Smokeless Tobacco Use among Canadian Youth in Grades 9 – 12

by

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A thesis

presented to the University of Waterloo

in fulfillment of the

thesis requirement for the degree of

Master of Science

in

Health Studies and Gerontology

Waterloo, Ontario, Canada, 2013

AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis,

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Abstract

Youth represent a substantial portion of smokeless tobacco (ST) users in Canada compared to the general population. Highest prevalence of use is typically seen in males, in current smokers, and in the Western provinces. ST use has also been associated with youth who participate in sports teams. Furthermore, ST has been marketed to youth through the use of flavours and sweeteners to make ST more attractive and appealing. The goal of this study was to determine the prevalence of ST use among Canadian youth and examine factors associated with its use.

The study used self-report data from 29,007 grade 9-12 youth who participated in the 2010-2011 Canadian Youth Smoking Survey (YSS). Logistic regression analyses were used to determine factors associated with ST ever and current use among Canadian youth as well as among the sub-population of youth smokers. A mediation analysis was also used to understand if (a) sports team participation or (b) physical activity mediate an association between attempting to quit smoking and ST use among youth smokers.

In 2010-2011, 5.3% of Canadian youth had ever used ST and 1.9% were current ST users. Odds of ST use were highest among males, grade 12 students, youth with more than $100 of weekly spending money and current smoking youth. This study was the first to identify associations between both physical activity and sports team participation and ST use among grade 9-12 Canadian youth. Continued monitoring of ST use among youth is recommended. Additionally, further research is needed to explore beyond individual-level factors and understand broader influences of ST use among youth.

Acknowledgements

I would like to sincerely thank my supervisor Dr. Scott Leatherdale for all his time, guidance, and support during the development of my thesis and throughout the duration of my graduate studies. I am also grateful to my committee members Dr. Ryan Kennedy and Dr. Steve Manske for their valuable advice and feedback. Furthermore, I would like to acknowledge the Propel Centre for Population Health Impact for providing me with access to the data from the Canadian Youth Smoking Survey that facilitated my research.

Finally, I would like to thank my family and friends for their support and encouragement. A special thanks to Chris for your love and support throughout this experience – I would not have been able to finish this degree without your motivation and patience.

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Chapter 1: Introduction

Smokeless tobacco (ST) is a non-combustible product that provides nicotine to users through absorption across the mucosal membranes of the mouth or nose (International Agency for Research on Cancer, 2008). ST is addictive and contains 28 known cancer-causing substances, the primary carcinogens being tobacco-specific nitrosamines (TSNAs) (Health Canada, 2010; IARC, 2007). The main types of ST currently available in North America are *chewing tobacco* and *snuff* (**Appendix A**). Chewing tobacco typically comes in two forms: loose leaf "chew" or moist "plug", and is placed between the lower lip and cheek, chewed, and saliva is spit out (Physicians for a Smoke-Free Canada, 2011). Snuff is finely ground tobacco that can by dry or moist. Dry snuff often comes in powder form and can be inhaled through the nose. Moist snuff, also called "dip" or "pinch", is placed between the lip and gum and does not need to be chewed (PSFC, 2011). Snus is a Swedish form of snuff recently introduced into the Canadian market in 2007, and has a lower TSNA content relative to other types of ST (Health Canada, 2010; Savitz, Meyer, Tanzer, Mirvish & Lewin, 2006). While the health effects of ST products are lower compared to cigarettes, ST use has been associated with oral cancer, leukoplakia, gum and tooth disease, gum recession, as well as esophageal and pancreatic cancer, and has been declared as carcinogenic to humans (U.S. Department of Health and Human Services, 1986; IARC, 2007).

Smokeless tobacco users in Canada represent less than 1% of the overall population, however, more than a third of users are under the age of 25 and 16% of those reporting current use are between the ages of 15-19 (Health Canada, 2011; PSFC, 2009). In 2010, 5% or 119,000 youth aged 15-19 reported ever using ST (Health Canada, 2010). Males are more likely than

females to report using ST, where 15% of males had tried ST compared to 2% of females in 2009 (Health Canada, 2010; PSC, 2011). According to 2008 data from the Canadian Youth Smoking Survey (YSS), grade 12 males have the highest prevalence of ST ever and current use (Kennedy, Leatherdale, Burkhalter & Ahmed, 2011). Additionally, Canadians who reside in the Western provinces are more likely to use ST (PSFC, 2011; Kennedy et al., 2011). ST use is also more common among current and former smokers compared to never smokers, where 16% of current smokers and 12% of former smokers reported having tried ST in 2006 compared to 4% of never smokers (Alberta Alcohol and Drug Use Commission, 2008). Participation in organized sports has been shown to predict smokeless tobacco use among youth in North America (Spence & Gauvin, 1996; Terry-McElrath, O'Malley & Johnston, 2011). Youth are considered at risk for using ST due to the marketing of ST products by the tobacco industry by adding sweeteners and flavours, making ST products more attractive to youth and easier to use (PSFC, 2009). While Canada prohibits the addition of flavours to cigarettes, these regulations do not apply to ST products (Bill C-32, 2009). Furthermore, it has been argued that smokeless tobacco could become a "gateway" product, hooking youth on nicotine before they move on to more harmful products such as cigarettes (Foulds, Ramstrom, Burke & Fagerström, 2003; Gartner, Hall, Chapman & Freeman, 2007).

The purpose of this research project was to examine the prevalence of ever and current ST use among Canadian youth, examine factors associated with ST ever and current use, and understand the association between physical activity, quit attempts, and ST use among youth smokers. The study used nationally representative data from students in grades 9-12 who participated in the 2010/2011 Canadian Youth Smoking Survey.

Chapter 2: Literature Review

2.1 Smokeless Tobacco

Smokeless tobacco (ST) is a leaf tobacco product that can be placed in the mouth or inhaled through the nose, providing nicotine to users without being smoked (Ontario Tobacco Research Unit, 2007; Health Canada, 2010). ST is addictive and contains over 3,000 chemicals, including sweeteners, flavourings, abrasives, salt and other chemicals (International Agency for Research on Cancer, 2007; OTRU, 2007). While some of these chemicals are naturally occurring, manufacturing, processing and length of storage can influence the levels of toxic chemicals present in smokeless tobacco products (Health Canada, 2010). Twenty-eight known cancer-causing chemicals have been identified in ST products, the primary carcinogens being tobacco-specific nitrosamines (TSNAs), N-nitrosonornicotine (NNN), and 4-(N-mathyl-N-nitrosamino)-1-(3-pyridyl)-1-butanone (NNK) (Health Canada, 2010; IARC, 2007). Other cancer-causing substances in ST include formaldehyde, acetaldehyde, arsenic, nickel, cadmium and benzopyrene (IARC, 2007).

2.1.1 Forms and Uses

There are two types of ST commercially available in North America: chewing tobacco and snuff (**Appendix A**).

Chewing Tobacco

Chewing tobacco is placed between the cheek and lower lip, and chewed to facilitate the release of nicotine (Wyckham, 1999). Chewing tobacco typically comes in the form of either loose leaf "chew", plug, or twist (Wyckham, 1999; Centers for Disease Control and Prevention, 2010). Loose leaf chewing tobacco is made from cigar tobacco leaves that are air cured, sweetened, cut and loosely packed to form small strips of shredded tobacco. Moist plug is made

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by mixing sweet tobacco leaves (burley, oriental, and cigar tobaccos), wrapping and compressing them into a cake or "plug" form (Physicians for a Smoke-Free Canada, 2011; CDCP, 2010). Twist chewing tobacco is made from cured tobacco leaves that are often flavoured and twisted together to resemble rope (CDCP, 2010).

Snuff

Snuff is ground or shredded tobacco and sold in powder form as 'dry' or 'moist' snuff in small pre-measured pouches that resemble small teabags (CDCP, 2010; OTRU, 2007). Dry powder snuff can be sniffed or inhaled into the nose and does not require spitting or swallowing of saliva (CDCP, 2010).

Pinch

"Pinch" or "dip" is another name for moist snuff, which is the predominant form of ST sold in North America (Wyckham, 1999; OTRU, 2007). Moist snuff is made from cured tobacco which is processed into 'fine cut' particles or 'long cut' strips and is often flavoured or sweetened (PSFC, 2011). A "pinch" of moist snuff is often placed between the cheek or lower lip and the gum where it releases nicotine by mixing with saliva (Wyckham, 1999). The saliva can be spit out; however there are also forms of moist snuff that do not require spitting (Wyckham, 1999; PSC, 2011)

Snus

Snus is a form of moist snuff mainly manufactured and consumed in Sweden and Norway and was introduced into the Canadian market in 2007 (OTRU, 2007; Health Canada, 2010). Snus is subject to humidifying agents and kept cold to avoid fermentation (PSFC, 2011). This processing method reduces the formation of nitrates and nitrosamines and is therefore much lower in TSNAs compared to other forms of smokeless tobacco (Savitz et al., 2006).

2.1.2 Usage Patterns and Trends

Patterns of ST use vary worldwide, with use typically seen in South-East Asia, North America and parts of Europe (World Health Organization, 2009). In Sweden for example, 27% of men use snuff daily (Patja, Hakala, Bostrom, Nordgren & Haglund, 2009). However, less than 1% of Canadians over 15 reported currently using ST products in 2010 (including both chewing tobacco and snuff) (Health Canada, 2011). The prevalence of current ST use in Canada has remained fairly stable during the past 10 years as well as the prevalence of ST ever use among those aged 15 or older at approximately 8% across Canada (Health Canada, 2010; OTRU, 2006). Certain subgroups in Canada have a higher prevalence of ST use. ST use is more common in men, those under the age of 25, and in the western provinces according to data from the Canadian Tobacco Use Monitoring Survey and the Canadian Community Health Survey (Health Canada, 2011; PSFC, 2011). Similar trends are seen in the United States, where in 2010, 3.5% of the population reported using ST products, with highest rates in men, young adults aged 18-24 years, adults with a high school education or less, and adults in states with high smoking prevalence (Substance Abuse and Mental Health Services Administration, 2011; CDCP, 2010).

2.1.3 Health Risks of Using Smokeless Tobacco

While the health risks of ST are lower than that of cigarettes, use of ST can have several negative health consequences. In 1986, the U.S. Surgeon General concluded that "the use of snuff can cause cancer in humans" (USDHHS, 1986). ST use has been associated with an increased risk of oral cancer, leukoplakia (precancerous soft tissue lesions on the cheek, gums or tongue), periodontal disease, receding gums, tooth decay, as well as esophageal and pancreatic cancer (USDHHS, 1986; CDCP, 2011; IARC, 2007).

Evidence on the degree to which these health effects are associated with ST use has been mixed. Health consequences among ST users can vary widely across regions and risk typically depends on type of ST consumed and the concentration of nitrosamines (Critchley & Unal, 2003; Boffetta, Hecht, Gray, Gupta & Straif, 2008). A 2008 review of epidemiological data from the USA and Asia demonstrate an increased risk of oral cancer, yet this risk is not confirmed in northern European studies where snuff use is high (Boffetta et al., 2008). However, northern European studies have shown increased risk of esophageal and pancreatic cancer (Boffetta et al., 2008). In India and Sudan, more than 50% of oral cancers are attributable to smokeless tobacco products used in those countries, where only about 4% of oral cancers in U.S. men are attributable to ST products (Boffetta et al., 2008). However, U.S. studies typically have very small sample sizes and do not have sufficient statistical power to demonstrate an effect unless the risk is huge (Critchley & Unal, 2003). More recently, a U.S. population-based case-control study reported positive associations between risk of head and neck cancer and ST use among never cigarette smokers as well as an association between head and neck cancer and long term use (>10 years) of ST (Zhou et al., 2013).

Health Effects of Snus

It is thought that snus may potentially exhibit fewer potential health hazards compared to traditional ST due it its lower TSNA content. However, studies have shown that snus may increase the risk of some cancers, similar to other ST products compared to non-users (Critchley & Unal, 2003; Winn, 1997; Luo et al. 2007). Alternatively, studies in Sweden where men have used snus for 20 years have not detected any increase in oral cancer or cardiovascular disease rates thus far (Critchley & Unal, 2003; Foulds et al., 2003; Asplund, 2003). However, there is the possibility that products marketed as snus in North America may not be processed or stored

the same way as in Sweden which may not guarantee the same level of TSNAs and thus may present increased health risks (OTRU, 2007).

