complete high school. For example, significant differences exist between individuals of various racial and ethnic backgrounds, with Asian-Americans having the highest high school graduation rates (91.8%) followed by Whites (82.0%), Hispanics (65.9%), American Indians/Alaska Natives (64.8%), and African-Americans (63.5%; Stillwell et al., 2011). The Southern region of the U.S. as a whole has dramatically higher percentages of dropouts than the Northern regions (Laird, Kienzl, DeBell, & Chapman, 2007; Stillwell et al., 2011). Parental education and other family characteristics are correlated with the likelihood of dropping out of high school; for example, students whose parents are less educated or have lower incomes are more likely to drop out (Rumberger & Lim, 2008).

1.2.2. Concentration of dropouts within schools

While dropout is a national issue, severe dropout problems are concentrated among a modest percentage of schools in the U.S. For between 900 to 1,000 high schools (8% of all regular and vocational high schools with 300 or more students) graduating is a 50/50 proposition at best (Balfanz & Legters, 2004).[1] Such schools have been labeled "dropout factories". If one expands the definition of a dropout factory to schools where the promoting power is 60% or less, then 18% of high schools fall into this category (Balfanz & Legters, 2004).

[1] The construct of promoting power is a comparison between the number of freshmen at a high school to the number of seniors four years later.

Table 1: National data sources on adolescent substance use in the United States			
	Monitoring the Future (MTF)	**Youth Risk Behavior Surveillance System (YRBSS)**	**National Survey on Drug Use and Health (NSDUH)**
Sample	50,000 high school students	15,000 high school students	70,000 individuals ages 12 and older
Subjects	Behaviors and attitudes	6 priority health-risk behaviors	Substance use and mental health
Timing	Annually since 1975	Spring and fall of odd-numbered years, since 1991	Annually since 1988
Setting	420 public and private high schools	High schools in 47 states, 6 territories, 2 tribal governments, and 22 of the largest urban school districts	Households
Funding	National Institute on Drug Abuse (NIDA)	Centers for Disease Control and Prevention (CDC)	Substance Abuse and Mental Health Services Administration (SAMHSA)
More Information	www.monitoringthefuture.org	www.cdc.gov/yrbss	oas.samhsa.gov/nsduh.htm

1.2.3. Adverse social, economic, and health consequences of dropping out

The adverse consequences associated with dropping out of high school are numerous and have been reviewed elsewhere (Belfield & Levin, 2007; Rouse, 2005; Tyler & Lofstrom, 2009). In addition to being more likely to be dependent on public assistance, dropouts are generally less healthy than individuals with more education (National Center for Health Statistics, 2012). Not only are adults without a high school diploma more likely to have a lower life expectancy, poorer health habits, and various chronic disease conditions, they are also more likely to have less healthy children, including children who are obese. High school dropouts are less likely to access preventive health services and be among the uninsured (National Center for Health Statistics, 2012).

The connection between high school dropout and these sorts of health outcomes are complex, but health literacy and income are important mediators of this relationship. Certainly employment opportunities are severely restricted for individuals who have not received a high school diploma. According to one recent study in California that estimated the economic advantages of graduation, each high school dropout earns on average $289,820 less during their lifetime than a high school graduate (Belfield & Levin, 2007).

High school dropouts are also over-represented among the incarcerated population, with 41.3% having only some high school education or less (Harlow, 2003). Alternately, among 16- to 24-year-old males on any given day in 2006 or 2007, 9.4% of dropouts were incarcerated vs. 4.5%

of high school graduates, including those who obtained additional education post-college (Sum, Khatiwada, McLaughlin, & Palma, 2009).

Although the primary focus of this report is how substance use contributes to high school dropout, dropout itself is a well-recognized contributor to substance use problems during adulthood. Studies have demonstrated that high school dropout increases one's risk for a subsequent alcohol use disorder (Crum et al., 2006) and later drug use (Beauvais, Chavez, Oetting, Deffenbacher, & Cornell, 1996; Substance Abuse and Mental Health Services Administration, 2013). In a national sample of 1,762 African-American youth, Kogan and colleagues (2005) observed a significant association between dropout and subsequent marijuana and cigarette use at age 18, independent of earlier drug use and problem behaviors at age 16. In a second analysis of the same dataset (although not restricted to African-Americans), Drapela (2006) found that high school dropout predicted a 30% increase in substance use four years later among 10,678 adolescents, independent of prior substance use and several other background factors. As discussed below, the fact that dropout is associated with later substance use problems does not negate the substantial contributory role that substance use plays in the pathway *to* dropout. As will be explained later, the research evidence supports that the relationship between substance use and dropout is bidirectional.

1.2.4. Correlates of and risk factors for high school dropout

Understanding what factors distinguish students who persist rather than fail during high school has been the focus of intensive research in the educational field (see Chapman, Laird, & KewalRamani, 2011; Dewey, 1999; Rumberger, 1987; Rumberger & Lim, 2008; Rumberger, 2011; Stillwell et al., 2011). Rumberger and Lim (2008) published a recent comprehensive review of research studies on the factors related to dropout, and divided them into individual characteristics and institutional characteristics; namely, family, school, and community characteristics. They stressed that dropout is not an event, but rather a complex process that can involve a multitude of influences that converge to result in the individual's decision to drop out.

Not surprisingly, many of the individual-level factors related to dropout are performance indicators such as grades, being held back, as well as attitudes such as academic expectations. Also highlighted were a number of behaviors that increase the risk for dropping out, including affiliating with deviant peers, delinquency, and drug use. Assuming adult roles early in life due to becoming a parent or working full-time because of family circumstances can propel a student out of school, although those events can also provide an incentive to be engaged in the workforce. Family characteristics were also found to be highly influential on the risk for dropout. In addition to having material resources, students from families with "social resources"—such as having high educational aspirations for their children, monitoring their child's progress, communicating with schools, and knowing the parents of their children's friends—were less likely to drop out. With respect to school characteristics, the review concluded that simply having a high level of school resources did not automatically raise the chances of graduation; rather, the actions and policies of the school appeared to matter more. For example, dropout is less frequent among schools with a strong academic climate. Moreover, not allowing students to drop out prior to age 18, a policy set by 20

states and the District of Columbia (Bush, 2010), has reduced, but not eliminated dropouts. Finally, having high levels of community resources is associated with lower high school dropout rates. On the other hand, growing up in high-poverty neighborhoods is not a guarantee that a student will fail to graduate if other supports in the school and family are in place that can monitor the child's progress and allow them to achieve their potential.

1.2.5. The under-recognition of substance use as a risk factor for dropout

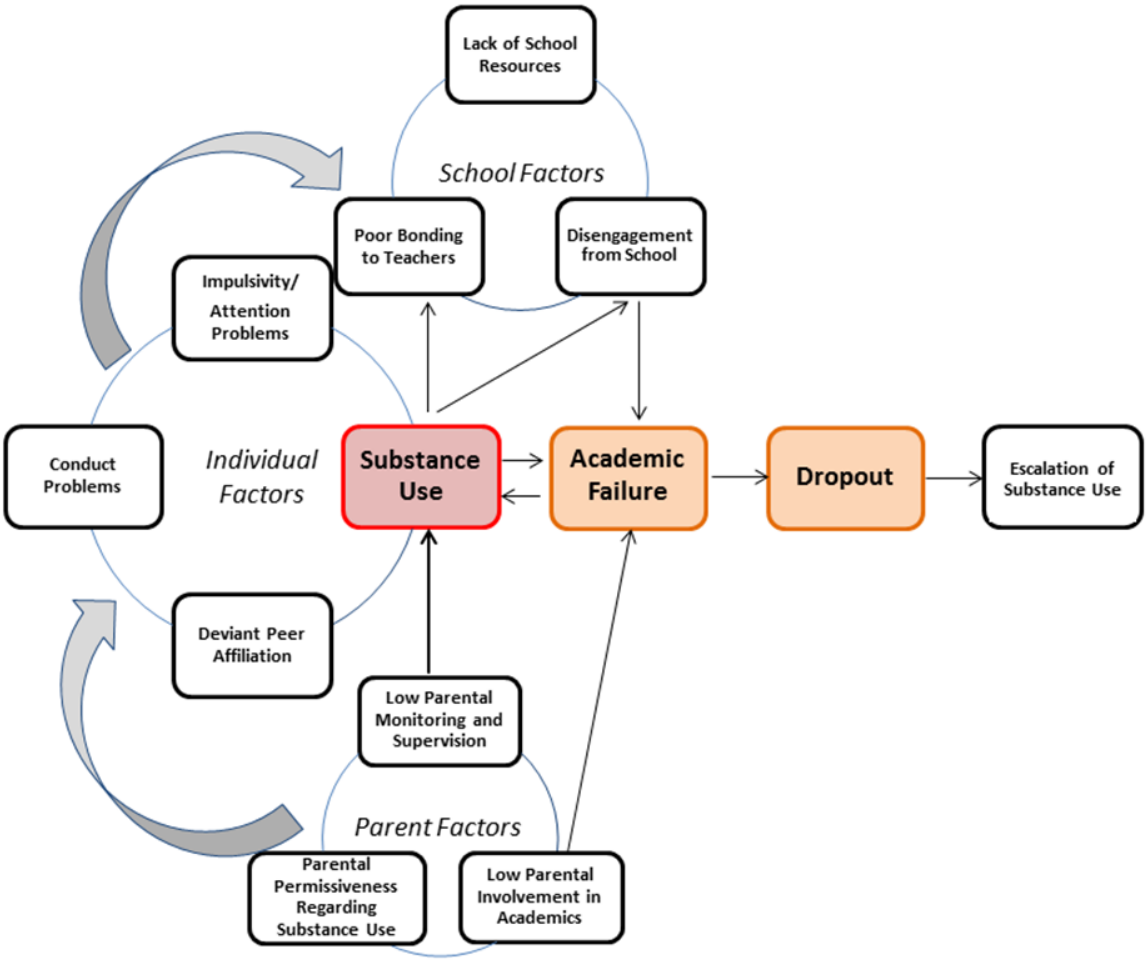
As will be described in ***Section 2***, substantial evidence has accumulated that clearly supports the role of substance use as a contributory factor for dropout. Moreover, clinical experiences with substance-using adolescents reinforce the notion that drug use leads to declines in academic motivation, study habits, and goal-setting (see ***Appendix 1***). Namely, adolescents in recovery report that, as their drug use problem escalated, they became completely disinterested in school and found it much easier to affiliate with drug-using peers than academically-achieving students. This pattern of "spiraling-out" is heard all too commonly by clinicians who treat adolescents with substance use disorders.

Unfortunately, the contributory role of substance use in the pathway to dropout is less recognized than other risk factors. Despite the compelling empirical and clinical evidence, the many reports published on the dropout crisis in America pay little attention to the drug use-dropout connection (Alliance for Excellent Education, 2010; Balfanz, 2007; Balfanz, Bridgeland, Moore, & Fox, 2010; Boys and Girls Clubs of America, 2010; Center for Labor Market Studies and Alternative Schools Network in Chicago, 2009; Chapman et al., 2011; Greene & Winters, 2006; Kennelly & Monrad, 2007; Melville, 2006; Thomasian, Pound, Wilhoit, & Welburn, 2008). Fortunately, more recent reports and reviews of research have begun to add drug and alcohol use to the list of contributory factors (Hammond, Linton, Smink, & Drew, 2007; Kreamer, Fields, Stutman, Anderson, & Barthwell, 2008; Rumberger & Lim, 2008), and thus recognize the opportunity for substance use prevention as part of the solution to the dropout crisis. Discussions related to how early academic difficulty is a risk factor for substance use and that dropout exacerbates substance use problems have overshadowed the fact that substance use is also a contributor to poor academic performance and dropout. As mentioned earlier, students who are less motivated than other students, not interested in studying, or chronically skipping class are well accepted to be at high-risk for dropout. But ultimately, to improve high school graduation rates, it is important to first understand the roots of these issues. Problems with motivation and ineffective study skills should be seen as proximal indicators of risk, and not necessarily risk factors themselves.

We call for a much more comprehensive view of the multiple causal components of dropout, which includes increased recognition of the contributory role of substance use. It follows from this model that interventions to reduce substance use should be seen as a viable strategy to reduce dropout. Our model is depicted in ***Box C*** and illustrates the inter-relationships of substance use with individual, parent, and school factors that are recognized to be influential for academic performance and demonstrates how substance use is a contributory factor in the chain of events leading to dropout.

Box C: Conceptual model of substance use and dropout

Substance use is conceptualized as being emblematic of a constellation of Individual Factors that constitute problem behaviors. Substance use has a reciprocal relationship with academic failure, such that they both influence each other. Because substance use influences the student's relationship with the school (i.e., School Factors), a feedback loop is created in which substance use undermines bonding to teachers and school engagement, which in turn contribute to academic failure, which in turn leads to further increases in substance use. Ultimately, substance-related academic problems can lead to dropout, which then sets the stage for further increases in substance use. All of this occurs against the backdrop of Parent Factors, which broadly influence the entire constellation of Individual Factors, including substance use. Similarly, School Factors are influenced broadly by the constellation of Individual Factors as a whole, including the effects of substance use specifically.



In addition to summarizing what has been learned in research studies, this model has the practical advantage of highlighting multiple intervention targets. Many parent, individual, and school factors are malleable and can be targeted at various stages of development—ideally, long before the onset of substance-related academic problems.

SECTION 2.
REVIEW OF THE SCIENTIFIC LITERATURE

2.1. Introduction

As discussed earlier, there is strong evidence to support substance use as part of the causal pathway that leads to dropout for some individuals. This section describes our review of the research studies from scientific literature that back up that claim. We begin by describing the methods we used to search and summarize the scientific literature. Next, we describe the results of the research studies we reviewed, which are organized into five main groups, as shown in ***Table 2***. Lastly, we discuss the limitations of these research studies, and conclude this section with a summary of the major findings and consistent themes we found.

