Risk Factors Associated with Self-reported Sexually Transmitted Infections among Postsecondary Students in Canada

Abstract

Background: Despite major public health efforts in addressing the burden of disease caused by sexually transmitted infections (STIs), rates among young adults continue to rise in Canada. The purpose of the study was to examine the prevalence and risk factors associated with acquiring STIs among postsecondary students in Canada. **Methods:** A secondary analysis of the American College Health Association-National College Health Assessment II-C Spring 2016 survey data (n = 43,780) was conducted. Sexually active participants (n = 28,831) were examined for their demographics, sexual behavior, alcohol and marijuana use, testing for human immunodeficiency virus (HIV), and human papillomavirus vaccination history. These factors were analyzed to help identify their possible association with acquiring an STI using logistic regression and multivariate modeling. **Results:** Among the study participants, 3.88% had an STI, with the highest rates observed among females and individuals aged 21–24 years old. Multivariate logistic analysis showed that participants who engaged in anal intercourse within the past 30 days (odds ratio [OR] = 1.634; 95% confidence interval [CI], 1.343–1.988), had four or more sexual partners in the last 12 months (OR = 4.223; 95% CI, 3.595–4.962), used marijuana within the past 30 days (OR = 1.641; 95% CI, 1.387–1.941), and had ever been tested for HIV (OR = 3.008; 95% CI, 2.607–3.471) had greater odds of acquiring an STI. **Conclusions:** The findings of this study highlight certain high-risk behaviors that are strongly associated with acquiring an STI among postsecondary students. Thus, efforts to design and deliver relevant educational programming and health promotion initiatives for this particular population are of utmost importance.

Keywords: *Behaviors, Canada, risks, sexually transmitted diseases and human immunodeficiency virus, students*

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Introduction

Sexually transmitted infections (STIs) are a significant public health concern in Canada and the world.[1] According to the World Health Organization, over 360 million people acquire an STI annually.[2] Among the most common, STIs are chlamydia, gonorrhea, human immunodeficiency virus (HIV), human papillomavirus (HPV), and herpes simplex virus (HSV)[2-4] resulting in a loss of over 65 million disability-adjusted life years in 2015.[5] In Canada, STIs and their health consequences are equally as important, with billions of dollars in estimated cost and significant implications for reproductive, maternal, and newborn health.[1,6]

It is estimated that approximately 80% of young Canadians between the ages of 20 and 24 years old are sexually active.[7] Unsurprisingly, this age group also reports the highest rates of STIs.[3,7] Postsecondary students, generally fall within this age group and given their sexual activity are at an increased risk to acquire an STI.[8,9] Most postsecondary students are living away from home for the first time, with minimal supervision and therefore, may engage in risky sexual behaviors such as unprotected sex, having multiple sexual partners, and having sex while under the influence of alcohol or drugs, which can put them at a higher risk for acquiring STIs.[8-11] A national sample of Canadian postsecondary students reported that less than half of them used a condom during their last vaginal intercourse.[12] Another study among eight Canadian universities found that 62% of students who had vaginal intercourse were never tested for STIs and 85% were never tested for HIV.[3]

Sociodemographic characteristics have also been reported to be associated with

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STIs. Risk factors include age, sex, race/ethnicity, and relationship status.[13] In 2012, Canadians aged 20–24 years old reported the highest rates of chlamydia, gonorrhea, HIV, HPV, and HSV infections with females having higher rates than males.[14-17] According to the Public Health Agency of Canada, the STI prevalence among Aboriginal peoples is estimated to be higher than the overall population rates particularly with respect to HIV.[8,18] Multiple studies also showed a strong correlation between marital and relationship status and the risk of acquiring an STI.[19,20]

Despite major public health efforts, including sexual health education, population screening, and early medical interventions,[2] the rates of STIs among young adults continue to rise in Canada.[8] This implies the need for further research into the epidemiology of STIs, and particularly among postsecondary students. The purpose of this study was to determine the prevalence and risk factors associated with STIs by analyzing secondary data from 41 Canadian postsecondary institutions.

