

ABSTRACT

Title of Thesis: SUBSTANCE USE AND ACADEMIC
OUTCOMES AMONG HIGH SCHOOL
SENIORS: EXAMINING THE INFLUENCE
OF EMOTIONAL ACADEMIC
ENGAGEMENT

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Substance use is prevalent among adolescents, with two-thirds trying alcohol and half trying an illicit drug by twelfth grade (Miech et al., 2015). Substance use is known to affect academic performance. This study utilized nationally representative data from the 2013 Monitoring the Future twelfth grade survey to examine the relationships between substance use, skipping school, grades, and academic engagement. One-quarter of respondents (26%) had never used a substance. The majority (67%) had used at least one substance during the past year. Substance use during their lifetime but not during the past year was uncommon (7%). Lifetime non-users were less likely than past-year users to skip school during the past month and to have low grades. Lifetime non-users also had greater academic self-efficacy and emotional academic engagement relative to past-year users. These findings underscore the importance of screening and intervention for substance use to promote academic achievement and adolescent wellbeing.

SUBSTANCE USE AND ACADEMIC OUTCOMES
AMONG HIGH SCHOOL SENIORS:
EXAMINING THE INFLUENCE OF EMOTIONAL ACADEMIC ENGAGEMENT

by

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Chapter 1: Introduction

Statement of the Problem

Improving educational outcomes among students in the United States is necessary to promote individual achievement and to sustain Americans' place in the increasingly global and knowledge-based economy. During the 2011 to 2012 academic year, 81% of students at public high schools in the United States graduated on time (Kena et al., 2015), and approximately two-thirds of high school graduates in the United States go on to attend college (Bureau of Labor Statistics, 2015). School attendance is a concern, given that students who miss school are more likely to leave high school before completing their degree (Mac Iver, 2010).

Academic outcomes are also important from a health perspective. Educational attainment has been linked to better health and lower mortality in adulthood (Hummer & Hernandez, 2013; Miech, Pampel, Kim, & Rogers, 2011; Ross & Wu, 1995). Not graduating from high school, specifically, is associated with lower life expectancy, increased likelihood of cigarette smoking, suicide attempts, asthma, diabetes, and heart disease, as well as less physical activity in adulthood (Maynard, Salas-Wright, & Vaughn, 2015; National Center for Education Statistics, 2012; Rogot, Sorlie, & Johnson, 1992; Ross & Wu, 1995; Vaughn, Salas-Wright, & Maynard, 2014). When compared with adults who did not complete their degree, high school graduates have higher incomes, and therefore are more likely to be able to afford healthy food, safe housing, and adequate health care (Freudenberg & Ruglis, 2007; Ross & Wu, 1995). High school graduates also have greater access to health information, through exposure to health educational programs in schools and greater adoption of technology (Freudenberg &

Ruglis, 2007; Fuchs, 2004). The importance of having a high school degree is enhanced among students who perform well in high school and subsequently attend college, as college graduation confers increased occupational opportunities and higher income. Finally, higher educational attainment is associated with increased social support and perceived control over one's life, which are in turn linked to better health (Ross & Wu, 1995; Uchino, 2006; Wallston, Wallston, Smith, & Dobbins, 1987). Given these health and economic implications of educational attainment, it is critical to identify ways to improve these academic outcomes.

Many factors affect academic outcomes among adolescents. In line with Bronfenbrenner's Ecological Systems Theory (1977), these factors occur levels ranging from the individual and microsystem (e.g., family and peers) to the macrosystem (e.g., the culture or economy), and each level influences academic performance. One of the factors occurring at the individual level is substance use. In the United States, 66% of adolescents have consumed alcohol by their senior year of high school and approximately half have tried an illicit drug (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2015). Substance use during adolescence is associated with a multitude of consequences for health and wellbeing, including increased risk for accidental injuries, hospitalizations, unplanned pregnancies, and substance dependence (French, Fang, & Balsa, 2011; Grant & Dawson, 1997; Helfrich & McWey, 2014; Hingson, Heeren, Jamanka, & Howland, 2000).

Among the factors that affect academic outcomes, substance use is a potentially malleable risk factor, especially if intervention occurs early in life (Carney & Myers, 2012). Screening and intervention is considered to be an important evidence-based

practice to prevent escalation of problems (Committee on Substance Abuse, 2011; Griffin & Botvin, 2010; Mitchell, Gryczynski, O'Grady, & Schwartz, 2013). The extant literature suggests that substance use and academic outcomes have a bidirectional relationship such that substance use leads to increasingly poor academic performance, and poor academic performance increases risk for substance use (Broman, 2009; Bryant, Schulenberg, Bachman, O'Malley, & Johnston, 2000; Crosnoe, 2006; Henry & Huizinga, 2007; King, Meehan, Trim, & Chassin, 2006; Patrick, Schulenberg, & O'Malley, 2016).

Purpose of the Study

The purpose of this study was to examine the relationship between substance use and two academic variables, skipping school and grades, among high school seniors. Data from Monitoring the Future (MTF), a nationally representative school-based survey of adolescents in the United States, was analyzed to evaluate how skipping school and grades differ between three groups of twelfth grade students: those who have abstained from the use of all substances in their lifetime (lifetime non-users), those who have used at least one substance during the past year (past-year users), and those who have used at least one substance during the past year but abstained during the past year (former users). This study also examined whether academic engagement mediates the relationship between substance use and the two academic outcomes.

These analyses provide two unique contributions. First, the study uniquely examined lifetime abstinence from all substance use, whereas existing studies on substance use and academic outcomes primarily measure past-month substance use and examine the influence of substances individually. Second, the study examined academic

engagement, an understudied factor in the relationship between substance use and academic outcomes, as a mediator.

Research Questions and Hypotheses

This study examined the following research questions:

1. Is lifetime abstinence from all substances associated with decreased skipping of school and higher grades among high school seniors? It was hypothesized that high school seniors who have never used alcohol, cigarettes, illicit drugs, or prescription medication used nonmedically would be less likely to report skipping school and more likely to report good grades than students who have used substances in their lifetime.

2. Does academic engagement mediate the relationship between lifetime abstinence from all substances and skipping/grades? It was hypothesized that academic engagement would be negatively associated with frequency of skipping school and positively associated with grades. Specifically, lifetime abstinence would be positively associated with academic engagement. Academic engagement would therefore be a mediator of the relationship between lifetime abstinence from substance use and skipping/grades.

Definitions

“*Illicit drugs*” refers to substances that are illegal to sell, buy, and/or use. Prescription drugs are considered illicit drugs when they are used nonmedically.

“*Skipping school*” is intentionally staying away (being absent) from school without a legitimate excuse.

“Nonmedical use of prescription drugs” means taking a prescription drug that was not prescribed to the user or for the purpose of getting high, feeling good, or experiencing another effect besides the medication’s purpose.

“Academic engagement” means “a student’s willingness, need, desire and compulsion to participate in, and be successful in, the learning process” (Bomia et al., 1997). *Emotional academic engagement* is a subtype of academic engagement that refers to a student’s positive and negative feelings toward academic experiences.

Chapter 2: Literature Review

This review will describe substance use among adolescents in the United States, the relationship between substance use and academic performance, and the connection between academic engagement and academic outcomes.

Substance Use among Adolescents in the United States

Current Prevalence and Historical Trends

Prevalence estimates for substance use among American adolescents are provided by three nationally representative datasets. First, the National Survey on Drug Use and Health (NSDUH) is an annual cross-sectional household survey on the use of tobacco, alcohol, and illicit drugs, the nonmedical use of prescription drugs, and mental health among non-institutionalized civilians ages 12 and older in the United States (Substance Abuse and Mental Health Services Administration, 2015a). Approximately 21,000 adolescents ages 12 to 17 were surveyed for the 2014 NSDUH. Second, the Youth Risk Behavior Surveillance System (YRBSS) is biennial report on health risk behaviors among students in grades 9 through 12 at public and private high schools across the United States (Brener et al., 2013). Data from a national survey as well as state, territorial, tribal, and local surveys are compiled to provide YRBSS estimates. Third, MTF is an annual classroom-based survey of substance use and related factors among eighth, tenth, and twelfth graders at public and private high schools in the United States (Johnston et al., 2015). In 2014, more than 40,000 students from 377 schools participated in MTF. Together, these three surveys provide both current prevalence estimates and information on historical trends in substance use among American adolescents. Table 1

provides lifetime and past-month estimates from the surveys for alcohol, cigarettes, and illicit drug use.

Table 1. Prevalence of Lifetime and Past-month Substance Use among Adolescents in the United States*

| | Lifetime use | | | Past-month use | | |
|--|--------------|-------|---------|----------------|-------|--------|
| | NSDUH | YRBSS | MTF** | NSDUH | YRBSS | MTF** |
| Alcohol | 30% | 66% | 27%-66% | 12% | 35% | 9%-37% |
| Cigarettes | 14% | 41% | 14%-34% | 5% | 16% | 4%-14% |
| Any illicit drug | 23% | - | 20%-49% | 9% | - | 8%-24% |
| Marijuana | 16% | 41% | 16%-44% | 7% | 23% | 7%-21% |
| Inhalants | 5% | 9% | 7%-11% | 1% | - | 1%-2% |
| Hallucinogens | 3% | 7% | 2%-5% | 1% | - | 1% |
| Cocaine | 1% | 6% | 2%-5% | <1% | - | 1% |
| Ecstasy | 1% | 7% | 1%-6% | <1% | - | 1% |
| Heroin | <1% | 2% | 1% | <1% | - | <1% |
| Methamphetamine | 1% | 3% | 1%-2% | <1% | - | <1% |
| Any prescription drug used non-medically | 9% | 18% | 20%*** | 3% | - | 6%*** |

*Data from: Centers for Disease Control and Prevention, 2015; Johnston et al., 2015; Substance Abuse and Mental Health Services Administration, 2015b.

**MTF provides estimates separately for eighth, tenth, and twelfth graders. The numbers provided in this table represent the range across these grades. In general, the lower numbers come from eighth grade estimates while the higher numbers come the twelfth grade estimates. The exception to this is inhalants, which is most prevalent among eighth graders for both lifetime and past-month use.

***Nonmedical prescription drug use is measured only among twelfth graders in MTF.

Alcohol is the most commonly used substance among adolescents, with lifetime use ranging from 27% among eighth graders in the MTF sample to 66% among the YRBSS sample and MTF twelfth graders (Centers for Disease Control and Prevention, 2015; Johnston et al., 2015; Substance Abuse and Mental Health Services Administration, 2015b). Less than one third report past-month use. Significant declines in the prevalence of alcohol use have been observed in all three datasets during the past two decades. Lifetime use is similar for males and females, and tends to be highest among Hispanic and non-Hispanic white adolescents and lowest among non-Hispanic black

adolescents (Centers for Disease Control and Prevention, 2015; Substance Abuse and Mental Health Services Administration, 2015b).

Lifetime cigarette use is less common than alcohol use. Less than one third of adolescents have smoked a cigarette at least once in their lifetime, and approximately one in ten have smoked during the past month. However, similar to alcohol use, there have been large declines in the prevalence of cigarette use since the 1990s. Demographic correlates of cigarette use are also similar to alcohol; while cigarette use is similar among males and females, it is most prevalent among Hispanic and non-Hispanic white adolescents and least prevalent among black adolescents (Centers for Disease Control and Prevention, 2015; Substance Abuse and Mental Health Services Administration, 2015b).

Estimates of lifetime use of any illicit drugs range from 20% among eighth graders to 49% among twelfth graders in the MTF sample (Johnston et al., 2015). Marijuana is the most commonly used illicit drug, with estimates for lifetime use ranging from 16% to 44% across the datasets, and past-month use ranging from 7% to 23% (Centers for Disease Control and Prevention, 2015; Johnston et al., 2015; Substance Abuse and Mental Health Services Administration, 2015b). Marijuana use is slightly more prevalent among males compared with females, and among black and Hispanic adolescents compared with white adolescents. Historical trends in marijuana use differ by dataset; while the lifetime prevalence of marijuana has increased approximately 10% among MTF samples (Johnston et al., 2015), there has been a small (approximately 4%) decline in estimates derived from NSDUH during the past decade (Substance Abuse and Mental Health Services Administration, 2015b).

