

# Substance use preferences and sexually transmitted infections among Canadian post-secondary students

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**Background:** In Canada, substance use is one of the key predisposing factors that may lead to risky sexual behaviors among post-secondary students. There is considerable economic burden and significant public health concern posed by substance use and sexually transmitted infections (STIs). The purpose of this study was to examine the prevalence of substance use preferences (alcohol, cannabis, and other drugs) and its association with STIs among Canadian post-secondary students.

**Materials and methods:** This is a cross-sectional study using data from the National College Health Assessment II, Spring 2016 survey conducted by the American College Health Association. There were 31,642 sexually active participants, representing 41 post-secondary institutions in Canada. Descriptive analysis and logistic regression were conducted to estimate the effect of substance use preferences on STIs.

**Results:** This study found that participants reported being current users of alcohol (80%), cannabis (23%), and other drugs (8%). Additionally, 3.96% of the participants self-reported being diagnosed or treated for an STI in the last 12 months. Multivariate logistic analysis revealed current cannabis use to be significantly associated with self-reported STIs (aOR, 1.34; 95% CI, 1.12–1.6). There was a significant association between current drug use and STIs among male (aOR, 3.04; 95% CI, 2.27–4.06) and female participants (aOR, 1.87; 95% CI, 1.52–2.30). Having multiple sexual partners, a history of sexual assault, being homosexual, Black, and >21 years old were also found to have a significant association with self-reported STIs ( $P$ -value <0.001).

**Conclusion:** In this study, significant associations were found between cannabis and other drug use and STIs among post-secondary students in Canada. The results of this study can help inform institutions of higher learning and public health professionals in the design, implementation, and evaluation of substance use and STI policies and effective school-based health programming.

**Keywords:** substance use, alcohol use, cannabis use, drug use, sexually transmitted infections, post-secondary students

## Introduction

Substance use and sexually transmitted infections (STIs) contribute to the global burden of disease and are responsible for large expenditures and significant strain on health care systems.<sup>1,2</sup> Substance use poses a significant threat to physical and mental health<sup>3</sup> and is reported to affect nearly 250 million people annually.<sup>4</sup> STIs are the most prevalent communicable diseases worldwide,<sup>5</sup> infecting more than 360 million people annually.<sup>6</sup> Young adults (aged 20–24 years) including post-secondary students are more likely to engage in risky behaviors such as substance use and unsafe sexual practices, which can lead to an increased risk of STIs.<sup>7–9</sup>

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STI rates are steadily increasing in Canada.<sup>10</sup> Specifically, it was reported that between 1998 and 2015, there was a considerable rise in the annual cases of chlamydia and gonorrhea, among all ages and genders.<sup>10</sup> These findings are particularly troubling because they mainly impact young adult, post-secondary students. According to the Canadian STI surveillance report (2013–2014), the highest rates of chlamydia and gonorrhea were seen among young adults aged 20–24 years.<sup>11</sup> Chlamydia cases were nearly four times higher among young adults (1,627.6/100,000 population) compared with adults aged 25–59 years (431.4/100,000 population).<sup>11</sup> Likewise, the gonorrhea rates were nearly three times higher among young adults (180.41/100,000 population) compared with adults (78.8/100,000 population).<sup>11</sup>

Several risk factors contribute to making young adult, post-secondary students more susceptible to STIs when compared with adults. These include inadequate knowledge,<sup>12</sup> increased independence,<sup>13</sup> perceived invulnerability,<sup>12</sup> inconsistent or inappropriate condom use,<sup>14,15</sup> access and use of social media to arrange for casual and multiple sexual partners,<sup>16–18</sup> and sexual encounters under the influence of substance use.<sup>8</sup> Substance use, in particular, plays a critical role by increasing risky sexual behaviors due to it causing disinhibition and impaired decision-making.<sup>14</sup>

Substance use is a major public health concern and predominately affects young adults including post-secondary students in Canada.<sup>19,20</sup> The most commonly used substances include alcohol, cannabis, and other drugs (hallucinogens, ecstasy, and cocaine).<sup>21</sup> The highest percentage of drinking in the last year was among young adults aged 18–24 years (83%).<sup>19</sup> Similarly, cannabis use in the last year was highest among young adults (25.5%), who reported rates that were more than two and a half times higher compared with adults  $\geq 25$  years old (10%; 2015).<sup>22</sup> Likewise, the prevalence of illicit drug use (including cannabis) in the last year for young adults (27%) was more than three times higher compared with adults (8%; 2013).<sup>20</sup>

