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A cross-sectional study of the relationship between substance use and sexual risk behaviors among high school students

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Abstract

Objectives: Sexual risk behaviors among adolescents lead to 10 million new STIs in the United States each year and have resulted in 194,377 infants born to women aged 15-19 years in 2017. The present study aims to examine the relationship between substance use and HIV/STI-related sexual risk behaviors among a national sample of adolescents in the United States. *Methods:* Participants included 9th - 12th grade adolescents (N=14,765) who completed the 2017 National Youth Risk Behavior Survey. The independent variables were alcohol, marijuana, heroin, and prescription pain medicine use. The dependent variables were ever had sexual intercourse, condom use at time of last sexual intercourse, and ever been tested for HIV. Unadjusted and adjusted logistic regression models were examined. *Results:* Lifetime use of alcohol (OR= 0.72, CI= 0.69, 0.74; OR= 0.93, CI= 0.89, 0.98) and marijuana (OR= 0.71, CI= 0.69, 0.74; OR= 0.83, CI= 0.80, 0.86) was associated with ever had sex and ever been tested for HIV. Lifetime use of marijuana (OR= 1.11, CI= 1.08, 1.15) and prescription pain medicine (OR= 1.15, CI= 1.08, 1.23) was associated with decreased use of condoms at time of last sexual intercourse. *Conclusions:* Adolescents who reported ever using alcohol were more likely to have had sex and to have ever gotten tested for HIV. Adolescents who reported ever using marijuana were more likely to have ever had sex and to have ever been tested for HIV; among sexually experienced marijuana users, they were less likely to have used a condom the last time they had sexual intercourse. The study highlighted the need to provide youth with increased STI/HIV knowledge, including the influence of substance use on sexual risk behaviors.

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Introduction

Epidemiology of Sexual Risk Behaviors

In 2016, among persons aged 15-19 in the United States, there were a total of 209,809 births, 488,700 cases of chlamydia, gonorrhea, and syphilis, and 1,652 reported diagnoses of human immunodeficiency virus (HIV) (Kann et al., 2018). Although the United States has made tremendous efforts and great strides towards improving its sexual health outcomes, problems still exist. Sexual risk behaviors are behaviors that place an individual at risk for human immunodeficiency virus (HIV), sexually transmitted infections (STIs), or pregnancy (Yan et al., 2007; Clayton et al., 2016). Some of these behaviors include ever having sexual intercourse, having multiple sexual partners, and not using a condom at time of last intercourse (Clayton, Lowry, August & Jones, 2016).

Many young people engage in sexual risk behaviors that result in unintended health outcomes. According to data from the National Youth Risk Behavior Survey (YRBS), in 2017 there was a decline in the percentage of high school students who reported they had ever had sex (39.5%) and those who had four or more sexual partners (9.7%) (Kann et al., 2018). These were the lowest levels since the Centers for Disease Control (CDC) began conducting the survey in 1991. However, a lower percentage of students who engaged in sex reported using condoms in 2017, declining from 61.5% in 2007 to 53.8%.

Although improvements are being made in some instances, the correct use of condoms helps prevent the transmission of HIV and STIs, both of which continue to be a concern in the United States (Kann et al., 2018). Americans age 15 to 24 make up just 27% of the sexually active population but account for half of the 20 million new STIs that arise in the U.S. each year (CDC, 2011). In 2010, persons aged 13 to 24 years accounted for 26% of the estimated new

HIV infections. Additionally, 44% of adolescents and young adults are living with HIV but are undiagnosed, the highest percentage of any age group (Handel et al., 2016).

There were a total of 194,377 infants born to women aged 15 to 19 in 2017. At a birth rate of 18.8 per 1,000 women, this was a record low for these U.S. teens, dropping 7% from 2016 (Martin, Hamilton, & Osterman, 2018). However, the U.S. teen pregnancy rate continues to be substantially higher than in other western industrialized nations and there is a persistence of racial/ethnic and geographic disparities (Sedgh et al., 2015; Romero et al., 2016). Among the 21 countries with complete statistics, the pregnancy rate among 15 to 19 year olds was the highest in the U.S. (57 pregnancies per 1,000 females) and the lowest in Switzerland (8 pregnancies per 1,000). The Netherlands, Singapore, and Slovenia followed Switzerland, tying for the second lowest teen pregnancy rates at 14 pregnancies per 1,000 females (Sedgh et al., 2015).

Although the birth rate showed the lowest rate ever recorded for U.S. adolescents, the teen birth rate remained approximately twice as high for Hispanic (39.8) and Black teens (37.0) compared with White teens (18.0) in 2014 (Sedgh et al., 2015). Additionally, the birth rate and racial/ethnic disparities for 2013 to 2014 ranged widely across states. In some states, these disparities reflected very low rates of birth among White teens. For example, in New Jersey the teen birth rate among Whites was well below the national rate, at 4.8 pregnancies per 1,000 females. However, the birth rates for New Jerseyan Hispanics (31.3) and Blacks (27.4) were also below the national rates for these groups, but still remained 6 to 7 times higher than the rate for Whites (4.8). In other states, like Nebraska, disparities reflected birth rates for Black and Hispanic teens that exceeded national rates for these groups (42.6 and 53.9 respectively).

While most high school students transition from childhood through adolescence to adulthood successfully and become healthy and productive adults, some subgroups of students have a higher frequency of many health-risk behaviors that do not place them on the path for success. Significant health disparities exist between demographic subgroups of youth defined

by sex, race/ethnicity, grade in school, and especially between sexual minority and nonsexual minority youth. The sexual health risk behaviors concerning to the public include having ever had sexual intercourse, had sexual intercourse with four or more persons, and used a condom during last sexual intercourse (Kann et al., 2018).

To assess whether changes had occurred in recent years in the proportion of U.S. high school students who have ever had sexual intercourse, the CDC examined trends overall from 2005 to 2015 and by grade, race/ethnicity, and sex. Nationwide, the proportion of high school students who had ever had sex decreased significantly overall and among 9th and 10th grade students, African American (Black) students in all grades, and Hispanic students in three grades (Ethier, Kann, & McManus, 2018). The overall decrease in the number of sexually experienced students was a positive change in sexual risk among adolescents, especially decreases among students by grade and race/ethnicity. These groups of students in particular have been determined in previous studies to be at higher risk for negative outcomes associated with early sexual initiation, such as greater numbers of partners, condom non-use, teen pregnancy, and STIs (Ethier, Kann, & McManus, 2018).

Despite improvements, disparities within sex and race/ethnicity these still exist. In 2015, there was a greater prevalence of males (43.2%) who had ever had sexual intercourse than females (39.25%) and a greater prevalence of Black students (48.5%) who ever had sex than Hispanics (42.4%) and Whites (39.9%) (Ethier, Kann, & McManus, 2018). Among students of differing grades, a difference in maturation was depicted by a greater prevalence of 12th grade students (58.1%) who had ever had sex than 11th (49.6%), 10th (35.7%), and 9th (24.1%) grade students.

Consequences of Sexual Risk Behaviors

Sexual risk behaviors often result in unintended health outcomes or consequences such as STIs, including HIV, and pregnancy. STIs and pregnancy can have significant health effects, especially for adolescents and young adults.

The common symptoms of STIs include vaginal discharge, urethral discharge or burning in men, genital ulcers, and abdominal pain (WHO, 2019). Although these symptoms can often be treated, there is pain and a lack of comfort that persists until a person seeks treatment. STIs left undiagnosed can have particularly severe consequences for young women, such as infertility, certain cancers, and other chronic diseases (Institute of Medicine Committee on Prevention and Control of Sexually Transmitted Diseases, 1997). Worldwide, human papillomavirus (HPV) infections cause 528,000 cases of cervical cancer and 266,000 cervical cancer deaths each year (WHO, 2019). Twenty-four thousand women become infertile each year due to undiagnosed STIs (Satterwhite et al., 2013). Additionally, STIs can increase the risk of HIV acquisition and cause infants severe issues when there is mother-to-child transmission of STIs during birth (WHO, 2019).

There are substantial social and economic costs that pregnancy and childbearing bring to teen parents and their children. These burdens cause an impact both immediately and in the long-term, and annually cost the U.S. approximately $9.4 billion (Sedgh et al., 2015). Data from the American Community Survey (ACS) indicated that unemployment, education attainment, and family income were lower in counties with higher teen birth rates, and pregnancy and birth are significant contributors to high school dropout rates among girls. Thirty percent of all teenage girls who dropped out of school cited pregnancy and parenthood as the key reasons, and the rate is higher for minority students: 36 percent of Hispanic girls and 38 person of Black girls (The National Center for Education Statistics, 2010).

Epidemiology of Substance Use

Substance use has been documented as a contributing factor to sexual risk behaviors among adolescents and young adults (Yan et al., 2007; Anderson & Mueller, 2008). This contribution leads to an impairment of judgment and decision-making, therefore increasing the risk for unintended health outcomes. These substances include the use of tobacco, alcohol, marijuana, cocaine, methamphetamines, heroin, ecstasy, and nonmedical use of prescription drugs. An association between these substances and current sexual activity, having multiple lifetime partners, inconsistent condom use, and early initiation of sexual intercourse has been well described in the literature (Clayton et al., 2019).