While evidence on the degree to which certain health consequences are associated with ST use is mixed, ST does increase the risk of potential health effects compared to non-users. The WHO IARC Working Group has concluded that ST "is carcinogenic to humans" due to its TSNA content (IARC, 2007). Furthermore, ST use can lead to nicotine addiction and dependence, which can be considered a health concern (CDCP, 2011). Some forms of ST, particularly Swedish snus, can contain and deliver quantities of nicotine comparable to that obtained from smoking cigarettes (Foulds et al., 2003).

2.1.4 Smokeless Tobacco and Harm Reduction

Harm reduction strategies seek to promote a product or health behaviour that has adverse health consequences as a substitute for one that has more severe adverse health consequences (Savitz et al., 2006; Hatsukami, Lemmonds & Tomar, 2003). Applying this principle to tobacco-related harm, "a product can be harm-reducing if it lowers total tobacco-related mortality and morbidity even though use of that product may involve continued exposure to tobacco-related toxicants" (Stratton, Shetty, Wallace, Bondurant & editors, 2000). ST products have been suggested as a potential harm reduction strategy to reduce the prevalence and population burden of cigarette smoking (Savitz et al., 2006; Gartner et al., 2007; Foulds et al., 2003; Hatsukami et al., 2003). The health consequences of using ST are significantly lower than those of smoking, including cardiovascular and respiratory risks (Gartner et al., 2007). Furthermore, the use of snus may present a lower risk of oral cancer compared to traditional ST due to its lower TSNA content (Gartner et al., 2007). The effect of snus on smoking and public health in Sweden is often used as evidence to support the use of smokeless tobacco in place of cigarettes (Gartner et

al., 2007; Foulds et al., 2003). Daily smoking among men in Sweden has dramatically decreased from 40% in 1976 to 16% in 2005, and Sweden has achieved the lowest smoking prevalence in all of Europe (Foulds et al., 2003; Patja et al., 2009; Savitz et al., 2006). Additionally, rates of lung cancer and myocardial infarction have dropped significantly in Sweden over the same time period (Foulds et al., 2003). The low overall prevalence of smoking and smoking-related disease in Sweden has been attributed to the use of snus as an alternative to cigarettes (Gartner et al., 2007). Moreover, 30% of male ex-smokers in Sweden reported using snus when quitting smoking, leading to the conclusion that snus may be a component of successful smoking cessation (Foulds et al., 2003).

However, critics of ST use as a form of harm reduction argue that ST has its own health risks and that no form of tobacco should ever be promoted, as it distracts from the overall goal of tobacco elimination (Gartner et al., 2007; Savitz et al., 2006). In addition, critics argue that Sweden's experience may be specific to that culture and likely not transferable to settings such as North America (Gartner et al., 2007). Taking a closer look at ST use and the 'Swedish experience' can prove that ST should not be promoted or encouraged as a harm reduction approach or alternative to cigarettes. While smoking prevalence in Sweden has decreased significantly, overall daily smoking prevalence in Sweden is still higher than in Canada (25% vs. 19%) (PSFC, 2007). Sweden also may have lower rates of mortality from smoking compared to Canada, but is making slower progress in the decline of smoking-related deaths relative to Canada (PSFC, 2007). Furthermore, it is unknown whether ST has a role as a 'gateway' to the use of cigarettes or uptake of more harmful substances (Gartner et al., 2007). Therefore, if ST is being encouraged as an alternative to cigarettes among youth, it is important to understand patterns of use among this subpopulation.

2.2 Youth and Smokeless Tobacco

While ST users in Canada represent less than 1% of the overall population, youth represent a substantial proportion of these users (Health Canada, 2011). Additionally, ST use among youth populations can have different consequences than use in adults, such as eventual cigarette use as well as other negative health behaviours (USDHHS, 1994). Furthermore, youth are considered at risk for using ST due to current regulations and marketing of ST products.

2.2.1 Patterns of Smokeless Tobacco Use among Youth

Of the 1% of Canadians who currently use ST, youth between the ages of 15-19 represent 16% of these users, according to data from the 2009 Canadian Tobacco Use Monitoring Survey (CTUMS) (Health Canada, 2010; PSFC, 2011). More than a third of ST users in Canada are under the age of 25, even though this age group represents 8% of the overall population (Health Canada, 2010; PSFC, 2011). Additionally, the prevalence of ST use is more than twice as high among teenagers and young adult men than among adult men over 25 years (Health Canada, 2010). Less than 1% of men over 25 reports having used ST in the past month, compared to 2% of 15-19 year old males and 2.6% of males 20-25 (PSFC, 2011).

Experimentation with ST is also higher among youth compared to the general population. In 2010, 5% or 119,000 youth aged 15-19 reported ever using ST (Health Canada, 2010). According to 2008 data from the Canadian Youth Smoking Survey (YSS), 5.3% of youth in grades 6-12 had tried ST and 2.1% were current users (Kennedy et al., 2011). Males in grade 12 had the highest prevalence of trying (19%) and currently using (7.3%) ST (Kennedy et al., 2011). Furthermore, the proportion of males reporting ever and current use of ST increased from grade 6 to 12, with the greatest increases between grades 9 and 10 (Kennedy et al., 2011).

Among youth in grades 6 to 12 reporting ever and current use in the 2008 YSS, prevalence was highest among males, among current smokers, among those with more than $100

of weekly spending money, and in those living in the western provinces (Kennedy et al., 2011).

The prevalence of ST current use was highest in British Columbia (8.3%) and lowest in Quebec

(2.3%) (Kennedy et al., 2011). There are also differences in prevalence within provinces. For

example, past year ST use in Ontario was higher among grades 9-12 students in North Simcoe

Muskoka and Northwest regions compared to the Ontario average in the 2011 Ontario Student

Drug Use and Health Survey (Paglia-Boak, Adlaf & Mann, 2011).

The prevalence of ST use among youth is higher in the U.S. relative to Canada. The

2011 Youth Risk Behavior Survey reported that 7.7% of high school students in the U.S. were

current ST users (CDCP, 2012). Additionally, regular snus use has been reported to be as high

as 13% among adolescent males in Sweden (Rodu et al., 2005).

2.2.2 Implications for Youth Using Smokeless Tobacco

There are different consequences for youth using ST compared to adults. Researchers

have suggested that ST could become a "gateway" product, hooking youth on nicotine before

they move on to more harmful products such as cigarettes (Foulds et al., 2003; Gartner et al.,

2007). Tobacco use in adolescence is associated with continuing use in adulthood and with

alcohol and illicit drug use, including marijuana (USDHHS, 1994; Leatherdale & Ahmed, 2010).

Studies have shown that youth who use cigarettes and ST are more likely than non-users to

engage in other high-risk behaviour including engaging in the use of other substances (e.g.

alcohol and illicit drugs) (AADAC, 2008; Everett et al., 2000). While there is mixed evidence

regarding whether ST use does in fact lead to smoking initiation, it is important to examine

patterns of both ST use and smoking among youth populations (Haddock et al., 2001; Rodu &

Cole, 2010).

2.2.3 Youth Access of ST in Canada and the Retail Environment

In Canada, the 1997 Federal *Tobacco Act* prohibits the sale or supply of tobacco products (including ST) to minors under the age of 18. Six provinces and 1 territory in Canada exceed federal regulations by banning the sale or supply of tobacco to anyone under the age of 19 (Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, Ontario, British Columbia, and Nunavut) (OTRU, 2010). Nova Scotia and Alberta also prohibit possession of tobacco for anyone under 19 and 18, respectively (OTRU, 2010). Additionally, Manitoba, Saskatchewan and the Northwest Territories prohibit youth access to retail locations where tobacco products are visible on the premises (OTRU, 2010).

Chewing tobacco and moist snuff are the most prevalent types of ST on the Canadian market (Euromonitor International, 2012). These popular spit and chewing tobacco products are made by the United States Smokeless Tobacco Company (USSTC) which is part of Altria (formerly Phillip Morris) and sold under brands such as Skoal and Copenhagen (Euromonitor International, 2012; Alberta Health Services, 2009; Wychkam, 1999). In 2007, the British American Tobacco-Imperial Tobacco Company began selling snus in Canada under the cigarette brand name "du Maurier", using the same colours and brand imagery as their cigarette packages (**Appendix B**) (Gilbert, 2009). BAT began test marketing snus in Edmonton, Alberta and Ottawa, Ontario in 2007 and as of 2009 was still assessing the test markets and had no immediate plans to expand the sale of snus in Canada (Gilbert, 2009). Since 2007, the company Swedish Match also began selling snus in Canada (PSFC, 2011).

2.2.4 Why are Youth at Risk for Using Smokeless Tobacco?

Youth are considered at risk for ST initiation due to the marketing of ST products by the tobacco industry, government regulations on ST products, and increasing environmental restrictions for cigarette smokers.

Marketing of Smokeless Tobacco Products

The tobacco industry has been accused of marketing ST products to youth by introducing flavours and through advertising to youth populations (PSFC, 2009). ST products are available in Canada in a variety of fruit and candy flavours, including chocolate, bubble gum, vanilla, banana split, and other flavours (PSFC, 2009). These flavours make smokeless ST more attractive to youth, by making them seem less threatening and harmful, as well as mask the unpleasant taste of tobacco, making the product easier to use (PSFC, 2009). Flavoured chew tobacco was introduced in Canada around 2005 (PSFC, 2009). Interestingly, overall sales of ST products in Canada increased 10% between 2005 and 2009 (PSFC, 2011). Canadian youth are more likely to report ever using flavoured tobacco (including ST, little cigars and cigarillos, and pipe tobacco) (Health Canada, 2008; PSFC, 2009). Furthermore, of the males who reported current ST use in 2009, more males 15-19 (89%) reported use of flavoured ST compared to the general user (65%) (PSFC, 2011). Additionally, the U.S. saw a 30% increase in ST use among high-school males after introduction of flavoured ST while adult use remained stable (National Survey on Drug Use and Health, 2007).

The tobacco industry invests a significant amount of money on advertising ST products in North America. In 2001, $237 million was spent on ST advertising in the U.S. including ads in publications popular with young males such as Sports Illustrated and Rolling Stone and continue to advertise in magazines with high adolescent readership (Federal Trade Commission, 2001; Morrison, Krugman & Park, 2008). In Canada, there are two means by which the tobacco

industry can advertise: on signs in areas where minors are prohibited (e.g. bars and nightclubs), and in publications provided by mail to a named adult (Health Canada, 2009). While it seem as though ST advertising to youth in Canada may be limited, exposure of Canadian youth to U.S. magazines that contain ST advertising is not uncommon. Furthermore, youth can often access ST content in online social media (Seidenberg, Rodgers, Rees & Connolly, 2012).

Youth in particular are more sensitive and responsive to tobacco advertising than adults (Morrison et al., 2008). Furthermore, it has been concluded that advertising is particularly effective with youth when it makes the use of products seen normal, which the tobacco industry may be attempting to do when marketing smokeless products (Morrison et al., 2008; American Psychological Association, 2007).

Smokeless Tobacco Regulations in Canada

In Canada, ST products are exempted from some federal laws or regulations that apply to cigarettes (PSFC, 2011). ST products can be sweetened or flavoured, even though such flavourings are not permitted in cigarettes or little cigars (PSFC, 2011). In June 2009, Parliament was approached by Canadian youth with concerns about the tobacco industry's practice of "candy-coating" ST products to encourage youth to try them (PSFC, 2011). At this time, the Parliamentary Committee decided not to extend the bill which banned flavouring from little cigars and cigarettes (C-32) to also include banning flavourings from ST products in Canada (Bill C-32, 2009; PSFC, 2011). Furthermore, the warnings required on ST products do not include images, and there are a smaller number of rotated warnings: Four rotated warnings are required on ST products ("This product is highly addictive", "This product causes mouth diseases", "Use of this product can cause cancer", and "Use of this product is not a safe alternative to cigarettes.") (PSFC, 2011). Alternatively, cigarette packages in Canada are

subjected to 16 rotated warnings as well as full-colour powerful graphic images (Health Canada, 2011). In September 2011, the Tobacco Products Labelling Regulations (Cigarettes and Little Cigars) came into force in Canada which strengthened labelling requirements for cigarettes and little cigar packages including graphic health warnings that cover 75% of the front and back of packages, health information messages enhanced with colour and easy to understand toxic emission statements (Health Canada, 2011). However, these new regulations do not cover ST products in Canada (Health Canada, 2011).