Approximately one in ten adolescents has used inhalants in their lifetime, while the use of hallucinogens, cocaine, ecstasy, heroin, and methamphetamine is uncommon (Centers for Disease Control and Prevention, 2015; Johnston et al., 2015; Substance Abuse and Mental Health Services Administration, 2015b). Decreases in the lifetime prevalence of these substances are consistent between among MTF and NSDUH samples (YRBSS does not report trends for these substances; Johnston et al., 2015; Substance Abuse and Mental Health Services Administration, 2015b). Similar to marijuana, the use of other illicit drugs is slightly more prevalent among males than females (Centers for Disease Control and Prevention, 2015; Johnston et al., 2015).

The differences in prevalence estimates between these three datasets are likely attributable to methodological factors (Gfroerer, Bose, Kroutil, Lopez, & Kann, 2012). First, the MTF and YRBSS questionnaires are primarily administered in classrooms, whereas NSDUH is administered in the home. Although the NSDUH questionnaire is computer-assisted, rather than a verbal interview, the presence of family members might lead to underreporting of substance use. Second, estimates from the YRBSS are computed the Centers for Disease Control and Prevention by integrating results from national, state, territorial, and local surveys. Differences in the administration between these various surveys might affect the overall estimates. Finally, NSDUH includes a slightly younger sample included in the NSDUH (ages 12 to 17, compared with ages approximately 14 to 18 in YRBSS) and the prevalence of substance use is low among 12- to 13-year olds (Centers for Disease Control and Prevention, 2015; Substance Abuse and Mental Health Services Administration, 2015a).

Trends in Abstinence among Adolescents

Overall, substance use among adolescents has declined significantly during the past several decades. An analysis of MTF data found that the percentage of twelfth

graders who have never used cigarettes, alcohol, or illicit drugs increased from 5% in 1976 to 25% in 2013 (DuPont, 2015). Similar large increases in abstinence estimates were found for eighth and tenth graders (24% to 62% and 13% to 39%, respectively).

Risk and Protective Factors for Substance Use in Adolescence

Substance use is a complex phenomenon, and many risk and protective factors for substance use among adolescents have been identified. Consistent with the social development model (Catalano, Kosterman, & Hawkins, 1996), these risk and protective factors occur at the individual as well as family, social/peer, and environmental levels. A brief review of these factors is provided below. There is some evidence that these factors vary through adolescence, with family factors having a stronger influence among younger adolescents, and peer factors having a stronger influence among older adolescents (Cleveland, Feinberg, Bontempo, & Greenberg, 2008).

Individual Factors. Although substance use in adulthood is more prevalent among males, this gender difference does not appear to exist in adolescence (Marschall-Lévesque, Castellanos-Ryan, Vitaro, & Séguin, 2014; Schulte, Ramo, & Brown, 2009). Significant gender differences that have been found among adolescents are generally small (Centers for Disease Control and Prevention, 2015; Johnston et al., 2015; Mulye et al., 2009). Racial differences are more notable. Non-Hispanic white, Hispanic, and American Indian/Alaskan Native race is associated with higher prevalence of alcohol and illicit drug use (Mulye et al., 2009). Historically, the prevalence of marijuana use was highest among white adolescents; however, this disparity equalized in the mid-2000s and marijuana is now slightly more prevalent among black adolescents (Johnston et al., 2015). Religiosity is negatively associated with substance use (Ford & Hill, 2012;

Gryczynski & Ward, 2011; Hemphill et al., 2011; Vaughan, de Dios, Steinfeldt, & Kratz, 2011; Wallace et al., 2007).

Several mental health conditions are associated with substance use in adolescence. A diagnosis of ADHD in childhood is positively associated with developing substance use disorder later in life (Charach, Yeung, Climans, & Lillie, 2011; Lee, Humphreys, Flory, Liu, & Glass, 2011; Wilens et al., 2011). Depression and suicide ideation are also positively associated with using substances and developing substance use disorder (Deas & Thomas, 2002; Diego, Field, & Sanders, 2003; Gart & Kelly, 2015; Taylor, 2011).

Several personality traits are also positively associated with substance use. Sensation-seeking, or the desire for varied and novel experiences, is strongly associated with increased risk for substance use (Andrucci, Archer, Pancoast, & Gordon, 1989; Castellanos-Ryan & Conrod, 2011; Crawford, Pentz, Chou, Li, & Dwyer, 2003; Hittner & Swickert, 2006; Malmberg et al., 2012). Two related traits, impulsivity and urgency, are also positively associated with substance use, particularly alcohol use (Dawes, Tarter, & Kirisci, 1997; Malmberg et al., 2012; Robinson, Ladd, & Anderson, 2014; Stautz & Cooper, 2013, 2014; Verdejo-García, Lawrence, & Clark, 2008).

Family Factors. Both current substance use and history of use by family members or other important adults increase the likelihood that an adolescent will use substances (Beyers, Toumbourou, Catalano, Arthur, & Hawkins, 2004; Ewing et al., 2015). Genetics studies, namely twin studies, have demonstrated that a predisposition for substance use dependence can be inherited (Goldman, Oroszi, & Ducci, 2005; Hopper, Crowley, & Hewitt, 2003; Kendler, Karkowski, Neale, & Prescott, 2000; Meyers & Dick, 2010).

These findings have been particularly strong for alcohol use and dependence (Ducci & Goldman, 2008; McGue, Elkins, & Iacono, 2000; Stacey, Clarke, & Schumann, 2009).

Several aspects of the relationship between adolescents and their parents are also known to affect risk for substance use. First, adolescents who report better relationships with their parents (e.g., less conflict, higher parental attachment) are less likely to report alcohol, tobacco, and marijuana use (Beyers et al., 2004; Hemphill et al., 2014; Kristjansson, Sigfusdottir, Allegrante, & Helgason, 2008). Second, increased parental monitoring, or the extent to which parents know how, where, and with whom their child spends time, has been shown to decrease the likelihood of substance use among adolescents (Branstetter & Furman, 2013; DiClemente et al., 2001; Hoffmann & Bahr, 2014; Van Ryzin, Fosco, & Dishion, 2012).

Social/Peer Factors. Adolescents are highly influenced by perceived peer substance use, particularly when the peers are perceived to be of a higher social status (D'Amico & McCarthy, 2006; Teunissen et al., 2012; Trucco, Colder, & Wieczorek, 2011). Adolescents who describe themselves as “popular” or having a higher social status at school are also at a higher risk for substance use (Otten, Wanner, Vitaro, & Engels, 2009; Sweeting & Hunt, 2015). Studies have consistently found that associating with deviant peers increases risk for substance use, regardless of whether deviance is defined as substance use or other conduct issues (Hemphill et al., 2011; Kristjansson et al., 2008; Marschall-Lévesque et al., 2014). Studies have also shown victims of bullying during adolescence are more likely to use substances, both concurrently and later in adolescence (Kelly et al., 2015; Radliff, Wheaton, Robinson, & Morris, 2012; Reisner, Greytak, Parsons, & Ybarra, 2015).

Environmental Factors. Adolescents from neighborhoods with high levels of disorder, more permissive drug laws, and greater perceived availability of drugs are more likely to report substance use (Beyers et al., 2004; Furr-Holden et al., 2011; Hemphill et al., 2011).

Relationship between Substance Use and Academic Outcomes

Both longitudinal and cross-sectional studies of adolescents have found an association between substance use and academic outcomes. Two conceptualizations of the relationship between substance use and academic outcomes have been examined in the research literature; one with academic performance as the predictor variable, and one with substance use as the predictor variable. Although various measures of academic performance have been utilized, the balance of the literature focuses truancy (skipping school) and grades.

Academic Performance as a Predictor of Substance Use

Longitudinal Studies. Several longitudinal studies have found grades to be a predictor of subsequent substance use. In his large study of $n=11,927$ middle and high school students, Crosnoe (2006) found that past-year alcohol use was significantly more likely at follow-up among students who reported receiving Ds or Fs at baseline. This relationship was stronger than the association between alcohol use at baseline and grades at follow-up, although both associations were significant. In her sample of seventh graders followed over three years, Henry (2010b) identified growth trajectories of grades and frequency of polydrug use. These trajectories were correlated, such that students who experienced declining grades over the three years also experienced increasingly frequent drug use.

One longitudinal study also examined the role of school bonding in the relationship between grades and cigarette use (Bryant et al., 2000). In this study, which followed a cohort of adolescents from eighth to twelfth grade, low grades in eighth grade were associated with increases in cigarette use between eighth and tenth, as well as tenth and twelfth, grades. School bonding was tested as a mediator but was not found to be significant.

Two longitudinal studies have investigated truancy as a predictor of substance use. First, Henry and Huizinga (2007) found that truancy at age 11 predicted initiating alcohol, tobacco, and marijuana use by age 15. This association was significant after controlling for a variety of other risk factors for substance use, including sex, race/ethnicity, grades, and self-rated commitment to schoolwork. The authors suggested that this relationship might be mediated by unsupervised time with deviant peers. Second, in a study of minority adolescents surveyed from ages 14 to 16, students who had skipped school during the past six months reported using significantly more substances (alcohol and other illicit drugs) than non-truant students, even when controlling for sex, race/ethnicity, and prior delinquency (Henry & Thornberry, 2010). Henry again posited that unsupervised time with peers could account for the increased substance use among truant youth, and also suggested that school bonding might act as a mediator in the relationship between truancy and substance use.

Cross-sectional Studies. Among the cross-sectional studies on academic factors related to use, truancy has emerged as having the strongest relationship. Hallfors et al. (2002) used combined data from two nationally-representative surveys of high school students (YRBSS and MTF) to investigate the relationship between risk-indicators and

past-month substance use. Truancy, defined as skipping or cutting school during the past four weeks, and grade point average (GPA) were both significantly associated with substance use. Specifically, truant students were three to four times more likely to use alcohol, three to six times more likely to use marijuana, and two to five times more likely to smoke (depending on grade level), compared with students who did not skip school. Odds ratios for low GPA also significant but smaller, suggesting that truancy is a stronger correlate of substance use than GPA. The authors theorized that lower grades during middle school eventually led to decreased motivation, which in turn contributed to weaker attachment to school and increased truancy.

Henry (2010a) examined past-month substance use among four categories of students: those who skipped only classes, those who skipped up to half a school day, those who skipped entire days of school, and those who had not skipped at all during the current school year. Cigarette, alcohol, and marijuana use was more prevalent among truant students, regardless of how much the students skipped. For example, 59% of “day skippers” reported cigarette use, compared with 17% of non-truant students. These variables remained significantly explanatory after controlling for school bonding, interest in school, and GPA.

Although truancy appears to be a stronger academic factor related to substance use (Hallfors et al., 2002), several studies have found significant associations between GPA and substance use. Hallfors, Hyunsan, Brodish, Flewelling, and Khatapoush (2006) investigated both GPA and truancy, and found that both were significant correlates of cigarette, alcohol, and marijuana use. Using a small sample of high school seniors ($n=89$), Diego, Field, and Sanders (2003) found GPA was negatively associated with

likelihood of using cigarettes, alcohol, marijuana, and cocaine. Compared with other variables, such as popularity and depression, academic performance had the strongest association with substance use among this sample. Similarly, Schulenberg, Bachman, O'Malley, and Johnston (1994) found that high school GPA was negatively associated with past-month use of cigarette, alcohol, marijuana, and other illicit drugs during senior year.

Only one cross-sectional study of school enjoyment and substance use was located. Among their sample of $n=112$ urban adolescents, Trenez, Dune, Zur, and Latimer (2015) found that students who felt good, very good, or excellent about school were 65% less likely to have problematic substance use than students who felt bad or not so good about school. Failing a class and being sent to the principal was also correlated with problematic substance use among this sample.

Conceptual Framework of Academic Outcomes Predicting Substance Use. After reviewing literature on substance use and academic performance, Bachman et al. (2008, p. 29) theorized the following conceptual framework for the relationship. When an adolescent performs poorly in school, the failure causes the student to feel distressed or to blame themselves. This negative emotions associated with academics leads the student to disengage from school. Substance use, and often association with other disengaged peers, is subsequently initiated by the student as a mechanism for coping with disengagement from school. Using this framework to guide their analyses of longitudinal data from MTF, the authors examined the relationship between academic outcomes and the use of cigarettes, marijuana, cocaine, and alcohol. The mechanisms linking academic outcomes and substance use were found to be similar across substances. In general, poor adjustment

at school, as measured by variables such as being sent to the principal, truancy, or suspensions, was associated with an increased likelihood of using these substances.

Substance use, in turn, was predictive of lower educational attainment.