According to the results from the 2017 national YRBS, it was reported that among high school students, 29.8% reported current alcohol use, 19.8% reported current marijuana use, 14.0% of students had misused prescription pain medication one or more times during their life, 8.8% had smoked cigarettes, and 13.2% had used an electronic vapor product on at least 1 day during the 30 days before the survey (Kann et al., 2018). However, the trends for high school students who ever used illicit drugs (14.0%) and ever injected drugs (1.5%) are moving in the right direction as their prevalence has decreased significantly since 2007 (Kann et al., 2018).

In terms of illicit drugs high school students had ever used in 2017, there was no significant difference between the percentages of male and female students, but there was a significantly higher percentage of Hispanic students (16.1%) that had ever used select illicit drugs than Black students (11.1%) (Kann et al., 2018).

Providing a demographic description of the high school students in 2017 that had ever injected illegal drugs, there was a significantly higher percentage of male students (2.0%) than female students (0.8%) that had ever injected illegal drugs. In terms of race/ethnicity demographics, there were no significant differences between the percentages of White students, Black students, and Hispanic students who had ever injected illegal drugs (Kann et al., 2018).

Consequences of Substance Use

Substance use can lead to physical and mental health problems, addiction, HIV, overdose, and even death. Research has shown that the abuse of alcohol, tobacco, and illicit drugs is the most serious health problem in the United States. It strains the healthcare system, burdens the economy and contributes to the death of millions of Americans every year (Ericson, 2001). In 2016 there were 21,815 alcoholic liver deaths and 34,865 alcohol-induced deaths in the United States (Xu et al., 2018). Also in 2016, 48.5 million Americans used illicit drugs or misused prescription drugs, and 66% of the more than 63,000 drug overdose deaths involved a prescription or illicit opioid (CDC, 2018).

Among teens, substance use can affect their growth and development, especially brain development; it can also contribute to the development of health problems during their adulthood, such as heart disease, high blood pressure, and sleep disorders (Johnson et al., 2014). Also, teens can increase their chances of becoming addicted or continuing to abuse substances later in life when they begin drinking at an early age.

Substance use disorders are also closely associated with HIV and other STIs. The sharing of needles, syringes, or other injection materials during injection drug use (IDU) can act as a direct route of HIV transmission if any of the materials were contaminated with HIV. Drinking alcohol and ingesting, smoking, or inhaling drugs is also associated with increased risk for HIV because of these substances' judgment altering effects which lead to risky sexual practices thus, making an individual more likely to get and transmit HIV. Additionally, in people living with HIV, using substances can accelerate progression of their disease, affect their ability to consistently take their antiretroviral therapy, and worsen the overall symptoms of HIV (CDC, 2018).

Proposed Research

The literature has provided a solid foundation in regards to establishing an association between substance use and sexual risk behaviors. Many of the studies examined substance use in terms of alcohol and "illicit drugs," clumping many substances into one category. However, this study will individually look at several substances (alcohol, marijuana, heroin, and prescription pain medication) and each one's influence on three sexual risk behaviors: abstinence, condom use, and HIV testing. Additionally, this study will expand on the literature by contributing an examination of the link between substance use and HIV testing among high school students, a topic that has only been touched on briefly and not at the national level for all high school students as a distinct population group.

Upon review of the previously existing research, this study set out to answer these questions:

RQ1: Is substance use associated with abstinence among high school students?

RQ2: Is substance use associated with condom use among high school students?

RQ3: Is substance use associated with getting tested for human immunodeficiency virus (HIV) among high school students?

The substances being referred to include alcohol, marijuana, heroin, and prescription pain medication.

The hypotheses are as follows:

H1a: Having at least one drink of alcohol will be negatively associated with abstinence among high school students.

H1b: Having ever used marijuana will be negatively associated with abstinence among high school students.

H1c: Having ever used heroin will be negatively associated with abstinence among high school students.

H1d: Having ever taken prescription pain medicine without a doctor's prescription or differently than how a doctor told them to use it will be negatively associated with abstinence among high school students.

H2a: Having at least one drink of alcohol will be negatively associated with condom use among high school students.

H2b: Having ever used marijuana will be negatively associated with condom use among high school students.

H2c: Having ever used heroin will be negatively associated with condom use among high school students.

H2d: Having ever taken prescription pain medicine without a doctor's prescription or differently than how a doctor told them to use it will be negatively associated with condom use among high school students.

H3a. Having at least one drink of alcohol will be negatively associated with getting tested for human immunodeficiency virus (HIV) among high school students.

H3b. Having ever used marijuana will be negatively associated with getting tested for human immunodeficiency virus (HIV) among high school students.

H3c. Having ever used heroin will be negatively associated with getting tested for human immunodeficiency virus (HIV) among high school students.

H3d. Having ever taken prescription pain medicine without a doctor's prescription or differently than how a doctor told them to use it will be negatively associated with getting tested for human immunodeficiency virus (HIV) among high school students.

Methods

This study was a secondary analysis of cross-sectional data. The dataset used for the study was the 2017 National Youth Risk Behavior Survey (YRBS), which monitors the health behaviors of adolescents. The purpose of this investigation was to examine the relationship between substance use - including alcohol, marijuana, heroin, and prescription pain medicine - and sexual risk behaviors among high school students. These behaviors include ever having had sex, ever having had unprotected sex, and having ever been tested for HIV.

Data Collection and Sampling Methodology

The YRBS is a school-based survey conducted biennially that monitors priority health risk behaviors that contribute to the leading causes of death, disability, and social problems among youth and adults in the U.S. The national surveys are representative samples of 9th through 12th grade students in public and private schools in the United States, produced by a three-stage cluster sample design. This National YRBS data was from 2017. The sampling frame included the 50 States and the District of Columbia but excluded Puerto Rico, the trust territories, and the Virgin Islands. The sample included 192 schools. Depending on the school, classes included in the sampling frame were either all classes in a required subject or all classes meeting during a particular period of the day. Schools and classes were selected using a random start and systematically with probability proportional to enrollment in grades 9 through 12. The 2017 YRBS school-level response rate was 75%, the student level response rate was 81%, and the overall response rate was 60%. The sample size for the 2017 YRBS was 14,765 students. Additionally, the YRBS data were weighted to adjust for school and student nonresponse and the oversampling of Black and Hispanic students.

Measures

Dependent Variables

Three dependent measures of sexual risk behaviors were examined: having ever had sexual intercourse, ever having had unprotected sex, and having ever been tested for HIV. Having ever had sexual intercourse was measured by the question, “Have you ever had sexual intercourse?” The response options were yes and no. Unprotected sex was measured by the question, “The last time you had sexual intercourse, did you or your partner use a condom?” The response options were I have never had sexual intercourse, yes, and no. Having ever been tested for HIV was measured by the question, “Have you ever been tested for HIV, the virus that causes AIDS? (Do not count tests done if you donated blood.)” The response options were yes, no, and not sure.

Independent Variables

The independent variables included a total of 4 substance use behaviors: lifetime use of alcohol, marijuana, and heroin, and misuse of prescription pain medicine. Lifetime use of alcohol was measured by the question, “During your life, on how many days have you had at least one drink of alcohol?” The response options were 0, 1 or 2, 3 to 9, 10 to 19, 20 to 39, 40 to 99, and 100 or more. All options were measured in days. Lifetime use of marijuana was measured by the question, “During your life, how many times have you used marijuana?” The response options were 0, 1 or 2, 3 to 9, 10 to 19, 20 to 39, 40 to 99, 100 and or more. All responses were measured in number of times. Lifetime use of heroin was measured by the question, “During your life, how many times have you used heroin (also called smack, junk, or China White)?” Misuse of prescription pain medicine was measured by the question, “During your life, how many times have you taken prescription pain medicine without a doctor’s prescription or differently than how a doctor told you to use it? (Count drugs as codeine, Vicodin, OxyContin, Hydrocodone, and Percocet.)” The response options for both lifetime use of

heroin and misuse of prescription pain medicine were 0, 1 or 2, 3 to 9, 10 to 19, 20 to 39, and 40 or more. All options were measured in times.

Covariates

There are some common underlying factors that may predispose teens to substance use and sexual risk behaviors. The covariates included in this analysis were age, gender, race, ethnicity, deviant behavior, association with substance using peers, sleep, and grades. Age was measured by the question, “How old are you?” The response options were 12 years or younger, 13 years old, 14 years old, 15 years old, 16 years old, 17 years old, and 18 years old or older. Research shows that early initiation of sexual activity is associated with having more sexual partners, not using condoms, STI, and pregnancy during adolescence (Ethier, Kann, & McManus, 2018). Gender was measured by the question, “What is your sex?” The response options were female and male. In one study, young men were found twice as likely as young women to have multiple partners while another study found that females report less frequent use of condoms during intercourse than males (Binson et al., 1993; Kaplan et al., 2001). Race was measured by the question, “What is your race? (Select one or more responses.)” The response options were American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, and White. It has been shown that some races, like American Indians and Alaska Natives (AI/AN), experience considerable health disparities. For example, available research suggests that AI/AN adolescents experience disproportionately high rates of substance use, pregnancy, STIs, and dating violence compared to adolescents in other racial/ethnic groups (Ravello et al., 2014). Ethnicity was measured by the question, “Are you Hispanic or Latino?” The response options were yes and no. Hispanic adolescents tend to be the second most prevalent group to have ever had sexual intercourse in high school, behind Black adolescents (Ethier, Kann, & McManus, 2018).

