ORIGINAL RESEARCH

Risk Factors For Sexually Transmitted Diseases in Canada and Provincial Variations

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Abstract

Objectives: This study explored factors associated with reporting ever having had a sexually transmitted disease (STI) in Canada and the provincial variations in these associations.

Methods**:** A sample of 35,099 Canadian adults was drawn from the 2009-2010 Canadian Community Health Survey, and analyzed using binary logistic regression to model the relationships that marital status, sex, household income, education, frequency of risky drinking, smoking status, immigration status, and Canadian region of residence have with ever being diagnosed with an STI. The model controlled for the age of the respondent.

Results: People living in the Territories had the highest odds of having ever been diagnosed with an STI (OR = 2.03, 95% CI (1.19,3.48)) and residents from the Maritime provinces (OR = 0.71, 95 % CI (0.59, 0.85)) and Ontario (OR = 0.79, 95 % CI (0.70, .89)) had the lowest odds for having been diagnosed with an STI. Being female was a risk factor with an odds ratio of 1.74 (95% CI (1.60, 1.88)). In our study, income, marriage and education were found to be protective factors. Behavioral factors such as smoking and binge drinking had significant harmful effects on sexual health. Current smokers had an odds 1.95 (95% CI (1.75, 2.18)) times higher than non-smokers of ever being diagnosed with an STI. Similarly, individuals with a binge drinking frequency of more than once per week had 1.77 (95% CI (1.57,1.99)) higher odds of having ever had an STI.

Conclusions: Both demographic and behavioral factors influence the likelihood of having ever been diagnosed with an STI in Canada. Women, people with lower income, lower education, or unmarried are more likely to have ever had an STI. Smoking and binge drinking are significantly associated with an increase in the likelihood of ever having an STI in Canada. Policy interventions such as providing accurate relevant information to higher risk populations, identified in this study, could prove beneficial. Screening interventions in clinic-based and non-clinical settings are also an important part of any STI prevention strategy. Tailored gender-specific health promotions interventions are also likely be more efficacious.

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Introduction

As STIs continue to present a significant public health challenge, it becomes increasingly important to identify the many social and psychological factors that lead individuals to make risky decisions regarding sexual behavior[1,2] . Socio-demographic factors, such as age and gender were found to be strong predictors of risky sexual behavior and the likelihood of contracting STIs. Due to a number of

rapid changes in physiology, psychology, and social behaviors, the teen years in particular represent a period of increased risk.[3]. Globally, the highest rates of STI contraction tend to occur in young adults between 15 and 24,[4,5] part of the elevated risk during this period has been attributed to behaviors including early sexual debut, smoking, and alcoholism.[6] STI risk and spread are also influenced by gender with men being more likely to actively transfer the diseases and women being more likely to be diagnosed multiple times with STIs.[7]

A number of social factors also act as strong predictors of STI risk. A well established protective factor against STIs is marital status, married individuals tend to take part in fewer high-risk sexual behaviors and so have a much lower probability of contracting STIs.[8] Individuals coming from families with a high socio-economic status (SES) also tend to have a much lower risk of contracting an STI owing to a number of factors; high SES tends to correlate strongly with higher educational attainment, better access to healthcare resources, and a tendency to be more cautious with regards to their health [9,10]

Objectives

To estimate factors associated with having ever had a Sexually Transmitted Disease (STIs) in Canada and explore provincial variation.

Methods

Data

The 2009-2010 Canadian Community Health Survey (CCHS) was used to identify socio-demographic and economic predictors of ever being diagnosed with a sexual transmitted disease in a Canadian context. The Canadian Community Health Survey (CCHS) is a cross-sectional survey that collects information related to health status, health care utilization and determinants of health for the Canadian population. The CCHS survey sampled from approximately 98% of the total Canadian population over the age of 12 across ten provinces and three territories encompassing 121 health regions in 2009, and 117 health regions in 2010. Populations excluded from this sample include individuals living on reserves or Aboriginal settlements, institutionalized populations, and populations from the Region du Nunivak and Region du Terres-cries-de-la-Baie-James health regions in Quebec. The sample size of this survey was 124,188.