Substance Use as a Predictor of Academic Outcomes

Considerably less research has focused on the effect of substance use on academic outcomes in high school as compared to the effect of academics on substance use.

However, both longitudinal and cross-sectional studies of adolescents have found an association between substance use and subsequent academic outcomes.

Longitudinal Studies. Many of the longitudinal studies examining substance use as a predictor of academic outcomes have focused on educational attainment, namely attending and completing college (King et al., 2006; Maggs et al., 2015; Patrick et al., 2016; Yan & Brocksen, 2013). In one large study of high school seniors followed to age 25, the likelihood of attending a four-year college and graduating from a four-year college by age 25 was significantly lower among respondents who had used cigarettes and marijuana during high school (Patrick et al., 2016). Another study that followed adolescents through age 25 found that increases in substance use throughout adolescence were associated with a lower likelihood of attending or graduating from college in young adulthood (King et al., 2006). Alcohol use also appears to be related, with one study reporting that binge drinking in high school was negatively associated with college enrollment by age 20, particularly among students who began drinking prior to age 13 (Yan & Brocksen, 2013).

This relationship between substance use and educational attainment might be mediated by socioeconomic status. Broman (2009) found that both alcohol use and illicit

drug use in adolescence were associated with years of education completed by young adulthood; however, this association was positive for alcohol use and negative for illicit drug use. In both cases, the association was partially mediated by socioeconomic achievement, which was operationalized as whether the respondent had received food stamps or similar subsidies during the past year.

Grades have been less frequently utilized as an academic outcome in longitudinal studies. Two such studies have focused on alcohol use. Crosnoe, Benner, & Schneider (2012) categorized adolescents in grades 7 to 12 as frequent, occasional, or non-users based on frequency of alcohol use during the past year at baseline. Baseline drinking category was significantly associated with GPA two years later, controlling for baseline grades. Balsa, Giuliano, and French (2011) found that the number of drinks during the past month and number of drinks per drinking occasion were negatively associated with GPA for male, but not female, adolescents. The magnitude of these associations was small, but the authors acknowledged a large proportion of missing data that could have excluded more extreme situations (e.g., students with very low grades or heavy alcohol use).

One study examined other substance use as a predictor of grades. Briere, Fallu, Morizot, and Janosz (2014) did not find an association between past-year use of marijuana, stimulants, hallucinogens, or “other hard drugs” in seventh grade and GPA in grades 10 and 11. However, controlling for baseline risk factors was complicated by multicollinearity between baseline variables, and the authors acknowledged this as a limitation.

Cross-sectional Studies. Although few cross-sectional have examined the relationship between substance use and academic outcomes, these studies have taken advantage of large nationally-representative samples. Two of these studies have used truancy as their academic outcome. Using data on eighth and tenth graders from one wave of MTF ($n=11,167$), Henry (2007) found that students who had used cigarettes, alcohol, and marijuana during the past month were significantly more likely than non-users to report skipping days of school during the past month. For example, 37% of tenth grade marijuana users reported skipping school, compared with only 12% of non-users. Similar results were found in the analysis of data from the National Household Surveys of Drug Abuse (now known as NSDUH; $n=15,168$) by Roebuck, French, & Dennis (2004). Among adolescents aged 12 to 18 who had not completed a high school degree, marijuana users were significantly more likely to have dropped out of high school than non-users. Among the adolescents who were still enrolled in school, marijuana use was positively associated with truancy.

Two other cross-sectional studies have used grades as their dependent variable. Martins and Alexandre (2009) utilized samples of adolescents from NSDUH and the YRBS ($ns=65,294$ and $27,592$, respectively) to test the association between the use of several substances (ecstasy, marijuana, alcohol, and tobacco) grades during the past semester. In both samples, low-to-moderate academic achievement was more prevalent among users of ecstasy, marijuana, alcohol, and tobacco. This association was stronger for ecstasy than for the other substances. One study using a smaller sample of African American adolescents ages 11 to 18 ($n=291$) similarly found that grades were

significantly lower among students who had used marijuana and/or alcohol during the past month (Clark, Belgrave, & Nasim, 2008).

Academic Outcomes Following Substance Use Treatment. Research on academic performance following substance use treatment is also useful for understanding this relationship, because these studies describe whether academic performance improves when substance use is no longer a factor. One study of adolescents who met criteria for substance dependence found that the likelihood of school attendance increased significantly twelve months following initiation of treatment (Balsa, Homer, French, & Weisner, 2009). Engberg & Morral (2006) reported similar results; adolescents who decreased their use of alcohol, stimulants, and other drugs after entering substance use treatment were significantly more likely to attend school twelve months after entering substance use treatment, compared with adolescents who did not decrease the frequency of their use. Increased likelihood of school attendance was also observed among baseline marijuana users who abstained completely from marijuana at follow-up. Finally, one longitudinal study of adolescents seeking inpatient treatment for substance dependence identified six trajectories of substance use over ten years from leaving treatment through young adulthood (Anderson, Ramo, Cummins, & Brown, 2010). The likelihood of graduating from high school was significantly higher among the abstainers and infrequent users compared with other trajectories of use. Collectively, these studies show that that decreasing or abstaining from substance use increases the likelihood of school attendance/completion, suggesting that substance use does negatively affect academic outcomes. These findings also demonstrate that substance users are not necessarily poor students to begin with; the improved outcomes following cessation from substance use

suggest that they are capable of being better students but are hindered academically by their substance use.

Mechanisms Linking Substance Use and Subsequent Academic Performance.

Two potential mechanisms have been suggested to explain declines in academic performance following initiation of substance use. First, substance use is associated with neurocognitive effects that can impede academic performance. These effects appear to be both acute (during or immediately following intoxication) and residual (occurring after a period of abstinence). Alcohol use during adolescence has been linked to deficits in verbal and nonverbal retention and visuospatial functioning, poor planning abilities, as well as structural deficits in the hippocampus (Brown, Tapert, Granholm, & Delis, 2000; De Bellis et al., 2000; Jacobus & Tapert, 2013; Zeigler et al., 2005). Similar results have been found for marijuana, with acute deficits in information processing, ability to recall information, concentration, attention, and impulse control found among adolescent marijuana users (Crean, Crane, & Mason, 2011; Fontes et al., 2011). There is also some evidence for residual neurocognitive effects of marijuana. Bolla, Brown, Eldreth, Tate, and Cadet (2002) found that heavy marijuana users experience deleterious effects in neurocognitive tasks testing verbal and visual memory, even after abstaining from marijuana for one month.

Although research on the neurocognitive effects of adolescent substance use has focused on alcohol and marijuana, one study found that methamphetamine users ages 13 to 18 performed worse than non-users on measures of non-verbal reasoning, verbal memory, and self-monitoring (Cuzen, Koopowitz, Ferrett, Stein, & Yurgelun-Todd, 2015). Similarly, one study of cognitive performance among young adults reported

poorer performance on verbal recall and spatial memory tasks among ecstasy users compared with ecstasy-naïve controls (Hanson & Luciana, 2004).

Across substances, these neurocognitive effects appear to be worse when substance use is initiated early in adolescence or when substance use is chronic (Crean et al., 2011; Ehrenreich et al., 1999; Fontes et al., 2011; Zeigler et al., 2005). These cognitive functions are essential for learning, and learning is likely to suffer among adolescents who experience deficits in these areas.

The second mechanism that has been suggested is related to reward perception and the relative prioritization of school versus the immediate rewarding sensations substance use (DuPont et al., 2013). The cognitive-motivational theories of addiction posit that substance use leads to an “attentional-bias craving cycle” (van Hemel-Ruiter, de Jong, Oldehinkel, & Ostafin, 2013). In this cycle, previous experience with the immediate rewarding effects of substance use creates an attentional bias among users, such that heightened attention is paid to drug-related cues. This heightened attention leads to cravings for the drug, which in turn increase the likelihood of repeated drug use. These theories are supported by laboratory studies showing that substance users are more sensitive to and more motivated by perceived reward than non-users. In their investigation of substance use and reward-related attentional bias, van Hemel-Ruiter, de Jong, Oldehinkel, and Ostafin (2013) found that engagement with reward and nonpunishment was heightened among adolescent substance users. The authors suggest that substance users are inclined toward enhanced processing of reward, thus creating attentional bias toward the positive effects of substance use.

Given attentional bias toward the immediate rewarding effects of substance use, it is plausible that reward perception might play a role in the relationship between substance use and academic performance. When compared with the immediate, and often strong, positive feelings of intoxication, academic tasks might feel less rewarding. The reward perception-based conceptualization of substance use and academic performance posits that as students begin to use substances, their attention is shifted toward seeking the immediate effects of substance use (DuPont et al., 2013). The students become less engaged in school as academic endeavors no longer feel rewarding. These endeavors are thus de-prioritized and academic performance suffers.

Directionality of the Relationship between Substance Use and Academic Outcomes

Despite the abundance of research on the relationship between substance use and academic outcomes among adolescents, debate remains over the directionality of the relationship. Taken in summary, however, the findings described in the previous sections suggest that there is a bidirectional relationship, such that substance use both influences and is influenced by academic outcomes. For example, Bachman et al. (2008) concluded that academic experiences predicts substance use more strongly than use predicts performance. However, significant findings linking substance use to subsequent academic outcomes were also found. For example, smoking at age 14 was associated with an increased likelihood of dropping out of high school by age 18, and smoking at age 18 was associated with lower educational attainment by age 22. These associations with substance use as the predictor variable were generally small, but did reach statistical significance. Additionally, a review of this conceptual framework by DuPont et al. (2013)

highlights the framework's assumption that academic performance is stable through adolescence. This element of the framework discounts individuals who experience significant declines in their academic performance during adolescence, and therefore might not be accurate for all adolescents.

Academic Engagement

Academic engagement is an important dimension of academic success (York, Gibson, & Rankin, 2015). The majority of research on academic engagement among adolescents focuses on engagement as a malleable characteristic rather than an outcome. A variety of terms has been used to describe the construct, including "engagement," "student engagement," "academic engagement," and "school engagement" (Connell & Wellborn, 1991; Fredricks, Blumenfeld, & Paris, 2004; Furlong et al., 2003; Libbey, 2004; Natriello, 1984).

Researchers have provided a multitude of conceptualizations of academic engagement, and no single definition of the construct has been widely accepted (Appleton, Christenson, & Furlong, 2008). Some, primarily earlier, examinations of engagement have used narrower definitions of the construct, such as participation in school activities (Finn, 1993; Natriello, 1984) or time spent on classroom tasks (Shepherd, Evans, Cherry, & Higgins, 1990). However, more recent conceptualizations of engagement have focused on its multidimensional nature (Appleton et al., 2008; Fredricks et al., 2004; Jimerson, Campos, & Greif, 2003), with Fredricks, Blumenfeld, and Paris (2004) describing it as a "meta construct."

Among the various conceptualizations of academic engagement, there are three commonly identified subtypes of engagement (Appleton et al., 2008). *Behavioral*

engagement is operationalized as participation in extracurricular activities, effort spent on schoolwork, and completion of assignments (Appleton et al., 2008; Fredricks et al., 2004; Jimerson et al., 2003). Earlier studies of engagement were often limited to the behavioral component (Jimerson et al., 2003). Due to the relatively easily observable nature of these measures, as well as its longer history in the literature, behavioral engagement is the most widely studied subtype of engagement (Appleton et al., 2008). Both cross-sectional and longitudinal studies have found a positive association between behavioral engagement and academic outcomes, such as test scores, overall grades, and persistence in school (Alexander, Entwisle, & Dauber, 1993; Alexander, Entwisle, & Horsey, 1997; Finn & Rock, 1997; Fredricks et al., 2004; Marks, 2000).

Emotional engagement is the positive and negative feelings a student has toward academic experiences (Appleton et al., 2008; Fredricks et al., 2004). This construct is sometimes limited to emotions toward teachers and peers (Jimerson et al., 2003), while other definitions include emotions toward a wider variety of aspects of the school experience (e.g., interest in course topics, perceived value of schoolwork; Fredricks et al., 2004). It is theorized that positive emotions increase a sense of belonging at school, which in turn increases motivation to complete schoolwork (Fredricks et al., 2004).