Table 2: Types of research studies reviewed for this report	
Cross-sectional[a] studies on the association between substance use and dropout	• Comparing dropouts with non-dropouts on substance use • Comparing substance users with non-users on rates of dropout
Longitudinal[a] studies examining substance use as a predictor of dropout	• Alcohol use only • Drug use other than alcohol • Both alcohol and other drug use • Composite measures of alcohol and drug use
Studies examining substance use disorder (SUD) rather than substance use, *per se,* as a correlate or predictor of dropout	
Studies examining the relationship between substance use and high school GPA	
Studies examining changes in academic performance following adolescent addiction treatment	

[a] *See **Box D** for an explanation of the differences between cross-sectional and longitudinal studies.*

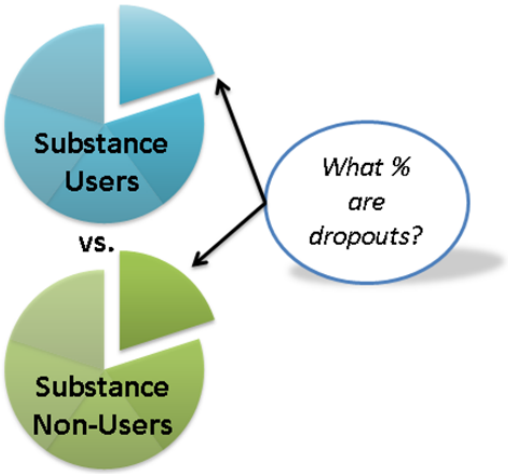
2.2. Methods Used to Review the Scientific Literature

We reviewed the scientific literature on this topic by electronically searching the Education Resources Information Center (ERIC) and PubMed databases with the search terms academic performance, high school dropout, and educational attainment, and related these terms to alcohol, drug, and substance use. Next, we reviewed the reference lists of all potentially relevant articles and thereby identified several additional articles that were not located by the electronic search. We restricted the pool of articles to: a) studies conducted on U.S. middle and high school students; b) empirical studies (rather than opinion pieces or reviews); and, c) studies that analyzed either

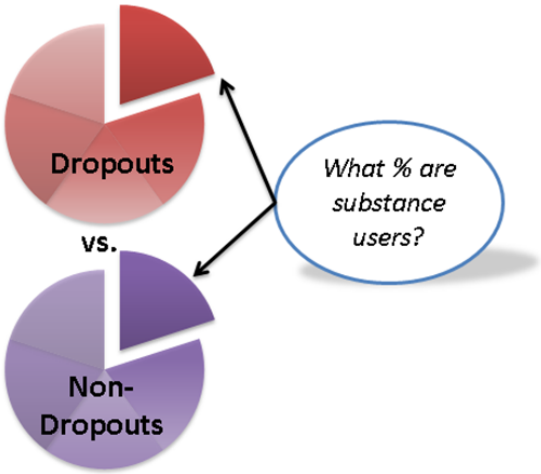
Box D: Methods used to compare research studies in this report

Cross-sectional studies compare two different groups of adolescents at one point in time. Below are the two main ways of comparing groups cross-sectionally. However, cross-sectional studies cannot tease out the temporality between substance use and dropout.

Method 1.
Compare substance users with non-users, and see how they differ on academic performance.

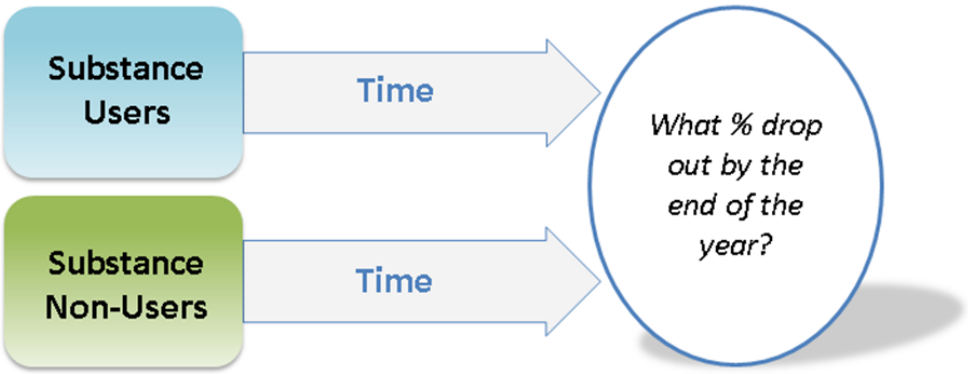


Method 2.
Compare dropouts with non-dropouts, and see how they differ on substance use.



Longitudinal studies follow two different groups of adolescents over time, and thus can show a clear before-and-after relationship between two events. Differences in timing are important in longitudinal studies, such as:

- How often were students assessed?
- How much time passed before the outcome was measured?



Results from various studies—whether cross-sectional or longitudinal—are not necessarily comparable if they were conducted in very different ways. For instance:

- **Variables.** How was "substance use" measured (e.g., binge drinking, dependence)? How was "academic performance" measured (e.g., dropout, GPA, delinquency)?
- **Age.** At what age were students assessed?
- **Sample size.** How many participants were assessed?
- **Number of covariates.** How many possible confounding factors did the researchers take into account (e.g., conduct problems, learning disability)?
- **Setting.** Were students sampled from one school or many? Was the sample urban, rural, underprivileged, etc.?

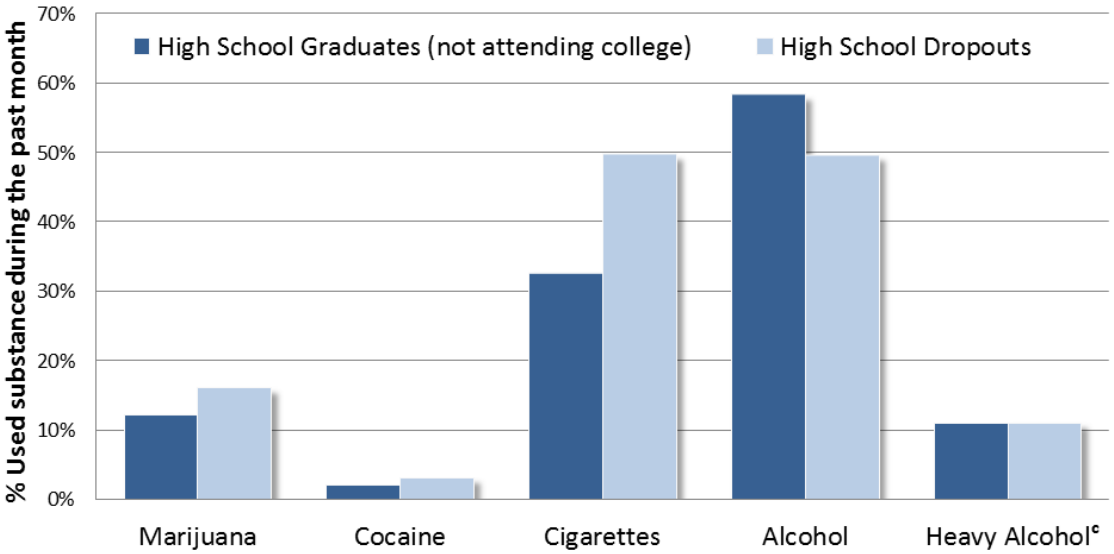
dropout, grade point average (GPA), and/or academic failure as an outcome variable (rather than studies that examined drug use as an outcome variable [those findings are mentioned in ***Section 1***]). After setting these selection criteria, and reviewing abstracts of potentially relevant articles, we identified 49 articles for thorough review that met our criteria. Included are three studies that examined the changes in academic performance exhibited by adolescents who had received addiction treatment. We reviewed both cross-sectional and longitudinal studies, which answer different kinds of questions, as shown in ***Box D***.

2.3. Cross-sectional Studies on Substance Use and High School Dropout

2.3.1. Comparison of dropouts with non-dropouts on substance use

By comparing individuals who have dropped out with those who have graduated from high school, a variety of studies have consistently demonstrated that dropouts have much higher rates of substance use. In an analysis of national data from the National Household Survey on Drug Abuse (NHSDA) on more than 12,000 17- to 22-year-olds, Groeferer and colleagues (1997) found that high school dropouts were significantly more likely than non-college-attending high school graduates to have used marijuana and cigarettes during the past month, holding constant age, race/ethnicity, and living arrangement. However, dropouts and graduates did not differ significantly on alcohol use or heavy drinking (see ***Figure 1***).

Figure 1: Rates of past-month substance use among 12,026 college-age persons in the United States,[a] by high school graduation status, from the National Household Survey on Drug Abuse, 1991 to 1993[b]



[a] The college-aged population was defined as all 17-to-22 year-olds who were not in high school and had not completed four years of college. Data from high school graduates attending college are not shown here.
[b] Data retrieved from Gfroerer, J. C., Greenblatt, J. C., & Wright, D. A. (1997). Substance use in the US college-age population: Differences according to educational status and living arrangement. *American Journal of Public Health, 87*(1), 62-65.
[c] Five or more drinks per occasion on each of five or more days during the past month.

A recent report published by the Substance Abuse and Mental Health Services Administration (2013) updated this analysis by looking at data from the 2002 through 2010 National Survey on Drug Use and Health (NSDUH). It showed that among 16- to 18-year-olds, students who were enrolled in twelfth grade used alcohol and other drugs at significantly lower rates than dropouts. Dropouts were more likely than enrolled twelfth grade students to have used the following substances during the past month: cigarettes (56.8% vs. 22.4%), alcohol (41.6% vs. 35.3%), binge alcohol (32.3% vs. 23.8%), any illicit drug (31.4% vs. 18.2%), marijuana (27.3% vs. 15.3%), and prescription drugs nonmedically (9.5% vs. 5.1%). This pattern was true among both males and females. Although substance use was more prevalent among twelfth grade aged males than females, more male dropouts and more female dropouts reported use than their school-enrolled counterparts. However, female dropouts did not differ significantly from their enrolled counterparts for past-month alcohol use. While both White dropouts and African-American dropouts were significantly more likely than White and African-American enrolled twelfth grade students to report substance use, this pattern was not true of Hispanic youth. Hispanic dropouts only reported significantly more cigarette use during the past month. According to the Substance Abuse and Mental Health Services Administration, because substance use is preventable public health problem, "prevention efforts targeted to adolescents generally and to those at risk of dropping out of high school more specifically might improve the educational, employment and financial, and health outcomes of many youths." (p. 4)

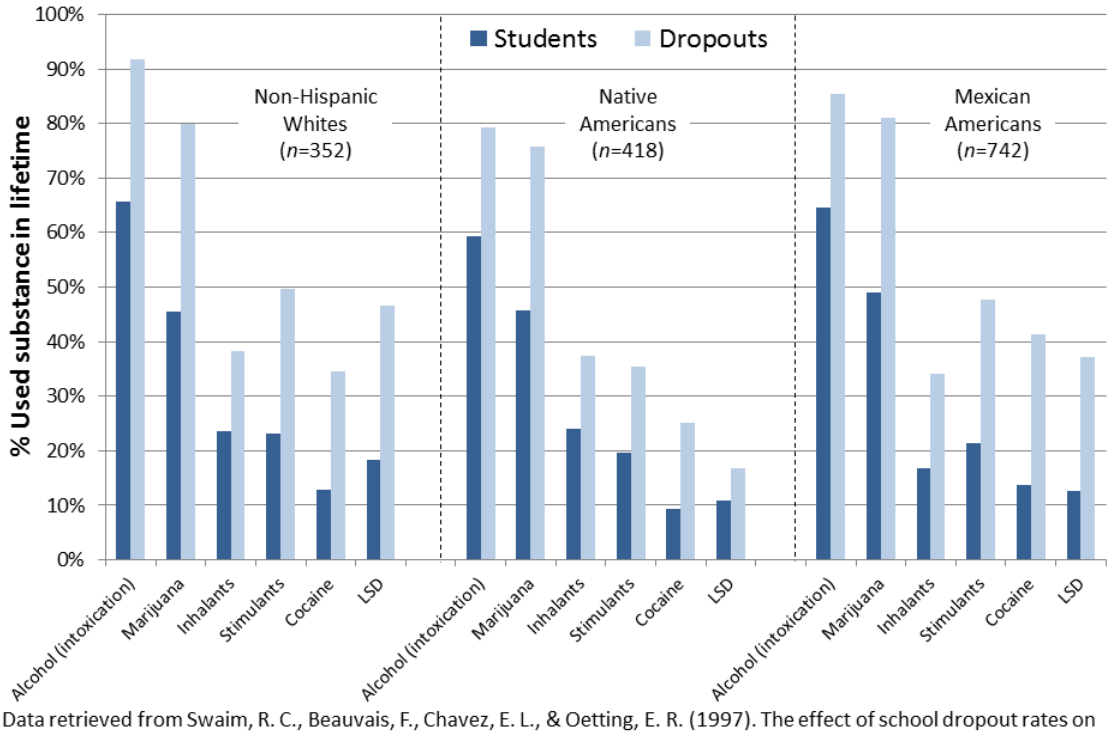
Yamada and colleagues (1996) analyzed cross-sectional data of 672 twelfth graders from one assessment of the National Longitudinal Survey of Youth (NLSY). They found that frequent drinking (defined as twice a week or more) and monthly marijuana use were more likely to be observed among those who did not graduate at the end of their senior year, compared with those who graduated on time. The authors estimated that the probability of graduating on time was reduced by 4.3% for frequent drinkers and by 5.6% for students who used marijuana at least once a month. The study design was strengthened by the inclusion of a large number of covariates in the statistical model (e.g., family structure, class rank, academic aptitude, religiosity, as well as socioeconomic and demographic characteristics), which made it possible to isolate the effect of substance use on dropout independent of these other factors.

These findings from large national surveys are reinforced by additional studies of smaller, geographically localized samples. Fagan and Pabon (1990) compared two samples of adolescents: a) 200 students who were currently attending high schools in 1985; and b) a group of 50 high school dropouts who were identified through various community settings in the same communities from which the schools were sampled. As expected, the groups differed in several significant ways. Male and female dropouts were more likely than on-track students to have histories of excessive drinking and more serious involvement with substance use. Interestingly, when dropouts were asked about factors underlying their decision to leave school, substance use was the least frequently reported contributing factor. In their minds, loss of interest in school and needing a job topped the list of reasons. This finding is very interesting because it highlights students' lack of awareness of the link between substance use and having a loss of interest in school.

From a clinical perspective, this lack of insight is common—and represents a potential opportunity for intervention. One of the goals in treating individuals with substance use problems is to make them aware of the connection between their behavior and their inability to set and attain goals that are important to them. In many cases this is difficult because users often perceive their substance use as innocuous or even beneficial for getting through their day. The other important finding from this study was that family supports for socialization and valuing of education were less frequent among the dropout group than the student sample.

Swaim and colleagues (1997) studied a matched sample of 774 dropouts and 738 students from communities in the Southwest, Midwest, and Western regions of the U.S. (see ***Figures 2 and 3***). Within all three ethnic groups studied (i.e., Non-Hispanic Whites, Native Americans, and Mexican Americans), dropouts had significantly higher lifetime and past-month estimates of alcohol intoxication, marijuana use, and inhalant use, relative to current students of the same gender, grade, and ethnicity. For instance, past-month prevalence of marijuana use was more than twice as high in dropouts compared with students, regardless of ethnicity. Moreover, lifetime and past-month use of stimulants, cocaine, and LSD were also significantly more prevalent among dropouts than students, albeit only within the Non-Hispanic White and Mexican American groups.