Young adult, post-secondary students are at an increased risk, and thus, a target population for the prevention and control of STIs.<sup>23</sup> To reduce the burden of STIs among young adults, it is essential to identify and quantify the relevant risk factors and implement effective intervention strategies. Substance use is an important risk factor for contracting STIs among young adults due to its high prevalence and capacity to link distal contextual factors (ie, emotional and mental health issues) and proximal risky sexual behaviors (ie, unprotected sex). Previous research into substance use and STIs among young adults found positive associations, however, the majority of studies focused on high-risk

groups (ie, street youth, minority groups, and problematic drug users).<sup>24–28</sup> Moreover, there is scarcity of studies in this area in Canada. Therefore, the purpose of this study was to examine the prevalence of substance use preferences (alcohol, cannabis, and other drugs) and its association with STIs among Canadian post-secondary students.

## Materials and methods

### National College Health Assessment II, Spring 2016

The present study analyzed secondary data from the National College Health Assessment II, Spring 2016 survey, conducted by the American College Health Association (ACHA). It is a national, comprehensive, cross-sectional survey, which collected data using self-administered questionnaires from 41 Canadian post-secondary institutions. The overall response rate was 19.2%. The questionnaire consisted of eight domains: 1) health, health education, and safety; 2) alcohol, tobacco, and drugs; 3) sexual behavior and contraception; 4) weight, nutrition, and exercise; 5) mental health; 6) physical health; 7) impediments to academic performance; and 8) demographic characteristics. The present study specifically focused on the following categories: alcohol, tobacco, and drugs; sexual behavior; physical health; and demographic characteristics. Details about the survey's design and methodology are published elsewhere.<sup>29</sup>

### Participants

In total, there were 43,780 participants from 41 post-secondary institutions in Canada. However, only 31,642 participants were eligible for inclusion in our study. Inclusion criteria were specified as follow:  $\geq 18$  years old, students attending Canadian post-secondary institutions, and self-reported sexual activity within the last 12 months.

### Measures

#### Outcome variable

The survey asked participants whether they were diagnosed or treated within the last 12 months by a professional for one of the following seven STIs: chlamydia, gonorrhea, HIV, genital herpes, genital warts, hepatitis B/C, or pelvis inflammatory disease. The response to the questions was dichotomous (yes or no). In our study, these variables were combined to create one variable (being diagnosed or treated with at least one STI in the last 12 months).

#### Exposure variables

Our study included preferences for three exposures of interest: 1) alcohol, 2) cannabis, and 3) other drug use.

Each exposure was further categorized as follows: never (never used), ever (used, but not in the last 30 days), and current users (used, in the last 30 days).

### Other covariates

The present study included sociodemographic and behavioral factors previously recognized in the literature as potential confounders<sup>28,30–32</sup> associated with our exposures and outcomes of interest. These included the following: age (18–19, 20–21, 22–23, and  $\geq 24$  years); biological sex (male or female); ethnicity (White, Black, Hispanic, Aboriginal, Asian/Pacific Islander, Biracial/Multiracial); sexual orientation (heterosexual, homosexual, bisexual, and others); sexual assault in the last 12 months (yes or no); multiple sexual partners (two or more) in the last 12 months (yes or no); and tobacco use in the last 30 days (never, ever, and current users).

### Data analysis and model building

Initially, frequency distributions of self-reported STIs in the last 12 months, substance use preference (alcohol, cannabis, and other drugs), and other covariates were tabulated. A sequence of univariate logistic regression analyses was conducted to measure crude associations between each independent variable and self-reported STIs ( $P$ -value  $< 0.25$ ). Multicollinearity among independent variables was checked using the variance inflation factor (VIF  $< 2.5$ ).<sup>33</sup> A multivariate logistic regression was used to assess adjusted associations between substance use preferences (alcohol, cannabis, and other drugs) and STIs, while accounting for other covariates.