Verbal consent was obtained from all participants prior to the administration of the interview, with the exception of respondents between the ages of 12 and 15 for whom parental consent was obtained. The interviews themselves utilized one of two interviewing techniques; Computer Assisted Personal Interview (CAPI) for face-to-face interviews, and Computer Assisted Telephonic Interview (CATI) for telephone interviews (Statistics Canada, 2014; Statistics Canada, 2011; Statistics Canada 2011). The survey sample was weighted as instructed by Statistics Canada so that it was representative of the Canadian population eligible for the survey.[11] More information regarding this survey is available at Statistics Canada's website.[12]

Variables

The binary outcome variable "Ever diagnosed with STI" from the survey was used in this analysis. The variables of interest in the model were based on available literature regarding the factors associated with risky sexual behavior and the risk of contracting an STI; they included Sex, Income, Marital Status, Education, Frequency of Risky Drinking, Used an illicit drug in the past year, Smoking Status, Immigration Status, and Province of Residence. The model also controlled for the age of the respondent. "Frequency of Alcohol Use" was recoded into the 'risky drinking' groups as defined by Thomas (2012): frequent (more than once per month), infrequent (at most once per month), and never, where risky drinking is defined as consuming five or more drinks on a single occasion. "Smoking Status" was recoded into the current, former, and never smoked groups. Age was recoded into the groups: 12-17 years, 18-24 years, 25-39 years, and 40 years and above. The provinces were categorized into six regions: Prairie Provinces, Maritime Provinces, Ontario, Quebec, British Columbia (BC), and Territories. The distributions of all these variables are presented in Table 1.

Statistical Analyses Methods

All statistical analyses were conducted using version 9.3 of Statistical Analysis Software (SAS). The regression analysis was conducted in a two-step process. The first step was a univariate analysis to test individual associations between the dependent and each of the independent variables. A significance value of 0.20 was used to adjust for the multiple comparisons and rule out predictor variables that would not contribute meaningfully to the multivariate analyses. All predictor variables that were found to be significant were included in step two, a multivariate analysis intended to identify which factors predicted STI acquisition in Canadians over the age of 12. In this final model, $p<0.05$ was used to identify significant associations. Hosmer and Lemeshow

Table 1: Variables used in the model

Variables	Number	Percentage
Ever diagnosed with an STD?		
Yes	2,888	8.2
No	32,211	91.8
Age		
12 - 17 years	778	2.2
18 - 24 years	5,773	35.7
25 - 39 years	16,031	45.7
40 years +	12,518	35.7
Gender		
Female	16,821	47.9
Male	18,279	52.1
Income		
No or <$20,000	2,043	5.8
$20,000 to $39,999	4,252	12.1
$40,000 to $59,999	5,380	15.3
$60,000 to $79,999	6,127	17.5
$80,000 or more	17,298	49.3
Marital Status		
Married	15,538	44.3
Single/never married	10,867	31.0
Common-law	6,353	18.1
Widow/separated/divorced	2,341	6.7
Education		
< Secondary	2,976	8.5
Secondary	5,227	14.9
Some post-secondary	3,260	9.3
Post-secondary graduate	23,636	67.3
Frequency of risky alcohol consumption		
Never	12,881	27.5
Infrequent	15,216	36.7
Frequent	12,564	35.8
Use of illicit drugs in the past 12 months		
Yes	3,032	8.6
No	11,668	33.3
Missing	20,400	56.1
Smoking Status		
Current smoker	9,659	27.5
Former smoker	12,876	36.7
Never smoked	12,564	35.8
Immigration Status		
Canadian Born	29,427	83.9
Not Canadian Born	5,621	16.0
Missing	51	0.1
Region		
Maritimes	2,544	7.2
Quebec	9,011	25.7
Ontario	12,926	36.8
Prairies	6,269	17.9
British Columbia	4,254	12.1
Territories	96	0.3

statistics were then used to assess the goodness of fit for the model.

Results and Discussion

A total of 2,888 (8.2%) respondents reported having been diagnosed with an STI at least once in their lifetime with the remainder being STI-free.

Because New Brunswick, Saskatchewan and Ontario were the only provinces that completed the portion of the survey relevant to illicit drug use, the variable could not be included in the regression analysis. After dropping this variable and eliminating any responses with missing data, the sample size for all subsequent analyses was 35,013.