Emotional engagement is related to research on the role of values in academics. Eccles (1983) proposed that performing academic behaviors is related the value placed on the behavior, and that value has four components: interest, attainment value, utility value, and cost. Three of these components are relevant to emotional engagement: interest (enjoying school activities), attainment value (perceiving school as important to one's self-schema), and utility value (perceiving school as important for accomplishing future

goals; Eccles, 1983; Fredricks et al., 2004). Eccles posited that the greater level of each of these types of values that is placed on school, the more motivated a student will be to engage in academic behaviors.

Emotional engagement has received less attention in the literature than behavioral engagement, and many studies that measure emotional engagement do not evaluate its effects separate from behavioral engagement (Fredricks et al., 2004). However, several studies have found an association between components of emotional engagement and academic outcomes. A study of seventh graders found that students who placed higher intrinsic value on school (i.e., were more interested in the coursework and perceived school to be important) performed better on school assignments (Pintrich & De Groot, 1990). A meta-analysis found that interest in coursework accounts for approximately 10% of variance in academic achievement among students in fifth through twelfth grade (Schiefele, Krapp, & Winteler, 1992). Another study found that test scores in fourth grade were positively associated with school identification, a combined measure of value and belongingness at school, in seventh grade (Voelkl, 1997). Finally, a longitudinal study that followed students as they transitioned from middle school to high school found that belongingness at school was associated with students' academic performance during the same school year (Gillen-O'Neel & Fuligni, 2013). The study also reported a gender difference in the trends of belongingness, such that it decreased among females throughout high school but remained stable for males.

Cognitive engagement focuses on the investment aspect of academic endeavors; it is the student's willingness to invest time and effort into performing tasks necessary for learning (Fredricks et al., 2004). This is considered to be distinct from behavioral

engagement (simply participating in academic activities) because cognitive engagement implies motivation to gain understanding of the material. Self-regulation is considered to be a marker of cognitive engagement, as the planning, monitoring, and evaluation involved in academic self-regulation indicates willingness to exert effort to learn (Fredricks et al., 2004).

Although defined separately, the three subtypes of academic engagement are related processes that influence each other. The relationship between engagement and school dropout is particularly useful for demonstrating how the subtypes interact (Appleton et al., 2008). From an engagement perspective, dropout is considered to be a gradual process (Appleton et al., 2008; Finn, 1989). Students who perceive school to be uninteresting or not valuable (i.e., low emotional engagement) are unlikely to invest time and effort into learning (i.e., low cognitive engagement). Unwillingness to invest time or effort, as well as negative emotionality towards school, decrease the desire to participate in school activities (i.e., low behavioral engagement).

Given these interrelationships, all three subtypes are important for determining a student's overall academic engagement, and therefore all three represent targets for interventions that promote academic outcomes. These interventions have focused primarily on behavioral engagement, as participation in academics (i.e., attendance) is easier to mandate than motivation or perceived value (Appleton et al., 2008; Fredricks et al., 2004; Mosher & MacGowan, 1985). However, interventions designed to promote overall academic engagement among adolescents have led to favorable academic outcomes, such as lower dropout rates, better attendance, completing more credits, and

completing assignments (Sinclair, Christenson, Evelo, & Hurley, 1998; Sinclair, Christenson, & Thurlow, 2005).

Contribution of the Present Study to the Literature

The present study makes two unique contributions to the literature on substance use and academic achievement. First, studies of substance use as a risk factor for poor academic outcomes have primarily operationalized “substance use” by measuring the use of various substances individually (Broman, 2009; Bryant, Schulenberg, O'Malley, Bachman, & Johnston, 2003; Clark et al., 2008; Henry, 2007; Patrick et al., 2016). No study that included a comprehensive measure of all substance use could be found. These analyses contribute towards this gap in the literature by comparing academic outcomes among students who have and have not abstained from all substance use. Additionally, the substance use variables used in prior studies have focused on past-month use (Broman, 2009; Bryant et al., 2003; Clark et al., 2008; Hemphill et al., 2014; Henry, 2007; Patrick et al., 2016). The present study examined lifetime abstinence from substance use, which has not been explored in the existing studies.

Second, these analyses explored the relationship between substance use and academic engagement among high school students. Although there is literature on substance use and academic outcomes, namely attendance and grades, the association between substance use and engagement remains understudied. Only two studies examining substance use and academic engagement could be located. One study only included students in middle school and did not measure illicit drug use (Li & Lerner, 2011). The other study found a significant association between substance use and academic achievement among high school students, but only measured illicit drug use

(Brière et al., 2014). Therefore, these analyses contribute to the understanding of the relationship between any substance use, academic engagement, and academic outcomes.

Chapter 3: Manuscript

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Substance Use, Academic Performance, and Academic Engagement among High School Seniors

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Abbreviations:

AOR: adjusted odds ratio
ASE: academic self-efficacy
CI: confidence interval
EAE: emotional academic engagement
MTF: Monitoring the Future study
PCA: principal components analysis

What's known on this subject: Substance use is prevalent among adolescents and known to affect academic performance. Few studies have focused on the association between abstaining from all substance use and skipping, grades, or academic engagement.

What this study adds: Adolescents who abstained from substance use had better grades and higher levels of academic engagement than former or current users. Screening and interventions to reduce substance use should be evaluated as a way to promote academic achievement.

Abstract

Background and objectives: Substance use is a prevalent risk behavior known to affect academic performance among adolescents. Understanding factors that influence academic performance among adolescents is necessary to promote academic achievement, which in turn affects health. This study aimed to: 1) describe the relationship between abstinence from substance use, skipping school, grades, and academic engagement; and 2) examine whether academic engagement mediates the relationship between substance use and skipping/grades.

Methods: We utilized a nationally representative data of high school seniors (N=13,180) from the 2013 Monitoring the Future dataset. Respondents were categorized as lifetime non-users, former users, and past-year users based on the use of 14 substances.

Regression models were used to evaluate the relationship between this substance use variable and four academic variables: skipping school, grades, academic self-efficacy, and emotional academic engagement. The academic engagement variables were evaluated as mediators of grades and skipping.

Results: Approximately one-quarter of respondents had never used cigarettes, alcohol, or other drugs during their lifetime. When controlling for demographics, past-year users were three times more likely than lifetime non-users to skip school and twice as likely to have low grades. Lifetime non-users reported significantly higher levels of academic self-efficacy and emotional academic engagement than past-year users. No evidence of mediation by academic engagement was found.

Conclusions: Findings suggest that adolescents who abstain from all substance use might experience better academic outcomes than substance users. Programs promoting

abstinence from substance use, as well as screening and intervention, could be an important strategy to promote academic achievement and overall adolescent health.

Introduction

In the United States, 66% of adolescents have consumed alcohol by their senior year of high school and approximately half have tried an illicit drug (Johnston et al., 2015). Substance use during adolescence is associated with a multitude of consequences for health and well-being, including increased risk for accidental injuries, hospitalizations, unplanned pregnancies, and substance dependence (French et al., 2011; Grant & Dawson, 1997; Hingson et al., 2000). While these health effects of substance use are well known, less attention has been directed at the impact of substance use on academic achievement. For instance, marijuana use has been associated with lower grades, a greater likelihood of skipping school and dropping out of high school, and a lower likelihood of enrolling in college (Bray, Zarkin, Ringwalt, & Qi, 2000; Brook, Stimmel, Zhang, & Brook, 2008; Hallfors et al., 2002; Homel, Thompson, & Leadbeater, 2014; Jiang, Mermin, Perry, & Hesser, 2013).

Promoting academic achievement in adolescence is relevant to adolescent and adult health. Not graduating from high school is associated with lower life expectancy, increased risk for cigarette smoking, suicide attempts, asthma, diabetes, and heart disease, as well as less physical activity in adulthood (Maynard et al., 2015; Rogot et al., 1992; Vaughn et al., 2014). When compared with adults who did not complete their degree, high school graduates have higher incomes, and therefore are more likely to be able to afford healthy food, safe housing, and adequate health care (Freudenberg & Ruglis, 2007; Ross & Wu, 1995). Higher educational attainment is associated with lower mortality

(Hummer & Hernandez, 2013; Miech et al., 2011), as well as increased social support and perceived control over one's life, which are in turn linked to better health (Ross & Wu, 1995; Uchino, 2006). Given the health implications of educational attainment, it is critical to encourage academic achievement early in life.

Substance use is among the many factors that can interfere with academic achievement. Not only is substance use associated with learning and memory deficits that can impede academic performance (Brown et al., 2000; Crean et al., 2011; Cuzen et al., 2015; De Bellis et al., 2000; Jacobus & Tapert, 2013), but it might also be related to decreased engagement or motivation in academic pursuits. As students become involved in substance use, their attention is shifted toward its immediate rewarding effects (van Hemel-Ruiter et al., 2013) rather than longer-term rewards associated with academic endeavors. These endeavors are thus de-prioritized and academic performance can suffer.

Although existing studies have found an association between substance use and academic outcomes (Bachman et al., 2008; Crosnoe, 2006; Hallfors et al., 2002; Henry, 2010a; Henry, 2010b; King et al., 2006), these studies have primarily measured past-month substance use. By comparison, lifetime abstinence from all forms of substance use is rarely considered. Furthermore, the association between substance use and academic engagement has not been studied.

The objectives of this study were to: (1) describe the relationship between lifetime abstinence from all substances and skipping school, low grades, and academic engagement among adolescents; and (2) examine whether academic engagement mediates the relationship between substance use, skipping, and grades. We hypothesized that adolescents who have never used alcohol, cigarettes, illicit drugs, and prescription

medications nonmedically would be less likely to skip school and have low grades than students who have used substances in their lifetime, and that differences in academic engagement explain these relationships.

Methods

Design

This is a cross-sectional analysis of secondary data from the 2013 Monitoring the Future (MTF) study (Inter-university Consortium for Political and Social Research, 2015). MTF is an ongoing nationally-representative, classroom-based study of students at public and private schools in the contiguous United States (Bachman, Johnston, O'Malley, Schulenberg, & Miech, 2015). Questionnaires are self-administered in classrooms at schools selected through multistage random sampling. The study is approved by the University of Michigan Institutional Review Board. Further detail regarding the study design and methods is available elsewhere (Bachman et al., 2015; Johnston et al., 2015).

Sample

The analytic sample consisted of 11,416 twelfth graders with valid data for lifetime and past-year substance use. Twelfth grade was chosen because of the availability of data on academic engagement, which is not assessed for younger students.

Measures

Substance Use. Lifetime and past-year use was assessed for 14 substances, including cigarettes, alcohol, eight illicit drugs, and four classes of prescription drugs used nonmedically, with the questions “On how many occasions (if any) have you used [substance]: a: in your lifetime? b: during the last 12 months?” Responses were provided

on a nine-point scale with options ranged from “0 occasions” to “40 or more,” and later dichotomized as “use” or “non-use.”

A variable was computed to categorize respondents into one of three mutually exclusive categories: lifetime non-users of any substance, former users (used at least one substance but no past-year use), and users of at least one substance during the past year. Due to missing data, respondents were first categorized based on their use of the eleven substances, and then reclassified as necessary based on responses for methamphetamine, MDMA, and inhalant use. MTF does not assess past-year cigarette use; past 30-day use was substituted when computing this variable.

Skipping School. Skipping school was assessed via the question “During the last four weeks, how many whole days of school have you missed because you skipped or ‘cut’?” Responses were provided on a 7-point scale ranging from “None” to “11 or more days” and later dichotomized as “None” or “1 or more days.”

Grades. To assess high school grades, students were asked, “Which of the following best describes your average grade so far in high school?” with nine response options ranging from “D” to “A.” These responses were dichotomized as “Low grades” (C+ or lower) or “High grades” (B- or higher).

Academic Engagement. Nine items assessed aspects of academic engagement. Table 2 lists these variables and their response options. A principal components analysis (PCA) was conducted for the nine items assessing academic engagement. Factors with eigenvalues > 1.0 were retained. Two items with factor loadings < 0.6 were dropped. The resulting PCA identified two factors. The first factor was comprised of two items, both related to academic self-efficacy (ASE). These items were averaged to create a self-

efficacy score, with higher scores indicating greater self-efficacy in academic abilities. The second factor was comprised of five items related to emotional academic engagement (EAE), which is the positive and negative feelings a student has toward academic experiences (Appleton et al., 2008; Fredricks et al., 2004). These items were averaged to create an EAE score. Higher EAE scores indicated more positive feelings towards school.