The variables with  $P$ -value  $> 0.05$  were tested for their confounding effect on the associations between substance use preferences (alcohol, cannabis, and other drugs) and STIs before exclusion. If the magnitude of change of the regression coefficients was  $\geq 10\%$  before and after adjusting, the variable was considered a confounder and kept in the model. Two-way interactions between exposures of interest and appropriate independent variables were analyzed and reported ( $P$ -value  $\leq 0.05$ ). Model fit was assessed using Hosmer–Lemeshow goodness-of-fit statistics<sup>34</sup> and the model's predicted probability was tested using ROC curve.<sup>35</sup> Data analysis was conducted using Statistical Analysis System version 9.4.

## Results

### Descriptive analysis

#### Sexually transmitted infections

There were 31,642 sexually active participants of whom 3.96% self-reported that they had been diagnosed or treated

**Table 1** Prevalence of self-reported STIs among sexually active Canadian post-secondary students, Spring 2016

STI	N	%	% of STI
Chlamydia	623	1.98	50.04
Genital warts	336	1.07	27.01
Genital herpes	270	0.86	21.81
Gonorrhea	136	0.43	10.92
HBV/HCV	102	0.32	8.21
PID	100	0.32	8.03
HIV	86	0.27	6.91
Total <sup>a</sup>	1,250	3.96	–

**Note:** <sup>a</sup>A larger sample size and overlap of frequencies were expected as participants might be co-infected with more than one infection.

**Abbreviations:** HBV, hepatitis B virus; HCV, hepatitis C virus; HIV, human immunodeficiency virus; PID, pelvic inflammatory disease; STIs, sexually transmitted infections.

for at least one STI in the last 12 months. Chlamydia was the most common self-reported STI (1.98%). Detailed statistics for STI occurrence among respondents can be seen in Table 1.

### Substance use

Table 2 shows the frequencies for substance use preferences (alcohol, cannabis, and other drugs) among participants. Nearly 80% of the respondents described themselves as current alcohol users, 23% current cannabis users, and 8% current other drug users.

### Other characteristics of the study population

The majority of the participants were female (70.74%), White (74.64%), heterosexual (79.9%), and  $\geq 24$  years old (32.18%). Of the participants, 20.04% reported tobacco use in the last 30 days, 14.63% sexual assault in the last 12 months, and 31.30% multiple sexual partners in the last 12 months. Detailed statistics are presented in Table 3.

**Table 2** Prevalence of substance use among sexually active Canadian post-secondary students, Spring 2016

Substance use	Categories		
	Never used N (%)	Ever used N (%)	Current used N (%)
Alcohol use	2,334 (7.42)	4,110 (13.06)	25,031 (79.53)
Cannabis use	14,968 (47.62)	9,240 (29.39)	7,226 (22.99)
Other drug use <sup>a</sup>	24,100 (76.34)	4,947 (15.67)	2,521 (7.99)

**Notes:** <sup>a</sup>Use of at least one of the following: cocaine (crack, rock, freebase); methamphetamine (crystal meth, ice, crank); other amphetamines (diet pills, bennies); sedatives (downers, ludes); hallucinogens (LSD, PCP); anabolic steroids (testosterone); opiates (heroin, smack); inhalants (flue, solvents, gas); MDMA (ecstasy); other club drugs (GHB, ketamine, rohypnol); or other illegal drugs.

**Abbreviations:** GHB, gamma-hydroxybutyrate; LSD, D-lysergic acid diethylamide; MDMA, 3,4-methylenedioxy-methamphetamine; PCP, phencyclidine.

**Table 3** Demographic characteristics of sexually active Canadian post-secondary students, Spring 2016

Variables	Categories	N (%)
Tobacco use	Never used	17,115 (54.31)
	Ever used	8,081 (25.65)
	Current used	6,315 (20.04)
History of sexual assault in the last 12 months	No	26,994 (85.37)
	Yes	4,626 (14.63)
Multiple sexual partners in the last 12 months	No	21,578 (68.70)
	Yes	9,829 (31.30)
Biological sex	Female	22,306 (70.74)
	Male	9,227 (29.26)
Sexual orientation	Heterosexual	25,183 (79.90)
	Homosexual	849 (2.69)
	Bisexual	2,081 (6.60)
	Others <sup>a</sup>	3,407 (10.81)
Age (years)	18–19	6,446 (20.47)
	20–21	8,972 (28.49)
	22–23	5,941 (18.86)
	≥24	10,134 (32.18)
Ethnicity	White	23,458 (74.64)
	Black	823 (2.62)
	Aboriginal	1,463 (4.65)
	Hispanic	722 (2.30)
	Asian	3,014 (9.59)
	Biracial	1,094 (3.48)
	Other	855 (2.72)