Smoking Restrictions do not Include Smokeless Tobacco

Across Canada, smoking is banned in all indoor public places and work places (Non-Smokers' Rights Association, 2011), and smoking restrictions are becoming increasingly common in outdoor areas (Beck, 2011). However, since ST products do not contribute to second-hand smoke exposure, they are often not included in these regulations and can be used in most public places (SFOA, 2010; Beck, 2011). This can be seen as a problem because smoking restrictions are created not only to reduce exposure to second-hand smoke, but also to denormalize smoking and help smokers quit. Furthermore, tobacco companies have already started marketing snus to current smokers in order to compensate for loss of sales due to these restrictions with slogans such as: "when you can't smoke, snus" (Gartner et al., 2007). Thus, youth smokers may resort to ST products in places where it is not possible to smoke. Furthermore, ST can be easy to conceal (especially if it is spitless) in places where tobacco is prohibited.

2.3 Youth Smoking Cessation and Smokeless Tobacco

In 2008, 11.6% of Canadian high school students were current smokers, according to data from the Youth Smoking Survey (Elton-Marshall, Leatherdale, Ahmed, Manske, & Burkhalter,

2010). While 73% of Canadian smokers in grades 9-12 had tried to quit smoking at least once, many of these quit attempts are unsuccessful and the majority of youth smokers do not want to use many of the existing best practices for cessation (e.g. behavioural counselling, telephone quitlines) (Elton-Marshall et al., 2010; CDCP, 2001; Fiore et al., 2008; Leatherdale & McDonald, 2005).

Interestingly, dual use of cigarettes and ST products are quite common in North America. According to data from the U.S. National Survey on Drug Use and Health, 85.8% of ST users had used cigarettes at some point in their lives and 38.8% of users currently smoked (Substance Abuse and Mental Health Services Administration, 2009). Additionally, daily use of both cigarettes and snuff on a daily basis was found to be higher among adolescents and young males relative to older tobacco users, according to data from four nationally representative U.S. surveys (Tomar, Alpert & Connolly, 2010). Tomar and colleagues (2010) also report that past-year quit attempts among daily smokers are more prevalent among non-daily snuff users (41.2%) compared to those who had never used snuff (29.5%). A study examining the appeal of ST products among young Canadian smokers reported that almost half would be willing to try ST products at times when they could not smoke (48.9%) or as a quit aid (48.1%) (Callery, Hammond, O'Connor & Fong, 2011). Among current youth smokers in Canada, current and former smokers in grades 6-12 were more likely to currently use ST in 2008 (Kennedy et al., 2011). Therefore youth smokers may be resorting to ST as an alternative to cigarettes (e.g. such as in places where smoking is restricted) or are using ST products in attempt to quit smoking, or both.

2.4 Physical Activity and Smokeless Tobacco Use

Participation in physical activity, particularly in organized sports teams, has shown to predict ST use among youth in the United States (Terry-McElrath et al., 2011; Finland (Mattila et al., 2012) and Norway (Martinsen & Sundgot-Borgen, 2012). Smokeless tobacco has historically been strongly associated with male dominated sports, such as with baseball in the U.S. (Severson, Klein, Lichtensein, Kaufman & Orleans, 2005; Eaves, 2011), and ice hockey in Finland and Sweden (Rolandsson et al., 2006; Mattila et al., 2012). For example, 36% of professional baseball players and 25% of minor league baseball players reported using smokeless tobacco in 2003 (Severson et al., 2005). In the past, tobacco companies frequently promoted ST at sporting events including giving free samples to athletes and fans, and famous athletes were often employed as product spokespeople (Connolly, Orleans & Blum, 1992). Additionally, ST has been perceived as athletic and masculine among young people (Kurey, Rodruigue & Perri, 1998). Substance use among sports teams has been associated with higher levels of conformity, perceived norms, and personality characteristics of competitiveness, extroversion, and risk-taking (Terry-McElrath et al., 2011). This may lead to a higher likelihood to conform to perceived substance use norms among sports teams (Terry-McElrath et al., 2011). Additionally, youth athletes may use ST in the place of cigarettes since ST would be less likely to negatively affect performance relative to cigarettes.

Participation in organized sports has been shown to predict ST use among a significant proportion of athletes at the post-secondary level (Morrell et al., 2005; Spence & Gauvin, 1996). The 2001 U.S. National Collegiate Athletic Association survey indicated that 23% of college male and female athletes used ST, including both chewing tobacco and snuff (Green, Uryasz, Petr & Bray, 2001). In a survey of Canadian university athletes, highest use of ST was reported among those in football and hockey (Spence & Gauvin, 1996). Unfortunately, these trends also

extend to youth who participate in sports teams in high school, indicating that youth may be introduced to and experiment with ST products at this age and then continue use at the post-secondary level. The 1997 Youth Risk Behaviour Survey found that both male and female high school athletes were more likely to use smokeless ST than their nonathletic counterparts and the effect was stronger for more highly involved athletes of both genders (Melnick, Miller, Sabo, Farrell & Barnes, 2001). Similar findings were reported by Terry-McElrath and colleagues (2011), where ST use was higher among U.S. high school and middle school athletes and rates have remained unchanged from 1991-2009.

While Canadian data on ST use and sports among high school students is limited, several regions in Canada have identified ST use among sports teams as a concern. The Sport Medicine and Science Council of Manitoba surveyed 2000 athletes 12-21 years of age regarding substance use (Kriellaars, personal communication, April 19, 2013). The survey found that males in baseball (54%), hockey (52%), rugby (38%) and football (23%) demonstrated highest prevalence of ST use. Additionally, the majority of ST users (71%) reported adopting ST in a sport setting. Therefore, it appears that type of sport (particularly male-dominated sports) plays a role in the increased risk of ST use among youth. Furthermore, several local province-based groups have formed to promote a tobacco-free environment in sport and recreation such as Ontario's 'Play, Live, Be Tobacco-Free' and 'Smokeless Not Harmless: athletes against tobacco' in Alberta. Therefore, nationally representative data on the influence of physical activity and participation in sports teams on ST use among youth would assist groups in Canada working to promote tobacco free sports among youth.

2.5 Physical Activity and Youth Smoking Cessation

Generally, youth who participate in physical activity are less likely to participate in risk-taking behaviours, including smoking (Nelson & Gordon-Larsen, 2006; Audrain-McGovern, Rodriguez & Moss, 2003). Additionally, youth smokers who are physically active are more motivated to quit smoking (Leatherdale, 2007). In a study of Canadian high school students, Leatherdale (2007) demonstrated that moderately active smokers were more likely to intend to quit smoking and those who were highly active were more likely to intend to quit in the next 30 days. Furthermore, youth smokers often want to quit smoking due to possible declines in athletic performance (Vuckovic et al., 2003; Riedel et al., 2002).

According to Canadian Community Health Survey (CCHS) data, nearly a quarter of Canadian adult smokers were classified as physically active in 2000 (deRuiter, Faulkner, Cairney & Veidhuizen, 2008). Furthermore, male and female smokers who were physically active were also 36% and 37% more likely to have attempted cessation within the past year, respectively, compared to physically inactive smokers (deRuiter et al., 2008). Thus there may be an association between possessing the motivation to quit smoking and making an effort to participate in regular physical activity. It is also interesting to note that physically active smokers were more likely to be young men (deRuiter et al., 2008), which are similar characteristics to ST users.

Therefore, we know that physical activity is associated with ST use, youth smokers who are active are more likely to attempt cessation; and that it is possible smokers may use ST products in attempt to quit or be encouraged to use it in sports team settings. Thus, it would be interesting to understand the association between physical activity, quit attempts and ST use. In other words, does physical activity mediate the association between quit attempts and ST use in

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youth smokers? Examining this association would have implications for ST use prevention programming such as targeting particular high school sports teams.

2.6 Bandura's Social Cognitive Theory and its Application to ST Use among Youth

Based on the evidence available, it can be concluded that youth represent a substantial portion of ST users in Canada as well as specific sub-groups (e.g. participation in sports and youth smokers). Albert Bandura's Social Cognitive Theory (SCT) (1986) will be examined to understand why youth and these sub-populations use ST.

Bandura's SCT (1986) can be used to understand the individual characteristics associated with ST use among youth. SCT emphasizes reciprocal determinism in the interaction between people and their environments and posits that human behaviour is the product of a dynamic interplay of personal, behavioural, and environmental influences as presented in **Figure 1** (Glanz et al., 2008).
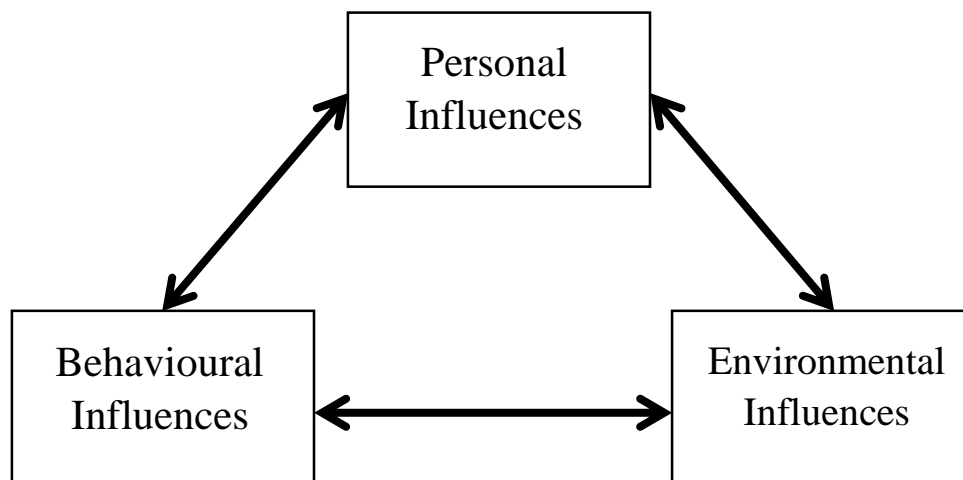
Figure 1: Theoretical model of Social Cognitive Theory (Bandura, 1986).

Personal influences on behaviour can include cognitive, affective, and biological factors. For example, personal influences on ST use may include age, gender, and perceived risk of using ST. *Environmental* influences refer to both physical and social environment contexts. Social environment factors that may influence ST use among youth may be siblings or friends using ST. Furthermore, youth who participate in sports teams may use ST due to influences by teammates who also use ST. These environmental factors can provide models for behavior which Bandura referred to as *observational learning*, where ST use may begin as a result of observing use among peers or credible role models (Glanz et al., 2002). *Behavioural* influences may refer to the behaviour of interest (in this case using ST) or behaviours that may influence ST use. For example, current youth smokers are more likely to use ST than former smokers and never smokers (Kennedy et al., 2011). Therefore, smoking may be a behaviour that influences ST use possibly by youth smokers using ST as an alternative to cigarettes in places where they cannot smoke or as a cessation aid by maintaining nicotine consumption.

The SCT provides a comprehensive framework for understanding multiple influences in health behaviours including ST use. A limitation of SCT is that it does not allow for the examination of broader environmental determinants of ST use such as school or community-level factors. However, these factors are outside the scope of this study.

2.7 Summary

It is apparent that youth represent a greater proportion of ST users than the general population in Canada. As youth are at increased risk for experimenting and using ST products, it is important to identify which sub-groups in the population are particularly susceptible. Furthermore, understanding how different factors associated with ST use interact, including

physical activity and dual use of ST and cigarettes among youth smokers, can aid in policy and

program development and inform future research on youth and ST.

Chapter 3: Study Rationale, Research Questions, and Hypotheses

3.1 Study Rationale

While less than 1% of the Canadian population uses smokeless tobacco (ST) products, more than a third of users are under the age of 25 and 16% of those reporting current use are between the ages of 15-19 (Health Canada, 2011; PSC, 2009). In 2008, 5.3% of youth had tried ST and 2.1% were current users among grade 6-12 students in Canada (Kennedy et al., 2011).