Performing the univariate analyses yielded that all the independent variables were significantly related to the dependent variable ($p<0.01$). The resulting multivariate logistic regression model was fit to the CCHS data:

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_{Age}X_{Age} + \beta_{gender}X_{gender} + \beta_{MaritalStatus}X_{MaritalStatus} + \beta_{income}X_{income} + \beta_{education}X_{ducation} + \beta_{smoking}X_{smoking} + \beta_{alcohol}X_{alcohol} + \beta_{immigration}X_{immigration} + \varepsilon,$$

where p is the probability of ever being diagnosed with an STI. It should be noted that all the assumptions underlying the validity of the above model were tested and no violations of these assumptions were found. Table 2 provides the resulting estimated odds ratios (ORs) and their 95% confidence intervals.

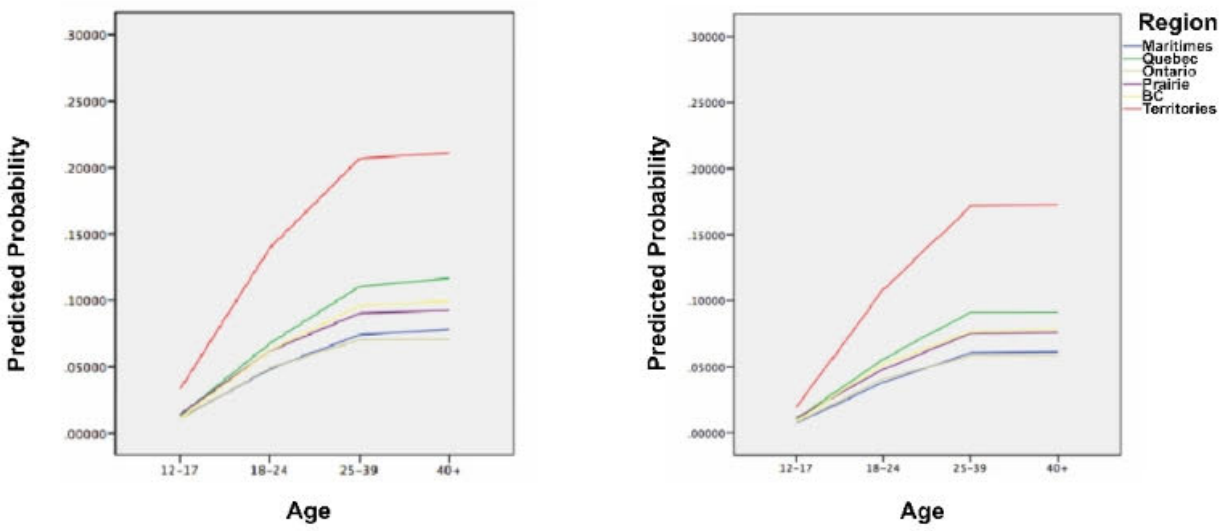
Socio-demographic Variables:

i. Region

All OR values were calculated with "Prairie Provinces" as the reference category. The region associated with the highest odds of reporting having ever being diagnosed with an STI was "Yukon/ NWT/Nunavut" (*OR* = 2.03, 95% CI (1.19, 3.48)). The regions associated with the lowest odds are the Ontario (*OR* = 0.79, 95% CI (0.70, 0.89)), and the "Maritime Provinces" (*OR* = 0.71, 95% CI (0.59, 0.85)), These results are consistent with the published literature that suggests that the Northern Territories tend to have the highest rate of STI diagnosis in Canada.[13]

ii. Age and Sex

Age and gender are well established in the literature as factors that significantly influence the risk of contracting STIs.[14,15] In our study, we found that



Figures: The above two figures illustrate the predictive probabilities for married, non-smoking, non-immigrant Canadians who never graduated from high school and from households with incomes less than $20,000. The left figure illustrates the predicted probabilities that females have ever been diagnosed with an STI across the different Canadian regions and age groups. The right figure is for males

those in adult age categories 18-24 years (*OR* = 5.91, 95% CI (3.07,11.36)), 25-39 years (*OR* = 11.95, 95% CI (6.23,22.89)), and 40 years +(*OR* = 14.07, 95% CI (7.33,27.02)) have a higher odds of having been diagnosed with an STI than the teenage group aged 12-17 years. We also found that the odds females were diagnosed with an STI were close to twice that of males (*OR* = 1.74, 95% CI (1.60, 1.88)). This result is not particularly surprising since the majority of incident infections worldwide tend to occur in women owing to a number of factors such as: male-to-female STI transmission being more likely than female-to-male transmission ([16]), higher likelihood of engaging in risky sexual behaviors out of financial need such as trading sex for money in order to support themselves.[15,17,18]