**Note:** <sup>a</sup>Asexual, pansexual, queer, questioning, same gender loving another or others.

## Univariate analysis

Univariate analysis was used to measure the crude associations of each independent variable with self-reported STIs. The strongest association was found between having multiple sexual partners and self-reported STIs (OR, 3.57; 95% CI, 3.17–4). Detailed information regarding crude ORs and their respective 95% confidence intervals are described in Table 4.

## Multivariate analysis

### Association between alcohol use and self-reported STIs

No significant association was found when comparing current or ever users vs never users of alcohol in terms of self-reported STIs (Table 4).

### Association between cannabis use and self-reported STIs

No significant association was found when comparing ever vs never users of cannabis with respect to self-reported STIs.

However, the comparison between current vs never users was significant (aOR, 1.34; 95% CI, 1.12–1.60; Table 4).

### Association between other drug use and self-reported STIs

The two-way interaction between biological sex and other drug use was significant. Therefore, adjusted ORs for the association between other drug use and self-reported STIs were analyzed for male and female participants. For male students, a significant association was found only when comparing current vs never users (aOR, 3.04; 95% CI, 2.27–4.06). For female students, significant associations were detected for both ever vs never users (aOR, 1.64; 95% CI, 1.37–1.96) and current vs never users (aOR, 1.87; 95% CI, 1.52–2.30; Table 4).

### Associations between other covariates and self-reported STIs

Participants who had multiple sexual partners in the last 12 months were nearly three times more likely to be diagnosed or treated for an STI compared with participants who did not (aOR, 2.95; 95% CI, 2.59–3.37). Participants who experienced sexual assault in the last 12 months were 57% more likely to report an STI compared with participants who did not (aOR, 1.57; 95% CI, 1.36–1.81). Homosexuals were two times more likely to be diagnosed or treated for an STI compared with heterosexuals (aOR, 2.04; 95% CI, 1.55–2.67), whereas other sexual orientations did not show significant difference from heterosexuals. STI risk was higher in Black compared with White students (aOR, 1.59; 95% CI, 1.15–2.20); however, no significant association was found for other ethnicities. The respondents who were 20–21 years old (aOR, 1.68; 95% CI, 1.39–2.03), 22–23 years old (aOR, 1.93; 95% CI, 1.57–2.36), and ≥24 years (aOR, 2.36; 95% CI, 1.95–2.85) were significantly more likely to self-report an STI compared with respondents who were 18–19 years old (Table 4).

## Discussion

Our study found that 93% of the sexually active, post-secondary students were lifetime alcohol users (current and ever users). This rate is close to the national average, which estimates that 91% of Canadians aged ≥15 years have used alcohol in their lifetime.<sup>36</sup>

However, the association between alcohol use and STIs was not significant in our study after adjusting for covariates. It is possible that recently launched health promotion initiatives and national guidelines related to alcohol use and

**Table 4** Crude and adjusted associations of substance use and other covariates with self-reported STIs among sexually active Canadian post-secondary students