Youth are considered at risk for using ST due to the marketing of ST products through the use of flavours and additives to make them more appealing and attractive to youth (PSC, 2009). Additionally, ST use is more common among current youth smokers than non-smokers and dual use is higher among younger populations (Kennedy et al., 2011; Tomar et al., 2009). It is important to explore ST use among the sub-population of youth smokers as using ST may initiate smoking among non-smokers or smokers may be using ST as a cessation aid (Gartner et al., 2007; Foulds et al., 2003). Youth who participate in sports teams are also at risk for using ST (Terry-McElrath et al., 2011). Therefore, it is important to understand what sub-populations of youth are using ST and to examine the factors associated with ST use.

Given that the 2010-2011 Youth Smoking Survey now includes questions regarding physical activity and participation in sports teams, we now have the opportunity to examine how exercise and athletic teams impact ST use. Findings from the study have the potential to guide future interventions and programs targeting youth ST use as well as public health policy planning and future research aimed at reducing the prevalence of ST use among Canadian youth and continued monitoring.

3.2 Research Questions

The purpose of the study was to examine the prevalence of ST use and factors associated with its use among Canadian youth in grades 9-12 using data from the 2010/2011 Youth Smoking Survey (YSS).

Research Question 1: What was the prevalence of ST ever and current use among grade 9-12 students in Canada in 2010/2011?

Research Question 2: What was the prevalence of ever using flavoured tobacco products and current use of flavoured ST among grade 9-12 students in Canada in 2010/2011?

Research Question 3: What sociodemographic factors (gender, grade, geographic region, spending money, etc.) are associated with ST ever and current use?

Research Question 4: Is there an association between ST ever and current use and being a (a) current smoker or (b) former smoker?

Research Question 5: Is there an association between ST ever and current use and (a) physical activity or (b) athletic team participation?

Research Question 6: Among current smokers, is there an association between ST ever and current use and trying to quit smoking?

Research Question 7: Among current smokers, does (a) sports team participation or (b) meeting Canada's physical activity guidelines mediate an association between ST use and attempting to quit smoking?

3.3 Hypotheses

The following hypotheses correspond to the above research questions of the same number.

Hypothesis 1: The prevalence of ever and current ST use among Canadian high school students in 2010-2011 will be the same as estimates reported in 2008-2009.

Hypothesis 2: The prevalence of ever using flavoured tobacco products and current use of flavoured ST will be similar to estimates for youth aged 15-19 in the 2009 Canadian Tobacco Use Monitoring Survey (CTUMS).

Hypothesis 3: Males will have increased odds of trying or currently using ST compared to females; ST use will be highest in the Western provinces; older grades will have increased odds of ever or current ST use; and youth with more spending money per week will have increased odds of reporting ever or current ST use.

Hypothesis 4: Current and former youth smokers will have increased odds of trying or currently using ST relative to never smokers.

Hypothesis 5: Meeting Canada's physical activity guidelines and participation in sports teams will both be associated with increased odds of ST ever or current use.

Hypothesis 6: Among current youth smokers, those who attempted to quit smoking will have increased odds of trying or currently using ST.

Hypothesis 7: Meeting Canada's guidelines for physical activity and participation in sports teams will mediate an association between attempting to quit smoking and ST ever and current use among current youth smokers.

Chapter 4: Methods

4.1 The 2010/2011 Youth Smoking Survey

Cross-sectional data from the 2010/2011 Canadian Youth Smoking Survey (YSS) were used for secondary analysis in this study. The YSS is a school-based survey of a nationally representative sample of grade 6-12 students in nine Canadian provinces (University of Waterloo, 2011). The YSS is a product of the pan-Canadian capacity building project funded through a contribution agreement between Health Canada and the Propel Centre for Population Health Impact from 2004 to 2007 and a contract between Health Canada and the Propel Centre for Population Health Impact from 2008-2011. The YSS consortium includes Canadian tobacco control researchers from all provinces and provided training opportunities for university students at all levels. The views expressed herein do not necessarily represent the views of Health Canada.

The YSS tracks changes in attitudes and behaviours of Canadian youth with respect to tobacco use, and provides benchmark tobacco use prevalence rates at national and provinces levels for Canadian youth every two years (University of Waterloo, 2011). Further details on the YSS and additional information in previous waves of the YSS is available from www.yss.uwaterloo.ca and Elton-Marshall et al. (2011).

Given that this study examined data from grades 9-12 inclusively, only responses ascertained from youth in these grades were analyzed. The reason for only analyzing data from grade 9-12 students is that ST use among grades 6-8 was expected to be negligible (Kennedy et al., 2011).

The 2010/2011 YSS was conducted between October 2010 and June 2011 in secondary schools in 9 Canadian provinces (University of Waterloo, 2011). Where the YSS is typically

conducted in 10 provinces, the 2010/2011 YSS did not include New Brunswick. Health Canada analyses indicate that smoking rate estimates did not change for Canada when NB was included (or not) in the sample (S. Manske, personal communication, April 2, 2012). The 2010/2011 YSS was the first wave to include questions about physical activity and eating behaviours, allowing for the opportunity to investigate relationships between these behaviours and tobacco use (University of Waterloo, 2011).

The 2010/2011 YSS Module B questionnaire (**Appendix D**) was administered to grades 7-12 and contains 190 items that assess youth tobacco use and behaviours, measures predictive of or related to youth tobacco use, questions regarding physical activity and eating behaviours, questions on participant demographics, as well as questions on alcohol and drug use (University of Waterloo, 2011).

4.1.1 Sampling and Study Design

The 2010/2011 YSS target population consisted of all Canadian residents attending private, public, and Catholic schools enrolled in grades 6 to 12 inclusively. Youth residing in New Brunswick, Yukon, Nunavut, and Northwest Territories and those living in institutions, on First Nations reserves were excluded from the sample, as well as youth attending special schools (e.g. schools for visually-impaired) or schools located on military bases (University of Waterloo, 2011).

School sampling was based on a stratified single stage design, with stratification based on two classifications (in most provinces): 1) health region smoking rate; and 2) type of school (elementary or secondary) (University of Waterloo, 2011). In the first stratum, all schools were divided into two groups based on the smoking rate for 15-19 year olds in the health region in which the school is located according to the school's postal code and Canadian Community

Health Survey (CCHS) data (University of Waterloo, 2011). Schools located in a health region where the smoking rate was lower than the median provincial smoking rate were classified as having "low" smoking rates and the remaining schools with smoking rates higher than the provincial median were classified as having "high" smoking rates (University of Waterloo, 2011).

Based on experiences with previous YSS cycles, a third classification was created for schools in urban areas of Ontario and Alberta (University of Waterloo, 2011). Schools defined as being part of the Greater Toronto Area (Ontario) and within 20 minutes of Calgary or Edmonton (Alberta), were assigned to an urban classification to acknowledge size of school boards in these areas as well as recruitment challenges due to competing research projects in these areas (University of Waterloo, 2011).

The provinces of Prince Edward Island and Quebec were subjected to a different sampling procedure due to collaboration with provincial projects: the School Health Action Planning and Evaluation System – Prince Edward Island (SHAPES-PEI) in PEI and EN FORME in Quebec (University of Waterloo, 2011). In PEI, schools were classified into "high" or "low" smoking rate stratum, but all 61 grade 6-12 public schools in the province were included in the YSS sample as part of collaboration with the SHAPES-PEI project (University of Waterloo, 2011). Secondary schools in Quebec were randomly sampled from a list of eligible schools within 13 of the 17 targeted health regions. A total of 2 to 8 secondary schools were randomly sampled from a list of eligible schools within each of the targeted health regions, based on the number of schools available within the region. Within each secondary I-V class, half the students were randomly assigned to receive the YSS Module B questionnaire and the other half the EN-FORME questionnaire (University of Waterloo, 2011).

For the second stratum, schools in all nine provinces were classified as either an elementary school or secondary school (University of Waterloo, 2011). This classification was based on enrolment, where if the total enrolment of elementary grades (grades 6-8 or grade 6 in Quebec) was greater to or equal to the total enrolment of the secondary grades (grades 9-12 or Secondary I to V in Quebec) for a school, the school was assigned to the elementary school stratum (University of Waterloo, 2011). Otherwise the school was classified as a secondary school. The 2010/2011 YSS wave did not differentiate between private and public schools and private schools were included in the overall sample (University of Waterloo, 2011).

Thus, with the exclusion of PEI and Quebec, there are two (or three) health region strata ("low" and "high", and "urban" for Ontario and Alberta) and two school-level strata ("elementary" or "secondary") defined within each provincial sampling frame (University of Waterloo, 2011). Crossing these stratifications yields six strata in Ontario and Alberta and four in each of the other provinces. Within each stratum, schools were selected based on random sampling (excluding PEI) (University of Waterloo, 2011). Two elementary schools were sampled for every secondary school due to lower enrolment in elementary school than secondary schools, thus ensuring appropriate distribution of schools in all grades (University of Waterloo, 2011).

The 2010/2011 YSS uses stratified random sampling to ensure there is a true nationally representative sample since variables of interest may differ across sub-groups within the population (e.g. elementary vs. secondary schools) (Rowntree, 1981). This sampling technique is intended to reduce random error and achieve greater statistical significance (Rowntree, 1981).

4.1.2 School and Student Recruitment

All 2010/2011 YSS project protocols and materials received ethics approval from the University of Waterloo Human Ethics Committee and the Health Canada Research Ethics Board prior to study implementation. Approval from provincial ethics institutional review boards and school board ethics review committees was also obtained when required.

School board recruitment began as early as February 2010 and school recruitment in April 2010. Secondary school boards were typically contacted via a formal application or a board recruitment package and follow-up phone calls. Once a school board was successfully recruited, schools within that school board were then approached with a YSS recruitment package and follow-up phone calls. Secondary schools without a governing school board were approached directly about the study. A combination of active permission and passive permission protocols were used to recruit students for the YSS depending on the method the school typically used to obtain parental permission at their school. Active permission protocols consisted of an information letter and permission form sent home with the students enrolled in grade 9 to 12 eligible classes. Information letters provided parents with details about the project, contact information for project staff, and a copy of the questionnaire. Only those students with a parent signed permission form were able to participate in the survey. For schools participating with passive permission protocols, parents were mailed the same information-permission letters and requested parents to call a toll-free number if they did not want their child to participate in the survey. If no call or permission letter was received, it was assumed that parents provided permission for their child to participate in the survey. Students also had the opportunity to decline participation themselves regardless of school permission protocol.

4.1.3 Data Collection

Data was collected in participating secondary schools between October 2010 and June 2011. On the day of the survey, teachers administered the questionnaire according to instructions provided to them. Students took approximately 35 minutes to complete the questionnaire. Teachers were asked not to circulate during the questionnaire to protect student confidentiality and completed questionnaires were placed in individual sealed envelopes by students.

4.1.4 Use of Survey Weights

Since the 2010/2011 YSS uses stratified random sampling, survey weights were needed to adjust for sampling methods and correct for the unequal probability of being selected. Survey weights were developed to account for the school selection within health region and school strata as well as to adjust for student non-response (University of Waterloo, 2011). Additionally, the weights were calibrated to the provincial gender and grade distribution so that the total of the survey weights by gender, grade and province would equal the actual enrolments in those groups (University of Waterloo, 2011). Therefore, the use of survey weights allows for generalizations to be made of the population from which the sample was drawn (University of Waterloo, 2011).

Therefore, survey weights were used in analyses to produce results based on population figures rather than estimates based on the sample of individuals included in the study (University of Waterloo, 2011). Additionally, use of survey weights will adjust for sampling methods and correct for the unequal probability of being selected. Thus, use of survey weights allows for generalizations to be made of the population from which the sample was drawn (University of Waterloo, 2011).

4.2 Study Measures

A summary table outlining each study measure can be found in **Appendix C**.

4.2.1 Dependent Measures

Smokeless Tobacco Use

The dependent (outcome) measure in this study is smokeless tobacco use which was classified into two categories: "*ever*" ST use and "*current*" ST users. "*Ever*" ST use was determined by asking the question "Have you ever tried any of the following (Mark all that apply)" where "Using smokeless tobacco (chewing tobacco, pinch, snuff, or snus)" was a possible response. If this response was selected it was considered "yes" and if left blank assumed "no" and coded as 1 = yes; 0 = no.