Methods

Study design

This study used the American College Health Association-National College Health Assessment II-C (ACHA-NCHA II-C), Spring 2016 survey data. This is a national survey prepared and coordinated by the ACHA.[21] Forty-one, self-selected Canadian postsecondary institutions participated in the survey. Institutions that either collected data by random sampling or surveyed all their students formed the Canadian reference group.[22-24]

Instrument

The primary data were collected through a self-reported online survey, which consists of over 300 questions in nine sections.[21,25] The generalizability, reliability, and validity analysis of this survey instrument have been statistically assessed and explained in detail elsewhere.[25,26]

Participants

A total of 43,780 students across Canada completed the survey with an overall response rate of 19.2%.[21] For the purposes of this study, we only included respondents who met the following criteria: They were at least 18-year-old, attended one of the participating Canadian College institutions, and self-identified as being sexually active during the last 12 months. Using these criteria, 28,831 (65.85%) students were eligible to be included in our study.

Variables explored

Variable selection process

This study examined a number of variables associated with both "high risk behaviors" as well as "high-risk groups" for STIs among postsecondary students in Canada. High-risk

behaviors were characterized on the basis of the number of sex partners, types of sexual behaviors (vaginal, anal, and oral sex), alcohol use, and marijuana use. High-risk groups were characterized on the basis of younger age participants, who were single, female, and minority (Aboriginals). Previous testing for HIV and HPV vaccination were also used as variables because recent reports in Canada suggest that sexually active individuals are not being tested for STIs, and specifically HIV[3] and it is feared that HPV vaccination may lead to increased risky sexual behavior among youth.[27]

Outcome variable

A dichotomous (yes, no) variable indicating whether or not the respondent had a history of STI over the past 12 months was created. Participants who reported receiving a diagnosis or treatment for any of the following infections (chlamydia, gonorrhea, HIV, HPV, and HSV) within the last 12 months were classified as having a history of STI.

Independent variables

Variables of interest in this study included in this study:
1. Demographics: Age group (18–20; 21–24; 25–29; 30 or more), Aboriginal status (yes, no), Biological sex (female, male), and relationship status was recoded as a separate dichotomous variable (yes, no)
2. Sexual behavior: The number of sexual partners in the last 12 months (one, two, three, four or more) and if the person had vaginal intercourse, anal intercourse and oral sex (never; yes, but not in the past 30 days; and yes, in the past 30 days)
3. Alcohol and marijuana use: Alcohol and marijuana use (never; yes, but not in the past 30 days; yes, in the past 30 days)
4. Testing and vaccination history: Ever been tested for HIV and HPV vaccination status (yes, no, don't know).

Statistical analysis and model building

Descriptive statistics and cross-tabulations were used to summarize general characteristics of the data. Univariate analyses to determine whether there was an association between the outcome (i.e., STI) and independent variables were carried out. Then, a series of bivariate logistic regression analyses were performed. We removed any variable with $P \geq 0.25$ from our first multivariable model. The remaining variables were analyzed for multicollinearity (variance inflation factor ≥ 2.5).

For model selection, we adapted the method as described by Hosmer *et al.*[28,29] A variable selection decision at every step of the modeling process was made using a $P \leq 0.05$ as the significance level. When a variable was removed, confounding was assessed by comparing the values of the estimated regression coefficients between the two models at each stage. Any change in the regression coefficient values by 20% or more was considered an indication of confounding and the variable was kept in the model. All

possible interactions among the variables in the model were checked, using 0.05 as the level of significance. Finally, Hosmer *et al*. Goodness of fit tests were used to determine the appropriateness of our model. Data were analyzed using both SAS software version 9.4 and SPSS Statistics software version 24 (SAS Institute Inc., Cary, North Carolina, USA).

Results

Descriptive statistics

A total of 43,780 Canadian postsecondary students participated in the Canadian ACHA-NCHA II-C, Spring 2016 survey. Among these participants, 28,831 (65.85%) reported being sexually active and 3.88% reported being diagnosed and/or treated with an STI within the last 12 months. The descriptive characteristics of the study population (demographics [sex, age, Aboriginal status and relationship status], sexual behavioral characteristics [vaginal and anal intercourse, oral sex, and number of sex partners], alcohol and marijuana use, HIV testing, and HPV vaccination) are presented in Table 1.