Variables	Categories	Crude OR (95% CI)	P-value ( $\alpha=0.25$ )	Adjusted OR (95% CI)	P-value ( $\alpha=0.05$ )
Alcohol use	Never used	1	<0.0001	1	>0.05
	Ever used	0.92 (0.67–1.25)		0.69 (0.50–0.96)	
	Current used	1.53 (1.19–1.96)		0.81 (0.61–1.07)	
Cannabis use	Never used	1	<0.0001	1	<0.01
	Ever used	1.67 (1.44–1.92)		1.14 (0.96–1.35)	
	Current used	2.67 (2.32–3.06)		1.34 (1.12–1.6)	
Other drug use <sup>a</sup>	Never used	1	<0.0001	–	–
	Ever used	2.17 (1.89–2.5)			
	Current used	3.87 (3.33–4.5)			
Other drug use by biological sex		–	–	–	<0.001
Other drug use <sup>a</sup> (male)	Never used	–	–	–	
	Ever used	–		1.12 (0.81–1.54)	
	Current used	–		3.04 (2.27–4.06)	
Other drug use <sup>a</sup> (female)	Never used	–	–	1	
	Ever used	–		1.64 (1.37–1.96)	
	Current used	–		1.87 (1.52–2.30)	
Tobacco use	Never used	1	<0.0001	1	>0.05
	Ever used	1.47 (1.28–1.69)		1.02 (0.87–1.20)	
	Current used	2.25 (1.97–2.57)		1.13 (0.96–1.33)	
Multiple sexual partners in the last 12 months	No	1	<0.0001	1	<0.0001
	Yes	3.57 (3.17–4.00)		2.95 (2.59–3.37)	
History of sexual assault in the last 12 months	No	1	<0.0001	1	<0.0001
	Yes	2.46 (2.17–2.79)		1.57 (1.36–1.81)	
Age (years)	18–19	1	<0.0001	1	<0.0001
	20–21	1.54 (1.28–1.85)		1.68 (1.39–2.03)	
	22–23	1.67 (1.38–2.03)		1.93 (1.57–2.36)	
	≥24	1.67 (1.40–2.00)		2.36 (1.95–2.85)	
Biological sex	Male	1	<0.01	1	–
	Female	1.19 (1.05–1.36)		–	
Sexual orientation	Heterosexual	1	<0.0001	1	<0.0001
	Homosexual	2.51 (1.95–3.23)		2.04 (1.55–2.67)	
	Bisexual	1.57 (1.28–1.92)		1.04 (0.85–1.29)	
	Other <sup>b</sup>	1.35 (1.14–1.61)		1.10 (0.92–1.32)	
Ethnicity	White	1	<0.0001	1	<0.05
	Black	1.51 (1.12–2.04)		1.59 (1.15–2.20)	
	Hispanic	1.14 (0.95–1.58)		1.34 (0.94–1.91)	
	Aboriginal	1.37 (1.08–1.74)		1.24 (0.96–1.59)	
	Asian/Pacific Islander	0.69 (0.55–0.87)		0.88 (0.69–1.12)	
	Bi/multiracial	1.37 (1.04–1.80)		1.17 (0.87–1.56)	
	Other	1.16 (0.83–1.61)		1.09 (0.77–1.55)	

**Notes:** Alcohol use and tobacco use were confounders for the cannabis use and other drug use. <sup>a</sup>Use of at least one of the following: cocaine (crack, rock, freebase); methamphetamine (crystal meth, ice, crank); other amphetamines (diet pills, bennies); sedatives (downers, ludes); hallucinogens (LSD, PCP); anabolic steroids (testosterone); opiates (heroin, smack); inhalants (flue, solvents, gas); MDMA (ecstasy); other club drugs (GHB, ketamine, rohypnol); or other illegal drugs. <sup>b</sup>Asexual, pansexual, queer, questioning, same gender loving another or others.

**Abbreviations:** GHB, gamma-hydroxybutyrate; LSD, D-lysergic acid diethylamide; MDMA, 3,4-methylenedioxy-methamphetamine; PCP, phencyclidine; STIs, sexually transmitted infections.

its associated risk to STIs have helped increase awareness and improve knowledge among post-secondary students in Canada.<sup>37-40</sup> Other studies contradict our finding and provide evidence that show alcohol use to be associated with STIs.<sup>24-28</sup> However, these studies used different target populations including street youth,<sup>24</sup> youth living with HIV,<sup>25</sup> African American youth,<sup>26,27</sup> and Aboriginal youth.<sup>28</sup> The differences in the demographics of these study populations suggest that post-secondary students are a distinct group and the findings from other vulnerable populations of similar age may not be generalizable to them.