"*Current*" ST use was determined by asking the question "In the last 30 days, did you use any of the following? (Mark all that apply)" where a possible response was "Smokeless tobacco (chewing tobacco, pinch, snuff, or snus)". If this response was selected it was considered "yes" and if left blank assumed "no" and coded as 1 = yes; 0 = no.

4.2.2 Independent Measures

Socio-demographic Measures

Consistent with Kennedy et al. (2011) the following socio-demographic characteristics were included in the analysis. Socio-demographic measures were controlled for in all models regardless of statistical significance.

School Grade

Grade level was determined by asking the question "What grade are you in?" where grades 6-12 were possible answers. Given that ST use among students in grades 6-8 is negligible (Kennedy et al., 2011), only responses from grades 9-12 were used in this study. Grade was

classified as an ordinal variable and coded as 3 = grade 12; 2 = grade 11; 1 = grade 10; 0 = grade 9. Grade 9 was used as the referent group in predictive models.

Age

Age was determined by asking the question "How old are you today?" where possible answers ranged from "11 years or younger" to "19 years or older". Age was classified as an ordinal variable and coded as 4 = ≥18; 3 = 17; 2 = 16; 1 = 15; 0 = ≤14. Grade level was used in predictive models as opposed to age because grade holds greater importance to school systems and for school-based interventions. However, age may have more value for regional or provincial sports authorities and was thus used for descriptive purposes but not included in predictive models.

Gender

Gender was determined via the question "Are you...Female? Male?" and was classified as a nominal variable. Responses were coded as 1 = male; 0 = female. Females were used as the referent group in predictive models.

Spending Money per Week

Spending money per week was determined by the question "About how much money do you usually get each week to spend on yourself or to save? Remember to include all money from allowances and jobs like babysitting, delivering papers…)" where responses range from Zero, $1 to $5, $6 to $10, $11 to $20, $21 to $40, $41 to $100, more than $100, I do not know how much money I get each week). Consistent with methods used by Kennedy et al. (2011), responses were collapsed into the following categories: $0, $1-$20, $21-$100, more than $100. Spending money per week was classified as an ordinal variable and responses were coded as 3 = more than

$100; 2 = \$21-100; 1 = \$1-20; 0 = Zero. Zero was used as the referent group in predictive models.

Geographic Region

Consistent with methods used by Kennedy et al. (2011), geographic region was categorized as Atlantic Canada (Newfoundland & Labrador, Prince Edward Island, Nova Scotia), Quebec, Ontario, Prairies (Manitoba, Saskatchewan, Alberta) and British Columbia. Geographic region was classified as a nominal variable and was coded as 4 = Prairies; 3 = Quebec; 2 = Ontario; 1 = Atlantic Canada; 0 = British Columbia. British Columbia was used as the referent group in predictive models. Individual provinces were used to examine ST use for descriptive purposes only.

Other Independent Measures of Interest

Current Smoking Status

Current smoking status was determined by two questions: "Have you ever smoked 100 or more whole cigarettes in your life?" (yes or no), and "On how many of the last 30 days did you smoke one or more cigarettes?" (none, 1 day, 2 to 3 days, 4 to 5 days, 6 to 10 days, 11 to 20 days, 21 to 29 days, 30 days). *Current smokers* were defined as having smoked 100 or more whole cigarettes in their lifetime and having smoked in the last 30 days. *Former smokers* were defined as having smoked 100 or more cigarettes in their lifetime but have not smoked at all during the 30 days preceding the survey. Smoking status was classified as a nominal variable and was coded as 2 = current smoker; 1 = former smoker; 0 = never smoker. Never smoker was used as the referent group in predictive models.

Quit Attempt

Quit attempt was determined via the question "Have you <u>ever</u> tried to quit smoking cigarettes?" Those who selected the answer "I have tried to quit once", "I have tried to quit 2 or

3 times", "I have tried to quit 4 or 5 times", or "I have tried to quit 6 or more times" were

classified as having ever tried to quit smoking. Quit attempt was classified as a nominal variable

and responses were coded as 1 = quit attempt; 0 = no quit attempt. No quit attempt was used as

the referent group in predictive models.

Participation in Sports Teams

Participation in sports teams was determined via the question "At your school, do you

participate in intramural or school team sports?" (Yes or no). Participation in sports teams was

classified as a nominal variable and responses were coded as 1 = yes; 0 = no. No was used as the

referent group in predictive models.

Physical Activity

Physical activity was determined by the question "Mark how many minutes of HARD

physical activity you did on each of the last 7 days. This includes physical activity during

physical education class, lunch, recess, after school, evenings, and spare time. **HARD** physical

activities are jogging, team sports, fast dancing, jump-rope, and any other physical activities that

increase your heart rate and make you breathe hard and sweat". This measure of self-report

physical activity is a valid and reliable measure for assessing group-level physical activity in

grade 9-12 populations (Wong, Leatherdale & Manske, 2006).

The physical activity measure was classified as a nominal variable based on whether or

not Canada's Physical Activity Guidelines for youth 12-17 years was met. It is recommended

that youth engage in vigorous intensity exercise for at least 60 minutes, three days per week

(Canadian Society for Exercise Physiology, 2012). Therefore, if this guideline was met based on

self-reported minutes of hard physical activity on each of the last 7 days, the physical activity

measure was coded as 1 = yes. If the guideline was not met, physical activity was coded as 0 = no. No was used as the referent group in predictive models.

Use of Flavoured Tobacco Products

The prevalence of ever using flavoured tobacco products was examined by the question "Have you ever used flavoured tobacco products (menthol, cherry, strawberry, vanilla, etc.?)" (Yes or no). Responses were coded as 1 = yes; 0 = no. Ever use of flavoured tobacco was used for descriptive purposes only and not included in predictive models.

Use of Flavoured ST

Current use of flavoured ST was determined by the question "In the last 30 days, did you use any of the following flavoured tobacco products? (Mark all that apply)" where a possible response was "Flavoured smokeless tobacco". If this response was selected it was considered "yes" and if left blank then "no", and coded as 1 = yes; 0 = no. Current use of flavoured ST was used for descriptive purposes only and not included in predictive models.

4.3 Data Analysis

The software SAS System for Windows Version 9.2 was used for all statistical analyses. The 2010/2011 YSS included a dummy question that had been inserted with other drug questions with the same responses to test that students are responding to drug questions truthfully (University of Waterloo, 2010). If a student had indicated that they use this drug then answers to questions regarding ST use were assumed invalid and the record was not included in the analyses. As mentioned in section 4.1.4, survey weights were used in all analyses to produce results based on population figures rather than estimates based on the sample of individuals included in the study (University of Waterloo, 2011).

4.3.1 Research Questions 1 & 2: Descriptive statistics

Frequency procedures were used to characterize the study sample, using the PROC

FREQ procedure in SAS 9.2. Frequency distributions were examined for the entire study sample

by gender, smoking status and ST use to determine the prevalence of ever and current ST use as

well as the prevalence of ever using flavoured tobacco and current use of flavoured ST. Initially,

unweighted frequency distributions were used to assess the appropriateness of collapsing

response categories, however only corresponding weighted estimates are reported which are a

more accurate representation of the Canadian youth population.

 Weighted frequency distributions were also used to examine the current smoking

population by gender and ST use. Weighted chi-square tests were conducted as part of the

descriptive analyses to determine if there were significant differences between the distribution of

independent variables and outcome variables of interest.

4.3.2 Research Questions 3-6: Multiple logistic regression

Since ever and current use of ST are both binary outcomes (i.e. responses are coded as 0

or 1), multiple logistic regression was appropriate for examining the direction and magnitude of

associations between independent measures and ST use among youth. However, there is the

potential for clustering of students within schools, where students who attend the same school

are more likely to have similar characteristics and behaviours (e.g. ST use) relative to students at

a different school. This violates the main assumption of standard logistic regression which

assumes that all observations are independent therefore, standard logistic regression procedures

could not be used. The PROC GLIMIX procedure in SAS produces a more sophisticated logistic

regression model where using a school-level random intercept allows for the model intercept to

vary across schools, thus controlling for clustering of ST use within schools. Weighted estimates

were used for all regression models to be consistent with similar data reported by Kennedy et al. (2008).

To answer research questions 3-6, regression models for ST ever and current use were examined for the *entire* youth population and the *current smoking* population. The first two models produced for the *entire* youth population (one for ST ever use and another for current ST use) contained all independent measures of interest (grade, gender, spending money per week, geographic region, current smoking status, participation in sports teams, and physical activity) and were used to answer research questions 3-5.

Next, two models were produced (again, one for ST ever use and another for current ST use) to assess the relationship between ST use and independent measures of interest (including attempting to quit smoking) for the *current smoking* population. These models were used to address research question 6.

4.3.3 Research Question 7: Multiple regression to establish mediation

To determine if (a) physical activity or (b) athletic team participation mediate a relationship between attempting to quit and ST ever or current use among current youth smokers, Barron and Kenny's (1986) multiple regression procedure was used to establish mediation. A mediator variable accounts for or explains the relationship between the dependent (DV) and independent variable (IV) and is thus part of the causal pathway (Barron & Kenny (1986). **Figure 2** presents an unmediated model of the relationship between attempting to quit smoking and ST use and **Figure 3** includes physical activity and athletic team participation as a mediator of the relationship between attempting to quit smoking and ST use.
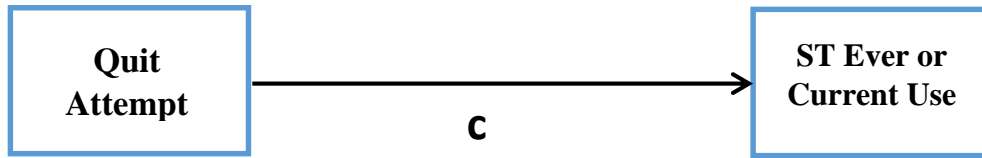
Figure 2: Unmediated model of the association between attempting to quit smoking and ST use.
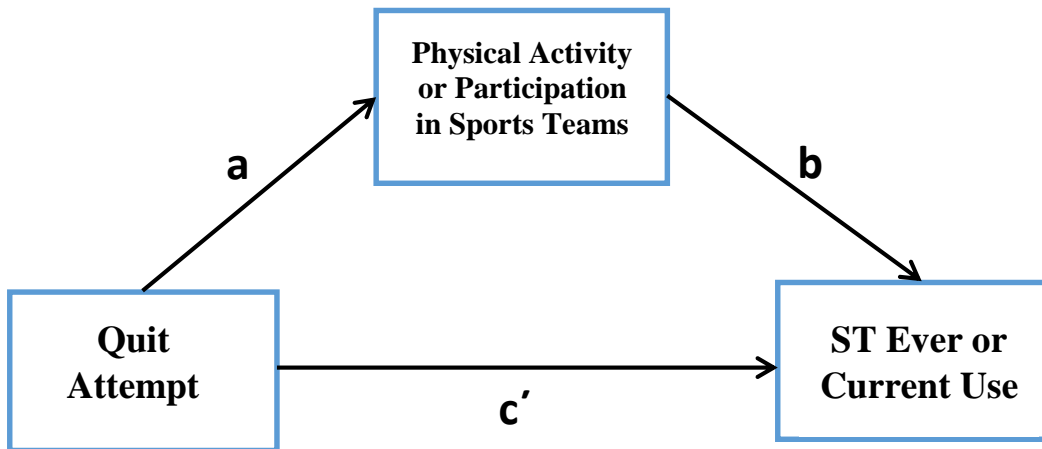
Figure 3: Conceptual model of physical activity as a mediator of the association between attempting to quit smoking and ST use.

Barron and Kenny (1986) developed what is known as the "causal steps" approach to test mediation, which has the dominant approach for over 20 years and involves multiple regression analyses. These steps to establish mediation are outlined below:

Step 1: The first step was to show that the IV was correlated with the DV. Given that attempting to quit smoking was the IV and ST use was the DV, ST use was used as the outcome variable in a logistic regression equation with attempting to quit as the predictor. This step tested the relationship between attempting to quit and (a) ST ever use and (b) ST current use and thus two models were be produced at this step. This step estimated and tested path *c* in **Figure 2**, to establish that there was an effect that could be mediated.