Deviant behavior was measured by the question, “How often do you wear a seat belt when riding in a car driven by someone else?” The response options were never, rarely,

sometimes, most of the time, and always. Risky driving behaviors among teens, including nonuse of seat belts, have been found to co-occur with other problem behaviors such as alcohol and illicit drug use, cigarette smoking, and unprotected sex (Shults et al., 2016). Association with substance using peers was measured by the question, “During the past 30 days, how many times did you ride in a car or other vehicle driven by someone who had been drinking alcohol?” The response options were 0 times, 1 time, 2 or 3 times, 4 or 5 times, and 6 or more times. Peer influence has been shown to be a prominent factor in adolescent decision making, including participation in health risk behaviors such as drinking alcohol (Marshall et al., 2018).

Sleep was measured by the question, “On an average school night, how many hours of sleep do you get?” The response options were 4 or less hours, 5 hours, 6 hours, 7 hours, 8 hours, 9 hours, and 10 or more hours. One study reported that more than two-thirds of US high school students reported insufficient sleep on an average school night which was associated with a variety of health-risk behaviors such as substance use or sexual risk behaviors (McKnight-Eily et al., 2011). Grades were measured was the question, “During the past 12 months, how would you describe your grades in school?” The response options were mostly A’s, mostly B’s, mostly C’s, mostly D’s, mostly F’s, none of these grades, and not sure. Previous literature has shown links between educational outcomes such as letter grades, test scores, or other measures of academic achievement, and health-related behaviors (Rasberry et al., 2017).

Data Analysis

All statistical analyses were conducted using IBM SPSS Statistics version 25 (Armonk, NY: IBM Corp; 2017). First, frequencies and percentages for all variables - dependent, independent, and covariates - were compiled. The responses excluded from the analysis included “never had sex” from the question regarding condom use, “not sure” from the question regarding HIV testing, and “none of the grades” and “not sure” from the question regarding grades. Second, the data were analyzed using logistic regression models to examine the relationship between the dependent variables and the independent variables. The logistic

regression model was utilized because the dependent variables were dichotomous. Odds ratios (ORs) were generated and 95% confidence intervals (CIs) were used to determine statistical significance. Unadjusted and adjusted values both recorded. The adjusted model included the covariates age, sex, race/ethnicity, seat belt use, association with substance using peers, sleep, and grades. The analysis was weighted using the *weight* variable to account for the complex sampling design of the 2017 national YRBS.

Results

Sample

Table 1 shows the lifetime prevalence of use for alcohol, marijuana, heroin, and prescription pain medicine. Approximately 40% of high school students in the sample had never taken a sip of alcohol and 17.3% had only ever used alcohol on 1 or 2 days. Approximately 36% of high school students had ever smoked marijuana, with 8.1% of students who used the drug 100 or more times. Ninety-eight percent of high school students had never used heroin, and 14.2% of high school students had ever used prescription pain medicine.

Table 1. Descriptive statistics of the independent variables: lifetime substance use of alcohol, marijuana, heroin, and prescription pain medicine

Variable	Frequency	Percent
Ever alcohol use		
0 days	5528	40.1
1 or 2 days	2384	17.3
3 to 9 days	2276	16.5
10 to 19 days	1292	9.4
20 to 39 days	951	6.9
40 to 99 days	656	4.8
100 or more days	692	5.0
Ever marijuana use		
0 times	9160	64.1
1 or 2 times	1185	8.3
3 to 9 times	1142	8.0
10 to 19 times	633	4.4
20 to 39 times	500	3.5
40 to 99 times	512	3.6
100 or more times	1150	8.1
Ever heroin use		
0 times	14087	98.0
1 or 2 times	102	0.7
3 to 9 times	51	0.4
10 to 19 times	29	0.2
20 to 39 times	19	0.1
40 or more times	92	0.6
Ever prescription pain medicine use		
0 times	12459	85.9
1 or 2 times	908	6.3
3 to 9 times	532	3.7
10 to 19 times	274	1.9
20 to 39 times	122	0.8
40 or more times	215	1.5

Table 2 shows the prevalence of sexual health behaviors. Approximately 40% of all high school students had ever engaged in sexual intercourse. Of those students who've had sex, 42% of them did not use a condom the last time they had sex. Additionally, only 12.1% of high school students had ever been tested for HIV.

Table 2. Descriptive statistics of the dependent variables: ever had sex, condom use, and HIV testing

Variable	Frequency	Percent
Ever sexual intercourse		
Yes	5192	39.2
No	8068	60.8
Condom use		
Yes	2931	58.0
No	2123	42.0
HIV testing		
Yes	1508	12.1
No	10938	87.9

Table 3 shows the prevalence of the covariates. The majority of the students in the sample were 16 years of age or older (61.9%) with 51% of those students being female. Approximately 44% of all high school students were White, 19.4% were Black or African American, and 10.7% were Hispanic/Latino. About 57% of students always wore their seat belt when riding in a car driven by someone else. Relatively 17% of students had rode in a car or other vehicle driven by someone who had been drinking alcohol during the past 30 days. Around 47% of students get less than an average of 8 hours of sleep on an average school night. Approximately 77% of high school students got either mostly A's (37.9%) or mostly B's (39.0%).

Table 3. Descriptive statistics of the covariates: age, sex, seat belt use, riding with a drinking driver, hours of sleep, grades in school, and race/ethnicity

Variable	Frequency	Percent
Age		
12 years or younger	59	0.4
13 years old	22	0.1
14 years old	1922	13.1
15 years old	3586	24.4
16 years old	3688	25.1
17 years old	3611	24.6
18 years old or older	1796	12.2
Sex		
Female	7526	51.0
Male	7112	48.6
Seat belt use		
Never	238	2.0
Rarely	520	4.4
Sometimes	1196	10.1
Most of the time	3174	26.7
Always	6746	56.8
Riding with a drinking driver		
0 times	12290	83.5
1 time	1034	7.0
2 or 3 times	781	5.3
4 or 5 times	181	1.2
6 or more times	429	2.9
Hours of sleep on school night		
4 or less hours	1052	8.9
5 hours	1553	13.1
6 hours	2961	25.1
7 hours	3322	28.1
8 hours	2235	18.9
9 hours	516	4.4
10 or more hours	172	1.5
Grades in school		
Mostly A's	4280	37.9
Mostly B's	4384	39.0
Mostly C's	2064	18.4
Mostly D's	377	3.4
Mostly F's	149	1.3
Race/Ethnicity		
American Indian/Alaska Native	137	0.9
Asian	648	4.5
Black or African American	2796	19.4
Native Hawaiian/Other Pacific Islander	116	0.8
White	6261	43.4
Hispanic/Latino	1543	10.7
Multiple – Hispanic	2104	14.6
Multiple – Non-Hispanic	823	5.7

Relationships Between Sexual Risk Behaviors and Substance Use

Table 4 shows the unadjusted and adjusted odds ratios and 95% confidence intervals for the association between high school students who had ever had sex and lifetime substance

use. In both the unadjusted and adjusted models, ever using alcohol (OR=0.72, CI=0.69, 0.74) and ever using marijuana (OR=0.71, CI=0.69, 0.74) decreased the odds of youth reporting they had never had sex (Figure 1a; Figure 1b; Table 4). A significant association was not found with heroin or prescription pain medicine, neither in the unadjusted or adjusted model (Table 4). The older the student, the less likely they were to never have had sex (OR=0.63, CI=0.61,0.66) (Table 4). Students who wore their seat belt more often were more likely to never have had sex (OR=1.22, CI=1.15,1.29) (Table 4). Those who had ever rode in a car during the past 30 days driven by someone who had been drinking alcohol were less likely to never have had sex (OR=0.93, CI=0.87, 0.99) (Table 4). Students who received worse grades in school were also less likely to never have had sex (OR=0.85, CI =0.81, 0.90) (Table 4). In comparison to Multiple Race - Non-Hispanic students, Asian students (OR=2.82, CI=1.93, 4.13) were more likely to never have had sex while in comparison, Black or African American students (OR=0.69, CI=0.55, 0.88) were less likely to never have had sex (Table 4).