Univariate analysis

Univariate analysis examining the association between STIs and demographics, sexual behaviors, alcohol and marijuana use, HIV testing, and HPV vaccination status are presented in Table 2. Biological sex, age, Aboriginal status, relationship status, vaginal intercourse, anal intercourse, oral sex, number of sex partners, use of alcohol, use of marijuana, HIV tested, and HPV vaccinated were significantly associated with STI status. On the other hand, body mass index classification, current residence, and international student status were not statistically significant.

Logistic regression modeling

The results of logistic regression modeling are presented in Table 3. The main findings from our analysis include female students were more likely to acquire an STI compared to males (odds ratio [OR] = 1.296; 95% confidence interval [CI], 1.106–1.519); individuals 21–24 years old were more likely to acquire an STI compared to individuals aged 18–20 (OR = 1.457; 95% CI, 1.247–1.701); those who engaged in anal intercourse within the past 30 days were more likely to have an STI compared to those who never engaged in anal intercourse (OR = 1.634; 95% CI, 1.343–1.988); students reporting four or more sex partners over the past 12 months were more likely to acquire an STI compared to those with one sex partner over the past 12 months (OR = 4.223; 95% CI, 3.595–4.962); students who used marijuana in the past 30 days were more likely to acquire an STI compared to students who never used it (OR = 1.641 95% CI, 1.387–1.941); and students who have ever been tested for HIV were more likely to acquire an STI compared to students who have not (OR = 3.008; 95% CI, 2.607–3.471).

Table 1: Descriptive characteristics of the sexually active college students in Canada

Outcome variable	Percentage		Total
STI[a] diagnosed or treated in the past 12 months among sexually active college students (*n*=28,831)			
Yes	3.88		1119
No	96.12		27,712
Independent variables	**Percentage**		**Total**
	With STI	**Without STI**	
Demographics			
Biological sex (*n*=28,758)			
Female	4.03	95.97	20,657
Male	3.52	96.48	8101
Age group (*n*=28,738)			
18-20 years	2.97	97.03	10,042
21-24 years	4.65	95.35	11,313
25-29 years	4.31	95.69	4150
30 years or more	3.46	96.54	3233
Aboriginal status (*n*=28,831)			
Yes	5.46	94.54	1483
No	3.80	96.20	27,348
Relationship status (*n*=28,776)			
Not in a relationship	5.03	94.97	8756
In a relationship	3.38	96.62	20,020
Sexual behavior			
Vaginal intercourse (*n*=28,660)			
Yes, in the past 30 days	4.05	95.95	21,225
Yes, but not in the past 30 days	3.23	96.77	5665
Never	3.84	96.16	1770
Anal intercourse (*n*=28,500)			
Yes, in the past 30 days	7.06	92.94	2350
Yes, but not in the past 30 days	5.57	94.43	8261
Never	2.73	97.27	17,889
Oral sex (*n*=28,659)			
Yes, in the past 30 days	4.38	95.62	19,564
Yes, but not in the past 30 days	2.78	97.22	7871
Never	3.27	96.73	1224
Number of sexual partners in the last 12 months (*n*=28,830)			
1 sex partner	2.09	97.91	19,066
2 sex partners	4.25	95.75	3624
3 sex partners	5.81	94.19	2151
4 or more sex partners	11.06	88.94	3989
Alcohol and marijuana use			
Alcohol use (*n*=28,691)			
Yes, in the past 30 days	4.25	95.75	23,135

Contd...

Table 1: Contd...

Outcome variable	Percentage		Total
Yes, but not in the past 30 days	2.22	97.78	3555
Never	2.35	97.65	2001
Marijuana use (*n*=28,656)			
Yes, in the past 30 days	6.44	93.56	6802
Yes, but not in the past 30 days	4.19	95.81	8504
Never	2.37	97.63	13,350
Testing and vaccination history			
Ever been tested for HIV (*n*=28,761)			
Yes	7.79	92.21	8772
No	2.02	97.98	18,551
Don't know	3.96	96.04	1438
HPV vaccination (*n*=28,600)			
Yes	4.13	95.87	11,827
No	4.01	95.99	12,481
Don't know	2.87	97.13	4292

[a]STI includes: Chlamydia, gonorrhea, HIV, HPV, and HSV. HIV=Human immunodeficiency virus, HPV=Human papillomavirus, HSV=Herpes simplex virus, STI=Sexually transmitted infection

Discussion

The present study describes the association of STIs with certain risk factors among postsecondary students in Canada. Our findings suggest that a wide array of demographic, sexual behaviors, marijuana use, history of HIV testing, and HPV vaccination factors influence the risk of acquiring an STI.