Covariates. Seven covariates were included due to their association with either substance use and/or academic performance: sex, age, race/ethnicity, highest level of parental education, hours worked per week during school year, geographic region of the respondent's school, and type of high school program. With the exception of geographic region, all covariates were self-reported. Race/ethnicity is a categorical variable computed by MTF based on self-report. Respondents selected one or more responses from a list of nine race/ethnicity categories. The responses were recoded to include "Black or African American," "White," or "Hispanic." Respondents who indicated other races or who indicated more than one race were coded by MTF as "Missing" for this variable. Respondents originally coded as "Missing" were recoded as "Other" and included in these analyses.

Table 2. MTF Items Assessing Academic Engagement and Principal Components Analysis (PCA) Results

| Variable | Question | Response Options | PCA Factor Loadings | | Final Result |
|---|--|---|---------------------|----------------|-----------------------|
| | | | Factor 1 | Factor 2 | |
| Self-rating: Intelligence | Compared with others your age throughout the country, how do you rate yourself on school ability? | 1 (Far below average) to 7 (Far above average) | 0.933 | - | Retained in ASE score |
| Self-rating: Ability in school | How intelligent do you think you are compared with others your age? | 1 (Far below average) to 7 (Far above average) | 0.925 | - | Retained in ASE score |
| Interest in courses | How important do you think the things you are learning in school are going to be for your later life? | 1 (Not important) to 5 (Very important) | - | 0.803 | Retained in EAE score |
| Likes going to school | Going to school has been an enjoyable experience for me. | 1 (Disagree) to 5 (Agree) | - | 0.774 | Retained in EAE score |
| School work is meaningful | How often do you feel that the school work you are assigned in meaningful and important? | 1 (Never) to 5 (Almost always) | - | 0.771 | Retained in EAE score |
| Importance of school topics for later life | How interesting are most of your courses to you? | 1 (Very dull) to 5 (Very exciting and stimulating) | - | 0.731 | Retained in EAE score |
| Enjoyment of school experience | Some people like school very much. Others don't. How do you feel about going to school? | 1 (I don't like it at all) to 5 (I like it very much) | - | 0.677 | Retained in EAE score |
| Satisfaction with educational experiences | How much do you agree or disagree with each statement below? Doing well in school is important for getting a good job. | 1 (Disagree) to 5 (Agree) | | <i>Dropped</i> | |
| Importance of doing well in school for getting a good job | How satisfied are you with your educational experiences? | 1 (Completely dissatisfied) to 7 (Completely satisfied) | | <i>Dropped</i> | |

Note: Seven of these items were form-specific and were not asked of all respondents. The PCA and subsequent academic engagement analyses were restricted to respondents with valid data for these items (n=1857). Only factor loadings > |0.3| are displayed.

Statistical Analyses

Data were analyzed using SPSS (IBM SPSS Statistics Version 22.0, IBM Corporation).

Comparisons between Substance Use Groups. All variables measured were examined for differences between the three groups of interest using z tests to compare proportions for categorical variables. Logistic regression models for skipping school and high school grades were developed, and linear regression models were developed for the ASE and EAE scores. All regression models were adjusted for covariates. Sex, age, and race/ethnicity were retained in these models regardless of statistical significance. Estimated marginal means measuring the likelihood of skipping school, likelihood of getting low grades, mean ASE score, and mean EAE score (adjusted for covariates) were obtained from the regression models.

Evaluation of Academic Engagement as a Mediator. Baron and Kenny's (1986) procedures were used to evaluate whether or not the ASE score or EAE score mediated the relationship between substance use group and the academic variables (ASE score, EAE score, skipping school and grades) for a total of four mediation analyses. Beta weights were examined to assess whether mediation occurred.

Results

Approximately one-quarter (26.1%) of the sample had never used any substance in their lifetime (see Table 4). Former substance use was uncommon (7.2%), while the majority of the sample (66.7%) used at least one substance during the past year. Half (47.4%) of the sample was male and the majority (60.2%) was white. Approximately one-quarter (27.7%) of the sample skipped at least one day of school during the past four

Table 3. Overall Sample Characteristics and Comparisons between Substance Use Groups

| | Overall (<i>n</i> =11461) | | Lifetime Non-users (<i>n</i> =2989; 26.1%) | | Former Users (<i>n</i> =822; 7.2%) | | Past-year Users (<i>n</i> =7650; 66.7%) | |
|--|-------------------------------|----------|--|----------|--|----------|---|----------|
| | % | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | <i>n</i> |
| Sex (% male) | 47.4 | 5432 | 48.1 ^{a,b} | 1389 | 45.1 ^a | 355 | 49.9 ^b | 3688 |
| Age (% 18 years or older) | 56.7 | 6493 | 55.0 ^a | 1638 | 59.4 ^a | 488 | 57.3 ^a | 4367 |
| Race/ethnicity | | | | | | | | |
| White | 60.2 | 6898 | 56.6 ^a | 1691 | 53.0 ^a | 436 | 62.4 ^b | 4771 |
| Black | 9.6 | 1101 | 11.9 ^a | 356 | 12.8 ^a | 105 | 8.4 ^b | 640 |
| Hispanic | 15.4 | 1761 | 14.2 ^a | 425 | 18.5 ^b | 152 | 15.5 ^{a,b} | 1184 |
| Other/biracial/missing | 14.8 | 1701 | 17.3 ^a | 517 | 15.7 ^{a,b} | 129 | 13.8 ^b | 1055 |
| Highest level of education completed by a parent | | | | | | | | |
| Less than a high school degree | 18.1 | 2213 | 15.2 ^a | 483 | 23.2 ^b | 221 | 18.6 ^c | 1509 |
| High school degree | 35.4 | 4330 | 32.8 ^a | 1039 | 35.6 ^{a,b} | 339 | 36.4 ^b | 2952 |
| Some college | 20.1 | 2454 | 20.3 ^a | 645 | 18.0 ^a | 171 | 20.2 ^a | 1638 |
| College degree or higher | 26.4 | 3235 | 31.7 ^a | 1004 | 23.1 ^b | 220 | 24.8 ^b | 2011 |
| Hours worked per week during school year | | | | | | | | |
| 0 hours | 39.7 | 4385 | 15.2 ^a | 483 | 23.2 ^b | 221 | 39.7 ^c | 4385 |
| Up to 10 hours | 21.2 | 2345 | 32.8 ^a | 1039 | 35.6 ^a | 339 | 21.2 ^b | 2345 |
| 11 to 20 hours | 20.4 | 2252 | 20.3 ^a | 645 | 18.0 ^{a,b} | 171 | 20.4 ^b | 2252 |
| More than 20 hours | 18.7 | 2065 | 31.7 ^a | 1004 | 23.1 ^b | 220 | 18.7 ^c | 2065 |
| Geographic region of school | | | | | | | | |
| Northeast | 20.6 | 2358 | 17.2 ^a | 513 | 14.4 ^a | 118 | 22.6 ^b | 1727 |
| North Central | 24.8 | 2848 | 27.8 ^a | 830 | 24.2 ^{a,b} | 199 | 23.8 ^b | 1819 |
| Southeast | 31.2 | 3576 | 30.6 ^a | 916 | 39.2 ^b | 322 | 30.6 ^a | 2338 |
| West | 23.4 | 2679 | 24.4 ^a | 730 | 22.3 ^a | 183 | 23.1 ^a | 1766 |

Table 3, continued

| | Overall (n=11461) | | Lifetime Non-users (n=2989; 26.1%) | | Former Users (n=822; 7.2%) | | Past-year Users (n=7650; 66.7%) | |
|--|----------------------|------|---------------------------------------|------|-------------------------------|-----|------------------------------------|------|
| | % | n | % | n | % | n | % | n |
| High school program* | | | | | | | | |
| College preparatory | 53.3 | 6104 | 61.7 ^a | 1810 | 47.5 ^b | 378 | 52.4 ^c | 3916 |
| General | 33.0 | 3781 | 26.2 ^a | 767 | 37.5 ^b | 298 | 36.3 ^b | 2716 |
| Vocational/technical | 3.5 | 398 | 2.9 ^a | 84 | 4.7 ^b | 37 | 3.7 ^{a,b} | 277 |
| Other/don't know | 8.0 | 918 | 9.3 ^a | 272 | 10.3 ^a | 82 | 7.5 ^b | 564 |
| Skipped school (% skipped at least one day during the past four weeks) | 27.7 | 3013 | 12.8 ^a | 360 | 21.1 ^b | 164 | 34.3 ^c | 2489 |
| Average high school grade (% B- or higher) | 84.9 | 9454 | 91.3 ^a | 2653 | 84.2 ^b | 666 | 82.5 ^b | 6135 |

Note: Cells within the same row not sharing a common superscript are significantly different at $p < .05$. MTF does not assess past-year cigarette use; past-30 day use was substituted when categorizing into the substance use groups.

Table 4. Results of Regression Models Evaluating the Association between Substance Use and Academic Variables

| | Skipping school | Low average grades | Academic self-efficacy score | Emotional academic engagement score |
|--|---------------------|---------------------|------------------------------|-------------------------------------|
| | AOR (95% CI) | AOR (95% CI) | AOR (95% CI) | AOR (95% CI) |
| Sex (Ref=Male) | 1.06 (0.96, 1.16) | 0.62 (0.55, 0.70)** | 0.78 (0.75, 0.81)** | 0.96 (0.89, 1.04) |
| Race (Ref=Non-Hispanic white) | | | | |
| Black | 0.88 (0.73, 1.04) | 2.02 (1.67, 2.46)** | 0.97 (0.90,1.04) | 1.16 (0.99, 1.35) |
| Hispanic | 1.10 (0.95, 1.26) | 1.35 (1.14, 1.60)** | 0.82 (0.77, 0.87)** | 1.23 (1.09, 1.39)** |
| Other/missing | 1.19 (1.04, 1.37)* | 1.15 (0.96, 1.38) | 0.95 (0.90, 1.01) | 1.05 (0.93, 1.18) |
| Age (Ref=Less than 18 years old) | 1.11 (1.01, 1.22)* | 1.15 (1.02, 1.30)* | 0.98 (0.94, 1.02) | 1.02 (0.94, 1.10) |
| Parents' highest level of education completed (Ref=Less than a high school degree) | | | | |
| High school degree | 0.92 (0.81, 1.06) | 0.72 (0.61, 0.84)** | 1.10 (1.04, 10.17)** | 1.06 (0.94, 1.20) |
| Some college | 0.92 (0.79, 1.08) | 0.58 (0.48, 0.69)** | 1.30 (1.22, 1.39)** | 1.00 (0.88, 1.14) |
| College degree or higher | 0.79 (0.68, 0.92)** | 0.42 (0.35, 0.51)** | 1.51 (1.42, 1.61)** | 1.09 (0.96, 1.24) |
| Hours worked per week during school year (Ref=0 hours) | | | | |
| Up to 10 hours | 1.13 (1.00, 1.29) | 0.70 (0.59, 0.83)** | 1.11 (1.06, 1.17)** | 0.95 (0.86, 1.06) |
| 11 to 20 hours | 1.42 (1.26, 1.61)** | 0.90 (0.76, 1.06) | 1.01 (0.96, 1.07) | 0.91 (0.82, 1.02) |
| More than 20 hours | 1.65 (1.46, 1.88)** | 1.17 (1.00, 1.36) | 1.01 (0.95, 1.06) | 0.81 (0.73, 0.91)** |
| Geographic region (Ref=Northeast) | | | | |
| North Central | 0.67 (0.58, 0.78)** | 1.04 (0.87, 1.24) | 0.97 (0.91, 1.03) | 0.98 (0.87, 1.10) |
| Southeast | 1.32 (1.16, 1.50)** | 0.94 (0.79, 1.11) | 1.00 (0.94, 1.06) | 0.98 (0.88, 1.10) |
| West | 1.33 (1.15, 1.53)** | 1.37 (1.14, 1.64)** | 1.03 (0.96, 1.09) | 0.98 (0.87, 1.11) |
| High school program (Ref=College preparatory) | | | | |
| General | 1.47 (1.30, 1.59)* | 3.17 (2.78, 3.61)** | 0.57 (0.55, 0.59)** | 0.74 (0.68, 0.81)** |
| Vocational/technical | 1.28 (0.99, 1.65) | 2.27 (1.68, 3.08)** | 0.67 (0.60, 0.74)** | 0.90 (0.72, 1.12) |
| Other/don't know | 1.19 (0.99, 1.43) | 3.98 (3.27, 4.85)** | 0.48 (0.44, 0.52)** | 0.73 (0.62, 0.86)** |
| Substance use (Ref=Lifetime abstinence) | | | | |
| Former user | 1.64 (1.32, 2.04)** | 1.63 (1.25, 2.11)** | 0.89 (0.81, 0.96)** | 0.87 (0.75, 1.00) |
| Past-year user | 3.16 (2.77, 3.59)** | 2.02 (1.72, 2.37)** | 0.90 (0.86, 0.95)** | 0.73 (0.66, 0.80)** |

CI, confidence interval; AOR, adjusted odds ratio. * $p < .05$, ** $p < .01$

weeks. High average grades (B- or higher) were reported by the majority of the sample (84.9%). Males, white adolescents, adolescents from the Northeast, and adolescents who did not work during the school year were overrepresented among the past-year users, relative to lifetime non-users. A greater proportion of lifetime non-users had at least one college-educated parent compared with former users and past-year users.