Step 2: The next step was to show that the IV is correlated with each mediator, where attempting to quit was the IV and (a) physical activity and (b) participation in sports teams were each tested as a mediator. Two regression models were produced in this step: the first with physical activity as the outcome and attempting to quit at the predictor; the second with athletic team participation as the outcome and attempting to quit as the predictor. This step tested pathway *a* (**Figure 3**) and treated each mediator as if it were an outcome variable.

Step 3: The third step was to show that the mediator affected the outcome variable, using the DV as the outcome variable in a regression equation and the IV and mediators as predictors. Thus four logistic regression models were constructed in this step: the first with ST ever use as the outcome and attempting to quit and minutes of physical activity as predictors; the second with ST ever use as the outcome and attempting to quit and athletic team participation as predictors; the third with ST current use as the outcome and attempting to quit and minutes of physical activity as predictors; and the fourth with ST current use as the outcome and attempting to quit and athletic team participation as predictors. This step estimated and tested path *b* in **Figure 3**. It was not sufficient to only correlate the mediator with the outcome; the mediator and the outcome may be correlated because they are both cause by the IV. Therefore when establishing the effect of the mediator with the DV, the IV was controlled for.

Step 4: The last step was to examine the effect of the IV on the DV when controlling for each mediator. If the mediator completely mediates the IV-DV relationship, the effect of the IV on the DV when controlling for the mediator (path *c´*) would be zero. The effects in both steps 3 and 4 were estimated in the same equations. If all four of these steps were met then it can be said that the mediator *completely* mediated the IV-DV relationship. However, if the first three steps were met but Step 4 was not, then *partial* mediation was indicated.

According to Baron and Kenny (1986), variables that may be correlated with the initial variable, mediator, or outcome, called covariates, are generally included in each equation. Therefore, gender, grade, region, and weekly spending money were included in all equations testing mediation.

4.3.7 Influence of Missing Data

As shown in Table (**Appendix E**), logistic regression models of the entire grade 9-12 population were estimated using data from 1,525,500 of 1,606,100 students in the weighted sample (Models 1 & 2). To determine whether these missing data had a significant impact on the model estimates, the missing values in *spending money per week* and *participation in sports teams* were coded as *missing* and included in Models 1 and 2. As shown in Table (**Appendix E**), including missing values in the models led to negligible changes in the estimates produced.

Additionally, regression models for the current smoking population were estimated using data from 119,500 of 131,800 students in the weighted sample (Models 3-10). To determine if the missing data had substantial impact on the model estimates, the missing values in *spending money per week*, *participation in sports teams*, and *quit attempt* were coded as *missing* and included in Models 3 and 4. As shown in **Table 5** (**Appendix E**), including missing values in the models led to minor changes in the estimates produced. In Model 3, grade 11 became a significant predictor of ST ever use among current smokers and grade 12 was no longer a significant predictor. In addition, making a quit attempt became a significant predictor of ever using ST among current smokers but only slightly. In Model 4, grade 11 became a significant predictor of current ST use among smokers and grade 12 was no longer a significant predictor. Moreover, physical activity no longer became a significant predictor of ST use among current

smokers. Since including missing values produced only minor changes in the estimates, it is still

reasonable interpret the results from the models which exclude the missing data.

Chapter 5: Results

5.1 Descriptive Statistics

Data were analyzed for 29,007 Canadian youth in grades 9-12. After applying population weights, the sample represents 1,525,500 Canadian high school students. An overview of the weighted sample statistics is outlined below. Complete descriptive statistics for the *entire* youth population and the *current youth smoking* population are provided in **Appendix F**.

5.1.1 Sample Characteristics

The weighted study sample was 49.1% (n = 748,300) female and 50.9% (n = 777,200) male. Of youth surveyed, 90.4% (n = 1,379,100) were never smokers, 8% (n = 121,800) were current smokers and 1.6% (n = 24,500) were former smokers. Among current youth smokers, 67.6% (n = 80,800) had made at least one quit attempt.

Among Canadian youth, 43.3% (n = 659,800) participated in sports teams and 39.2% (n = 597,500) met Canada's physical activity guidelines by engaging in at least 60 minutes of intense physical activity at least 3 times per week. Among current smokers, 28.5% (n = 34,000) reported participating in sports teams and 38.6% (n = 46,200) met Canada's guideline for physical activity.

Prevalence of ever using flavoured tobacco was 24.5% (n = 374,400) among the entire grade 9-12 population and the prevalence of current flavoured ST usage was 1.8% (n = 26,800). Among current youth smokers, where 88.7% (n = 106,000) reported ever use of flavoured tobacco and 7.9% (n = 9,400) currently used flavoured ST.

5.1.2 Prevalence of Ever and Current ST Users

Overall, 5.3% (n = 80,200) of youth had ever used ST and 1.9% (n = 29,000) were current ST users. As shown in **Figure 4**, prevalence of ever ST was highest among current youth smokers (23.1%, n = 28,100), followed by former smokers (18.7%, n = 4,600) and never smokers (3.5%, n = 47,500). Similarly, current youth smokers (9.8%, n = 12,000) also had a higher prevalence of current ST use compared to former smokers (3.2%, n = 800) and never smokers (1.2%, n = 16,200).
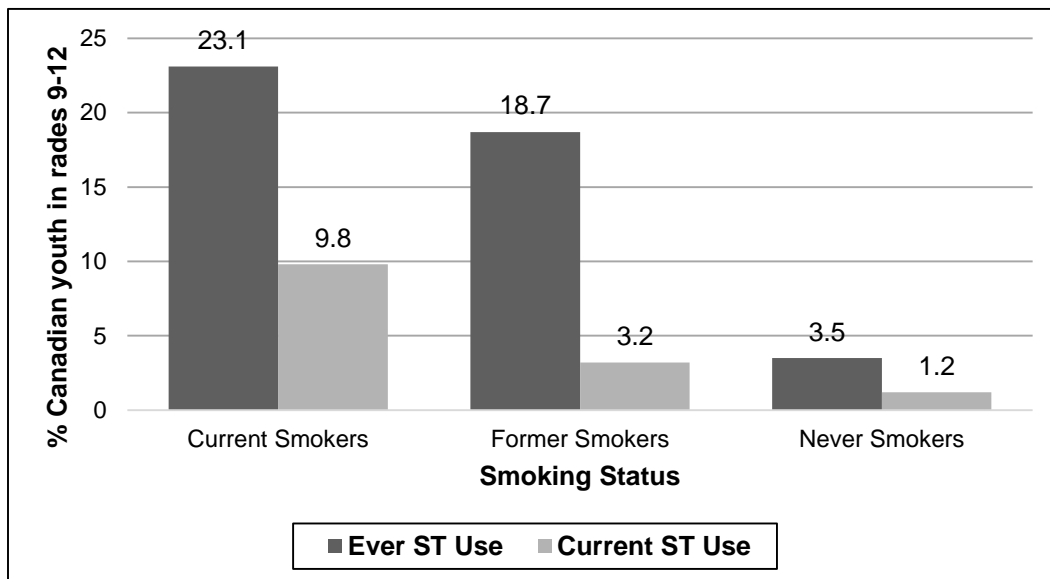
Figure 4: Prevalence of ever and current ST use among Canadian youth by smoking status

Males had a higher prevalence of both ST ever and current use compared to females. Among the entire youth population, 8.9% (n = 68,800) of males reported ever trying ST compared to 1.5% (11,400) of grade 9-12 females. Additionally, 3.4% (n = 26,400) of males we current users compared to 0.3% (n = 2,600) of females. Among smokers, 33.5% (n = 22,900) of male smokers had tried ST compared to 9.1% (n = 4,700) of female smokers. Similarly, 15.8% (n = 10,800) of male smokers were dual users compared to 2% (n = 1,000) of females.

As shown in **Figure 5**, prevalence of ever and current ST use increased by grade. Grade 12 had the highest prevalence of ever (8.1%, n= 29,300) and current (2.9%, n = 10,400) ST use and grade 9 had the lowest prevalence of ever (2.5%, n = 9, 300) and current (1%, n = 3,700) use among youth in grades 9-12. Among current youth smokers, grade 12 had the highest prevalence of ST ever (27.3%, n = 12,000) and current use (12.5%, n = 5,500). Grade 10 smokers had the lowest prevalence of ever (16.5%, n = 4,300) and current (8.1%, n = 2,100) ST use.
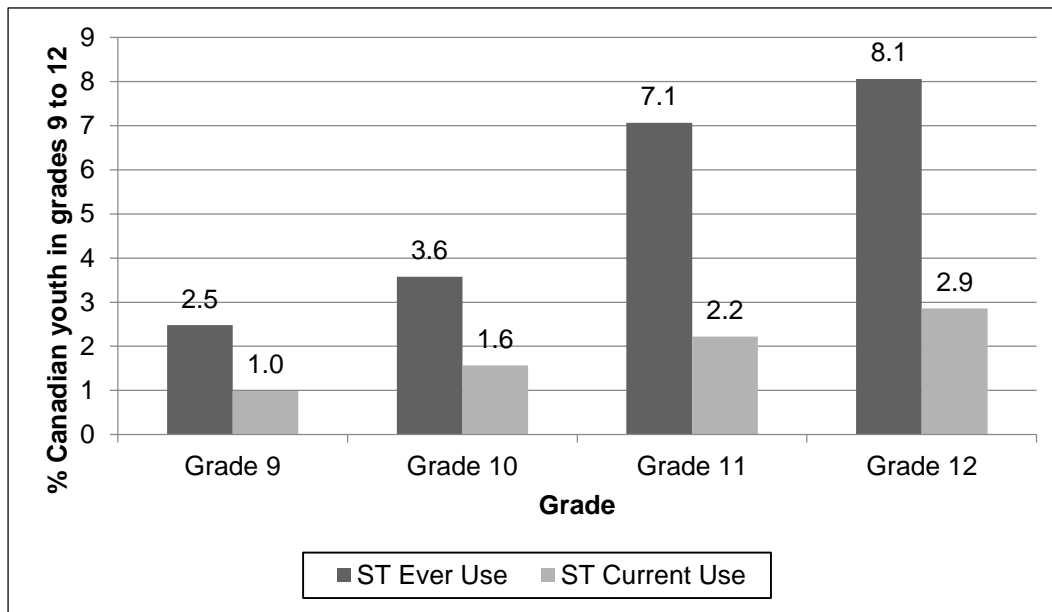
Figure 5: Prevalence of ever and current ST use among Canadian youth by grade

When prevalence of ST use was examined by age, youth 18 and over had the highest prevalence of ST ever 12.8%, n = 12,200) and current use (3.6%, n = 3,700), as shown in **Figure 6**. Youth who were 14 and under had the lowest prevalence of ST ever (2.2%, n = 5,800) and current (0.9%, n = 2,500) use.
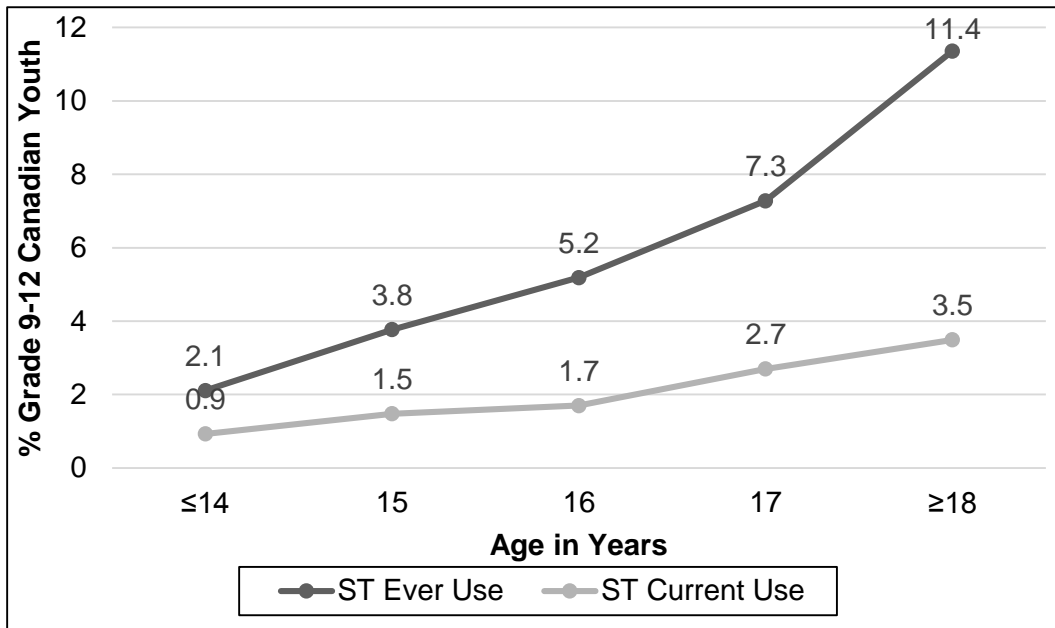
Figure 6: Prevalence of ever and current ST use among Canadian youth by age