Figure 2: Lifetime prevalence of substance use among 1,512 seventh through twelfth graders in the Southwestern United States, by dropout status and race/ethnicity[a]

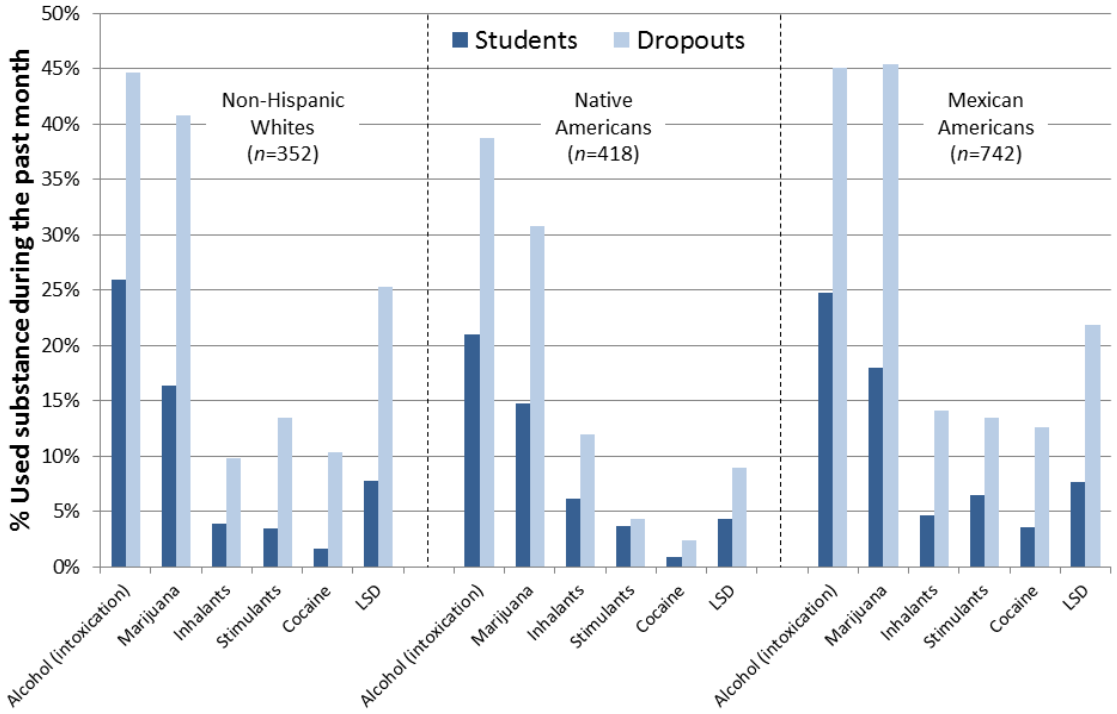


[a] Data retrieved from Swaim, R. C., Beauvais, F., Chavez, E. L., & Oetting, E. R. (1997). The effect of school dropout rates on estimates of adolescent substance use among three racial/ethnic groups. *American Journal of Public Health, 87*(1), 51-55.

Two additional studies were conducted with minority adolescents residing in the Southwestern part of the U.S. First, Beauvais and colleagues (1996) reported statistically significant differences in drug use between three groups: students in good academic standing, students in poor

academic standing, and school dropouts. Dropouts were defined as students recruited from the community who had not attended school for at least 30 days, had not officially transferred to another school, and who had not been in contact with school authorities seeking readmission. All groups were matched on the school they were or had been attending. Results showed that about one-fifth of female dropouts and about one-third of male dropouts were involved in heavy drug use, much higher than students in good academic standing. Students in poor academic standing had estimates that fell in between the two extreme groups. Importantly, while a statistical interaction was found with gender (males had higher rates of drug use than females), the authors failed to find a statistical interaction with ethnicity, suggesting that drug use was equally important for all academically at-risk students regardless of ethnicity.

Figure 3: Past-month prevalence of substance use among 1,512 seventh through twelfth graders in the Southwestern United States, by dropout status and race/ethnicity[a]



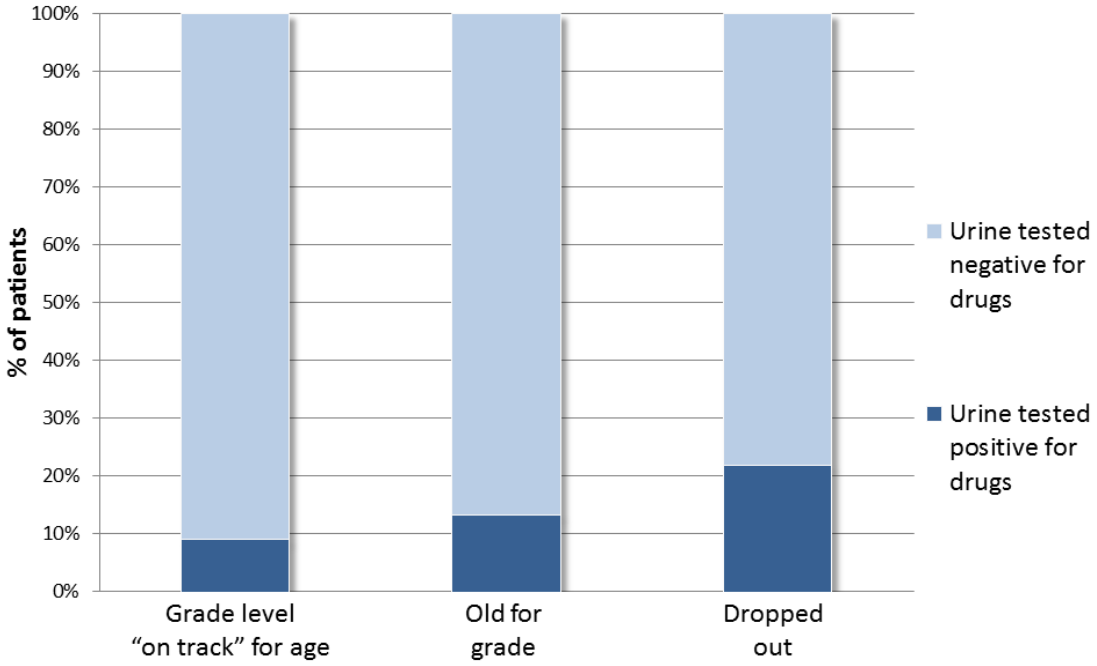
[a] Data retrieved from Swaim, R. C., Beauvais, F., Chavez, E. L., & Oetting, E. R. (1997). The effect of school dropout rates on estimates of adolescent substance use among three racial/ethnic groups. *American Journal of Public Health, 87*(1), 51-55.

In a later study using the same population, Arellano and colleagues (1998) published similar findings related to alcohol use, where dropouts were 2.5 times more likely to be frequent users of alcohol, 3.2 times more likely to be heavy drinkers, and 3.0 times more likely to report frequent drunkenness when compared with their in-school counterparts.

Guagliardo and colleagues (1998) assessed a predominantly African-American (92.3%) and female (67.9%) sample of 1,720 inner-city adolescents (ages 12 to 18) attending a medical clinic in Washington, DC. As shown in ***Figure 4***, compared with students whose current grade level was "on track" for their age, patients who self-identified as dropouts were more than twice as likely to test positive for illicit drugs, and three times as likely to report an early age of drug use initiation (i.e.,

before age 14). Furthermore, among current students, those who were old for their grade were more than 40% more likely than on-track students to test positive for drugs, leading the authors to express concern over a possible negative influence that old-for-grade students might have on their on-track peers.

Figure 4: Urine drug positivity rates by school status among 1,720 adolescent patients who visited an outpatient clinic in Washington, DC, between April 1994 and March 1996[a]



[a] Data retrieved from Guagliardo, M. F., Huang, Z., Hicks, J., & D'Angelo, L. (1998). Increased drug use among old-for-grade and dropout urban adolescents. *American Journal of Preventive Medicine, 15*(1), 42-48.

In contrast to the numerous studies focusing on economically disadvantaged minority youth at risk for dropout, Franklin and Streeter (1995) described a sample of 200 middle-class dropouts (88% White) who were attending an experimental alternative school located in an affluent suburban area. Although this study did not include a comparison sample of non-dropouts, it offers valuable insights into the perceptions of high school dropouts. The investigators found that one in five (21.5%) cited drug and alcohol problems as a factor contributing to their dropout. Yet a standardized psychological/behavioral assessment revealed that half (50.5%) were at risk for drug problems, one-fourth (24.5%) had a clinically significant drug abuse problem, and 8.0% had a clinically significant alcohol use problem. Nearly half of the sample (45.4%) had been in drug treatment. None of the other problem areas that were assessed in the study—including delinquency, risk-taking, and educational adjustment—were seen in such a large proportion of these middle-class, predominantly White dropouts.

2.3.2. Comparison of substance users with non-users on rates of dropout

Other cross-sectional studies have examined the substance use-dropout relationship by comparing substance users with non-users on their dropout rates (see ***Box D***). An early study of

this type was conducted by Friedman and colleagues (1985), who observed a significant association between alcohol and drug use severity and subsequent failure to graduate among a sample of students attending urban high schools in Philadelphia, even after adjusting for a variety of family background characteristics, academic motivation, and conduct problems.

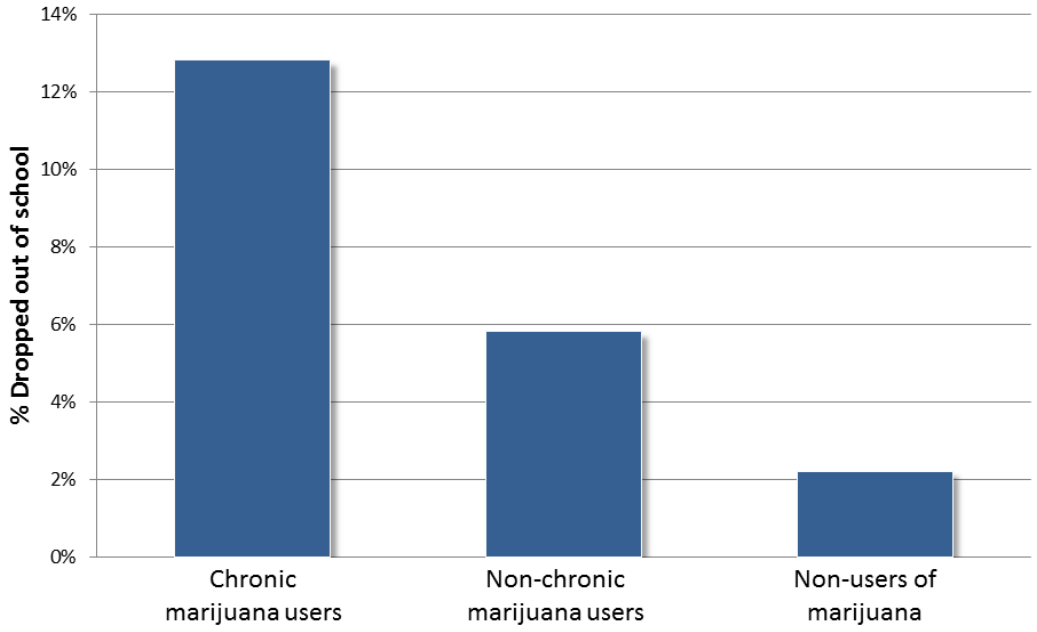
In another early study, Mensch and Kandel (1988) used event-history analysis to document that students who tried marijuana, cigarettes, or other illicit drugs were more likely to drop out of high school. Moreover, the earlier use was initiated, the greater their likelihood of dropping out. While prior alcohol use was not found to differentiate dropouts from non-dropouts in this study, age of alcohol use initiation was significantly associated with dropout among males. The fact that the drug use-dropout effect remained significant—independent of several other risk factors for dropout such as family structure, academic aptitude, self-esteem, and delinquency—led the researchers to conclude that "dropping out is a partial function of drug use itself." (p. 111)

More recently, this type of research design was adopted in an analysis of the 1997 to 1998 National Household Survey on Drug Abuse (NHSDA; see ***Figures 5 and 6***). Roebuck and colleagues (2004) classified all 12- to 18-year-olds into three mutually exclusive groups based on their marijuana use frequency during the past year: non-users, non-chronic users (i.e., less than weekly), and chronic users (i.e., weekly or more). Because the sample was restricted to adolescents who had not yet graduated or completed twelfth grade, the researchers could examine how these three groups differed on school enrollment and attendance. Although chronic marijuana users had the highest level of dropout risk and truancy, dropout risk was significantly higher for all levels of marijuana use compared with non-users, even controlling for demographics, alcohol use, and other substance use. For example, the rate of dropout among non-chronic users (5.8%) was twice as high compared with non-users (2.2%). Chronic users had nearly six times as many dropouts as non-users (12.8% vs. 2.2%). Similarly, both chronic and non-chronic marijuana users skipped more days of school during the past month, on average, relative to non-users (1.34 and 0.77 vs. 0.19 days, respectively). Any alcohol use during the past year was used as a control variable in the analyses and was also significantly related to dropout.

A significant association between marijuana use frequency and risk for dropout was also found in a smaller study by Trampush and colleagues (2009). Interestingly, the original aim of the study was to investigate the extent to which a childhood diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) contributed to an increased risk for dropout. After controlling for IQ, frequency of paternal contact, and frequency of marijuana use, a diagnosis of ADHD did not have a significant effect on dropout status.

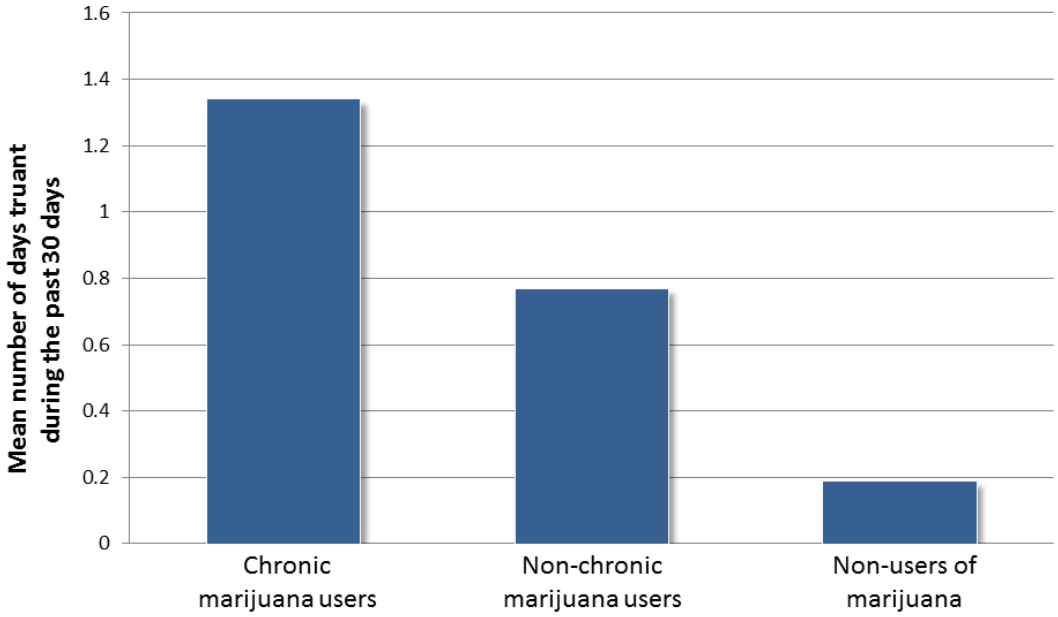
One cross-sectional study demonstrated that more intensive drug involvement distinguishes students at high risk for dropout, even before the dropout occurs. Eggert and Herting (1993) studied a sample of high school students in one urban school district (ages 14 to 19, 79.3% White, 49.3% female). A subset of 160 students at high risk for dropout was identified based on their academic standing, and compared with 203 "typical" students who were randomly selected. High-risk youth had more severe patterns of alcohol and drug involvement than typical students, as evidenced by more frequent drug use, more access to drugs, less control over their drug use, and

Figure 5: Dropout status by marijuana use category, among 15,168 adolescents in the United States who had not completed high school, from the National Household Survey on Drug Abuse, 1997 to 1998[a]



[a] Data retrieved from Roebuck, M. C., French, M. T., & Dennis, M. L. (2004). Adolescent marijuana use and school attendance. *Economics of Education Review, 23*(2), 133-141.