Skipping School

As hypothesized, past-year users were three times more likely than lifetime non-users to skip school (AOR = 3.16, 95% CI: 2.77-3.59; see Table 4). Former users were significantly more likely to skip school than lifetime non-users (AOR = 1.64, 95% CI: 1.32-2.04). Even after adjusting for covariates, 15% of lifetime non-users skipped school during the past month, compared with 22% among former users and 35% among past-year users (see Figure 1a).

High School Grades

As hypothesized, past-year users were twice as likely as lifetime non-users to get low grades (prevalence 21% compared with 11%; AOR = 2.02, 95% CI: 1.72-2.37), even after adjusting for covariates. Former users were also more likely than non-users to get low grades, but were not significantly different from past-year users. All covariates were significant in this model.

Academic Self-Efficacy and Emotional Academic Engagement Scores

Compared with past-year users, the lifetime non-users had significantly higher scores for both ASE and EAE (scores adjusted for covariates; see Table 4, Figure 1b). Former users were not significantly different than lifetime non-users or past-year users on either measure of academic engagement.

Figure 1a. Estimated Marginal Means for Probability of Skipping School or Getting Low Average Grades

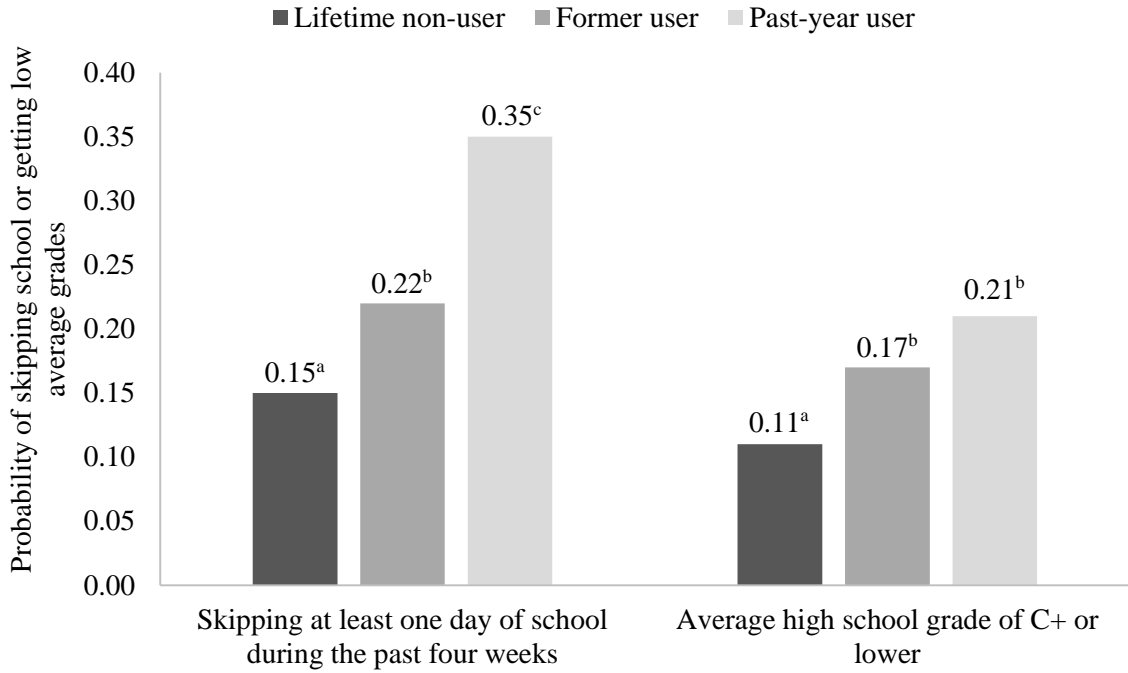
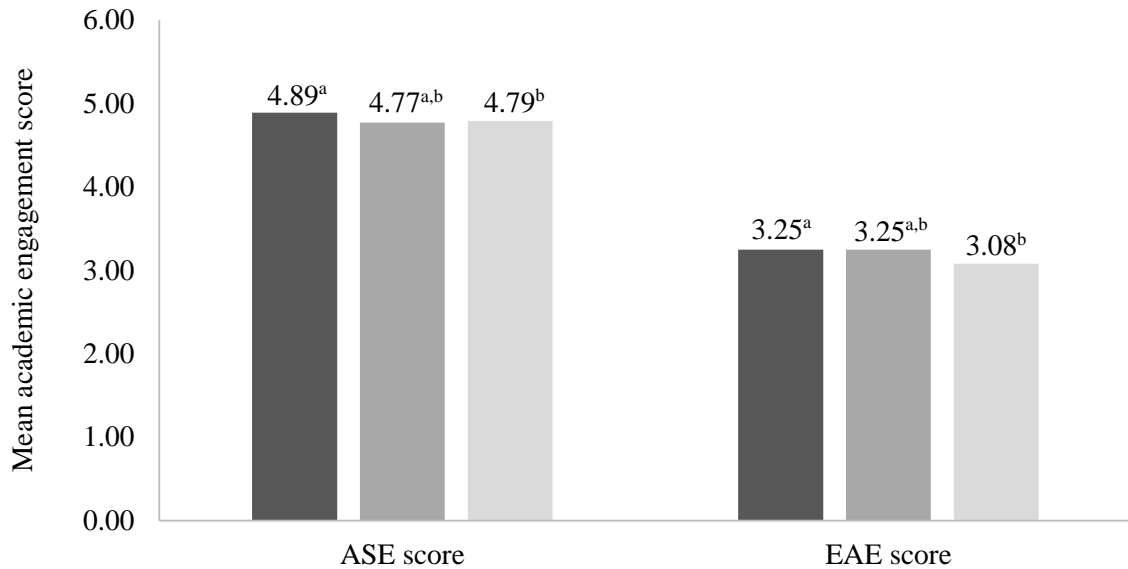


Figure 1b. Estimated Marginal Means for Academic Engagement Scores



Note: Estimate marginal means are adjusted for covariates. ASE scores ranged from 1-7, with higher scores indicated greater self-efficacy in academic abilities. EAE scores ranged from 1-5, with higher scores indicating greater positive feelings towards school. Bars within the same variable not sharing the same superscript are significant different than each other at $p < .05$.

Mediation Analyses

The three-group substance use variable had a direct effect on each engagement score, and each engagement score had a direct effect on the academic outcome (all $ps < .001$). However, beta weights decreased by less than one standard error when academic self-efficacy and EAE scores were added as factors into the analyses modeling the relationship between the three-group substance use variable, skipping, and grades. Therefore, no clear evidence of mediation was found.

Discussion

Utilizing a large, nationally representative sample of high school seniors, we examined the associations between abstinence from substance use and academic variables. Although the majority of the sample had used at least one substance during the past year, a sizeable minority of high school seniors (26.1%) had abstained from all forms of substance use in their lifetime. The results provide support for the hypothesized association between lifetime abstinence from substance use and academic variables. Specifically, lifetime abstinence was significantly associated with a decreased likelihood of skipping a day of school during the past four weeks and an increased likelihood of having an average high school grade of C+ or lower. These findings are consistent with previous studies of adolescents that found an association between substance use and grades (Balsa et al., 2011; Clark et al., 2008; Crosnoe et al., 2012; Martins & Alexandre, 2009), as well as skipping school (Henry, 2007).

In contrast to other studies that look abstinence from one substance, this study focused on adolescents who abstained from all substance use. Research to describe motivations for not using substances could inform efforts to prevent adolescent substance

use. One such study, also utilizing MTF data, found that 50% of high school seniors had never used marijuana during their lifetime. Among these students, concerns about psychological and physical harms were the most frequently cited reasons for abstaining from marijuana use (Terry-McElrath, O'Malley, & Johnston, 2008). However, further research is needed to describe characteristics of abstainers and their reasons for non-use. Additionally, whereas the focus of the present study was to evaluate the overall association between abstinence and academic variables, future studies should examine the potential moderating effects of race, gender, and socioeconomic status.

Although “experimentation” with substance use is considered to be a common behavior in adolescence (Griffin & Botvin, 2010), desistance of substance use was less common among this sample than persistence. The former use subsample might reflect adolescents who ceased using substances following treatment for a substance use disorder. Further research is warranted to describe long-term patterns of early substance use involvement during adolescence.

This study extends the literature by demonstrating differences in academic engagement between substance users and non-users. Specifically, we found that lifetime non-users had greater self-efficacy in their academic abilities and more positive feelings towards their education, relative to past-year substance users, even after adjustment for a number of potentially confounding variables. This finding is consistent with previous work that found an increased likelihood of illicit drug use among adolescents with declining academic engagement (Li & Lerner, 2011).

Contrary to our hypothesis, no evidence of a mediating effect of academic engagement was found, although a direct relationship was found between substance use

and academic performance. It is possible that our operationalization of academic engagement was not sufficient to detect a mediating effect. Future research is needed to evaluate other measures of academic engagement as a mechanism underlying the association between substance use and academic achievement.

Additional research is needed to evaluate other factors that might mediate the relationship between substance use and academic outcomes. In particular, peer and parental factors should be considered, as they have been shown to affect both risk for substance use and academic performance. Affiliation with deviant peers is a risk factor for substance use during adolescence (Van Ryzin et al., 2012), and association with these peers might negatively affect negative engagement (Stanard, Belgrave, Corneille, Wilson, & Owens, 2010). By contrast, positive family relationships and parental monitoring in high school appear to be protective factors related to substance use (Branstetter & Furman, 2013; Clark, Shamblen, Ringwalt, & Hanley, 2012; Van Ryzin et al., 2012).

Several limitations of the present study must be noted. First, we are unable to infer causality in differences in academic outcomes by substance use due to the cross-sectional nature of the data. Future research should utilize longitudinal research designs to examine temporality in the relationship between substance use and subsequent changes in academic engagement and academic outcomes. Second, self-report data may be influenced by recall or social desirability bias. Third, we had to make inferences regarding group membership if a student had not used MDMA, methamphetamine, or inhalants. However, it is unlikely that this decision impacted our results given that the use of illicit drugs other than marijuana rarely occurs in the absence of alcohol, cigarette, or marijuana use (Conway et al., 2013; O'Grady, Arria, Fitzelle, & Wish, 2008). Although

we controlled for a variety of covariates, we were unable to account for the effects of externalizing behaviors and conduct problems, which are more common among substance users than non-users and is negatively associated with academic achievement (Hinshaw, 1992; King & Chassin, 2008). To ease interpretation of estimates from the regression models, dichotomized variables were used for skipping school and grades. It is possible that using continuous variables for these measures would alter the interpretation of the results.

Finally, adolescents who dropped out of high school or were not present in class on the day of data collection are not included in this sample. Adolescents who skip school are more likely to be substance users than students who do not skip (Hallfors et al., 2002; Henry, 2010a), and high school students who have a substance use disorder or experience serious academic failure might drop out prior to their senior year. Therefore, these results may underestimate the prevalence of substance use, skipping, and low grades. Further research on this topic utilizing community-based samples, rather than school-based, is needed to avoid possible bias from absenteeism and dropout.