Table 4. Unadjusted and adjusted odds ratios and 95% confidence intervals for the association between high school students who have ever had sex and their lifetime use of alcohol, marijuana, heroin, and prescription pain medicine

	Unadjusted		*Adjusted*	
Variable	**OR**	**95% CI**	**OR**	**95% CI**
Ever alcohol use	0.69	0.67, 0.70	0.72	0.69, 0.74
Ever marijuana use	0.67	0.65, 0.69	0.71	0.69, 0.74
Ever heroin use	0.90	0.76, 1.06	0.91	0.74, 1.11
Ever prescription pain medicine use	0.98	0.93, 1.05	0.98	0.91, 1.05
Age			0.63	0.61, 0.66
Seat belt use			1.22	1.15, 1.29
Riding with a drinking driver			0.93	0.87, 0.99
Hours of sleep on school night			1.00	0.97, 1.04
Grades in school			0.85	0.81, 0.90
Sex				
Female			0.95	0.86, 1.04
Male			---	---
Race/Ethnicity				
American Indian/Alaska Native			0.76	0.34, 1.78
Asian			2.82	1.93, 4.13
Black or African American			0.69	0.55, 0.88
Native Hawaiian/Other Pacific Islander			0.61	0.35, 1.05
White			1.12	0.95, 1.41
Hispanic/Latino			1.20	0.94, 1.53
Multiple – Hispanic			1.10	0.86, 1.39
Multiple - Non-Hispanic			---	---

Table 5. Unadjusted and adjusted odds ratios and 95% confidence intervals for the association between high school students who used a condom the last time they had sex and their lifetime use of alcohol, marijuana, heroin, and prescription pain medicine

	Unadjusted		*Adjusted*	
Variable	**OR**	**95% CI**	**OR**	**95%**
Ever alcohol use	1.05	1.01, 1.09	1.03	0.99, 1.08
Ever marijuana use	1.12	1.09, 1.15	1.11	1.08, 1.15
Ever heroin use	1.12	0.99, 1.25	1.04	0.89, 1.20
Ever prescription pain medicine use	1.14	1.07, 1.21	1.15	1.08, 1.23
Age			1.07	1.01, 1.14
Seat belt use			0.84	0.78, 0.89
Riding with a drinking driver			0.99	0.92, 1.07
Hours of sleep on school night			0.97	0.92, 1.02
Grades in school			1.07	1.00, 1.15
Sex				
Female			0.52	0.46, 0.60
Male			---	---
Race/Ethnicity				
American Indian/Alaska Native			0.78	0.29, 1.06
Asian			1.23	0.67, 2.27
Black or African American			1.13	0.83, 1.55
Native Hawaiian/Other Pacific Islander			1.03	0.49, 2.17
White			1.12	0.79, 1.34
Hispanic/Latino			0.74	0.81, 1.55
Multiple – Hispanic			0.66	0.54, 1.00
Multiple - Non-Hispanic			---	---

Table 5 shows the unadjusted and adjusted odds ratios and 95% confidence intervals for the association between high school students who used a condom the last time they had sex and lifetime substance use. For the unadjusted model, there was a significant association with alcohol use (OR=1.05, CI=1.01, 1.09); however, in the adjusted model, alcohol was no longer statistically significant (Table 5). Ever using marijuana (OR=1.11, CI=1.08,1.15) and ever using prescription pain medicine (OR=1.15, CI=1.15,1.23) increased the odds of youth reporting they did not use a condom the last time they had sex (Figure 2b; Figure 2d; Table 5). A significant association was not found with heroin (Table 5). The older the student, the more likely they were to have not used a condom the last time they had sex (OR=1.07, CI=1.01, 1.14) (Table 5). Males were less likely to have not used a condom the last time they had sex (OR=0.52, CI=0.46, 0.60) than females (Table 5). Students who wore their seat belt more often were less likely to to have not used a condom the last time they had sex (OR=0.84, CI=0.78, 0.89) (Table

5). Students who received worse grades in school were also more likely to have not used a condom the last time they had sex (OR=1.07, CI=1.00, 1.15) (Table 5).

Table 6 shows the unadjusted and adjusted odds ratios and 95% confidence intervals for the association between high school students who have ever been tested for HIV and lifetime substance use. Ever using alcohol (OR=0.93, CI=0.89, 0.98) and ever using marijuana (OR=0.83, CI=0.80, 0.86) decreased the odds of youth reporting they had never been tested for HIV (Figure 3a; Figure 3b; Table 6). In the unadjusted model there was a significant association with heroin use (OR=0.85, CI=0.76,0.95); however, in the adjusted model, heroin was no longer statistically significant (Table 6). A significant association was not found with prescription pain medicine, neither in the unadjusted or adjusted model (Table 4). The older the student, the less likely they were to have never been tested for HIV (OR=0.83, CI=0.78, 0.88) (Table 6). Males were more likely to have never been tested for HIV (OR=1.66, CI=0.78, 0.88) than females (Table 6). Those who had ever rode in a car during the past 30 days driven by someone who had been drinking alcohol were less likely to have never been tested for HIV (OR=0.89, CI=0.83, 0.96) (Table 6). Students who got more hours of sleep on an average school night were more likely to have never been tested for HIV (OR=0.82, CI=0.76, 0.88) (Table 6). Students who received worse grades in school were also more likely to have never been tested for HIV (OR=0.82, CI=0.76, 0.88) (Table 6). In comparison to Multiple Race - Non-Hispanic students, White students (OR=1.43, CI=1.10, 1.88) and Hispanic/Latino (OR=1.79, CI=1.26, 2.54) were more likely to have never been tested for HIV (Table 6).

Table 6. Unadjusted and adjusted odds ratios and 95% confidence intervals for the association between high school students who have ever been tested for HIV and their lifetime use of alcohol, marijuana, heroin, and prescription pain medicine

	Unadjusted		*Adjusted*	
Variable	**OR**	**95% CI**	**OR**	**95% CI**
Ever alcohol use	0.93	0.89, 0.96	0.93	0.89, 0.98
Ever marijuana use	0.81	0.77, 0.84	0.83	0.80, 0.86
Ever heroin use	0.85	0.76, 0.95	0.97	0.83, 1.13
Ever prescription pain medicine use	0.96	0.91, 1.03	1.00	0.93, 1.07
Age			0.83	0.78, 0.88
Sex			1.66	1.44, 1.92
Seat belt use			1.05	0.97, 1.13
Riding with a drinking driver			0.89	0.83, 0.96
Hours of sleep on school night			1.06	1.00, 1.12
Grades in school			0.82	0.76, 0.88
Race/Ethnicity				
American Indian/Alaska Native			1.40	0.48, 4.14
Asian			1.14	0.69, 1.86
Black or African American			0.78	0.57, 1.06
Native Hawaiian/Other Pacific Islander			1.57	0.64, 3.81
White			1.43	1.10, 1.88
Hispanic/Latino			1.79	1.26, 2.54
Multiple – Hispanic			1.34	0.97, 1.84

Figure 1. Percentage of high school students who ever had sex and their lifetime use of substances