Figure 6: Truancy[a] by marijuana use category, among 15,168 adolescents in the United States who had not completed high school, from the National Household Survey on Drug Abuse, 1997 to 1998[b]



[a] Truancy was measured only for adolescents who were currently enrolled in school.
[b] Data retrieved from Roebuck, M. C., French, M. T., & Dennis, M. L. (2004). Adolescent marijuana use and school attendance. *Economics of Education Review, 23*(2), 133-141.

more adverse consequences from drug use. For example, weekly marijuana use was reported by 19% of high-risk youth, compared with only 3% of typical students. Not surprisingly, many high-risk youth experienced adverse psychosocial consequences from their alcohol and other drug use, such as family conflict, skipping class, and getting into trouble at school, whereas substance-related consequences experienced by typical students were usually limited to physical symptoms resulting from acute alcohol intoxication. The authors speculated that the transition from low dropout risk to high dropout risk might be related to an increase in drug access and a decrease in self-control of drug use.

2.4. Longitudinal Studies on Substance Use as a Predictor of Dropout

Prospective longitudinal studies are superior to cross-sectional studies because they can lead to a better understanding of the timing between substance use and academic outcomes (see ***Box D***). A wide variety of datasets have been used to investigate the prospective association between substance use and high school dropout, including large nationally representative samples of school children, general community samples, and smaller samples of special populations, including students with disabilities (Hollar & Moore, 2004), urban adolescents (Green, Doherty, Stuart, & Ensminger, 2010; Trampush et al., 2009), and African-Americans (Ensminger & Lamkin, 1996; Green et al., 2010; Zimmerman & Schmeelk-Cone, 2003). In this section, we discuss the findings of these and other longitudinal studies.

2.4.1. Longitudinal studies of alcohol use only

We identified three studies that examined the association between alcohol use and dropout without measuring other types of drug use. Although these studies are helpful in understanding how alcohol use might contribute to dropout, their findings are limited because alcohol and other drug use are highly correlated.

The first is a study by Dee and Evans (2003), which is one of the most cited longitudinal studies to refute the presence of a relationship between alcohol drinking and high school dropout. In that study, investigators analyzed data from the National Education Longitudinal Survey (NELS-88), which obtained a nationally representative sample of students enrolled at 1,052 grade schools across the U.S. Students were first assessed during the eighth grade in 1988, and then completed follow-up assessments every other year through 1994, corresponding to tenth grade, twelfth grade, and two years after twelfth grade. Drinkers were defined as having had at least one drink during the past month, and heavy drinking was defined as having had five or more drinks in a row at least once during the two weeks prior to being surveyed. High school completion was measured by receiving either a traditional diploma or a GED by the end of the study period (i.e., two years after twelfth grade). Adjusting for parental education, family structure, and school, the investigators initially found that students who drank or drank heavily in tenth grade were 3.5 and 5 percentage points less likely than non-drinkers, respectively, to complete high school by the end of the study period. A second analysis tested the hypothesis that prior academic achievement predicts drinking levels during twelfth grade. They observed that test scores during eighth and tenth grade had been

lower for twelfth graders who drank than for non-drinking twelfth graders, regardless of whether they were already drinking by tenth grade. Thus, the authors concluded that the initial association they observed was merely correlational and not causal, since academic difficulties could have preceded the onset of drinking in twelfth grade. However, a major limitation of this study is that dropouts were omitted from the second analysis because they were likely to differ greatly from enrolled students in terms of having both heavier patterns of alcohol consumption and lower academic performance. Another limitation is that a GED was treated as equivalent to a traditional diploma.

In a later study, Renna (2008) examined the potential effect of alcohol consumption on graduation rates, and advanced the earlier work by Dee and Evans (2003) in two ways. First, separate analyses were conducted for receiving a high school diploma and obtaining a GED. Second, rather than using schools as a sampling frame, the investigators gathered survey data by mail from a random sample of 2,263 youth living in the U.S. who were participants in the National Longitudinal Survey of Youth (NLSY). By using this type of sampling design, dropouts were retained in the analysis sample. The outcome variable of the study—educational attainment—was assessed at age 19 and again at age 25. This study produced two important findings. First, the authors observed that binge drinking during twelfth grade significantly reduced educational attainment, such that each additional episode of binge drinking per month decreased the probability of graduating by 2.45 percentage points. Second, in order to rule out a simple correlational relationship between binge drinking and educational attainment, Renna (2008) examined the influence of state alcohol policies—as a proxy for binge drinking rates—on educational attainment. In that analysis, Renna (2008) demonstrated that, although binge drinking *per se* had no net effect on educational attainment—similar to what Dee and Evans (2003) reported—more frequent binge drinking (as indicated by a lower minimum legal drinking age) predicted greater likelihood of obtaining a GED than a diploma, and, therefore, lower likelihood of graduating on time (i.e., by age 19). These findings were strengthened by statistical adjustment for a wide array of individual background characteristics. Together, these findings suggest that students who drink heavily are at risk for experiencing significant setbacks in completing high school, even though they might eventually go back and earn their GED by age 25.

Koch and McGeary (2005) used yet another approach to examine the relationship between alcohol use and dropout. They analyzed data from the 1979 to 1996 NLSY to develop a statistical model to predict high school completion as a function of early initiation of alcohol use and several other variables, including demographics and family history. They observed that alcohol use onset before age 14 was strongly associated with dropping out of high school by age 20. In that sample, 39.3% of females and 47.8% of males who initiated alcohol consumption by age 14 did not complete their high school degree by age 20, as compared with 27.1% of females and 32.1% of males who delayed initiation of alcohol use until after age 14. Unfortunately, no analyses were performed to indicate how different ages of alcohol use initiation were associated with the likelihood of high school completion.

2.4.2. Longitudinal studies of drugs other than alcohol

Some studies investigating the association between substance use and dropout only included measures of illicit drug use, but not alcohol. All of these studies found that drug use during high school is related to a decreased likelihood of graduation.

Kaplan and Liu (1994) conducted a longitudinal study of 2,805 seventh graders in Houston in 1971. The students were then followed up in eighth grade and again in their mid-twenties. A single measure of drug use (i.e., marijuana use during the past 30 days) was used in a series of logistic regression models as a predictor of high school dropout after statistical adjustment for father's education, gender, race, ethnicity, deviant behavior, psychological distress, lack of personal control, and grades. The results showed that although marijuana use during the seventh grade accounted for only a small proportion of the variance explained in dropout, it retained statistical significance after adjustment for control variables. Moreover, the study provided three possible explanations for how marijuana use might have influenced dropout: a) via low levels of motivation; b) via the experience of negative social sanctions; and c) via the adoption of precocious roles (e.g., pregnancy). Although this study was well-designed and based on a sophisticated theoretical framework, sample attrition over time was significant, with marijuana users dropping out of the study far more often than non-users. Nevertheless, the fact that marijuana use still predicted high school dropout even with this substantial attrition bias underscores the importance of marijuana use as a potential contributing factor to dropout.

In another large longitudinal study of 1,392 adolescents ages 16 to 18 from one school system in the Southeast U.S., Bray and colleagues (2000) found that marijuana use initiation significantly predicted subsequent dropout from high school, holding constant demographics and onset of other drug use. Specifically, marijuana initiators were 2.3 times more likely to drop out of high school than non-users. Unfortunately, the study did not examine the impact of marijuana use frequency or duration on the risk for dropout.

Two studies used longitudinal data from the Woodlawn study in Chicago to investigate the drug use-dropout relationship in an urban, predominantly African-American sample. Starting in 1966, all first-grade children in nine public and three parochial schools were assessed by their teachers, and a structured assessment interview was conducted with their mothers. Ten years later children and their mothers were reassessed, and in 1982, school graduation records were obtained. In the first study, Ensminger and Lamkin (1996) examined the relationship between dropout and an array of community-level variables (neighborhood, family residential mobility) as well as individual and family characteristics, and found that adolescent marijuana smoking frequency was related to the risk for high school dropout. Strikingly, living in a poverty census tract was not a statistically significant predictor of high school graduation after accounting for individual and family-level variables. In a second study utilizing the same dataset, Green and colleagues (2010) observed that marijuana use frequency was a strong predictor of dropping out of high school, even after adjustment for a number of potential confounding variables such as gender, socioeconomic status, family background, school adaptation, school achievement, and delinquency.

Finally, in a study of 3,525 males in the 1988 National Longitudinal Survey of Youth (NLSY) cohort, Register and colleagues (2001) found that males who ever used illicit drugs by age 18 attained, on average, approximately one year less of formal education by middle adulthood, as compared with non-users, even after holding constant sociodemographic factors such as parental education, living in an urban area, number of dependents by age 18, and marital status by age 18. However, this association retained statistical significance only for Whites, not for Blacks or Hispanics. Among Whites, the association held true regardless of whether the drug use variable included marijuana only or other drugs. Although this study did not investigate high school dropout *per se* as an outcome variable, the findings on decreased educational attainment are relevant and are consistent with other studies investigating the drug use-dropout relationship.

2.4.3. Longitudinal studies of both alcohol and drug use

Studies that have measured both alcohol and other types of drug use separately are useful to understand the relative importance of each type of substance to dropout. The majority show that the relationship with high school dropout is weaker for alcohol use than for other forms of drug use. In this section, we also review findings related to the predictors of educational attainment from the Monitoring the Future (MTF) study, the largest ongoing nationwide survey to monitor adolescent drug use trends.

Newcomb and Bentler (1986) examined the predictive relationship of high school drug use frequency for five categories of substances (cigarettes, alcohol, marijuana, "hard" drugs including prescription drugs used nonmedically, and nonprescription drugs) with high school graduation. Participants were 479 young adults ages 19 to 23 originally recruited during seventh through ninth grade from 11 schools across Los Angeles county. The authors found that, with the exception of nonprescription drugs, all the other drug use frequency measures significantly predicted lower likelihood of high school graduation. However, due to considerable overlap in the variance explained by these measures, only cigarette and "hard" drug use retained statistical significance in the combined model, even after statistical adjustment for grades and educational plans during high school.

Similar findings were reported by Garnier and colleagues (1997) who recruited 194 families through physicians' offices in California and assessed them from 1974 to 1992. The past-six-month frequency of alcohol and other drug use was measured and analyzed in relation to high school dropout. Their results showed that adolescent drug use, more than alcohol use, was associated with increased chances of dropping out of high school. This study was unique in that it examined several factors related to family functioning and found, not surprisingly, that families where adolescents used drugs had more dysfunction in other areas, including exposure to parental drug use or family nonconventionality. The authors concluded that these problems are also likely contributors to lowered academic achievement in drug-using adolescents.

In addition to studies of general community samples, the prospective relationship between substance use and dropout has been replicated in special populations, such as African-Americans and students with disabilities. Zimmerman and Schmeelk-Cone (2003) initially ascertained a

sample of 681 African-American ninth graders and re-interviewed them annually for the next three years, regardless of continued school attendance. Only students who had a GPA of 3.0 or lower were eligible for the study, presumably to maximize the sample size for dropouts. The last wave of data was collected six years post-baseline, at which time 16.4% had not received a high school diploma or GED. The investigators assessed alcohol and marijuana use and school motivation over time. Low school motivation contributed to continued drug use but was not a significant predictor of dropout. Nevertheless, both alcohol and marijuana use during high school independently increased the likelihood of not completing school even though this effect was not mediated through low school motivation.

Prompted by earlier findings showing that students with disabilities are at higher risk than their non-disabled peers for both substance use and dropout, Hollar and Moore (2004) investigated the relationship between substance use and dropout among 1,021 students with disabilities who were identified in the National Education Longitudinal Survey (NELS-88) national dataset. These students were identified in eighth grade by their parents as having either a physical, sensory, learning, emotional, or health disability, and had received special education. Substance use information (i.e., alcohol, tobacco, marijuana, and cocaine) was used from the twelfth grade assessment. The investigators examined several educational, social, and functional outcomes, three of which specifically pertained to dropout: dropping out by twelfth grade, not graduating in 1992 (i.e., on time), and not earning a high school diploma or equivalent by 2000 (i.e., eight years post-high school). All three of these outcomes were significantly more likely among students who were daily cigarette smokers, binge drinkers, or lifetime marijuana users in twelfth grade, as compared with their non-using counterparts. Lifetime cocaine users were also more likely to have dropped out by twelfth grade. The study did not examine whether or not substance use influenced dropout risk differentially by disability type. The authors called for increased attention to the substance use problems of students with disabilities, and the need for prevention strategies that specifically address this subpopulation.

To address the question of the relationship between early substance use—namely use that is present in middle school—and later dropout, Ellickson and colleagues (1998) measured the substance use patterns of a large cohort of students (*n*=4,390) who were first enrolled in the study as seventh graders from public schools in Oregon and California. Importantly, to isolate the specific contribution of substance use, the investigators statistically adjusted for a wide range of other factors that could be related to dropout—namely, demographics, family background, academic orientation, problem behavior, peer influence, and school environment. The results showed that after adjustment for covariates, early cigarette use, but not alcohol use, predicted dropping out of high school. The study's results were strengthened by the use of non-response weighting procedures to adjust for attrition bias that might have resulted from individuals dropping out of the study being different from individuals who did not have missing data. Another strength of the design was the use of saliva tests to validate self-reported cigarette smoking. The investigators speculated that alcohol use was too prevalent in the sample (74.4% of the sample had tried alcohol by the seventh grade) to have predictive value for dropout. Because all of the early marijuana users also smoked cigarettes, the authors re-ran their statistical model without cigarette use, and found that marijuana use significantly predicted dropout, but that alcohol use remained statistically non-

significant. The absence of a relationship between alcohol use and dropout in the overall sample might be related to the fact that alcohol use was measured with a one-time assessment of use in seventh grade.