iii. Marital Status

The evidence in the literature indicates that marriage tends to have a protective effect against STIs. [19] This study confirms a protective effect of marriage, finding that single or never married Canadians (*OR* = 1.74, 95% CI (1.56,1.95) and widow =ed, separated, or divorced Canadians (*OR* = 1.71, 95% CI (1.48,1.99) had higher odds of being diagnosed with an STI when compared to married individuals .Interestingly, we also found that those in common law relationships had higher odds than married individuals for being diagnosed with an STI (*OR* = 1.50, 95% CI (1.34, 1.68).

iv. Education

An individual's level of educational attainment plays a pivotal role in their ability to understand and act on information delivered as part of prevention programs.[20] This study found that Canadians who minimally completed secondary school had lower odds of being diagnosed with an STI than those who has not completed secondary school: (*OR* = 0.69, 95% CI (0.58,0.81)); (OR=0.69, 95% CI (0.58, 0.84)); and (OR=0.81, 95% CI (0.70,0.93)) respectively.

v. Income

Higher annual income is associated with lower likelihood to ever be diagnosed with a STI, the higher the income the lower the likelihood of being diagnosed.[21] We found that having a household income of $60,000-$79,999 CAD (OR=0.69, 95% CI (0.58,0.82)) and at least $80,000 CAD (OR=0.80, 95% CI (0.68, 0.94)) as protective. If one's household income was between $20,000 - $39,999 CAD or $40,000 - $59,999 CAD, the individual's odds for being diagnosed with an STI was the same as someone whose household income was less than $20,000 CAD. This protective effect is likely best explained by the fact that individuals with lower income tend

to have limited access to both the healthcare resources and a lower level of knowledge regarding how to prevent infection.[22]

Behavioral Variables:

i. Smoking

The substantial negative effects on public health caused by smoking are well documented and smoking is often quite common amongst individuals who engage in risky sexual behaviors.[23] This study found that there was a significant link between smoking and STI risk with daily smokers being more likely to be diagnosed with a STI than non-smokers (*OR* = 1.57, 95% CI (1.43, 1.71)). Even occasional smokers were more likely than non-smokers to be diagnosed with an STI (*OR* = 1.43, 95% CI (1.24, 1.64)). These finding are consistent with the established literature that has found a significant relationship between smoking and risk of contracting STIs, irrespective of the frequency of smoking.[24]

ii. Frequency of Risky Drinking

Risky drinking (also called binge drinking or heavy episodic drinking) is a behavior in which five or more drinks are consumed within a single sitting. Binge drinking is associated with a higher likelihood to be diagnosed with a STI.[25,26] In line with these previous findings, the current study found that, as the frequency of binge drinking increased, there was a corresponding increase in the odds of an STI diagnosis. Using non-binge drinkers as the reference category, we found that those who engaged in binge drinking frequently (i.e. at least once a week) had the highest risk of being diagnosed with an STI (*OR* = 1.77, 95% CI (1.57, 1.99)), followed by those who would binge drink less than once per week (*OR* = 1.48, 95% CI (1.34, 1.63)).

Other variables:

i. Immigrant status

This study found that Canadian born individuals had a higher odds of reporting ever being diagnosed with a STI when compared to immigrant populations (OR = 1.32, 95% CI (1.16, 1.50), a finding that contradicts the established literature. Part of these differences may be attributed to stringent laws and procedures used by Citizenship and Immigration Canada to determine the health status of immigrants before they enter the country.[27] However, HIV and syphilis are the only mandatory STI tests for immigrant/refugee applicants; most STIs do not prevent entry to Canada so there must be other factors that need to be explored in further research studies.