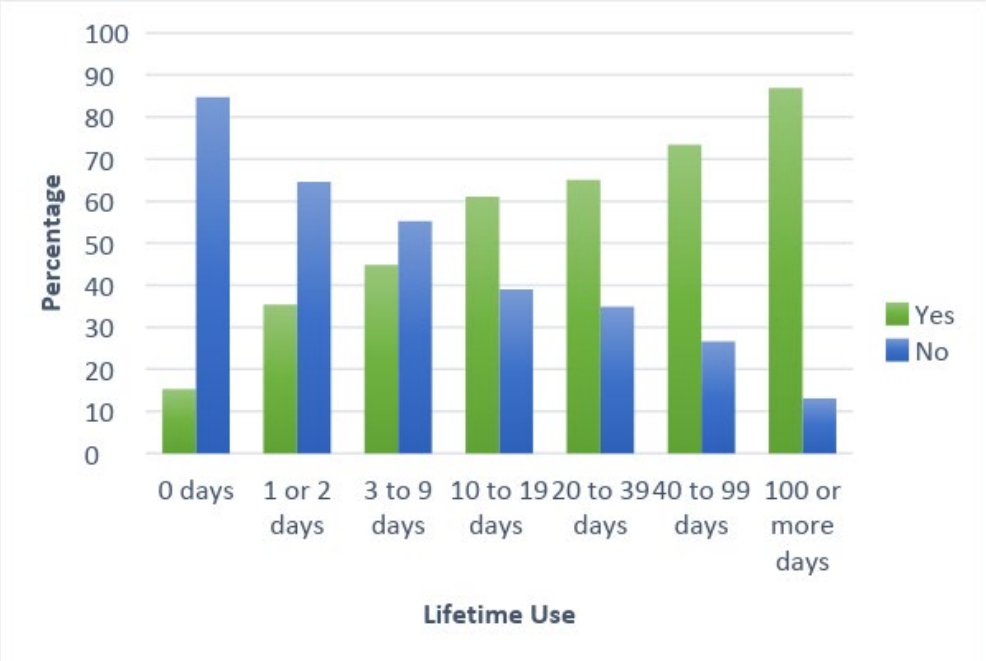

Figure 1a. Alcohol use

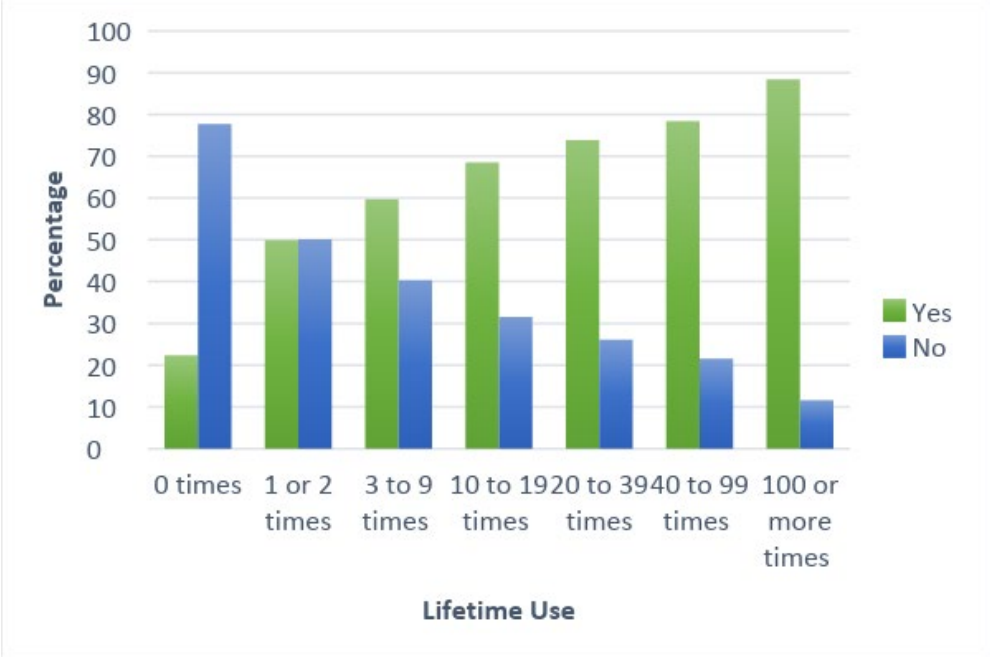

Figure 1b. Marijuana use

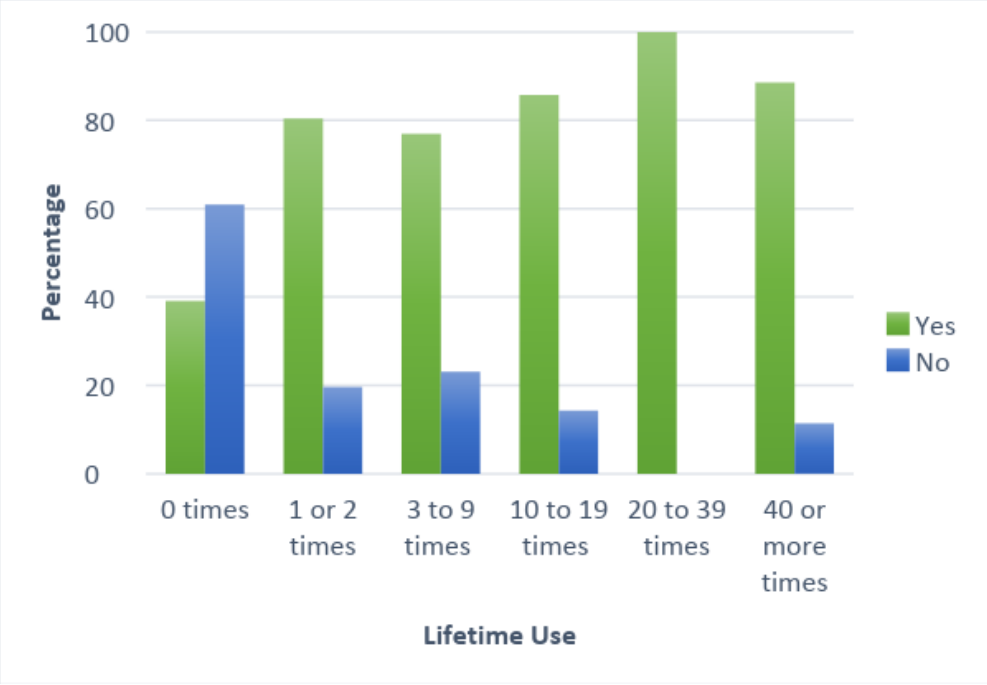

Figure 1c. Heroin use

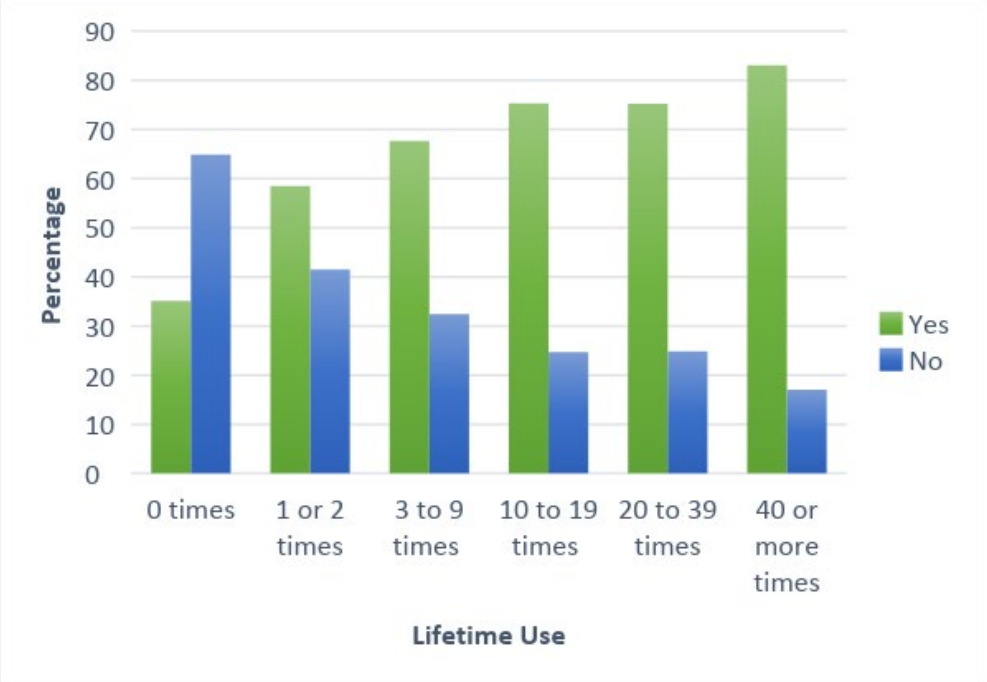

Figure 1d. Prescription pain medicine use

Figure 2. Percentage of high school students who used a condom the last time they had sex and their lifetime use of substances