Early substance use was also the focus of two studies using data from the Rochester Youth Development Study (RYDS), which began surveying 775 middle school adolescents in 1988 and assessed them through age 20. The investigators measured early substance use frequency for alcohol, marijuana, and other drugs. Krohn and colleagues (1997) observed that early substance use was related to dropout and other "precocious transitions" such as impregnating a partner or moving out of the parental home. For males but not females, this association remained significant even when several demographic, peer, and parent factors were held constant. Interestingly, this study also demonstrated the bidirectional relationship between substance use and dropout, in that dropout predicted greater likelihood of substance use during young adulthood, even independent of early substance use and other control variables. In a seven-year study of 538 males in the RYDS, McCluskey and colleagues (2002) observed that more frequent substance use (including alcohol, marijuana, and other illicit drugs) by age 15 was positively associated with greater risk for subsequent dropout, even holding constant family and school factors.

Finally, the Monitoring the Future (MTF) study has yielded several publications and reports focused on how tobacco, alcohol, marijuana, and other drug use relate to educational outcomes, including high school dropout (Bachman et al., 2007a; Bryant, Schulenberg, Bachman, O'Malley, & Johnston, 2000; Bryant, Schulenberg, O'Malley, Bachman, & Johnston, 2003). Here we briefly describe the findings specifically related to high school dropout that were reported in their book "The Education-Drug Use Connection" (Bachman et al., 2007b). This book described the results of longitudinal analyses that were conducted on nationally representative samples of students that were originally enrolled in the study as eighth graders in 1991 to 1993 and followed up with mail surveys every two years (i.e., at modal ages 16, 18, 20, and 22). One major strength of their analytic strategy was the use of structural equation modeling to examine the various ways in which substance use and academic outcomes are linked over the course of adolescent development.

One central premise of their work is that educational achievement is a stable characteristic of most people, and therefore school difficulties would usually manifest early, and set the stage for disengagement in academic pursuits, involvement in delinquency, and subsequent substance use. In general, the authors concluded that poor academic performance in the early years is an important risk factor for the development of subsequent substance use. The authors recognize that,

> …an effect on substance use on educational success might grow stronger over time through the buildup of educational setbacks. Thus, substance use might have a greater impact on later-occurring, cumulative educational indicators such as dropping out of high school or educational attainment in adulthood rather than earlier or more immediate measures such as school engagement. (p. 28)

They also state that "the normative stability in academic achievement may hide smaller segments of the population whose substance use does alter their academic achievement trajectory". (p. 19)

Their empirical findings provide some evidence that substance use contributed to the risk for later dropout. The degree to which these associations hold true varies by substance, with cigarette smoking having the strongest association. Eighth graders who smoked cigarettes during the past 30 days were more likely to become high school dropouts than non-smokers, and the quantity of smoking was related to risk for dropout in a dose-dependent fashion. Conversely, individuals who self-reported superior grades were less likely to smoke in the future.

With respect to marijuana, evidence supported a relationship between early academic failure and marijuana use, but after adjustment for covariates, the relationship between marijuana use and high school dropout did not retain statistical significance. However, frequent and heavy marijuana use was associated with decreases in academic performance. The authors argue that because the majority of students in the U.S. do not smoke marijuana frequently, it cannot be seen as a major cause of poor educational outcomes. With respect to alcohol use, heavy drinking was negatively correlated with educational success during adolescence (especially at ages 14 to 16). Cocaine use reported at modal age 16 appears to contribute to dropping out of high school.

According to the authors, the major implications of their finding is that preventing academic failure and promoting school achievement will be a better way to solve the drug problem than instituting traditional drug prevention programs. They state that "early educational interventions, additional support for low-achieving students, and a focus on personal growth rather than social comparisons could be some of the most effective ways to decrease substance use and delinquency when students reach adolescence." (p. 30)

One limitation of MTF is that the follow-up response rates declined over time (81% for the first follow-up assessment, 67%, 63%, and 57% thereafter until participants were a modal age of 22). More importantly, the investigators acknowledge that attrition was disproportionately higher among students who were substance users by the end of eighth grade, and that dropouts were likely to be underrepresented in the sample that responded to mail surveys during the follow-up period. The investigators utilized statistical techniques to partially compensate for potential attrition bias. Another important consideration when interpreting the findings is that most analyses used dichotomous measures of past 30-day substance use versus non-use; only a few analyses focused on the frequency of use within the past year or the past 30 days.

On the whole, the general conclusions stated in this book favor the idea that substance use is a result of rather than a contributory factor to academic performance, but the authors qualify this interpretation with several important points. First, as mentioned earlier, one of the foundational elements of their thinking is that educational success and failure are relatively stable during the early years of development. Therefore, it is likely that early academic failure begets continued declines in motivation and academic performance. However, the authors acknowledge that this overall premise might obscure individual cases that experience dramatic drops in academic performance, and for these individuals, it is entirely plausible that substance use can be at the root of this change in their achievement trajectory. Another critical issue that they raise concerns developmental timing. The authors acknowledge that the negative impact of early substance use on academic performance might grow stronger over time. The analyses provide evidence that in many

cases early educational failure might precede the onset of substance use early in development. However, continuing to experience academic failures might lead to worsening of a substance use problem, which in turn might result in later dropout. This notion comports with the findings of Zimmerman and Schmeelk-Cone (2003), who observed that low academic motivation can precede alcohol use, and continued and worsening alcohol use can precipitate dropout. The authors make a strong case that strengthening school experiences and providing the proper support to students who are struggling academically during the early years of adolescence might be one viable way of preventing substance use initiation. This idea is not in conflict with the major premise of the present report—that preventing substance use might reduce the likelihood of subsequent dropout.

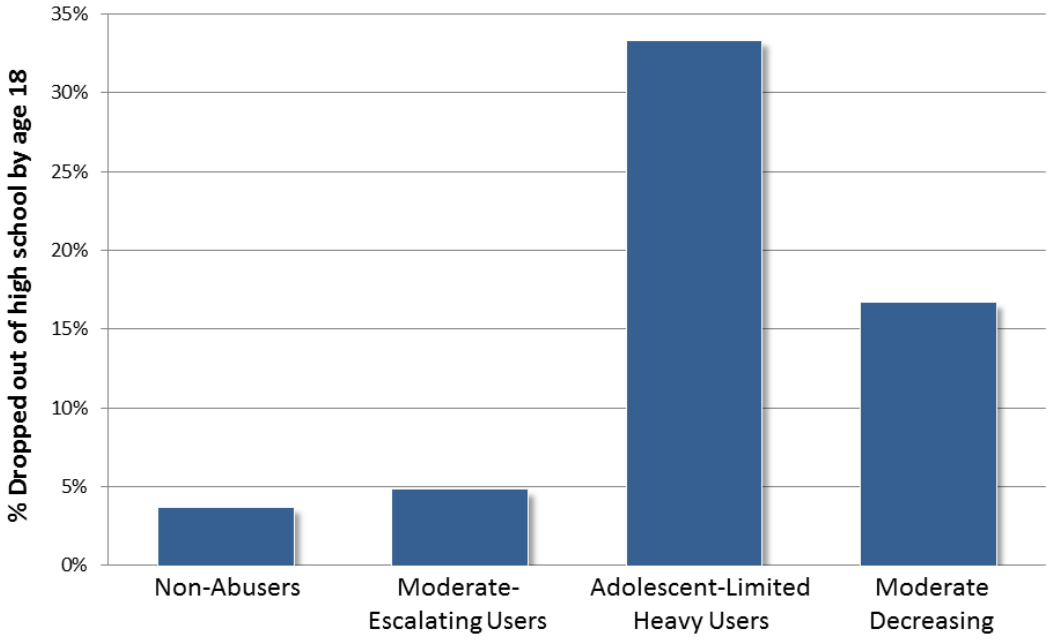
2.4.4. Longitudinal studies using a composite measure of alcohol and drug use

Other investigators have used a composite measure of alcohol and drug involvement (including frequency of use and selling) rather than separately examining the effects of each drug. The advantage of this approach is that high scores on such a measure can indicate greater severity of drug involvement, and thereby inform about the "dose-response" relationship between overall substance use involvement and risk for dropout. On the other hand, the limitation of this approach is that the unique influence of a given substance on dropout cannot be examined separately.

In one study by Tanner and colleagues (1999), National Longitudinal Survey of Youth (NLSY) data were used to create a composite index of substance use during adolescence: the number of occurrences during the past year of drinking alcohol, smoking or selling marijuana or hashish, and using other drugs. The study examined 2,257 14- to 17-year-olds who were attending school in 1979. Dropout was assessed in 1990 and 1992, when participants were 25 to 30 years of age. This measure of drug use/selling significantly predicted both lower likelihood of high school graduation by 1992 and fewer years of educational attainment by age 25 to 30. This effect held true for both males and females, even controlling for demographic and academic variables. Youth who dropped out of school prior to study enrollment were not included.

In an eight-year study of 496 adolescent females ages 13 to 20, Marti and colleagues (2010) used a statistical technique to derive different groups within their sample, based on developmental trajectories of substance use frequency (including alcohol, marijuana, and other drugs; see ***Figure 7***). They found that the trajectory group who started using heavily early (i.e., by age 13) versus late (steadily increasing from age 14 onward), experienced a 4.5 times greater likelihood of school dropout by age 18. Compared with non-abusers (3.7% of whom experienced dropout), every substance use trajectory group had a higher rate of school dropout by age 18 ("moderate-escalating" group: 4.8%; "adolescent-limited heavy" group: 33.3%; and "moderate decreasing" group: 16.7%).

Figure 7: High school dropout by age 18 among 496 female middle school students in a large United States city, by substance abuse developmental trajectory group membership[a]



[a] Data retrieved from Marti, C. N., Stice, E., & Springer, D. W. (2010). Substance use and abuse trajectories across adolescence: A latent trajectory analysis of a community-recruited sample of girls. *Journal of Adolescence, 33*(3), 449-461.

2.5. Studies Examining Substance Use Disorder as a Correlate or Predictor of Dropout

In addition to the preceding studies that assessed substance use or frequency of use, four studies were located in our review that examined the relationship between substance use disorder (SUD, defined by meeting standard psychiatric criteria for abuse or dependence) and dropout. Using SUD as a predictor is important because it enables one to understand the relationship between the most severe manifestation of substance use and risk for academic failure. However, it is important to recognize that this approach is, by definition, conservative because it does not account for how dropout might be impacted by less intense substance use patterns that do not qualify the individual for a diagnosis of SUD.

One of the first investigations of this kind utilized data from the New Haven site of the National Institute of Mental Health's Epidemiologic Catchment Area (NIMH ECA) dataset. It did not specifically focus on high school dropout as an outcome, but rather income with years of educational attainment as a potential mediator. Using data from 561 males ages 25 to 64, the researchers concluded that the presence of alcoholism symptoms prior to age 18 was significantly related to reduced educational attainment by 11%, which in turn was related to reduced earnings. An important strength of the study was that fathers' educational and occupational status were

included, which were known to influence sons' occupational status, at least during the historical period in which this study was conducted (Mullahy & Sindelar, 1994).

Two other studies used data from the National Comorbidity Survey (NCS), a large nationally representative study, and its later replication. First, in a sample of 5,877 15- to 54-year-olds, Kessler and Foster (1995) documented that onset of SUD prior to high school graduation was associated with more than a two-fold increased odds of dropout. They also observed a dose-response relationship between the number of psychiatric disorders and the likelihood of dropout, such that the presence of multiple psychiatric disorders was related to an even greater dropout risk than a single disorder. They concluded that 3.7% of dropout cases were attributable to prior SUD, with slight differences for males (4.9%) and females (2.4%).

Second, Breslau and colleagues (2008) conducted a survival analysis from NCS data collected on a sample of 5,692 U.S. adults ages 18 and older and found that individuals who met criteria for any SUD prior to age 18 were nearly three times as likely as their counterparts to have dropped out of high school, even controlling for the effects of demographics and several childhood adversity measures related to educational attainment. More specifically, alcohol dependence was associated with a 90% increase in the likelihood of dropping out, and drug dependence was associated with a 250% increase.

A smaller study of 240 mothers and their adolescent children by Bohon and colleagues (2007) investigated the impact of maternal depression on dropout, and SUD in the child was also included in the assessment. In addition to finding a strong and significant effect of maternal depression on risk for dropout, the study also found that SUD prior to ninth grade significantly predicted dropout. The final models also adjusted for mother's educational level, IQ of the child, and behavioral problems.

2.6. Studies Examining the Relationship Between Substance Use and High School GPA

The studies discussed thus far examined dropout as the outcome variable of interest. Because of the relatedness of academic performance, as measured by high school GPA, to dropout, we included studies that we located as part of our review that focus on GPA as the dependent variable.

One of the earliest published studies to examine the relationship between substance use and school grades was conducted in California. Paulson and colleagues (1990) collected data from 446 youth sampled using various community outreach methods (e.g., Boys Clubs). The sample was divided into those who did and did not use alcohol or any other drug during the past 30 days. In this study, significantly fewer substance users reported excellent or above average grades (6.4% and 38.7%, respectively) compared with non-users (13.6% and 50.4%, respectively). Substance users also had more absences from school, lower educational aspirations (defined as their desired level of education), lower expectations of completing postsecondary education, and lower perceived importance of learning. Similarly, 80.2% of the non-users reported that their parents would like

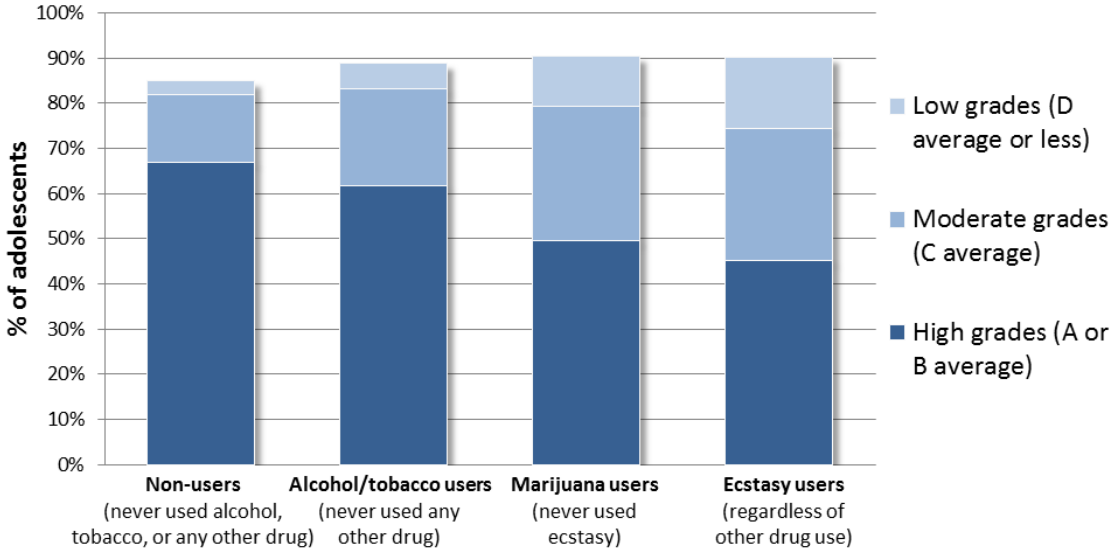
them to complete some college, as compared with 65.2% of the users, although this difference was not statistically significant. Interestingly, virtually none (95.4%) of the entire sample reported that they were thinking about dropping out of school, with no statistically significant differences between users and non-users on the intention to drop out.