As shown in **Figure 7**, youth with more spending money per week had a higher prevalence of ST ever and current use. Youth with more than $100 of spending money per week had the highest prevalence of ST ever (9.2%, n = 19,800) and current use (3.5%, n = 7,600) compared youth with no weekly spending money (ST ever use = 3.3%, n = 9,722; ST current use = 1.2%, n = 3,600). A similar pattern emerged among current youth smokers, where smokers with more than $100 of weekly spending money had a higher prevalence of ST ever (29.8%, n = 8,400) and current use (16.8%, n = 4,700). However, smokers with $1-$20 of weekly spending money had the lowest prevalence of ever ST use (17.5%, n = 5,100) and smokers with $21-$100 of weekly spending money had the lowest prevalence of current ST use (6.7%, n = 2,600).
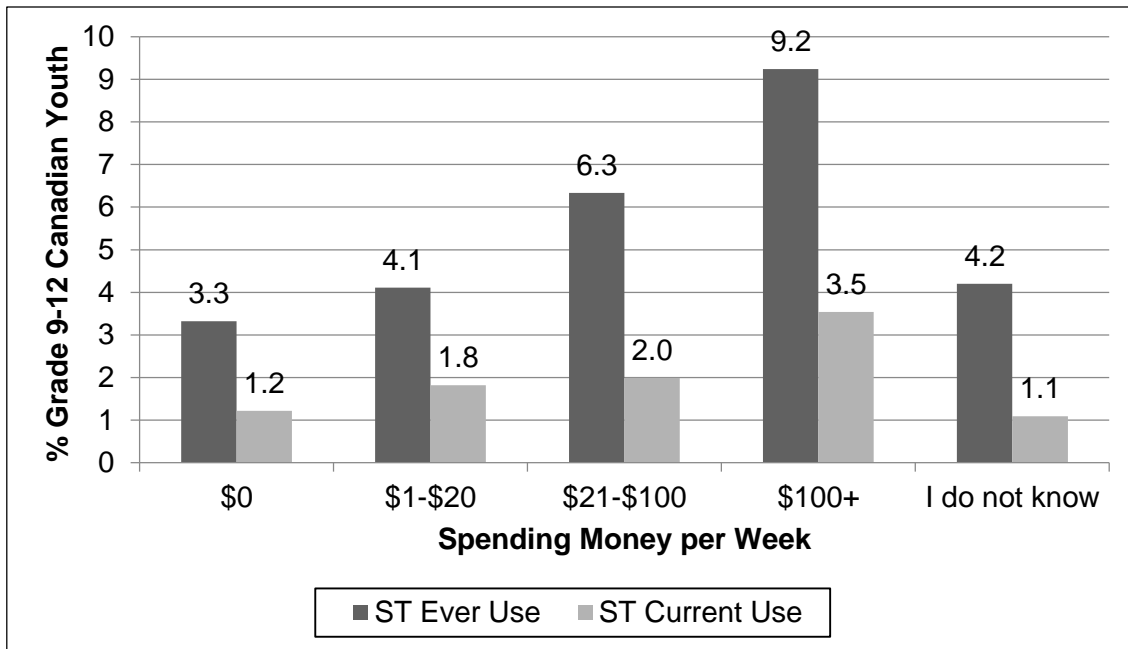
Figure 7: Prevalence of ever and current ST use among Canadian youth by weekly spending money

Among current youth smokers who reported ST ever use, 67.5% (n = 18,600) had made at least one quit attempt and 60% (n = 7,000) of dual users reported having ever attempted smoking cessation.

Among youth in grades 9-12, those who participated in sports teams had a higher prevalence of ST ever (6.5%, n = 42,900) and current use (2.8%, n = 18,700) compared to non-participants as shown in **Figure 8**. Among youth who participated in sports teams, ST ever and current use increased by grade, as shown in **Figure 9**, where grade 12 youth in sports had the highest prevalence of ever (10.88%, n =14,500) and current use (5.28%, n = 7,000) compared to youth in younger grades. Similarly, youth who engaged in intense physical activity for an hour at least three times per week had a higher prevalence of ever (6.3%, n = 37,400) and current ST use (2.4%, n = 14,000) compared to student who did not meet the guidelines as shown in **Figure 8**.
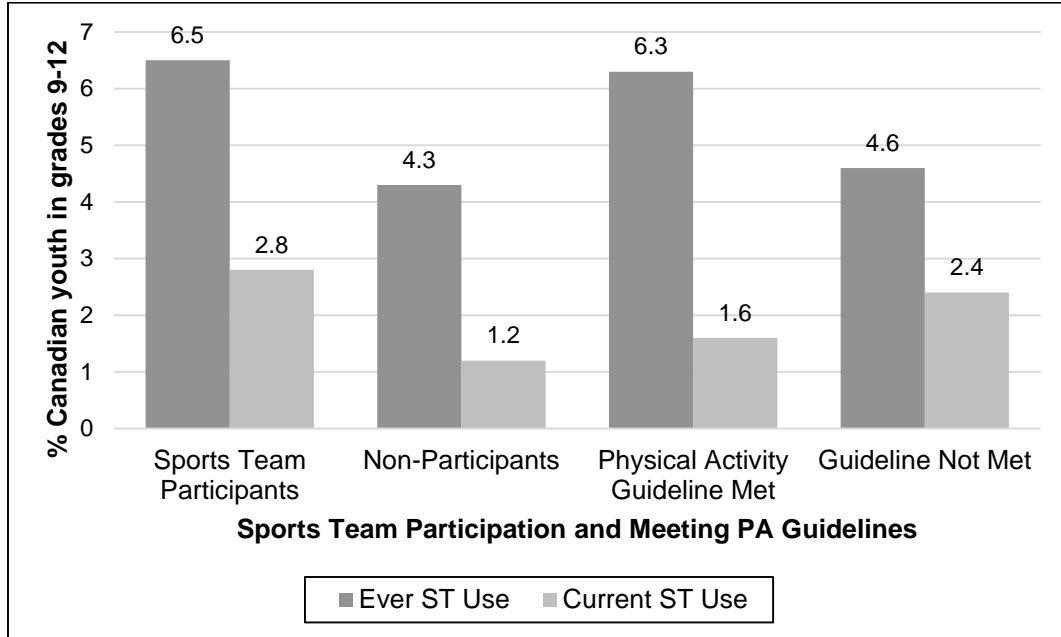
Figure 8: Prevalence of ST use among Canadian youth by sports team participation and meeting Canada's guidelines for physical activity
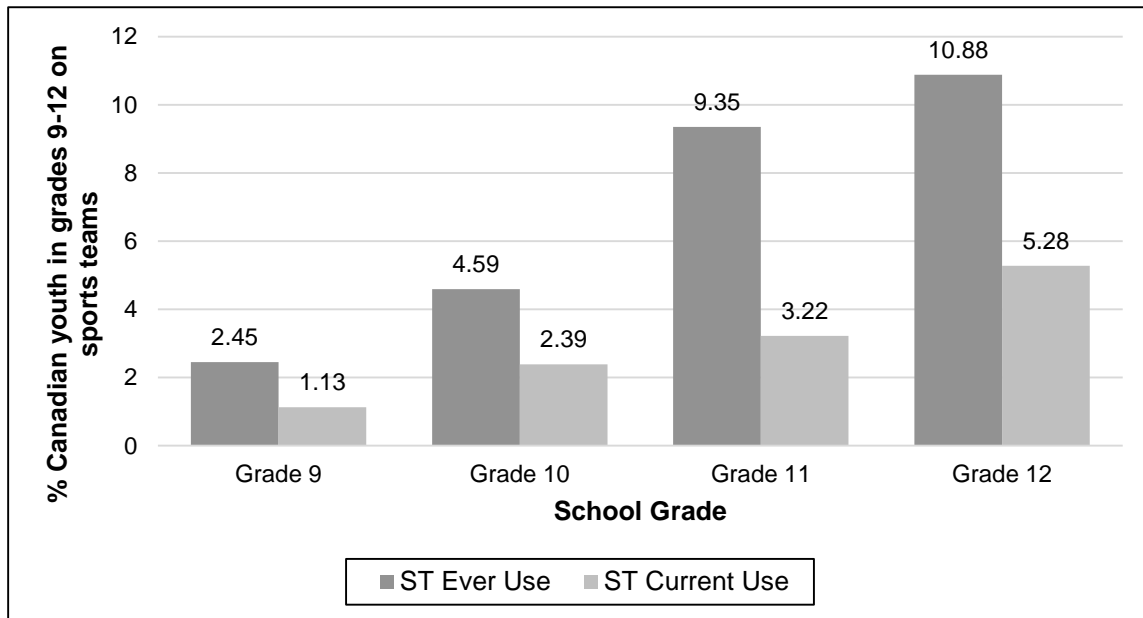
Figure 9: Prevalence of ST use among Canadian youth who participate in sports teams by grade

Among current youth smokers, those who participated in sports teams had a higher prevalence of ST ever (35.2%, n = 10,800) and current (17.8%, n = 6,100) use compared to non-participants. Additionally, youth smokers who met Canada's physical activity guidelines also had a higher prevalence of ST ever (26%, n = 12,000) and current (12.4%, n = 5,800) use compared to physically inactive youth.