Table 2: The estimated odds ratios of ever being diagnosed with an STI in Cana-

Variables	OR	95% Confidence Interval	
Age (12 to 17 years)			
18 to 24 years	5.91*	3.07	11.36
25 to 39 years	11.95*	6.23	22.89
40 years +	14.07*	7.33	27.02
Gender (Male)			
Female	1.74*	1.60	1.88
Income (<$20,000)			
$20,000-$39,999	0.85	0.72	1.02
$40,000-$59,999	0.85	0.71	1.00
$60,000-$79,999	.69*	0.58	0.82
$80,000+	.80*	0.68	0.94
Marital Status (Married)			
Single/never married	1.74*	1.56	1.95
Common-law	1.50*	1.34	1.68
Widow/separated/divorced	1.71*	1.48	1.99
Education (< Secondary)			
Secondary graduate	0.69*	0.58	0.81
Some post-secondary	0.69*	0.58	0.84
Post-secondary graduate	0.81*	0.70	0.93
Frequency of Risky Drinking (Never)			
Infrequent	1.48*	1.34	1.63
Frequent	1.77*	1.57	1.99
Smoking Status (Never smoked)			
Former smoker	1.76*	1.59	1.95
Current smoker	1.95*	1.75	2.18
Immigration Status (Not Canadian born)			
Canadian Born	1.32*	1.16	1.50
Region (Prairie Provinces)			
Maritime Provinces	0.71*	0.59	0.85
Quebec	1.10	0.97	1.23
Ontario	0.79*	0.70	0.89
British Columbia	1.05	0.91	1.20
Yukon/NWT/Nunavut	2.03*	1.19	3.48

*P<0.05. The phrase in parentheses after each bolded variable name is the reference category.

Goodness of fit

The Hosmer and Lemeshow test was conducted to assess the goodness of fit of the statistical model. At the 0.05 level of significance, we have evidence to conclude that the model fits the data well (p = 0.8717).

Limitations

A key limitation for this study was the fact that data regarding drug use was only available for the provinces of Saskatchewan, New Brunswick and Ontario. Previous research has provided strong evidence that drug use is an important factor to be considered when studying the risk of contracting STIs.[17,28] Due to the lack of data, illicit drug use could not be included as a variable in the analysis. Finally, this study was not able to include on-reserve First Nations populations, who often experience an elevated risk of contracting STIs.[13]

Conclusions

Our study shows that the odds of reporting having ever had an STI were highest for people residing in the Territories, followed by BC, the Prairie Provinces, the Eastern Provinces, and residents of the Maritime Provinces proved to have the lowest risk of contracting STIs. These results are consistent with the literature on STI trends in Canada (Centre for Communicable Diseases, PHAC, 2012). The results suggest that the Territories are in need of increased preventative measures, and educational programs targeted towards sexual health and safety. The Territories are administered by the federal government, whereas the provinces each have their own provincial government and regional health authorities that may use very different prevention programs. The results of this study also suggest that both the Prairie and BC regions would benefit from sexual health interventions.

This study's results are consistent with the published literature in regards to the effects of both age and gender. Increased age and being a female were significantly associated with reporting having ever had an STI. Part of the elevated risk associated with increased age can be explained by the fact that older adults often have other behavioral risk factors such as smoking and alcohol use.[21] Females are often more vulnerable to contracting STIs due to easier transmission from males to females, and the higher likelihood of women being involved in the sex trade.[17] Prevention programs should therefore be tailored to meet the increased needs of females, both improving their knowledge base regarding STIs and addressing the social and financial factors.

Both education and income are acknowledged as major factors that have a significant effect on STI risk in the literature.[21,29] Consistent with existing evidence, we found that lower education and lower income were associated with higher odds of reporting having ever had an STI. Therefore more attention should be given at both the Federal and Provincial level sexual education. Smoking and binge drinking are factors associated with higher likelihood of reporting having ever been diagnosed with STIs, One of the examples of prevention strategies that has proven effective is providing accurate relevant information on safer sex to higher risk population.[30] Screening interventions in clinic-based settings including screening individuals, treating patients and partners, and rescreening persons to detect repeat infection are also key parts of any effective STI control and prevention strategy.[31] In addition, screening at non-clinical settings can also be a very important component of STI prevention and control programs. For example, School-based screening programs can be useful.[32] Another possible policy intervention is standard STI partner services, including the identification and notification of sex partners of infected persons, and the referral of those partners to receive appropriate care.[33] Finally, targeted health promotion interventions have the potential to counterbalance existing messages and increase awareness of consequences of sexual risk behavior, hence can change perceptions and expectations about sexual health.[34]

***The views expressed** in this paper represent **those of the authors** and are **not** necessarily the opinions of **Statistics Canada**

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