Similar findings were observed in much later analyses of the 2002 to 2005 National Survey on Drug Use and Health (NSDUH) and 2001 to 2003 Youth Risk Behavior Survey (YRBS) by Martins and Alexandre (2009). Compared with non-users, drug-using adolescents earned significantly lower grades (see ***Figures 8 and 9***). Specifically, compared with non-users of any substances, lifetime marijuana users were three times as likely to earn a C average and six to seven times as likely to earn a D average (reference=A or B average), holding constant demographics. Lifetime ecstasy use, which was much less prevalent than marijuana use, was even more strongly related to lower grades, with ecstasy users being four times as likely to earn a C average and 12 times as likely to earn a D average, compared with non-users of any substances. Thus, even while students are still in school, drug use is an important marker for academic problems. Given that ecstasy use is likely to be a proxy for an overall heavier pattern of substance use—including alcohol, marijuana, and other illicit drugs—these findings add to other evidence supporting the existence of a dose-response relationship between drug use and academic problems (see ***Section 2.4.4.***).

Crosnoe (2006) used data on 11,927 middle and high school students from the National Longitudinal Study of Adolescent Health (Add Health) dataset to investigate the extent to which the frequency of alcohol use during the past year was associated with academic failure. Students were assessed at two time points, in 1995 and one year later. Information from parent interviews gathered during the first wave of data collection was also used for analyses. Academic failure was measured by self-report as the number of D's or F's students received. In addition to demographic factors, several other covariates were assessed, including family organization, peer norms, school and family bonding, delinquency, and marijuana use. Using cross-lagged panel models, the investigators concluded that, after adjustment for all the covariates, the evidence for early academic failure predicting alcohol use was stronger than the evidence for alcohol use predicting later academic failure.

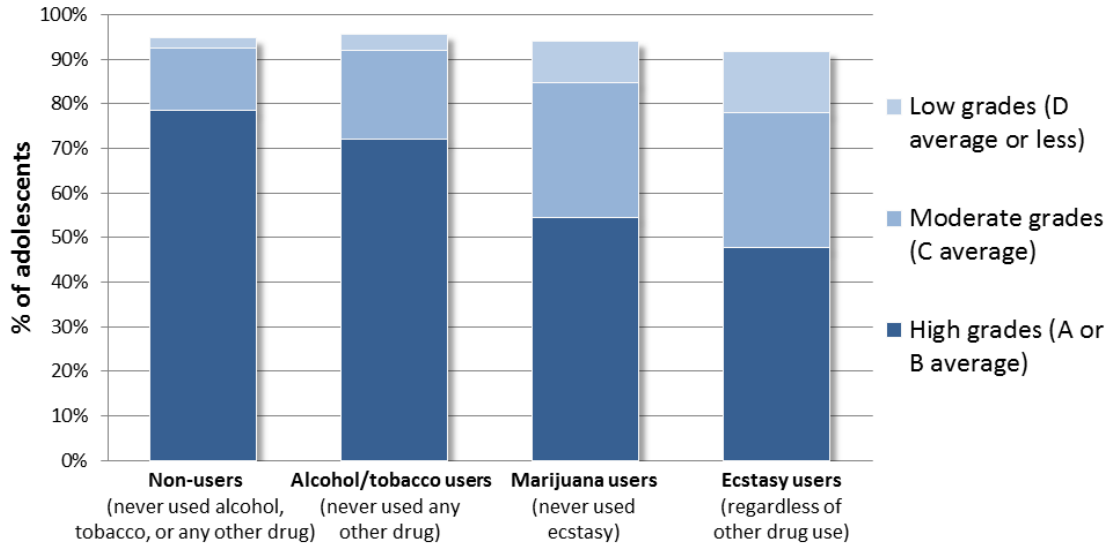
In a follow-up analysis of the same dataset, Crosnoe and colleagues (2012) used transcript data instead of self-reported grades to test the "self-medication" hypothesis—namely, that feelings of not fitting in leads to alcohol use, which in turn leads to decreased academic performance. The findings did not support the self-medication hypothesis; instead, the association was operating in the opposite direction of what was expected. Alcohol use at Wave 1 was significantly associated with decreases in GPA at Wave 2, and this effect appeared to operate through increased feelings of social marginalization (e.g., not being socially accepted, trouble getting along with others, etc.). This effect was especially strong in schools with low overall levels of drinking, such that drinking students felt even more marginalized when fewer of their peers were drinking.

Figure 8: Academic achievement among 65,294 12- to 17-year-olds in the United States, by lifetime substance use, from the National Survey on Drug Use and Health, 2002 to 2005[a]



[a] Data retrieved from Martins, S. S. & Alexandre, P. K. (2009). The association of ecstasy use and academic achievement among adolescents in two US national surveys. *Addictive Behaviors, 34*(1), 9-16.
Note: Substance use categories are mutually exclusive. Bars due not sum to 100% due to missing data. After adjusting for demographics and survey year, grades from the last semester of school differed as follows: alcohol/tobacco users were 50% and two times more likely than non-users to report moderate (C average) and low grades (D average or less), respectively; marijuana users were three and six times more likely than non-users to report moderate and low grades, respectively; and ecstasy users were four and twelve times more likely than non-users to report moderate and low grades, respectively.

Figure 9: Academic achievement among 27,592 ninth through twelfth graders in the United States, by lifetime substance use, from the Youth Risk Behavior Survey, 2001 to 2003[a]



[a] Data retrieved from Martins, S. S. & Alexandre, P. K. (2009). The association of ecstasy use and academic achievement among adolescents in two US national surveys. *Addictive Behaviors, 34*(1), 9-16.
Note: Substance use categories are mutually exclusive. Bars due not sum to 100% due to missing data. After adjusting for demographics and survey year, grades from the last semester of school differed as follows: alcohol/tobacco users were 60% and 90% more likely than non-users to report moderate (C average) and low grades (D average or less), respectively; marijuana users were three and seven times more likely than non-users to report moderate and low grades, respectively; and ecstasy users were four and twelve times more likely than non-users to report moderate and low grades, respectively.

In another recent study of the Add Health cohort, Balsa and colleagues (2011) combined self-reported data on substance use and background characteristics with GPA data from school transcripts, spanning two consecutive years of high school. They found that alcohol use was related to small but statistically significant reductions in GPA one year later, as well as and increases in the number of skipped school days. However, these associations were significant only for males. Although females' drinking did not appear to lower their grades, it was related to an increased probability of having academic difficulty (per self-report) one year later. When drug use was included in the model, the effect of alcohol use decreased, suggesting that drug use might be more strongly associated than alcohol use with decreases in GPA. Because this study focused on changes in GPA, by definition it excluded students who dropped out of school after the first wave of data. Considering that these dropouts had more intense drinking patterns, lower GPAs, and more missing GPA data while they were still enrolled (as compared with their peers who stayed in school), these findings are not as useful as one would hope to explain the connections between substance use and GPA, and certainly cannot inform about the drug use-dropout relationship.

DeSimone (2010) used combined data from the 2001 and 2003 Youth Risk Behavior Surveys (YRBS) to investigate the relationship between binge drinking and grades among high school drinkers. Binge drinking (defined as consuming five or more drinks within a few hours on at least one occasion) had a small negative impact on grades, even after adjustment for several potentially confounding variables, including self-esteem, depression, and risk aversiveness. The results of a subgroup analysis suggested that the effect of binge drinking on grades might be larger for students who are more risk-averse, future-oriented, and drug-free. Importantly, the inclusion of cigarette smoking and other drug use in the model reduced the strength of the association between binge drinking and academic performance—similar to findings from Balsa and colleagues (2011) and Newcomb and Bentler (1986) discussed above—suggesting that drug use is more strongly associated with academic performance than alcohol use.

Sabia (2010) reported similar findings in a longitudinal analysis of Add Health data. Specifically, while binge drinking was observed to have a negative impact on grades and to increase the likelihood of suspensions and unexcused absences among both male and female high school students, the effect was dampened significantly when marijuana use frequency was added to the model, showing that marijuana use is more strongly related to grades than alcohol. However, in the final model, frequent binge drinking (more than once per month) was associated with moderate declines in GPA, unexcused absences, and out-of-school suspensions. This study was somewhat unique in that it also adjusted for having a biological parent with alcohol problems, which was observed to have a significant negative impact on educational outcomes.

2.7. Studies Examining Changes in Academic Performance Following Addiction Treatment

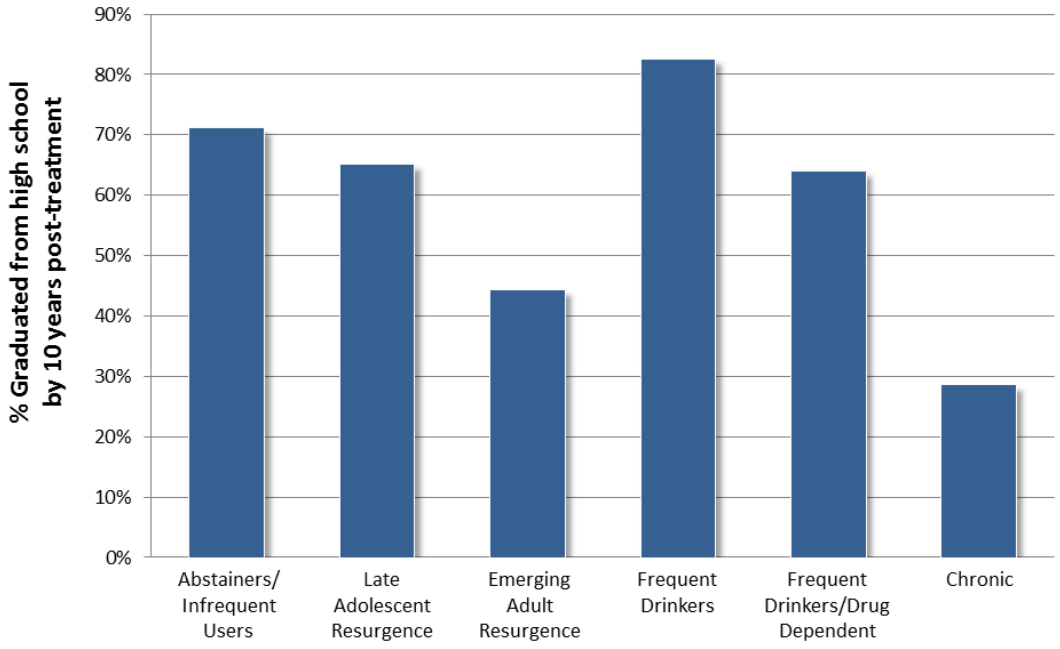
If substance use is detrimental to academic performance, it follows that academic performance should improve after substance use is stopped. We found three studies that examine the academic outcomes of adolescents after they received treatment for substance use problems.

These studies highlight the malleability of substance use, and provide clear hope that addressing substance use is a viable dropout prevention strategy.

First, Engberg and Morral (2006) studied adolescents entering treatment for alcohol and other drug use. Data were combined from seven treatment sites, representing follow-up of 1,084 adolescents quarterly for a year following treatment admission. Results indicated that individuals who ceased marijuana use were more likely to be attending school, independent of prior substance use and other baseline characteristics. Interestingly, reductions in marijuana use frequency did not increase the probability of school attendance unless those reductions amounted to complete cessation. Additionally, school attendance was more likely among individuals who used alcohol and stimulants less frequently. An important advancement of this study over prior studies was that, by testing alternative models with random and fixed effect estimators, the authors ruled out the possibility that the observed associations between substance use and attendance could be attributed to factors such as personality traits or underlying predisposition to attend school. This study is significant because it highlights the potential of effective interventions not only to reduce drug use, but also to benefit secondarily students' academic performance.

Second, Balsa and colleagues (2009) studied 384 adolescents who completed intake assessments at four intensive outpatient treatment programs that were part of a private managed care organization in California during 2000 and 2002. Findings indicated that treatment initiation (defined as having at least two visits by 60 weeks after intake) significantly predicted increased likelihood of attending school one year later.

Figure 10: High school graduation among 153 adolescents following inpatient drug treatment, by substance use trajectory group membership[a]



[a] Data retrieved from Anderson, K. G., Ramo, D. E., Cummins, K. M., & Brown, S. A. (2010). Alcohol and drug involvement after adolescent treatment and functioning during emerging adulthood. *Drug and Alcohol Dependence, 107*(2-3), 171-181.

In a smaller study of 153 adolescents attending one inpatient drug treatment center, Anderson and colleagues (2010) identified six drug use trajectory groups during the ten years following treatment (see ***Figure 10***). Within each trajectory group, they then quantified the proportion who had graduated from high school. They observed the highest rates of high school graduation among abstainers (71.1%) and in the group that was characterized by no drug use, but some alcohol consumption after the attainment of legal drinking age (82.6%). In comparison, the lowest graduation rate was found among the individuals who relapsed to a chronic drug use pattern (28.6%), with the remaining groups having intermediate graduation rates.

2.8. Limitations of the Research

Inherent in all research studies investigating complex behavior among adolescents are methodological limitations. The studies we reviewed were no exception and several had noteworthy limitations. First, many of the studies were published prior to 2000 or utilize samples of students that attended school two decades ago or more. This is problematic not necessarily because the quality of the research can be criticized for being dated, but because contemporaneous student samples are growing up and going to school within a different historical context. For one, the drug landscape has changed—for example, with greater opportunities today for nonmedical use of prescription drugs. Additionally, markedly increased availability of marijuana is on the rise, more so in some regions of the country than others. Moreover, the increasingly high levels of the active ingredient in marijuana, THC, are of great concern.

Almost all of the studies reviewed used a fairly cursory way to characterize the substance use of participants. Only four publications were identified that measured substance use disorder on the basis of a diagnostic interview (Bohon et al., 2007; Breslau et al., 2008; Kessler & Foster, 1995; Mullahy & Sindelar, 1994). Most studies used a single measure such as frequency of marijuana use during the 30 days prior to being surveyed. Although measures such as this have validity in detecting individuals with a current drug problem, they do not capture changes in substance use patterns over time. Future studies should attempt to understand how changes in the severity of substance use are related to changes in academic performance over time. The study by Anderson and colleagues (2010) used state-of-the-art statistical techniques to isolate groups of individuals who have various substance use trajectories following drug treatment. Similar methods could be applied with data derived from community samples. In ***Section 4.1.***, we call for other ways in which research designs could be enhanced to give us a more complete understanding of the drug use-dropout relationship.