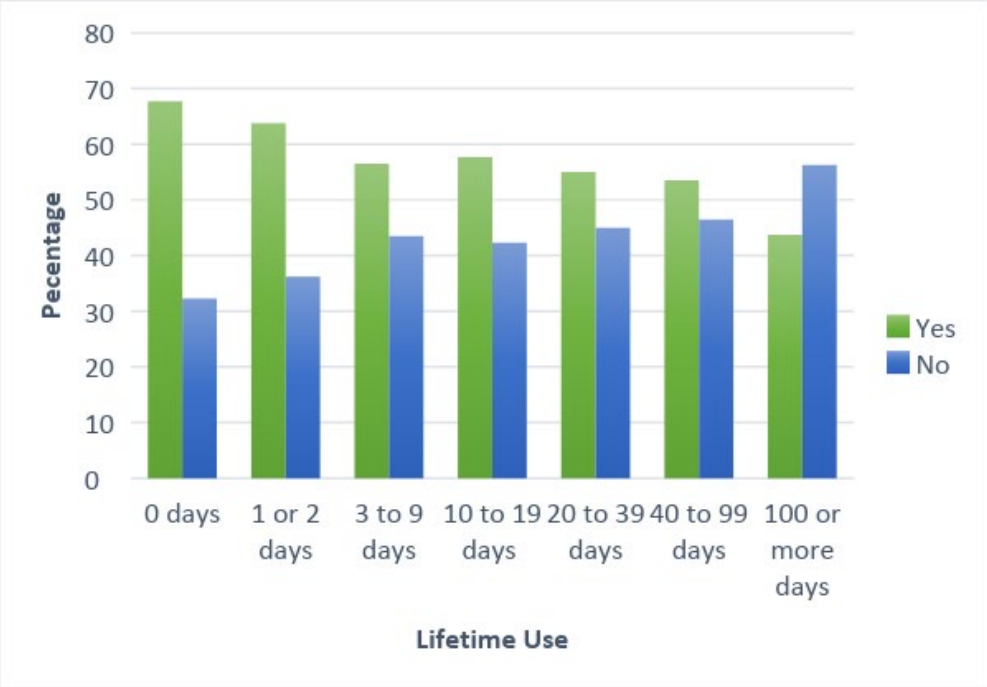

Figure 2a. Alcohol use

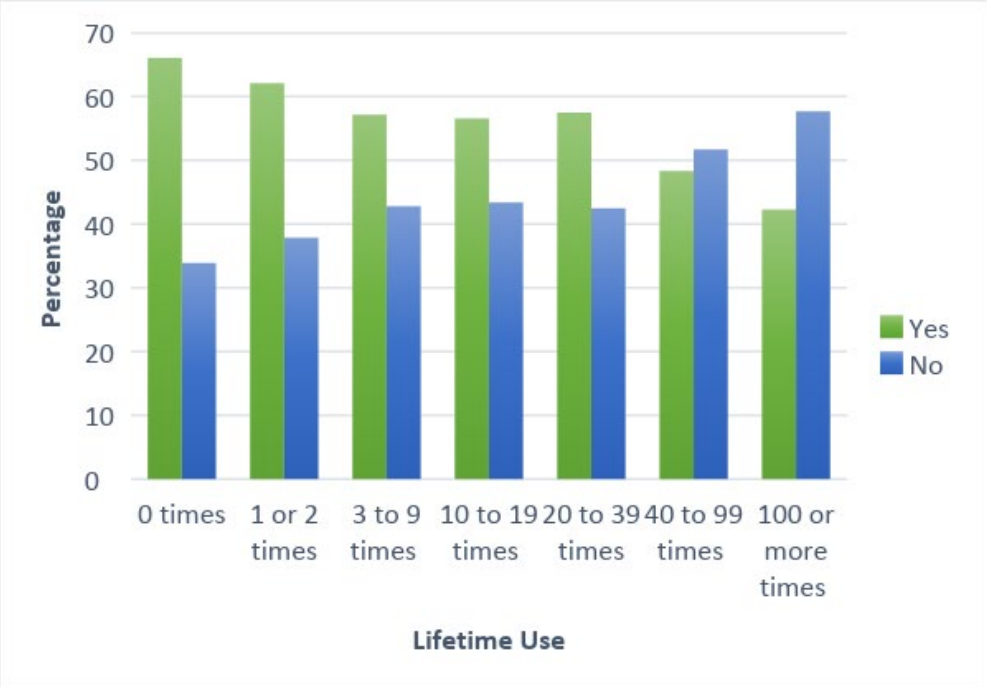

Figure 2b. Marijuana use

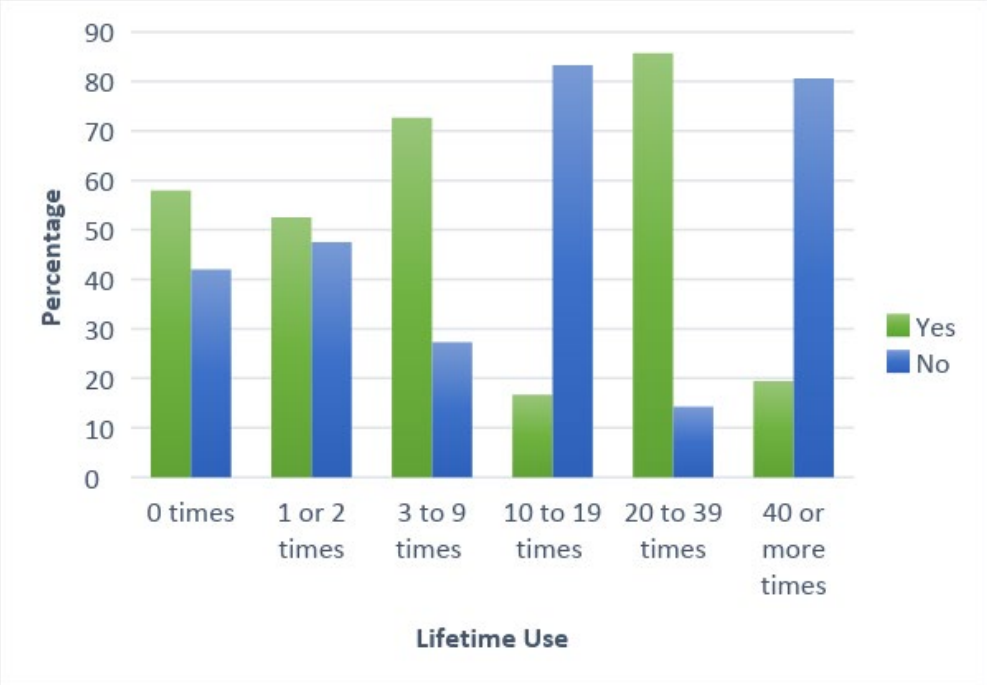

Figure 2c. Heroin use

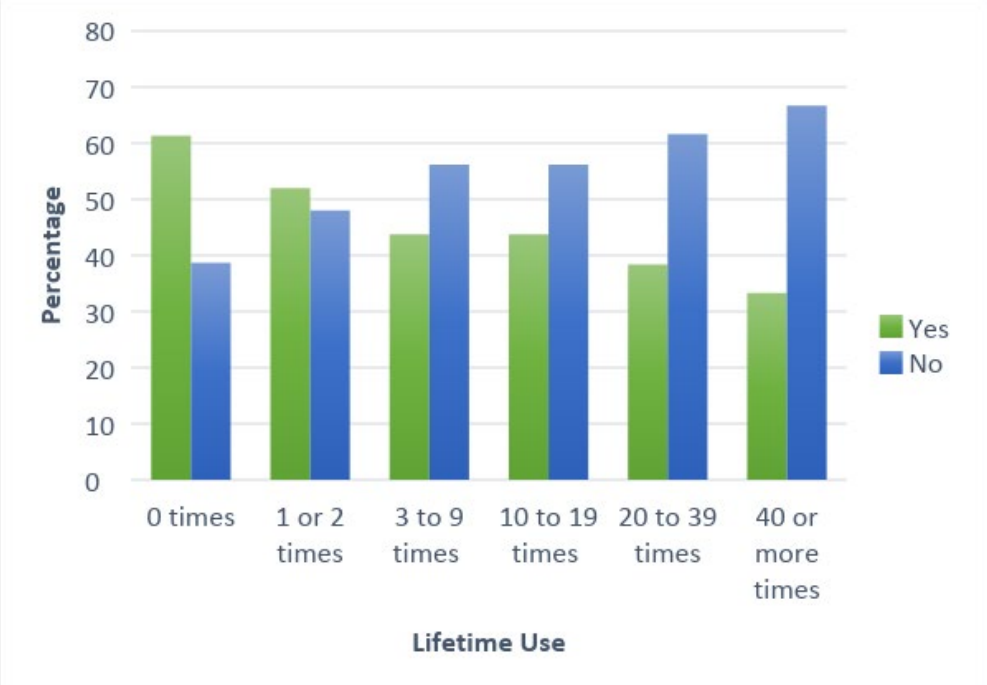

Figure 2d. Prescription pain medicine use

Figure 3. Percentage of high school students who had ever been tested for HIV and their lifetime use of substances