With respect to clinical implications, these findings underscore the importance of prevention, screening, and intervention efforts related to adolescent substance use. Screening and intervention is considered to be an important evidence-based practice to prevent the escalation of problems related to substance use (Committee on Substance Abuse, 2011; Griffin & Botvin, 2010; Mitchell et al., 2013). The American Academy of Pediatrics recommends using the CRAFFT to screen all adolescent patients for alcohol and drug use at well visits, as well as acute care visits when appropriate (Committee on Substance Abuse, 2011; Knight, Sherritt, Shrier, Harris, & Chang, 2002). However,

screening for substance use is not a common practice, with less than half of primary care physicians screening their adolescent patients for alcohol and drug use using a validated screening tool (Harris et al., 2012; Sterling, Kline-Simon, Wibbelsman, Wong, & Weisner, 2012). Brief advice about substance use given by physicians to adolescent patients has been shown to be effective at reducing substance use, and interventions are particularly beneficial when they occur early in adolescence (Carney & Myers, 2012). The findings of the present study could be a compelling argument for conveying to adolescent patients, as well as parents, that abstaining from substance use is associated with better academic achievement than current or even former use. Inquiring about school, such attendance and grades, could be incorporated into adolescent patient-provider communication. Additionally, academic engagement measures could be used to develop a screening tool to quickly identify adolescents who are at risk for academic difficulties and substance use.

Conclusions

A sizeable minority of adolescents have abstained from substance use in their lifetime. Lifetime non-users are less likely to skip school or get low grades and have higher levels of academic engagement relative to former and current substance users. Screening and intervention to address substance use among adolescents is important to promote academic achievement and adolescent wellbeing.

Chapter 4: Summary

This study analyzed a large, nationally representative sample of high school seniors to examine the relationship between substance use, academic performance, and academic engagement. Specifically, I sought to: (1) describe the relationship between substance and two academic outcomes, skipping school during the past month and average high school grades; and (2) evaluate whether academic engagement mediates the relationship between substance use and skipping school/grades.

One-quarter of high school seniors (26%) had never used any substance in their lifetime, while two-thirds (67%) had used at least one substance during the past year. As hypothesized, past-year users were three times more likely than lifetime non-users to skip school during the past four weeks and twice as likely to have “low” average grades (C+ or lower) in high school.

Former substance use (use during their lifetime but not during the past year) was uncommon (7%). However, this group appears to differ from lifetime non-users and past-year users. Former users were more likely than lifetime non-users to skip school and get low average grades. They were also less confident in their academic abilities and had less positive feelings towards their education, relative to lifetime non-users. Past-year users had less positive feelings towards school and were more likely to skip school than former users, but these groups did not differ significantly on academic self-efficacy or average grades.

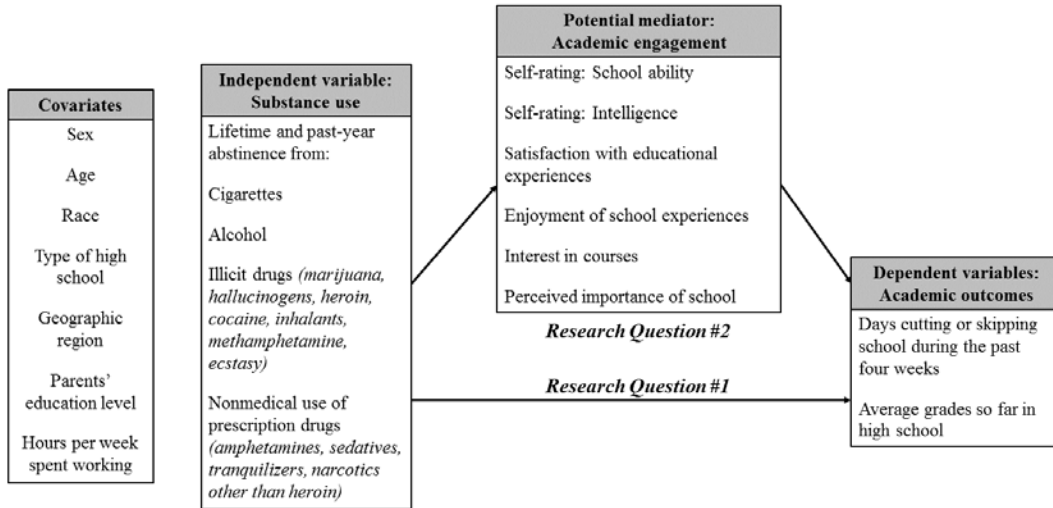
The three substance use groups differed significantly on the measures of engagement. Specifically, lifetime non-users were more confident in their academic abilities relative to both former users and past-year users, and had more positive feelings

toward their education relative to past-year users. However, no evidence was found to support that academic engagement mediates the relationship between substance use and skipping school/grades. Further research is needed to examine other potential mechanisms that underlie the effect of substance use on academic outcomes.

In conclusion, a sizeable minority of high school seniors have abstained from all substance use during their lifetime, and these students experience better academic outcomes than substance users. Programs promoting abstinence from substance use, as well as screening and interventions to address substance use, are important to promote academic achievement and adolescent wellbeing.

Appendices

Appendix 1: Conceptual Model for Relationship between Lifetime Abstinence from Substance Use, Skipping School, and Grades among High School Seniors



Appendix 2: Monitoring the Future Variables Used in Analyses

Academic outcomes

| Variable description | MTF abbreviation | Question | Response options | Form | Available n | Variable # |
|---|-------------------------|---|---|-------------|--------------------|-------------------|
| Days cutting or skipping school (past four weeks) | #DA/4W SC MS CUT | During the last four weeks, how many whole days of school have you missed because you skipped or “cut”? | 1: None 2: 1 day 3: 2 days 4: 3 days 5: 4-5 days 6: 6-10 days 7: 11+ days | Core | 12,054 | V2176 |
| Average grades | R HS GRADE/D=1 | Which of the following best describes your average grade so far in high school? | 1: D 2: C- 3: C 4: C+ 5: B- 6: B 7: B+ 8: A- 9: A | Core | 12,383 | V2179 |

Academic engagement

| Variable description | MTF abbreviation | Question | Response options | Form | Available n | Variable # |
|---|-------------------------|---|--|-------------|--------------------|-------------------|
| Self-rating: Ability in school | RT SF SCH AB>AVG | Compared with others your age throughout the country, how do you rate yourself on school ability? | 1: Far below average 2: Below average 3: Slightly below average 4: Average 5: Slightly above average 6: Above average 7: Far above average | Core | 12,415 | V2173 |
| Self-rating: Intelligence | RT SF INTELL>AVG | How intelligent do you think you are compared with others your age? | 1: Far below average 2: Below average 3: Slightly below average 4: Average 5: Slightly above average 6: Above average 7: Far above average | Core | 12,427 | V2174 |
| Satisfaction with educational experiences | SAT EDUC EXPRNC | How satisfied are you with your educational experiences? | Likert 1 (completely dissatisfied) to 4 (neutral) to 7 (completely satisfied) | 1 | 2,186 | V1645 |

Academic engagement, continued

| Variable description | MTF abbreviation | Question | Response options | Form | Available n | Variable # |
|---|-------------------------|--|--|-------------|-----------------------------|-------------------|
| Enjoyment of school experience | GO SCH ENJY XPR | How much do you agree or disagree with each statement below? Going to school has been an enjoyable experience for me. | 1: Disagree 2: Mostly disagree 3: Neither agree nor disagree 4: Mostly agree 5: Agree | 1 | 2,166 | V1680 |
| School work is meaningful | SC WRK NVR MNG | How often do you feel that the school work you are assigned in meaningful and important? | 1: Never 2: Seldom 3: Sometime 4: Often 5: Almost always | 1, 6 | 4,005 (1,891 + 2,114) | V1683, V6221 |
| Interest in courses | MST COUR V DUL | How interesting are most of your courses to you? | 1: Very dull 2: Slightly dull 3: Fairly interesting 4: Quite interesting 5: Very exciting and stimulating | 1, 6 | 4,055 (1,886 + 2,169) | V1684, V6222 |
| Likes going to school | R LIKES SCHOOL | Some people like school very much. Others don't. How do you feel about going to school? | 1: I don't like it at all 2: I don't like it very much 3: I like it some 4: I like it quite a bit 5: I like it very much | 1, 2 | 3,839 (1,893 + 1,946) | V1682, V2371 |
| Importance of doing well in school for getting a good job | DO WL SC IMP/JB | How much do you agree or disagree with each statement below? Doing well in school is important for getting a good job. | 1: Disagree 2: Mostly disagree 3: Neither agree nor disagree 4: Mostly agree 5: Agree | 1 | 2,165 | V1681 |
| Importance of school topics for later life | LRN SCH NT IMP | How important do you think the things you are learning in school are going to be for your later life? | 1: Not important 2: Slightly important 3: Fairly important 4: Quite important 5: Very important | 1, 6 | 4,041 (1,884 + 2,157) | V1685, V6223 |

Substance use variables—Lifetime use

| Variable description | MTF abbreviation | Question | Response options | Form | Available n | Variable # |
|--|----------------------------------|---|-------------------------|-------------|--------------------|-------------------|
| Ever smoked cigarettes | EVR SMK CIG, REGL (dichot) | Have you ever smoked cigarettes? | 0: No 1: Yes | Core | 12,779 | V2101D |
| Ever drank alcohol | EVER DRINK | Next we want to ask you about drinking alcoholic beverages, including beer, wine, liquor, and any other beverage that contains alcohol. Have you ever had any alcoholic beverage to drink--more than just a few sips? | 1: No 2: Yes | Core | 10,407 | V2103 |
| Ever used marijuana or hashish | #XMJ+HS/LI FETIME (dichot) | On how many occasions (if any) have you used marijuana (grass, pot) or hashish (hash, hash oil) in your lifetime? | 0: No 1: Yes | Core | 12,608 | V2115D |
| Ever used LSD | #X LSD/ LIFETIME (dichot) | On how many occasions (if any) have you used LSD (“acid”) in your lifetime? | 0: No 1: Yes | Core | 12,680 | V2118D |
| Ever used hallucinogens other than LSD | #X PSYD/ LIFETIME (dichot) | On how many occasions (if any) have you used hallucinogens other than LSD (like mescaline, peyote, “shrooms,” psilocybin, PCP) in your lifetime? | 0: No 1: Yes | Core | 12,619 | V2121D |
| Ever used amphetamines | #X AMPH/ LIFETIME (dichot) | On how many occasions (if any) have you taken amphetamines on your own – that is, without a doctor telling you to take them – in your lifetime? | 0: No 1: Yes | Core | 12,600 | V2127D |
| Ever used sedatives nonmedically | #X SED/BARB/ LIFE (dichot) | On how many occasions (if any) have you take sedatives on your own – that is, without a doctor telling you to take them – in your lifetime? | 0: No 1: Yes | Core | 12,616 | V2133D |
| Ever used tranquilizers nonmedically | #X TRQL/ LIFETIME (dichot) | On how many occasions (if any) have you taken tranquilizers on your own – that is, without a doctor telling you to take them – in your lifetime? | 0: No 1: Yes | Core | 12,613 | V2136D |

Substance use variables—Lifetime use, continued

| Variable description | MTF abbreviation | Question | Response options | Form | Available <i>n</i> | Variable # |
|----------------------------------|----------------------------------|--|---|-------------|-------------------------------|-----------------------|
| Ever used inhalants | #X INHL/ LIFETIME (dichot) | On how many occasions (if any) have you sniffed glue, or breathed the contents of aerosol spray cans, any other gases, or sprays in order to get high in your lifetime? | 0: No 1: Yes | Core | 6,332 | V2145D |
| Ever used narcotics nonmedically | #X NARC/ LIFETIME (dichot) | On how many occasions (if any) have you taken narcotics other than heroin on your own – that is, without a doctor telling you to take them – in your lifetime? | 0: No 1: Yes | Core | 12,522 | V2142D |
| Ever used heroin | #X H/LIFETIME | On how many occasions (if any) have you used heroin in your lifetime? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 12,603 | V2139 |
| Ever used crack cocaine | #X CRACK/ LIFETIM | Forms 1,3,4,6: On how many occasions (if any) have you used “crack” (cocaine in chunk or rock form) in your lifetime? Forms 2,5: On how many occasions (if any) have you used “crack” cocaine in your lifetime: | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 12,267 | V2459 |

Substance use variables—Lifetime use, continued

| Variable description | MTF abbreviation | Question | Response options | Form | Available n | Variable # |
|----------------------------------|--------------------------|--|---|------|-------------|------------|
| Ever used crack cocaine | #X CRACK/ LIFETIM | Forms 1,3,4,6: On how many occasions (if any) have you used “crack” (cocaine in chunk or rock form) in your lifetime? Forms 2,5: On how many occasions (if any) have you used “crack” cocaine in your lifetime? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 12,267 | V2459 |
| Ever used other forms of cocaine | #XOTH COKE/LIFE | On how many occasions (if any) have you used cocaine in any other form in your lifetime? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 8,383 | V2042 |
| Ever used methamphetamine | #X METHAMPH / LIFE | On how many occasions (if any) have you used methamphetamine (meth, speed, crank, crystal meth) by any method in your lifetime? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 4,196 | V2029 |
| Ever used ecstasy | #X MDMA/ LIFETIME | On how many occasions (if any) have you used MDMA (“ecstasy”) in your lifetime? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 4,217 | V2032 |