Another major methodological limitation concerns studies that sampled students from schools. As DeSimone (2010) articulated, these samples have special limitations for investigating the association between alcohol and drug use and dropout:

> Because the YRBS is administered to students during class sessions, the estimates do not pick up potential effects of drinking on school dropout. Moreover, students with high absenteeism rates are less likely to be sampled. If absent students drink more heavily and perform more poorly in

> school than do others, and drinking directly reduces grades (possibly through absenteeism), this selection process will bias the estimated drinking effect towards zero. (p. 1485)

This limitation also holds true, to a lesser extent, for other studies that we reviewed that utilized large community-based datasets. In several studies, marijuana and alcohol use frequency was greater in individuals who had dropped out of the study as compared with students who completed all assessments. Future studies should overcome this limitation by enrolling individuals into research outside of classroom settings and/or following up with participants regardless of continued school attendance.

2.9. Summary of Research Findings

High school dropout is a massive problem in the U.S. and it has serious social and economic consequences for individuals and society. While the heterogeneity of the processes involved in dropout presents challenges to researchers, understanding them is critical because preventive interventions must be directed at the many components of the causal chain leading to dropout. The research studies we reviewed demonstrate the critically important role of substance use in the chain of events leading to dropout. Most produced quite similar findings, despite using different types of samples from various regions of the country and different ways of measuring substance use. Several studies demonstrated a relationship between substance use and dropout using longitudinal designs that statistically adjust for the effects of potential confounding variables, such as demographic variables, parental education, and propensity for rule-breaking behavior. Some studies found that the effect of substance use operates via decreasing students' motivation to stay in school and by decreasing their engagement in academic pursuits, which is consistent with clinical experiences with youth seeking help for their drug and alcohol use problems.

Several major conclusions can be drawn from our review. First, substance-using students, compared with non-users, are at increased risk for academic failure, including dropout, especially when their substance use is frequent and severe. From a clinical perspective, it is not difficult to imagine why the severity of a drug or alcohol problem would be a crucial dimension accounting for the association between substance use and academic difficulties.

Second, marijuana use appears to have a stronger negative relationship with academic outcomes such as GPA and risk for dropout than alcohol use. However, regardless of substance type, the more frequent and/or severe the involvement of substance use, the more likely it will be for substance use to affect academic performance and increase the risk for dropout. We speculate that the lack of strong associations with alcohol, compared with marijuana, is due, in part, to differences in the patterns of consumption between alcohol (which is typically consumed sporadically during adolescence) and marijuana (which might be consumed more regularly). For instance, it might be less obvious to a school official that a student is high on marijuana as compared with being intoxicated on alcohol. Similarly, marijuana is more likely to be used throughout the day and day after day—more like tobacco—than is alcohol. Because they might have an easier time escaping detection, marijuana-using students might not hesitate to smoke

during the week before going to school, thus compromising their ability to participate in school or comprehend the material being presented in a classroom. Alcohol might be more likely to be consumed at night with friends on the weekends, rather than before school. However, these scenarios are speculative, and are in need of confirmation by both qualitative and empirical studies. Moreover, in the studies that showed weak associations with alcohol, the students investigated were, on average, very low level drinkers. Some researchers even mentioned that the heavier drinking adolescents dropped out of school and thus were not available to participate in follow-up research interviews. Alcohol use is more prevalent and thus less likely to distinguish students with academic problems from those who are not experiencing difficulties. However, it is also true that frequent heavy drinking, as opposed to any alcohol use, does appear to be associated with dropout in several studies, even when drug use is included as a separate predictor.

Third, it is clear that dropout is the end result of a process that involves multiple events, the timing of which might differ across individuals. Substance use might appear early or later in the chain of events that eventually leads to dropout. In the case of a student who was performing adequately or even superiorly in school prior to initiating substance use, once substance use begins, a slight drop in academic performance might be seen initially. Disengagement from school might occur as substance use becomes more frequent. The risk for dropout increases as substance use increases. Importantly, the earlier the age of initiation of substance use, the greater the risk for extensive substance involvement later on, and the more serious the consequences.

An alternative scenario is a student who experiences early learning difficulties, which then leads to problems engaging in school, selecting peers with similar problems, skipping class, using drugs and alcohol, and ultimately dropping out of school. These two scenarios differ with respect to which problem (substance use or academic difficulties) comes first, but both are possible. Clinical experience clearly supports a multitude of pathways leading to different types of adverse outcomes during adolescence.

The finding that the association between alcohol use and dropout was strongest for students who were risk-averse and drug-free (DeSimone, 2010) is intriguing because it supports anecdotal clinical evidence about the devastating impact of substance use on academically-achieving students. For example, the onset of a substance use problem could have a dramatic impact on a student without pre-existing learning problems, and who is a high achiever in middle school, because in a sense, they have "farther to fall." Clinically, cases have been seen where the strong positive drive for academic pursuits and extracurricular activities has been replaced with an equally strong relationship with marijuana and alcohol.

Fourth, many studies highlighted the associations between substance use and a constellation of other problem behaviors such as conduct problems, impulsivity, and delinquency. These behaviors can lead to difficulties socializing appropriately with peers and teachers and work in concert with substance use to exacerbate academic performance problems.

Fifth, the cessation of substance use following treatment is associated with improvements in academic performance. This type of evidence strongly supports the contributory role of substance use in academic failure.

Lastly, our review revealed a severe lack of attention to the large segment of the population who are high school dropouts with respect to the need to address their substance use problems. While the need for remedial education and employment opportunities is clearly recognized, equally important is the need for interventions targeted at reducing substance use among these individuals. Not addressing these issues is likely to lead to escalating problems, criminal justice involvement, and continued marginalization from the productive workforce.

SECTION 3.
MECHANISMS LINKING SUBSTANCE USE WITH DROPOUT

So far, the preceding sections have illustrated the widespread agreement that an association between substance use and dropout exists, and evidence has been described supporting the claim that the association is bidirectional. In this section, we discuss several possible non-mutually-exclusive mechanisms that could link substance use with dropout.

3.1. Substance Use "Hijacks" Neurobiological Reward Pathways in the Brain, Making Academic Pursuits Less Meaningful to the Individual as their Relationship with Substances Becomes Stronger

A cardinal feature of the progression from substance use to addiction is the individual's increased level of preoccupation with the drug. Activities once enjoyed or people once important take a "back seat" to the relationship with the drug. Recent research has confirmed the neurobiological processes that underlie this intense desire to seek out and use the drug, even in the face of damaging personal consequences or the effects on others (National Institute on Drug Abuse, 2010). Clinicians working with adolescents have long recognized that pleasures associated with school achievement decrease very quickly when drug use begins and escalates. The phenomenon is often referred to drugs "hijacking" the brain's reward system and is a key mechanism to explain the association between substance use and high school dropout. Clinical experiences support the notion that adolescent alcohol and drug use is often associated with reductions in the number of hours committed to studying, completing homework assignments, and attending school (see ***Appendix 1***). A vicious cycle ensues, especially when students begin affiliating with other drug-using peers who, because of their drug use, have little interest in pursuing academic goals.

3.2. Substance Use During Adolescence is Associated with Neurocognitive Deficits

Exposure to alcohol and drugs, especially during the vulnerable period of adolescent development, can lead to acute cognitive difficulties such as difficulty concentrating and sleep disturbances. These cognitive problems might make it more difficult to function academically. Recent research has identified areas of the brain involved in learning and memory that are affected adversely by alcohol consumption (Zeigler et al., 2005). Other research studies have observed structural and functional changes in adolescent brain development associated with early heavy alcohol consumption that can manifest as poor planning, impaired executive functioning, and spatial and attention deficits (Brown, Tapert, Granholm, & Delis, 2000; Jacobus & Tapert, in press; White & Swartzwelder, 2005).

The cognitive effects of marijuana use have been summarized in several reviews of the literature (Ashton, 2001; Crean, Crane, & Mason, 2011; Hall, 2009; Hall & Degenhardt, 2009; Schweinsburg, Brown, & Tapert, 2008). Deficits appear to be strongly related to both age of onset (Ehrenreich et al., 1999; Pope et al., 2003), as well as frequency and duration of use. While acute effects of marijuana intoxication are well recognized and include numerous attention and concentration difficulties, as well as decreased working memory, decision response speed, and information processing (Bolla, Brown, Eldreth, Tate, & Cadet, 2002; Solowij et al., 2002), longer-term problems have been demonstrated as well (Hanson, Cummins, Tapert, & Brown, 2011; Schwartz, Gruenewald, Klitzner, & Fedio, 1989). Neuropsychological deficits include impaired planning, organizing, and problem solving. Newer research has confirmed earlier findings of Solowij and colleagues (1991) showing longer term residual deficits related to allocation of attentional resources, filtering out irrelevant material, and retrieval and immediate verbal memory deficits (Solowij et al., 2011; Takagi et al., 2011), all of which are necessary for performing well in and outside of the classroom. Importantly, these problems have been demonstrated even after statistically adjusting for premorbid intellectual ability (Solowij et al., 2011). Fontes and colleagues (2011) demonstrated that early-onset marijuana users were more likely than late-onset users to show deficits on sustained attention, impulse control, and executive functioning. Moreover, researchers are beginning to uncover possible neuroanatomical correlates to some of these performance deficits using magnetic resonance imaging (MRI; Bava, Jacobus, Mahmood, Yang, & Tapert, 2010).

3.3. Early Learning Difficulties Lead to School Failure and Subsequently to Substance Use

Several studies reviewed in this paper have concluded that early learning difficulties preceded the onset of substance use. Having such early learning difficulties might set off a cascade of effects—poor school performance leading to disengagement from school activities because of frustration, and subsequent affiliation with peers with similar problems that might provide opportunities to initiate substance use. Students with Attention Deficit Hyperactivity Disorder (ADHD), for example, are at risk for both substance use and poor performance in school (Biederman & Faraone, 2005; Klein et al., 2012; Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1993; Marshal, Molina, & Pelham, 2003).[2] Many students, however, might not meet the specific clinical criteria to receive diagnosis of ADHD, but could still exhibit subtle problems in attention as well as an inability to plan and regulate their behavior (beyond what could be attributed to "normal" adolescent development). These students might have a greater propensity than other students for involvement in substance use (McGue, Iacono, Legrand, Malone, & Elkins, 2001; Sloboda, Glantz, & Tarter, 2012; Tarter et al., 2011). Lejeuz and colleagues (2010) comprehensively reviewed the various dimensions of impulsivity and their relation to alcohol use, related problems, and alcohol

[2] An in-depth discussion of ADHD, its relationship with student functioning, and its treatment is beyond the scope of this paper; the reader is referred to Tamm and colleagues (2012) and Wilens and colleagues (2011) for more information about ADHD and its treatment.

use disorder and concluded that there is clear evidence of the role of impulsivity in the spectrum of alcohol involvement. Several features of impulsivity described by Lejeuz and colleagues (2010), including a diminished ability to focus on tasks at hand (i.e., attentional impulsiveness) or a tendency to act on the spur of the moment, might also be related to one's ability to perform well in school. The important thing to keep in mind is that substance use is certainly not going to improve academic performance among students with ADHD or with more subtle learning deficits. To the contrary, because substance use will most likely exacerbate the problem, addressing it must be part of the intervention plan to ensure success in school.

3.4. "General Deviance" is a Common Root for both Academic Failure and Drug Use

Rather than assume a causal relationship at all, many have argued that the connection between drug use and academic failure can be explained by the fact that both are the result of an individual's propensity for deviant behavior. General deviance is characterized by a low degree of commitment to traditional values and disrespect for rules and authority (McGee & Newcomb, 1992). Problem Behavior Theory, originally advanced by Jessor and Jessor (1977) and further articulated by Donovan and Jessor (1985), postulates that multiple problem behaviors are often observed in the same individual. Having this orientation, individuals are not likely to be interested in following the rules necessary to advance in academic settings and have few self-imposed boundaries on risky behavior such as drinking or drug use. This theory stresses the importance of social contexts that perpetuate problem behaviors, such as deviant peer affiliation that favors non-conventional values and activities, and community and family influences conducive to the escalation of problem behaviors. The social context of drug use tends to promote adoption of anti-conventional norms including a rejection of the value of education (see Fergusson & Horwood, 1997; Kandel, Davies, Karus, & Yamaguchi, 1986; Lynskey & Hall, 2000).

Empirical evidence for such a problem behavior syndrome has been demonstrated in several studies, and this theory remains well accepted (McGee & Newcomb, 1992; Newcomb & Bentler, 1986; Newcomb et al., 2002). As adolescent drug users engage in a whole host of impulsive and rule-breaking behaviors, they are likely to be disruptive to other children and school officials, leading to parental frustration and sometimes parental rejection (see Brook, Brook, Zhang, & Cohen, 2009; Pires & Jenkins, 2007). As a result, these children might not be given appropriate opportunities to succeed in school environments. Unfortunately, little is being done to address drug use at this stage—one of the more malleable aspects of the problem behavior syndrome. Knowing that adolescent substance use is part of a larger constellation of problem behaviors among some youth should not deter parents or other professionals from acting and intervening to address the substance use.

SECTION 4.
RECOMMENDATIONS

4.1. What Do We Still Need To Know? Setting a Research Agenda

Although we believe the evidence linking substance use and dropout is substantial enough to generate immediate action on several fronts, an invigorated research agenda is required to answer several critical questions. We recommend the following research areas for consideration:

1. Studies focused on the academic performance of adolescents who have received early intervention or drug treatment services or who are attending recovery high schools. We found only three published studies in the literature that assessed academic outcomes among a sample of adolescents who attended drug treatment (Anderson et al., 2010; Balsa et al., 2009; Engberg & Morral, 2006). These studies made a convincing case that drug use is a factor in declining academic performance by showing that when the substance use ceased, many individuals were able to get back on track academically. Certainly, our clinical experience echoes this finding. More studies of this type with samples of adolescents receiving and benefiting from help for their drug problems are needed to replicate or refute these findings. It will be important for such studies to document whether substance use ceased altogether not only during treatment, but during a prolonged follow-up period. It is commonly recognized that cessation of substance use will require long-term monitoring and management. Recovery high schools are promising models to enhance the success of young people who have prior substance use (Lanham & Tirado, 2011) and studies are underway to evaluate the impact of attending recovery high schools on fulfilling educational goals (Moberg & Finch, 2007).