From the demographic perspective, the results of our study show significant associations between being a female in the 21–24 age group and the likelihood of acquiring an STI (OR = 1.296; 95% CI, 1.106–1.519 and OR = 1.457; 95% CI,1.247–1.701, respectively). Our findings for females[13,30] in this age group[3,7,8,13] are consistent with those reported in previous studies. In 2010, The Association of Universities and Colleges of Canada reported that 86% of full-time undergraduate students were under the age of 25-year-old.[31] This group is not only among the most sexually active subpopulation[9,13] but are also more likely to engage in risky sexual behaviors,[32] which puts them at an increased risk to contract an STI. The reasons for higher rates of STIs among females as compared to males are multifactorial and in the literature have been attributed to a more delicate vaginal mucosa and the tendency for most STIs to be less symptomatic in women and therefore, go untreated.[33]

Regarding sexual behaviours, our study results demonstrate that participants who had ever engaged in anal intercourse, and those who did so within the past 30 days, are

Table 2: Univariate analysis of sexually transmitted infections among sexually active college students in Canada

Independent variables	OR (95% CI: Lower–upper)	*P* (α=0.25)
Demographics		
Biological sex (reference: Male)		
Female	1.151 (1.004-1.320)	0.0444
Age group (reference: 18-20 years)		
21-24 years	1.594 (1.380-1.843)	<0.0001
25-29 years	1.474 (1.220-1.781)	
30 years or more	1.173 (0.941-1.464)	
Aboriginal status (reference: No)		
Yes	1.727 (1.382-2.159)	<0.0001
Relationship status (reference: yes, in a relationship)		
No	1.512 (1.337-1.709)	<0.0001
Sexual behavior		
Vaginal intercourse (reference: Never)		
Yes, in the past 30 days	1.056 (0.821-1.358)	0.0185
Yes, but not in the past 30 days	0.836 (0.629-1.110)	
Anal intercourse (reference: Never)		
Yes, in the past 30 days	2.711 (2.260-3.251)	<0.0001
Yes, but not in the past 30 days	2.103 (1.846-2.395)	
Oral sex (reference: Never)		
Yes, in the past 30 days	1.354 (0.981-1.870)	<0.0001
Yes, but not in the past 30 days	0.847 (0.601-1.193)	
Number of sexual partners in the last 12 months (reference: 1 sex partner)		
2 sex partners	2.082 (1.722-2.516)	<0.0001
3 sex partners	2.894 (2.355-3.556)	
4 or more sex partners	5.830 (5.068-6.708)	
Alcohol and marijuana use		
Alcohol use (reference: Never)		
Yes, in the past 30 days	1.847 (1.373-2.484)	<0.0001
Yes, but not in the past 30 days	0.945 (0.656-1.362)	
Marijuana use (reference: Never)		
Yes, in the past 30 days	2.839 (2.449-3.291)	<0.0001
Yes, but not in the past 30 days	1.802 (1.545-2.102)	
Testing and vaccination history		
Ever been tested for HIV (reference: No)		
Yes	4.093 (3.598-4.655)	<0.0001
Don't know	2.001 (1.506-2.658)	

Contd...

Table 2: Contd...		
Independent variables	**OR (95% CI: Lower–upper)**	***P* (α=0.25)**
HPV vaccination (reference: No)		
Yes	1.033 (0.910-1.174)	0.0008
Don't know	0.707 (0.579-0.864)	

OR=Odds ratio, CI=Confidence interval, HIV=Human immunodeficiency virus, HPV=Human papillomavirus

significantly more likely to acquire STIs compared to those who never engaged in anal intercourse (OR = 1.535; 95% CI, 1.330–1.772 and OR = 1.634; 95% CI, 1.343–1.988, respectively). These findings are similar to those reported in the previous studies.[34,35]

Engaging in heterosexual anal intercourse is not an uncommon practice among sexually active young women,[35] with even greater rates reported in those with higher education and income level.[35,36] Interestingly, we found that 37% of our study participants have engaged in anal intercourse, which is higher than the 23% reported in previous research among sexually active undergraduate students.[34] These results emphasize the importance of openly discussing anal intercourse during any sexual health consult with postsecondary students and raising awareness of its potential risks.