According to our findings, the prevalence of lifetime cannabis use (53%) was higher among sexually active post-secondary students compared with the national statistics (44.5%).<sup>41</sup> As Canada plans to legalize the recreational cannabis in 2018,<sup>42</sup> higher rates of cannabis use may be anticipated due to easier access, higher social acceptance, lower prices, and decreased perceived harm.<sup>43-45</sup> Therefore, it is important to continue to research the health consequences of cannabis use and raise awareness, among post-secondary students. In our study, current cannabis users were 32% more likely to self-report STIs in the last 12 months compared with never users. Our findings are consistent with those reported in previous studies.<sup>25-28</sup> There are different possible explanations for our results. One hypothesis suggests that cannabis acts as a potential immunosuppressant, reducing proinflammatory immune markers responsible for fighting infectious agents, making users more susceptible to STIs.<sup>46,47</sup> Secondly, it is postulated that cannabis use leads to increased risky sexual behaviors (ie, unprotected sex) due to disinhibition and impaired decision-making, which may result in increased risk to contract STIs.<sup>26,48</sup>

Among our study population, 8% reported currently using other drugs. Our analysis found that male (three times) and female (two times) current other drug users were significantly more likely to self-report STIs in the last 12 months compared with never users. According to the literature, when males use illicit drugs, they tend to use them with greater frequency, magnitude, and are more likely to engage in simultaneous poly-drug use compared with females.<sup>49,50</sup> Our results suggest that 1 in 12 post-secondary students engage in current other drug use regardless of their knowledge and setting. These students are a vulnerable group and prime candidates to benefit from school-based health interventions that address other drug use and STIs.

Additionally, our study revealed a number of interesting findings. The prevalence of self-reported chlamydia (1,980/100,000) and gonorrhoea (430/100,000) infections among sexually active Canadian post-secondary students were significantly higher than those reported among the general

population (668/100,000 and 87/100,000, respectively).<sup>11</sup> Among post-secondary students, having multiple sexual partners had the strongest association with STIs. This result may be attributed to the influence of peers, absence of parental supervision, a growing hook-up culture, and mental stressors.<sup>51,52</sup> When examining sexual orientation, homosexuals were more likely to report STIs, which is consistent with the findings reported in the literature.<sup>12</sup> These findings reflect an opportunity to design and implement specifically tailored health promotion activities and safe sex practices that address the unique needs of post-secondary students in Canada.

## Strengths and limitations

The strengths of our study include: 1) a population of interest that is vulnerable and to date not well characterized in Canada; 2) a large, national sample size representing 41 post-secondary institutions across Canada; 3) the diverse background of its participants (ie, inclusion of both sexes, different sexual orientations, and different ethnic groups); 4) the use of a survey instrument that is robust, valid, and reliable; and 5) the inclusion of different substance use variables (alcohol, cannabis, and other drugs) in the multivariate logistic regression analysis, which ensured pure estimates (odds ratios). There were also several limitations to this study: 1) it used a cross-sectional design and thus, reported on associations but cannot infer causation; 2) it relied on self-reported responses on substance use and STIs, which may underestimate the extent of the problem due to stigmatization, social desirability, and recall bias; 3) it was unable to analyze the magnitude of substance use and the event-specific sequence (ie, if substance use immediately preceded contracting an STI or not); and 4) it had a rather low participation rate (19.2%).

## Implications for future research

Future research among post-secondary students in Canada is warranted to examine the following: 1) the association between substance use and STIs by using specific measures (ie, magnitude, severity, and event-specific sequence of substance use and clinically diagnosed STIs); 2) the long-term impact of cannabis use on health-related outcomes including STIs; 3) the association between specific illicit drug use and STIs; and 4) the relationship between socioeconomic and environmental factors on substance use and STI occurrence.

## Conclusion

In this study, a significant association was found between cannabis and other drug use and STIs among post-secondary students in Canada. The results of this study can help inform

institutions of higher learning and public health professionals in the design, implementation, and evaluation of substance use and STI policies and effective school-based health programming. Future initiatives need to emphasize both collaboration and integration of substance use and STI services to improve the overall health and well-being of post-secondary students.

## Ethics statement

This study is exempt from ethics approval because it relies on the use of ACHA micro-files and secondary analysis of anonymous data (Tri-Council Policy Statement, articles 2.2 and 2.4, respectively). Participation in this survey was voluntary.

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## Author contributions

All authors contributed to data analysis, drafting and revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

## Disclosure

The authors report no conflicts of interest in this work.

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