Substance use variables—Past-year use

| Variable description | MTF abbreviation | Question | Response options | Form | Available n | Variable # |
|---|-------------------------|---|---|-------------|--------------------|-------------------|
| Past-year use of alcohol | #X ALC/ ANN SIPS | On how many occasions (if any) have you had alcoholic beverages to drink—more than just a few sips—during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 12,379 | V2105 |
| Past-year use of marijuana or hashish | #XMJ+HS/ LAST12MO | On how many occasions (if any) have you used marijuana (grass, pot) or hashish (hash, hash oil) during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 12,600 | V2116 |
| Past-year use of LSD | #X LSD/ LAST 12MO | On how many occasions (if any) have you used LSD (“acid”) during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 12,675 | V2119 |
| Past-year use of hallucinogens other than LSD | #X PSYD/ LAST 12MO | On how many occasions (if any) have you used hallucinogens other than LSD (like mescaline, peyote, “shrooms” or psilocybin, PCP) during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 12,616 | V2122 |
| Past-year use of amphetamines | #X AMPH/ LAST12MO | On how many occasions (if any) have you taken amphetamines on your own—that is, without a doctor telling you to take them—during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 12,607 | V2128 |

Substance use variables—Past-year use, continued

| Variable description | MTF abbreviation | Question | Response options | Form | Available n | Variable # |
|---|-------------------------|--|---|------|-------------|------------|
| Past-year use of crack cocaine | #X CRACK/ LAST12M | On how many occasions (if any) have you used “crack” (cocaine in chunk or rock form) during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 12,266 | V2460 |
| Past-year use of cocaine other than crack | #XOTH COKE/12MO | On how many occasions (if any) have you used cocaine in any other form during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 8,382 | V2043 |
| Past-year use of methamphetamine | #X METHAMPH /12MO | On how many occasions (if any) have you used methamphetamine (meth, speed, crank, crystal meth) by any method during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 4,159 | V2030 |
| Past-year use of ecstasy | #X MDMA/ LAST 12MO | On how many occasions (if any) have you used MDMA (“ecstasy”) during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 4,212 | V2033 |
| Past-year use of heroin with a needle | #X H 12M USE NDL | On how many occasions (if any) have you taken heroin using a needle during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 6,361 | V2511 |

Substance use variables—Past-year use, continued

| Variable description | MTF abbreviation | Question | Response options | Form | Available n | Variable # |
|---|----------------------|---|---|------|-------------|------------|
| Past-year use of heroin without a needle | #X H 12M W/O NDL | On how many occasions (if any) have you taken heroin WITHOUT using a needle during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 6,333 | V2514 |
| Past-year nonmedical use of sedatives | #X SED/ BARB/12MO | On how many occasions (if any) have you taken sedatives on your own—that is, without a doctor telling you to take them—during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 12,616 | V2134 |
| Past-year nonmedical use of tranquilizers | #X TRQL/ LAST12MO | On how many occasions (if any) have you taken tranquilizers on your own—that is, without a doctor telling you to take them—during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 12,614 | V2137 |
| Past-year nonmedical use of narcotics other than heroin | #X NARC/ LAST12MO | On how many occasions (if any) have you taken narcotics other than heroin on your own—that is, without a doctor telling you to take them—during the last 12 months? | 1: 0 occasions 2: 1-2x 3: 3-5x 4: 6-9x 5: 10-19x 6: 20-39x 7: 40+ occasions | Core | 12,532 | V2143 |

Covariates

| Variable description | MTF abbreviation | Question | Response options | Form | Available <i>n</i> | Variable # |
|---|------------------------|--|--|------|--------------------|----------------|
| Sex | Rs SEX | What is your sex? | 1: Male 2: Female | Core | 12,257 | V2150 |
| Race* | Rs RACE B/W/H | How do you describe yourself? | 1: Black 2: White 3: Hispanic | Core | 10,827 | V2151 |
| Age | AGE <> 18 DICHOTOMY | Variable created based on three questions: 1) In what year were you born?; 2) In what month were you born?; and 3) Date of questionnaire administration (recorded by interviewer). | 1: < 18 years 2: 18+ years | Core | 12,686 | RESPONDENT_AGE |
| Mother's education level | MOTHR EDUC LEVEL | What is the highest level of school your mother completed? | 1: Grade school 2: Some high school 3: Completed high school | Core | 12,611 | V2164 |
| Father's education level | FATHR EDUC LEVEL | What is the highest level of schooling your father completed? | 4: Some college 5: Completed college 6: Graduate or professional school after college 7: Don't know, or does not apply | Core | 12,607 | V2163 |
| High school program | R'S HS PROGRAM | Which of the following best describes your present high school program? | 1: College prep 2: General 3: Vocational/technical 4: Other, or don't know | Core | 12,448 | V2172 |
| Geographic region | SCH REG-4 CAT | N/A | 1: Northeast 2: North central 3: South 4: West | Core | 13,180 | V13 |
| Hours per week spent working during the school year | HRS/W WRK SCHYR | On the average over the school year, how many hours per week do you work in a paid or unpaid job? | 1: None; 2: 5 or less hours 3: 6 to 10 hours 4: 11 to 15 hours 5: 16 to 20 hours 6: 21 to 25 hours 7: 26 to 30 hours 8: More than 30 hours | Core | 12,251 | V2191 |

*Respondents were allowed to pick one or more of the following options: Black or African American; Mexican American or Chicano; Cuban American; Puerto Rican; Other Hispanic or Latino; Asian American; White (Caucasian); American Indian or Alaska Native; Native Hawaiian or Other Pacific Islander. This variable, the only race variable available, is recoded in this dataset to only include Black or African American; White (Caucasian); or Hispanic. Respondents who indicated other races, or who indicated more than one race, are "missing."

Appendix 4: Comparison of Respondents Included and Excluded in Academic Engagement Analyses

| | Included in analyses | | Excluded from analyses | | Sig. |
|---|----------------------|----------|------------------------|----------|------|
| | % | <i>n</i> | % | <i>n</i> | |
| Sex (% male) | 47.7 | 862 | 50.2 | 5242 | .059 |
| Race | | | | | |
| Non-Hispanic white | 58.8 | 1091 | 55.7 | 6305 | .014 |
| Black | 10.2 | 190 | 10.8 | 1224 | |
| Hispanic | 15.6 | 290 | 15.3 | 1727 | |
| Other/missing | 15.4 | 286 | 18.3 | 2067 | |
| Age (% less than 18 years old) | 43.1 | 795 | 4603 | 42.5 | .629 |
| Parents' highest level of education completed | | | | | |
| Less than a high school degree | 17.3 | 309 | 18.2 | 1904 | .630 |
| High school degree | 35.4 | 634 | 35.4 | 3696 | |
| Some college | 21.0 | 376 | 19.9 | 2078 | |
| College degree or higher | 26.4 | 472 | 26.5 | 2763 | |
| Hours worked per week during school year | | | | | |
| 0 hours | 41.2 | 756 | 39.9 | 4160 | .550 |
| Up to 10 hours | 20.2 | 371 | 21.1 | 2196 | |
| 11 to 20 hours | 20.7 | 380 | 20.1 | 2093 | |
| More than 20 hours | 18.0 | 330 | 18.9 | 1965 | |
| Geographic region | | | | | |
| Northeast | 18.5 | 343 | 20.5 | 2317 | .263 |
| North Central | 24.7 | 458 | 24.3 | 2752 | |
| Southeast | 33.1 | 614 | 32.1 | 3635 | |
| West | 23.8 | 442 | 23.1 | 2619 | |
| High school program | | | | | |
| College prep | 54.0 | 987 | 53.1 | 5637 | .574 |
| General | 33.6 | 614 | 34.1 | 3620 | |
| Vocational/technical | 4.1 | 74 | 3.7 | 394 | |
| Other/don't know | 8.3 | 152 | 9.1 | 970 | |
| Substance use | | | | | |
| Lifetime non-user | 20.7 | 328 | 26.9 | 2661 | .000 |
| Former user | 10.8 | 170 | 6.6 | 652 | |
| Past-year user | 68.5 | 1038 | 66.5 | 6567 | |

UNIVERSITY OF MARYLAND COLLEGE PARK
Institutional Review Board
Human Subject Research Determination

| | | | |
|------------------------|--|---------------|--|
| Principal Investigator | | Email Address | |
|------------------------|--|---------------|--|

| | | | |
|------------------------------|--|----------------------|--|
| Student/Co- Investigators | | Email Address(es) | |
|------------------------------|--|----------------------|--|

| | |
|----------------|--|
| Department | |
| ORA Proposal # | |

1. Project Information:

A. **Provide a brief description of the project:** Describe the specific objectives, including background information and rationale for the proposed project. This summary should be written in a way that will be intelligible to non-specialists in your specific subject area.

B. **Describe the subject population/type of data/specimens to be studied:** Identify who your subjects will be and indicate the type of data or specimens you will collect. Describe the methods in which the data or specimens will be collected, stored, and how confidentiality will be maintained.

2. Determination of Research – 45 CFR 46.102 (d):

Research means a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge (publication, presentation, etc.)

A. For existing specimens, was the data/specimen(s) obtained in a systematic manner?

No Yes Not Applicable-does not involve the collection of existing data

B. For future data collection, will the data/specimen(s) be obtained in a systematic manner?

No Yes Not Applicable-does not involve future data collection

C. Is the project designed to develop or contribute to generalizable knowledge (publication, presentation, etc.)?

No Yes

D. Is the intent of the project to create an archive for the purpose of providing a resource for others to do research?

No Yes

E. For research only involving coded private information or specimens, was the private information or specimens collected specifically for the currently proposed research project through an interaction or intervention with living individuals?

No Yes Not Applicable-does not involve coded private information/specimens

3. **Determination of *Human Subject* – 45 CFR 46.102(f):**

Human subject means a living individual about whom an investigator (whether professional or student) conducting research obtains **(1)** Data through intervention or interaction with the individual, or **(2)** Identifiable private information.

Intervention includes both physical procedures by which data are gathered and manipulations of the subject or the subject's environment that are performed for research purposes.

Interaction includes communication or interpersonal contact between investigator and subject.

Private information includes information about behavior that occurs in a context in which an individual can reasonably expect that no observation or recording is taking place, and information which has been provided for specific purposes by an individual and which the individual can reasonably expect will not be made public (for example, a medical record). Private information must be individually identifiable (i.e., the identity of the subject is or may readily be ascertained by the investigator or associated with the information) in order for obtaining the information to constitute research involving human subjects.

A. Does the study involve intervention or interaction with a ***human subject***?

No Yes

B. Does the study involve access to identifiable **private information**?

No Yes

C. Are data/specimens received by the investigator with identifiable **private information**?

No Yes

D. Are the data/specimens coded such that a link exists that could allow the data/specimen(s) to be re-identified?

No Yes

- If Yes: Is there a written agreement that prohibits the Principal Investigator, Co-Investigator, student investigator(s), and any other members of the research team from access to the link?

† No Yes

(If Yes, please explain below.)

†

- Are there other legal requirements that prohibit the release of the key to the investigators, until the subjects are deceased?

No Yes

(If Yes, please explain below.)



1204 Marie Mount Hall
College Park, MD 20742-5125
TEL 301.405.4212
FAX 301.314.1475
irb@umd.edu
www.umresearch.umd.edu/IRB

DATE: January 19, 2016

TO: Amelia Arria
FROM: University of Maryland College Park (UMCP) IRB

PROJECT TITLE: [830944-1] Substance use and academic outcomes among high school seniors: Examining the influence of emotional academic engagement

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF NOT HUMAN SUBJECT RESEARCH
DECISION DATE: January 19, 2016

Thank you for your submission of New Project materials for this project. The University of Maryland College Park (UMCP) IRB has determined this project does not meet the definition of human subject research under the purview of the IRB according to federal regulations.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact the IRB Office at 301-405-4212 or irb@umd.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Maryland College Park (UMCP) IRB's records.

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