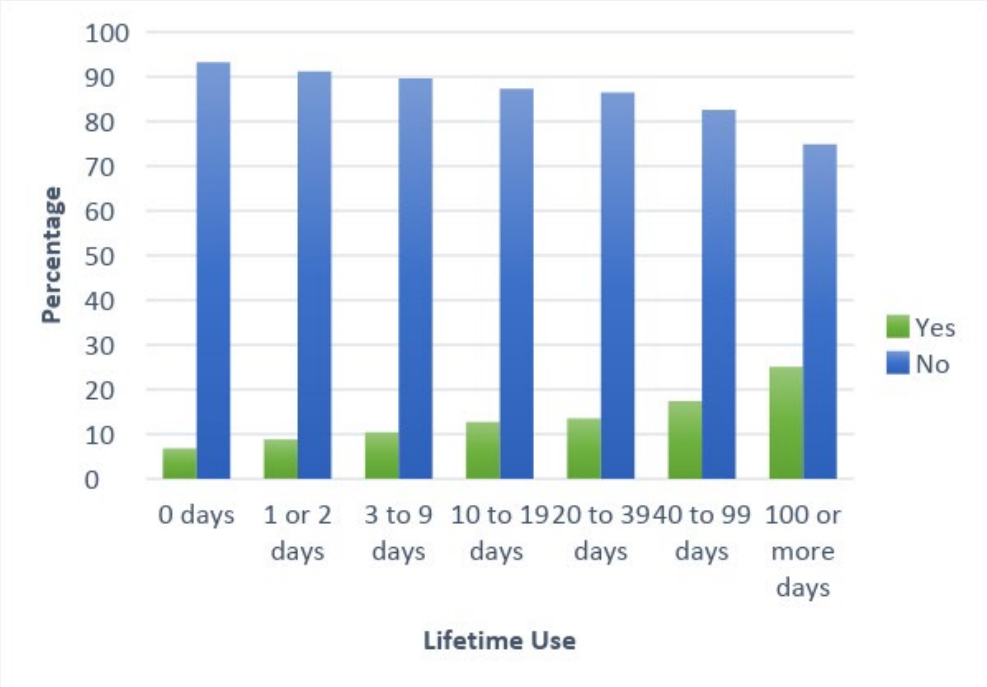

Figure 3a. Alcohol use

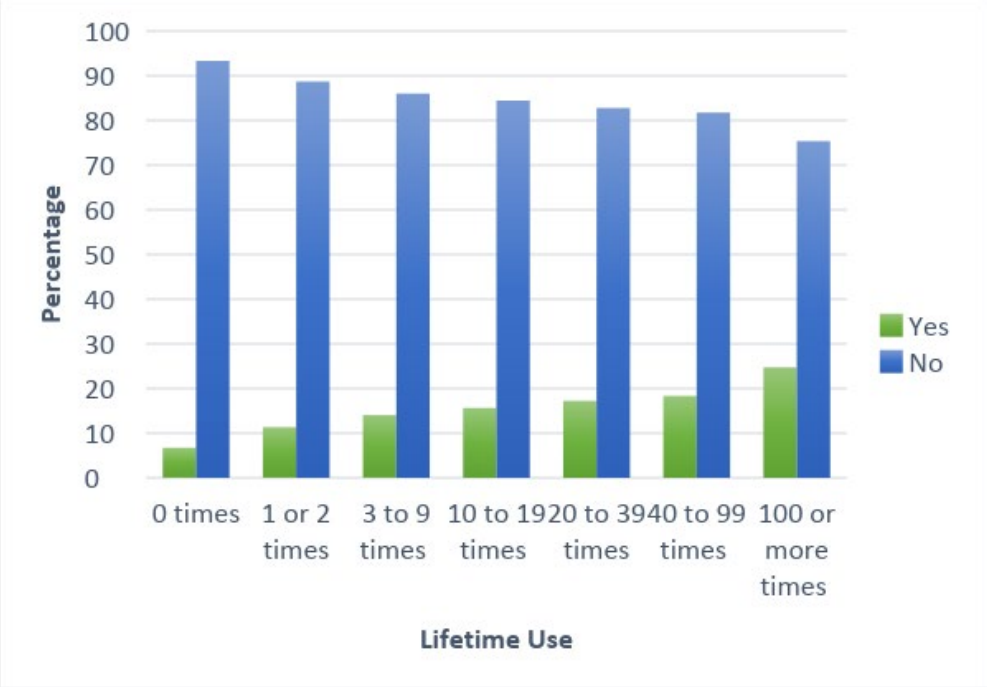

Figure 3b. Marijuana use

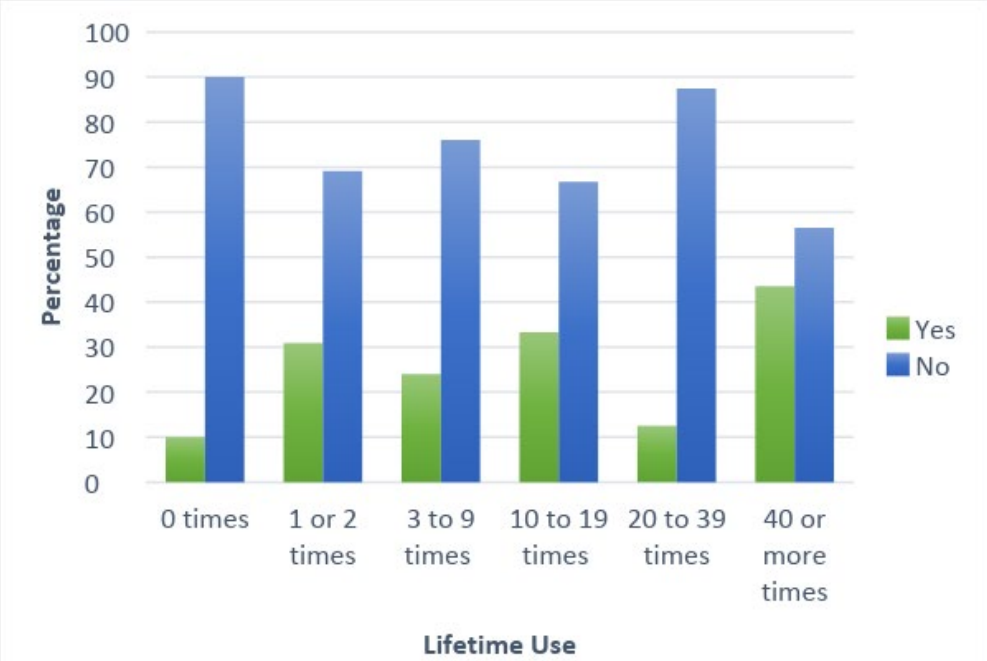

Figure 3c. Heroin use

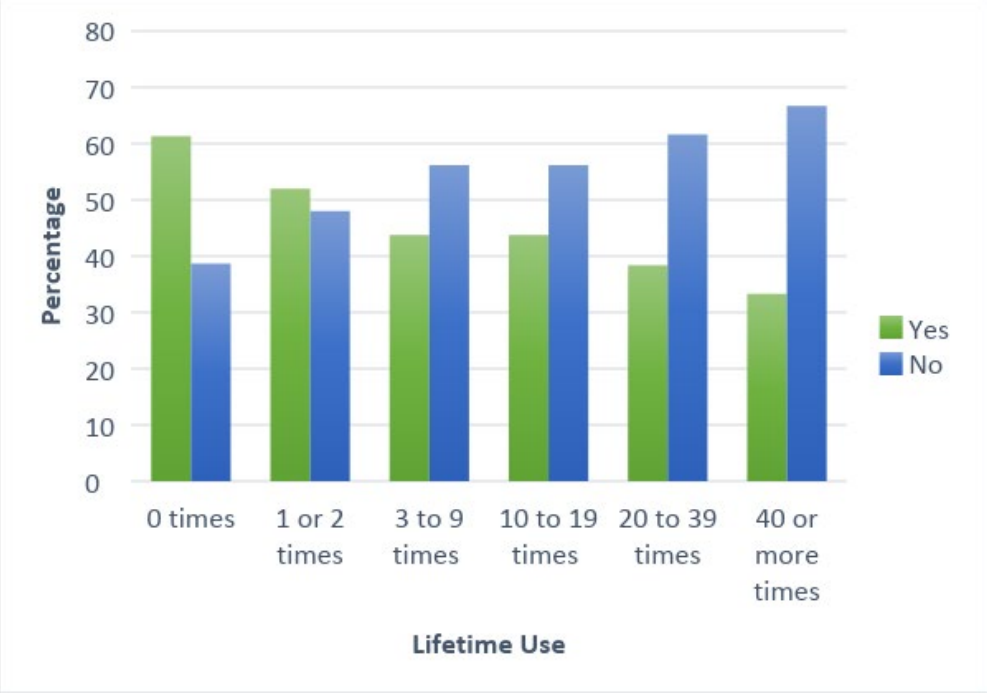

Figure 3d. Prescription pain medicine use

Discussion

The study examined the relationships between sexual risk behaviors and substance use among a representative group of adolescents in the United States who participated in the 2017 YRBS. Specifically, the model examined three major outcome variables: ever had sex, condom use, and HIV testing. The study was one of the few studies that has examined high school students who have ever had sex, rather than their recent sexual activity. Additionally, it is also one of the few to examine the association between substance use and HIV testing among all high school students, rather than those who are sexually experienced.

The findings indicate that substance use was significantly associated with sexual risk behaviors. Adolescents who reported ever using alcohol were more likely to have had sex and to have ever gotten tested for HIV. Adolescents who reported ever using marijuana were more likely to have ever had sex and to have ever been tested for HIV; among sexually experienced marijuana users, they were less likely to have used a condom the last time they had sexual intercourse. Additionally, among adolescents who had had sex, those reporting ever using prescription pain medicine were less likely to have worn a condom the last time they had sex. Heroin use was not associated with any sexual risk behavior.

In general, research on substance use and sexual risk behaviors among adolescents indicates that the strength of these associations varies by substance type but the findings are inconsistent. A recent study found that marijuana and cocaine use were more predictive of sexual risk than alcohol use among adolescents (Ritchwood et al., 2016); however, a different study found that alcohol use was more predictive of sexual risk behavior than marijuana use (Gillman et al., 2016).

Marijuana was the only substance that was significantly associated with ever having sex, unprotected sex, and HIV testing. The hypotheses supported by the findings included H1b and

H2b, which predicted a negative association with marijuana and abstinence and condom use, respectively. Hypothesis H3b, which predicted a negative association with marijuana and HIV testing, was rejected. Existing research has also found an association between marijuana and decreased condom use; however, these studies did not include ever having sex or HIV testing as variables (Anderson & Mueller, 2008; Clayton et al., 2019). In other studies, having ever used marijuana was associated with having multiple sex partners/4+ sexual partners and recent sexual activity. Some of these studies focused on other populations of high school students including those in rural settings and LGB (lesbian, gay, bisexual) students. These populations often face greater consequences than other populations; rural adolescents in particular are experiencing increased problems related to substance use and HIV and students who self-identified as LGB had a higher prevalence of sexual risk behaviors and substance use when compared with heterosexual students (Yan et al., 2007; Clayton et al., 2019).

As previously discussed, the literature has established a general link between substance use and sexual risk behaviors. In a sample of Black college students, lifetime marijuana use was associated with history of STI (Keen, Blanden, & Rehmani, 2016). In another national study examining the association of MDMA/ecstasy and other substance use with self-reported sexually transmitted diseases (STDs) among college-aged adults, marijuana use increased the odds of both past-year and lifetime STDs (Wu et al., 2009). If we speculate that high school students would parallel with college students, we can suggest that the students are contracting these STIs because they are having sex and not using a condom. Therefore, these students would seek healthcare for their STIs, based on symptoms, concern, or diagnosis of sexual partners. Furthermore, once in a healthcare setting, these students may be tested for HIV as part of the overall STI panel, explaining the increase in HIV testing with marijuana use among high school students.