2. Studies linking regional data on adolescent substance use patterns with data on school dropout. Several federally funded datasets exist that contain regional data on adolescent drug use (see ***Table 1***). Studies are needed that link these regional data to school dropout statistics in the same areas, and perhaps over time. Such ecological analyses are not without limitations, but they might offer a promising and cost-effective way of understanding the association from a broader national and regional context.

3. Studies that examine the association between substance use and more nuanced patterns of academic performance. Most studies that we reviewed focused on a few major academic outcomes such as failure to graduate and GPA. A few examined unexcused absences, skipped classes, and study time, all of which might be considered intermediary outcome variables. However, additional longitudinal research is needed to examine changes in academic performance that parallel changing patterns of substance use. Clinically, drug use is accompanied by precipitous drops in academic performance that are out of the ordinary for the individual, although by other standards, they might be performing adequately. For example, decreased academic performance as

measured by receiving mostly As one semester to mostly Bs in the next semester could easily go unnoticed. However, it is important to understand the degree to which such subtle changes in academic performance could be related to drug use. Such information could be useful for parents and educators for identifying problems at very early stages.

4. Studies that examine the cumulative and interactive impacts of multiple risk and protective factors, such as early onset psychiatric symptoms. Although many studies statistically adjusted for a wide range of covariates to isolate the potential impact of substance use on academic outcomes, few studies explored the cumulative effect of multiple risk factors or the interactions between variables. Because several other factors are known to be significantly influential on a child's risk for drug initiation and subsequent problems, it is important to understand their association with academic performance as well. For one, mental health problems often co-exist with substance use and both could potentially reduce academic performance.

5. Studies that examine parenting expectations regarding substance use as well as expectations of academic achievement on academic performance. Studies are needed to further understand the impact of parent practices on the substance using behaviors of their children, as well as of setting high expectations for academic achievement, both of which might have a beneficial impact on reducing drug use as well as sustaining academic success.

6. Studies that examine academic performance outcomes as part of evaluations of substance prevention programs. Several randomized controlled drug prevention program trials have been conducted with the primary outcome variable being substance use initiation or progression to more severe drug involvement (Ellickson, McCaffrey, Ghosh-Dastidar, & Longshore, 2003; Kellam et al., 2011). It is not clear whether or not these trials collected data on academic performance in tandem with drug use outcomes. New data are needed to understand the possible benefits that reducing drug use has on increasing school engagement and high school graduation rates.

4.2. Implications for Education Professionals

It is imperative that high schools develop cost-effective strategies to identify and intervene with students to prevent dropout. Ultimately, to improve student retention, it will be necessary to expand and enhance communication regarding exemplary models of success that have had positive impacts on improving student retention, especially among the most at-risk students. Basic information on successful existing models are needed. For instance, the extent to which high schools are engaged in screening and intervening with students at risk for dropout is not known. Obviously, high schools vary tremendously with respect to their emphasis on and resources available for academic assistance services. It is important to understand the type and intensity of various programs, practices, and policies related to assisting students with academic challenges.

As part of a broad comprehensive plan to improve academic outcomes, high schools should develop strong policies to reduce substance use by students as well as address related problem behaviors and mental health problems. The settings and ways that substance use problems among

youth in schools are detected, if at all, have not been described. Having a coordinated plan to address substance use and related problems among students who are experiencing academic difficulties is an important first step. A second step would be to develop early warning and continued care monitoring systems to track their progress and provide more intensive supports as necessary. These strategies would have wider appeal if they were regarded as necessary supports for promoting success, rather than as punitive methods that lead to student expulsion, which would defeat their intended purpose entirely. Developing standardized assessment and intervention practices related to substance use and mental health problems is also necessary, and should include identifying and training responsible personnel, utilizing reliable measures for detecting problems, understanding how often to administer such measures, and developing individualized action plans on the basis of ongoing assessment results. As argued by Beauvais and colleagues (1996), the multi-problem nature of youth either at risk for dropout or who have already dropped out calls for more comprehensive and intensive solutions.

Similar to the training that is taking place in medical schools to identify and address substance use in patients, training related to how to recognize and address alcohol and drug use could be integrated into standard curriculum for educational professionals. For example, screening and brief intervention (SBI) strategies have demonstrated efficacy in identifying youth at risk for alcohol and drug involvement and have shown small, but promising effects, for interventions (Harris et al., 2012; Spirito et al., 2004). Additional research is needed to refine and evaluate new SBI approaches both in educational settings and in primary care settings. These types of interventions could plausibly reduce the chance for drug involvement, and also improve academic performance. On the bright side, most students who are involved with alcohol and/or drugs during middle and high school do not meet criteria for dependence. It is much easier to intervene at this early stage than later when problems escalate and have impacts on not only the individual's well-being and safety, but potentially cause harm to others (e.g., car accidents). Schools should be prepared to facilitate referrals to professionals who can help families address the continuum of problems that might exist, including co-morbid mental health problems. Linkages between schools, specialty care centers, and community-based resources should be in place for more serious cases.

A very thoughtful analysis of what it might take to improve academic performance was described in a case study report by Socias and colleagues (2007). The authors began by identifying a unique set of schools in California—namely, schools where at least 50% of the students were disadvantaged (as defined by being eligible for free or reduced price lunch), but at the same time had unusually high academic achievement rates. Basically, the six schools they studied were the worst of the worst, but achieving like the best of the best—they labeled these schools as "Beating-the-Odds" (BTO) schools. They then investigated the "common denominator" strategies and policies that these schools had in place. Four themes emerged: a) connecting with and engaging students; b) engaging parents and community members to support school efforts; c) providing interventions and individualized supports to students at risk for dropping out; and d) creating a culture of accountability and high expectations. This case study provided valuable lessons about what might be possible, even in the face of challenges and adversity.

4.3. Implications for Parental Involvement

Parents play a critical role in a child's development by setting educational standards and expectations in the context of a warm and supportive relationship. As educational task demands become greater as children get older, so do the competing influences of extracurricular activities, friendships, and exposure opportunities for drug use. Parents are confronted with the enormous challenge of having to maintain awareness of all the different influences on their child's behavior. Empowering parents and caregivers with practical knowledge, tools, and resources to be an effective parent is one of the most promising strategies for reducing the risk for substance use. Decades of research have identified several ways in which parents directly influence their child's behavior. Parent behaviors that have shown to reduce the risk for substance use involvement include monitoring and supervision of child activities and whereabouts (Ary et al., 1999a; Ary, Duncan, Duncan, & Hops, 1999b; Chilcoat & Anthony, 1996; Richardson, Radziszewska, Dent, & Flay, 1993), expressing disapproval of underage drinking and other drug use (Boyle & Boekeloo, 2006; Catalano et al., 1992), and communicating a zero-tolerance message (Abar, Morgan, Small, & Maggs, 2012). Moreover, parents can influence their child's behavior by restricting alcohol availability, encouraging healthy peer selection, and increasing perceived risk through parent-child communication (Bahr, Hoffmann, & Yang, 2005; Dick & Kendler, 2012; Kelly, Comello, & Hunn, 2002).

Parents must be encouraged to recognize that a decline in academic performance might be an early warning sign of learning problems, substance use, and/or mental health problems. This insidious process might go unnoticed at first because parents might expect that a previously achieving student will recover quickly from a temporary "dip" in academic performance. In such cases, it might be prudent to consider the possibility that substance use might underlie the decrease in academic motivation or performance. A comprehensive assessment should follow—including an assessment not only of possible learning disabilities, but also of possible drinking, drug involvement, and mental health problems. In this way, parents can serve as a "first-line defense" in addressing a child's problem. Proactively addressing the problem is warranted rather than waiting for it to resolve itself without intervention.

4.4. Implications for the Design of Interventions

A challenge of designing intervention strategies to improve academic performance among youth and reduce the risk for school failure is the need to identify the intervention target—that is, we need to choose the most important outcome of our intervention strategy. Possible outcomes include eliminating alcohol and drug use, reducing school absences, or promoting a sense of commitment to school-related activities. The goals of any intervention strategy can be multifaceted.

Another challenge in designing an intervention is how to choose a target population—for example, should "at-risk" be defined as students who are identified to be drug users in schools? Or should the focus be only on students who are having academic difficulties? Should all students be

screened on a routine basis, or just the students who exhibit some kind of problem or come to the attention of school authorities?

Next, who would be enlisted as the "change agent" in the intervention? Possible individuals include teachers, parents, coaches, other caregivers or trusted adults, peers, and even community members, such as businesses who can reinforce the value of schooling for ensuring employment opportunities. Reiff (1998) argues that physicians who routinely care for adolescents have a role in facilitating academic support since academic failure should be seen as a "failure to thrive". Intervention strategies that are most likely to have an impact include those that are comprehensive and address many facets of behavior and the environment in which the child lives. Moreover, single-shot solutions are not likely to be effective; rather interventions that continuously monitor students and are adapted based on the child's progress hold more promise.

4.5. Implications for Policy Makers

Policy makers have long recognized the severity of the dropout crisis and its ramifications for securing America's global competitiveness. Steadily increasing resources are being directed to address the problem. In the 2009, 2011, and 2012 State of the Union addresses, President Obama highlighted the need to increase graduation rates (Obama, 2009, 2011, 2012). However, little attention has been paid to the notion that reducing substance use is a viable strategy for improving school performance and addressing the dropout crisis. We expect that the research evidence provided in this report will create new opportunities for policy makers seeking successful solutions for the dropout crisis. To this end, policy makers must recognize that schools should bolster their current capacity to screen and intervene early to address student substance use. As mentioned earlier, rather than a punitive approach where students with drug and alcohol problems are expelled from school, more constructive alternatives should be implemented.

Reducing the nation's dropout rate needs to be approached with a can-do spirit, supported by aggressive research on not only the nature of the problem but also specific cost-effective scalable interventions that hold the promise of significantly reducing dropout. We believe reducing substance use—preventing it in the first place and stopping it when it has already occurred—is a vitally important part of reducing dropout and that substance use by youth is one of the contributory factors that is most responsive to successful interventions. In the past, substance use prevention and intervention strategies have been largely neglected in the design of programs, practices, and policies to reduce high school dropout. As we have shown in this report, there is abundant evidence that substance use and dropout are connected. We believe that an honest appraisal of that evidence can only lead to the logical conclusion that a significant increase is needed in both research and programmatic actions to reduce this path to dropout.

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APPENDIX 1.
RESULTS OF A YOUTH SURVEY

We conducted a qualitative survey with a convenience sample of eleven young adults between the ages of 17 and 21 with histories of substance abuse problems. They were ascertained from either an addiction treatment center in Maryland (*n*=5) or a recovery high school (*n*=6). Participants were asked about the effects of alcohol and other drug use on their own academic performance and school attendance.

All participants agreed that alcohol and other drug use had a negative impact on their academic performance and school attendance. They reported that when they stopped using alcohol and other drugs, their school attendance and academic performance improved.

Table 3: Results of a qualitative survey of 11 young adults with histories of substance abuse problems

		n	%
Did your use of alcohol and other drugs have a negative impact on your academic performance and/or your school attendance?	Yes	11	100%
	No	0	0%
If YES, to what extent did your use of these drugs affect academics? School attendance?	**Academics**		
	Major Impact	9	82%
	Minor Impact	2	18%
	Attendance		
	Major Impact	7	64%
	Minor Impact	4	36%
When you stopped alcohol and drug use, did stopping improve these two areas of your school life?	Yes	10	90%
	No	1	10%
If YES, to what extent did your stopping affect them?	**Academics**		
	Major Impact	7	70%
	Minor Impact	3	30%
	Attendance		
	Major Impact	9	90%
	Minor Impact	1	10%

When asked how the use of drugs affected academics and attendance, responses from high school age youth included:

> "[Drugs] took the place of studying. They decreased my motivation." (18-year-old male)
>
> "I didn't care about my academics and I skipped some days of school to use as well." (18-year-old male high school senior)
>
> "I didn't want to do anything." (17-year-old female high school senior)
>
> "Lazy, unwillingness, no motivation, slept in class, wouldn't go to school, skipped school often." (18-year-old female high school senior)
>
> "I stopped focusing on wanting good grades. I stopped studying, doing homework and as a result, my grades went down. I skipped school, came in late, went to classes late and had my mom call me in sick." (17-year-old female high school senior)
>
> "With pot mostly my grades went down the drain." (17-year-old male high school senior)

When asked how stopping use affected academics and attendance, responses from high school age youth included:

> "I started doing my school work and going to school." (18-year-old male high school senior)
>
> "I went to school and cared about my grades." (17-year-old female high school senior)
>
> "I had more motivation, improved grades and relationships with teachers. I cared about my future and wanted to go to college." (18-year-old female high school senior)
>
> "I was able to do assignments, study, and focus because I wasn't high. I was able to learn. I actually cared about school and would go so I didn't have to make up work. I wouldn't be tired from the night before and wouldn't have to call in sick." (17-year-old female high school senior)

When asked how the use of drugs affected academics and attendance, responses from college age young adults included:

> "I never went to class." (20-year-old female college junior)
>
> "I did not care about school. I would skip class to use." (19-year-old female college student)
>
> "I did not go to school—wanted to get high more than study." (21-year-old female college student)
>
> "I slept at school." (18-year-old female college freshman)

When asked how stopping use affected academics and attendance, responses from college age young adults included:

> "My academics improved immediately because I had time to study and I could remember what I studied. The attendance did not improve quickly because it took quite some time to show up to class regularly." (21-year-old female college junior)

> "I rarely to never skip class and I am now on the Dean's List. I have been sober for almost two years." (20-year-old female college junior)

> "I stopped for a year and a half while in high school. I cared about my school work. I wanted to get to college." (21-year-old female college student)

> "I did not go to class and when I did, I had a hard time remembering what I learned." (21-year-old female college junior)

> "I started to care about my grades. I started going to class and taking it seriously. "I actually cared about where my life was going." (18-year-old female college freshman)

Three staff members at a recovery school reported that youth alcohol and other drug use is a major factor that contributes to poor academics and poor school attendance. Likewise, they each reported that achieving abstinence significantly improves academics and attendance.

Two staff members listed substance use as the top factor that contributes to poor academic performance and poor school attendance. The third staff member named substance use third, following poverty and trauma.

With regard to the 12-step programs, staff members reported:

> "If a student is faithful in attending their meetings weekly and staying sober, I see their grades and attendance stay in a normal pattern. When they are using, they are all over the place; including grades, attendance, and moods." (50-year-old female administrative assistant with 6 years' experience working with youth)

> "Recovery (12-step fellowship) seems to be the missing piece to long-term success as it provides structure, support, and accountability." (41-year-old female educator with 20 years' experience working with youth)

> "Through participation in the 12-step programs students adopt a new philosophy on how to live their lives. They become open-minded and willing to look at how their choices are impacting their lives and futures. The program offers them an opportunity to repair harms to those that have been affected by their use and restore those relationships. They begin to build their self-esteem through service work offered by the program. Their sponsors lead by example and hold them accountable." (32-year-old female clinician with 6 years' experience working with youth)