Our study results indicate that participants with four or more sexual partners, in the last 12 months, and those who used marijuana, particularly in the last 30 days, had a significantly greater likelihood of acquiring STIs (OR = 4.223; 95% CI, 3.595–4.962 and OR = 1.641; 95% CI, 1.387–1.941, respectively). These findings are noteworthy because several studies report an association between multiple sexual partners and higher use of marijuana[37-41] and lower use of condoms during sex.[42] Possible explanations for these risky behaviors may include peer influence and the tendency for having casual sex among postsecondary students.[43,44] Our results may have significant implications, given the upcoming changes in Canadian legislation regarding the legalization of marijuana use and merit further research.

Limitations and strengths

This study has a number of limitations and several strengths. First, since participating postsecondary institutions in the survey were self-selected, the results may not be generalizable. However, all Canadian institutions that participated in the survey were included in the analysis.[21] This, along with the large sample size, help minimize the risk of bias. Second, as with all other self-reported data, our results are subject to recall and social desirability bias. As for the latter, while it is impossible to eliminate, numerous studies have shown the use of anonymous web-based survey tends to reduce it.[45,46] Moreover, the relatively recent time-frame of most questions (last 30 days or last

Table 3: Multivariable analysis of sexually transmitted infections among sexually active college students in Canada

Variable	OR (95%CI: Lower-upper)	*P* (α=0.05)
Demographics		
Biological sex (reference: Male)		
Female	1.296 (1.106-1.519)	0.0014
Age group (reference: 18-20 years)		
21-24 years	1.457 (1.247-1.701)	<0.0001
25-29 years	1.284 (1.037-1.590)	
30 years or more	1.124 (0.865-1.461)	
Sexual behavior		
Anal intercourse (reference: Never)		
Yes, in the past 30 days	1.634 (1.343-1.988)	<0.0001
Yes, but not in the past 30 days	1.535 (1.330-1.772)	
Oral sex (reference: Never)		
Yes, in the past 30 days	0.591 (0.415-0.843)	<0.0001
Yes, but not in the past 30 days	0.446 (0.308-0.644)	
Number of sexual partners in the last 12 months (reference: 1 sex partner)		
2 sex partners	1.965 (1.612-2.397)	<0.0001
3 sex partners	2.468 (1.982-3.074)	
4 or more sex partners	4.223 (3.595-4.962)	
Alcohol and marijuana use		
Alcohol use (reference: Never)		
Yes, in the past 30 days	0.948 (0.686-1.309)	0.0369
Yes, but not in the past 30 days	0.694 (0.473-1.017)	
Marijuana use (reference: Never)		
Yes, in the past 30 days	1.641 (1.387-1.941)	<0.0001
Yes, but not in the past 30 days	1.296 (1.097-1.532)	
Testing and vaccination history		
Ever been tested for HIV (reference: No)		
Yes	3.008 (2.607-3.471)	<0.0001
Don't know	1.853 (1.383-2.481)	
HPV vaccination (reference: No)		
Yes	0.911 (0.783-1.059)	0.0571
Don't know	0.778 (0.630-0.961)	

OR=Odds ratio, CI=Confidence interval, HIV=Human immunodeficiency virus, HPV=Human papillomavirus

12 months), would minimize the chance of recall bias.[47] Finally, our study is cross-sectional in design and therefore, unable to draw causal inferences between the variables explored and the occurrence of STIs. Our study also has a

number of significant strengths. It uses recent data (2016) from the largest-ever Canadian cohort to complete the ACHA-NCHA II survey. The survey instrument is robust, generalizable, reliable, and valid. Our findings provide valuable insight into the risk factors associated with STIs among Canadian postsecondary students.

Conclusions

This study underscores the significance of STIs as a serious and growing public health concern. Postsecondary students are particularly vulnerable to STIs, which makes understanding their sexual behaviors an important topic for consideration. Furthermore, a number of risky sexual behaviors among this population occur concurrently, which increases their likelihood of acquiring STIs. Our findings could prove useful to university health centers, health care practitioners, and health educators in search of ways to reduce postsecondary students' risk of STIs.

Conflicts of interest

There are no conflicts of interest.

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