Alcohol was found to be significantly associated with ever having sex and HIV testing in this study. The hypothesis supported by the finding was H1a which predicted a negative

association with alcohol and abstinence. Hypothesis H3b, which predicted a negative association with alcohol and HIV testing, was rejected by the findings. The existing literature has not made either of the current study's predicted associations. The established research studying alcohol and sexual risk behavior has instead focused on the number of recent sexual partners and current/recent sexual activity, and unprotected sex (Yan et al., 2007; Anderson & Mueller, 2008; Clayton et al., 2019). However, studies have found that there is not a significant association between ever drinking alcohol and condom use among the sexually experienced, which parallels our finding (Anderson & Mueller, 2008; Clayton et al., 2019).

It is likely that an association was not found between alcohol and condom use because it has been found that people who use condoms when they are sober also tend to use them when drinking, and people who fail to use condoms when drinking probably also fail to use them when sober (Weinhart & Carey; 2000). However, as previously stated, substance use does increase the chances for engagement in sexual risk behaviors. Therefore, it is reasonable to suggest that high school students who have ever had a drink are more likely to have had sex. One reason an adolescent using alcohol might get tested for HIV could be their exposure to a healthcare setting. Alcohol-related emergency department (ED) visits are increasing at a greater rate than overall ED visits, with 3,856,346 alcohol-related visits from 2010-2011 among patients aged 18 years or older with alcohol intoxication. Approximately 8% of those visits were from patients aged 18 to 21 (Mullins, Mazer-Amirshahi, & Pines, 2017). Adolescents that end up in the emergency department for an alcohol-related visit may be tested for HIV as part of their overall workup.

A significant association was found between the misuse of prescription pain medicine and decreased condom use. This finding supports the existing literature (Clayton et al., 2016; Clayton et al., 2019). Conversely, a study using data from the 2011 and 2013 YRBS found a significant association between the misuse of prescription pain medicine and an increase in high school students who had ever had sex (Clayton et al., 2016). However, our finding did not

support this relationship. It is possible an association was not found because of the smaller sample size used in the study as the 2017 YRBS data were used rather than a combination of data from more than one year as the study by Clayton et al. used.

As prescription pain medicine is a fairly new question on the YRBS and a newly researched drug, there is little information that exists as to why this drug increases sexual risk behaviors, specifically unprotected sex. The hypothesis supported by the findings was H2d, which predicted a negative association with prescription pain medicine misuse and HIV testing. However, we can speculate that students who are using prescription pain medicine either underestimate their risk of STIs and pregnancy or they're simply reckless enough to have unprotected sex. This could be due to a feeling of invincibility or continuation of recklessness from the deviant behavior of using drugs in the first place. There have been previous studies that have suggested that nonmedical use of prescription drugs among youth is associated with negative outcomes such as decreased academic performance, delinquency, dropping out of school, and other substance use (Clayton et al., 2016).

In our study, heroin was not found to have a significant association with any sexual risk behaviors. The existing literature often lists heroin as a group of "illicit drugs" rather than researching the drug as an independent variable. In one study examining the association between substance use and sexual risk behaviors among high school students by their sexual identity, illicit drugs included the following: cocaine, heroin, methamphetamines, ecstasy, inhalants, hallucogenic drugs, and injecting any illegal drug. The study found an association with illicit drug use and current sexual activity and 4+ sexual partners for both heterosexual and LGB students, while no condom use during last sexual intercourse was only associated among heterosexual students (Clayton et al., 2019). Other studies have also included heroin as an illicit drug rather than an independent variable. Therefore, it is reasonable to suggest that previous literature has not found an association between heroin and sexual risk behaviors, because the effect of heroin use has not been independently researched. However, in a study of 1,199 high

school students with a history of sexual intercourse from the 2013 New York City YRBS, heroin use was significantly and positively associated with no prior history of HIV testing in an adjusted analysis (Gao et al., 2017).

Limitations

Our data are limited by several factors. First, as the YRBS collects self-reported data, reliability of the responses given by participants can be questioned. However, good test-retest reliability has been reported with the dataset and administration methods that encourage truthful responding are utilized by the YRBS (Milhausen et al., 2003). Second, as previously mentioned, the YRBS does not collect socioeconomic variables such as poverty, household income, and parent education. These factors have frequently been identified as associated with adolescent risk behaviors (Ramirez, Zimmerman, & Newcomb, 1998). Third, recall bias must be considered. As students are being asked to recall events that have occurred throughout their lifetime in this case, the accuracy or completeness of the study could be skewed if they are not accurately remembering every instance of the situation being asked of them. Fourth, social desirability bias is another limitation to the study. Due to the self-report of the respondents, this type of response bias should be considered as this population is more likely to be influenced by their peers.

Lastly, there are broad explanatory models that exist for substance use and sexual risk behaviors. Some suggest these behaviors are linked through contextual factors, such as economic disadvantage, placing adolescents at risk for elevated rates of both substance use and sexual risk behaviors (Jackson et al., 2012). Other researchers have suggested that some adolescents use substances to lower inhibition and facilitate sexual activity, in turn leading to sexual risk behaviors (Bellis et al., 2008). Unfortunately, neither economic status nor reasons for substance use are included in the YRBS.

Implications

Despite these limitations, the present study has contributed new empirical information to the existing literature regarding substance use and sexual risk behaviors among high school students. These findings suggest a clear connection between substance use and the likelihood that high school students have ever had sex, their use of condoms, and whether they have ever been tested for HIV. Establishing this connection highlights the need to provide youth with increased STI/HIV prevention knowledge, including the influence of substances.

Sexual self-efficacy should be stressed in the high school curriculum. Sexual self-efficacy is the confidence in one's ability to initiate and engage in safe-sex practices; it has been identified as a strong factor that increases the likelihood of adolescents practicing safer sex or postponing sex (Bachanas et al., 2002). With condom use continually decreasing, and adolescents holding the highest rate of STIs among all age groups in the U.S., interventions should include components that increase condom use self-efficacy, build skills for communicating with sexual partners about STI prevention and address the behaviors associated with sexual risk behaviors (Sieving et al., 1997). On average, women - especially young women - are at a greater risk of contracting HIV/AIDS because they have a hard time talking to their male partners about safer sex practices such as condom use (DHHS, 2007). This is supported by the finding that female adolescents report less frequent use of condoms during intercourse than males (Kaplan et al., 2001).

Although abstinence is the only method 100% effective at preventing pregnancy and STIs/HIV, condoms used perfectly during every single sexual experience, can be 98% effective. Additionally, when used with another form of birth control such as the pill, intrauterine device (IUD), or shot, extra pregnancy prevention and protection against STDs are gained (Planned Parenthood, 2019). Females are often put in charge of acquiring other birth control methods; however, both males and females can be responsible for condom use. Although females have been found to use condoms less often than males, condom use across all adolescent populations continues to decrease (Kann et al., 2018). Furthermore, these sexual self-efficacy

interventions should be implemented in high schools, both public and private, for all students in 9th grade. The earlier students can not only be told how to use condoms effectively, but how to confidently communicate with their partner in order to follow through with practicing safe sex, the better off they'll be in the future.

In practice, state-mandated sexual risk reduction prevention efforts do not appear to be associated with reduced sexual risk behaviors (Palepu et al., 2005). Additionally, the "one-size-fits-all" approach is inadequate because different sexual risk practices are found across substance-using groups. As shown by our findings, because there are varying associations between sexual risk behaviors and substance use, in order to be most effective, preventive interventions should be guided by empirical knowledge on the nature of the relationships between substance use and behaviors that lead to STIs in sexually active populations. In order to achieve more effective STI/HIV prevention among high-risk substance-abusing youth, more intensive and better-tailored efforts will be needed to promote sexual risk reduction. In order to better tailor these efforts, high school health curriculums need to stress the connection between substance use and sexual risk behaviors, teaching the two topics simultaneously.

Although new and innovative interventions can be designed and discussed, there is an issue of sexual health policy in the United States. Today, most states have a policy requiring HIV education, usually in conjunction with broader sex education (Guttmacher Institute, 2019). However, as the debate continues over the relative merits of abstinence-only-until-marriage approaches versus more comprehensive approaches intensifies, states have enacted a number of specific content requirements. There are only 22 states that mandate both sex education and HIV education; there are only 13 states that require that, when provided, sex and HIV education program instruction be medically accurate; there are only 8 states that require that the program is appropriate for a student's cultural background and not be biased against any race, sex or ethnicity; only 18 states and the District of Columbia require that information on contraception

be provided; and there are 3 states that require that only negative information is provided on sexual orientation.

Irregularities continue to exist among the policies of the individual states; change needs to occur and policies need to be updated and comprehensive in order to best suit the needs of the country's adolescent population.

Conclusions

Our results suggest that substance use is associated with ever having sex, condom use, and HIV testing among high school students. Marijuana had the greatest impact on the sexual risk behaviors of high school students, with alcohol second, prescription pain medicine next, and heroin having no significant impact. Additionally, this study expanded upon the existing research by examining the variables ever had sex and HIV testing, which were not commonly found in previous studies, and not found in a national study.

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