As shown in **Figures 10 and 11**, there were substantial regional differences in ST ever and current ST use within the grade 9-12 population. Prevalence of ST use was highest in the Prairies (ST ever use = 8.2%, n = 24,200; ST current use = 2.7%; n = 7,900) with Saskatchewan reporting the highest prevalence (ST ever use = 12.8%, n = 6,300; ST current use = 5.3%, n = 2, 600). Quebec had the lowest prevalence of ST ever and current use.
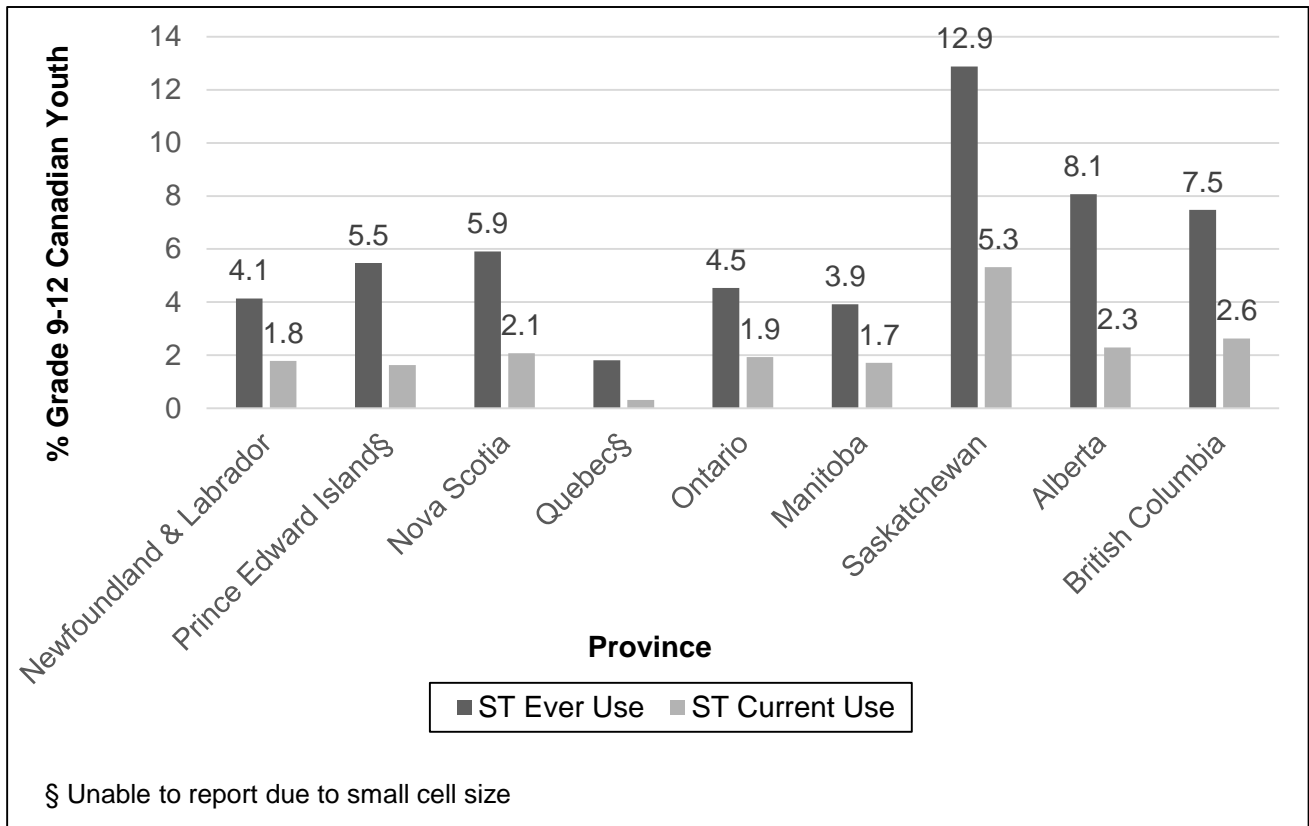
Figure 10: Prevalence of ever and current ST use among Canadian youth by province
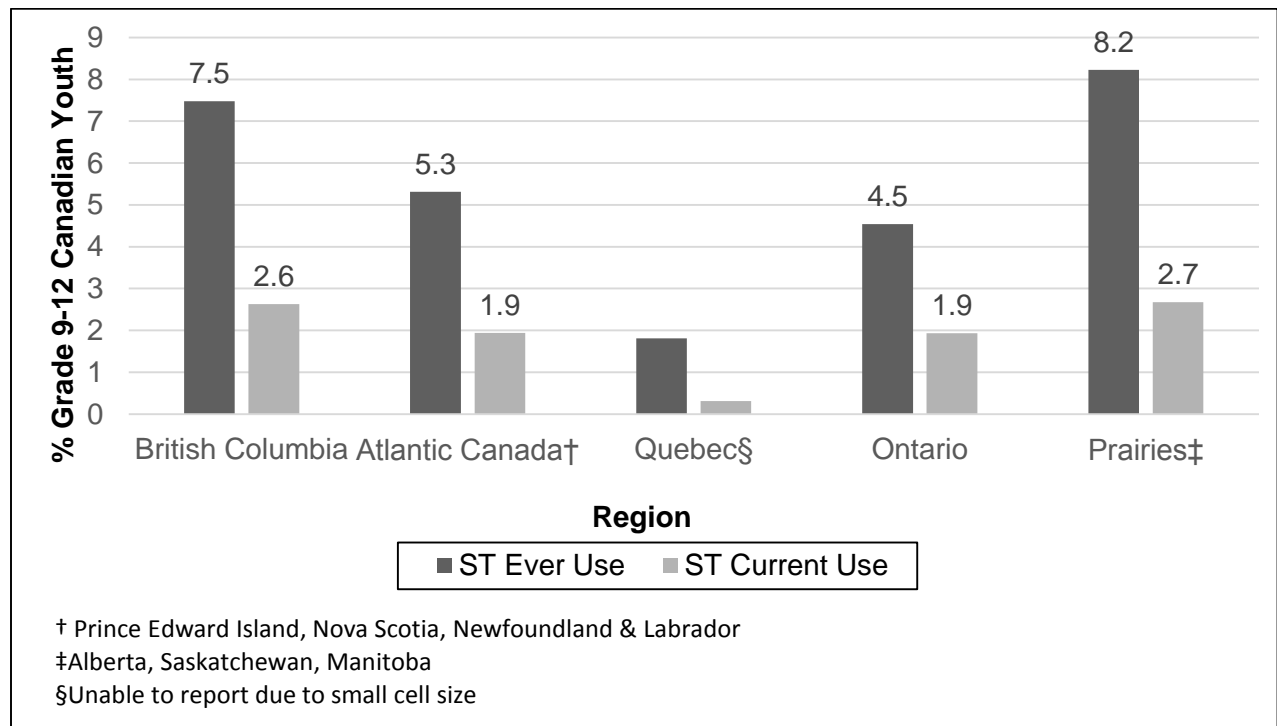
Figure 11: Prevalence of ever and current ST use among Canadian youth by region

5.1.3 Summary of Descriptive Statistics

Among Canadian youth in grades 9-12, prevalence of ST ever and current use was highest among males (ST ever use = 8.9%; ST current use = 3.4%), current smokers (ST ever use = 23.1%; ST current use = 9.8%), respondents with more than $100 of weekly spending money (ST ever use = 9.2%; ST current use =3.5%), those in grade 12 (ST ever use = 8.1%; ST current use = 2.9%), youth who participate in sports teams (ST ever use = 6.5%; ST current use = 2.8%) and physically active youth (ST ever use = 6.3%; ST current use = 2.4%).

Similar trends were seen among current youth smokers, where prevalence of ST ever and current use was highest among males (ST ever use = 23.1%; ST current use = 9.8%), respondents with more than $100 of weekly spending money (ST ever use = 29.8%; ST current use = 16.8%) , those in grade 12 (ST ever use = 27.3%; ST current use = 12.5%), youth smokers who participate in sports teams (ST ever use = 35.2%; ST current use = 17.8%), and youth smokers who are physically active (ST ever use = 26%; ST current use = 12.4%).

5.2 Factors Associated with ST Use

Four logistic regression models were developed to examine factors associated with ST use among the entire grade 9-12 youth population and among current smoking youth. A summary of these analyses can be found in **Table 1** and the complete models can be found in **Appendix H.** All associations discussed below existed while controlling for all of the other variables in **Table 1**.

Model 1: Ever ST use vs. Never ST use among Canadian youth

Gender was significantly associated with ever ST use among the grade 9-12 population, where males had 6.81 (95% C.I.: 6.65-6.97) increased odds of trying ST compared to females. School grade was also associated with ever ST use, where odds of trying ST increased by grade.

Grade 12 had the highest odds of trying ST (OR: 4.09, 95% C.I.: 3.91-4.28) relative to grade 9. Weekly spending money was a significant predictor of ever ST use, where students had increased odds of trying ST as spending money increased. Students with more than %100 of weekly spending money had the highest odds (OR: 1.71, 95% C.I.: 1.66-1.76) of trying ST relative to students with no spending money. Smoking status was significantly associated with trying ST. Current smokers had 10.35 (95% C.I.: 10.1-10.60) increased odds and former smokers had 6.40 (95% C.I.: 6.11-6.70) increased odds of trying ST relative to never smokers. Participation in sports teams was a significant predictor of ever ST use, where students on a sports team had 1.97 (95% C.I.: 1.93-2.01) increased odds of trying ST compared to non-participants. Additionally, meeting Canada's guideline for physical activity had 1.03 (1.01-1.05) increased odds of trying ST compared to students who did not meet the guidelines.

Model 2: Current ST use vs. Non-users among Canadian youth

Gender was a significant predictor of current ST use, where males had 11.10 (95% C.I.: 10.59-11.64) increased odds of being current users compared to females. Additionally, grade was significantly associated with currently using ST. Grade 11 had the highest odds (OR: 2.02, 95% C.I.: 1.89-2.16) of current use followed by grade 12 (OR: 1.84, 95% C.I.: 1.72-1.97) and grade 11 (OR: 1.62, 95% C.I.: 1.52-1.73), relative to grade 9 students. Weekly spending money was also a significant predictor of currently using ST. Having $1-20 of spending money had a 1.47 (95% C.I.: 1.40-1.54) increased odds of using ST followed by more than $100 (OR: 1.34, 95% C.I.: 1.27-1.41) and $21-100 (OR: 1.28, 95% C.I.: 1.22-1.35) compared to students with no spending money. Smoking status was a significant predictor of current ST use, where current smokers had 12.76 (95% C.I.: 12.3-13.24) increased odds of also using ST and former smokers had 2.08 (95% C.I.: 1.86-2.30) increased odds of currently using ST compared to never smokers.

Additionally, participation in sports teams had 3.50 (95% C.I.: 3.38-3.62) increased odds of currently using ST relative to non-sports team members. Meeting Canada's guidelines for physical activity resulted in a 6% (95% C.I.: 0.91-0.97) reduced odds of currently using ST compared to students who did not meet the guidelines.

Model 3: Ever ST use vs. Never ST use among Canadian youth smokers

Gender was significantly associated with trying ST among youth smokers, where males had 6.89 (95% C.I.: 6.57-7.23) increased odds of trying ST relative to females. Grades 12 (OR: 1.16, 95% C.I.: 1.06-1.27) and 10 smokers (OR: 1.13, 95% C.I.: 1.03-1.24) had increased odds of ever ST relative to grade 9 smokers. Weekly spending money was significantly associated with trying ST. Having more than $100 resulted in 1.26 (95% C.I.: 1.16-1.36) increased odds and having $21-$100 resulted in 1.24 (95% C.I.: 1.15-1.34) increased odds of trying ST compared to those with no spending money. Having $1-$20 resulted in 49% (95% C.I.: 0.47-0.56) reduced odds of trying ST compared to students with no weekly spending money. Smoking youth who participated in sports teams had 1.69 (95% C.I.: 1.61-1.77) increased odds of trying ST compared to smokers not on sports teams. Additionally, smoking youth who met Canada's guideline for physical activity had 1.13 (95% C.I.: 1.08-1.18) increased odds of trying ST compared to smokers who did not meet the guidelines.

Model 4: Current ST use vs. Non-users among Canadian youth smokers

Gender was a significant predictor of using ST among youth smokers, where males had 13.75 (95% C.I.: 12.50-15.12) increased odds of also using ST compared to female smokers. Grade 10 had the highest odds (OR: 1.51, 95% C.I.: 1.33-1.73) of currently using ST compared to grade 9 students. Grade 12 smokers had 1.18 (95% C.I.: 1.04-1.35) increased odds of also using ST relative to grade 9 smokers. Weekly spending money was significantly associated with

reduced odds currently using ST among youth smokers. Those with $21-$100 of spending money were least likely (OR: 0.37, 95% C.I.: 0.33-0.41) to use ST in addition to cigarettes. Youth smokers who had made at least one quit attempt had 24% (95% C.I.: 0.71-0.81) reduced odds of currently using ST, relative to smokers who had never attempted to quit. Youth smokers who participated in sports teams had 2.14 (95% C.I.: 2.00-2.29) increased odds of also using ST compared to youth smokers not on sports teams. Youth smokers who met Canada's guidelines for physical activity had 7% (95% C.I.: 0.87-0.99) reduced odds of also using ST compared to smokers who did not meet the guidelines.

Table 1: Logistic Regression Models Examining Factors Associated with ST Use among Canadian Youth in Grades 9-12 (2010-2011)

Parameters		Entire Youth Population		Current Youth Smokers	
		Model 1: Ever ST Use (n=1,525,500)	Model 2: Current ST Use (n=1,525,500)	Model 3: Ever ST Use (n=119,500)	Model 4: Current ST Use (n=119,500)
Gender	Female[a]	1.00	1.00	1.00	1.00
	Male	**6.81 (6.65,6.97)**	**11.10 (10.59,11.64)**	**6.89 (6.57,7.23)**	**13.75 (12.50,15.12)**
Grade	9[a]	1.00	1.00	1.00	1.00
	10	**1.57 (1.50,1.64)**	**1.62 (1.52,1.73)**	**1.13 (1.03,1.24)**	**1.51 (1.33,1.73)**
	11	**3.30 (3.15,3.45)**	**2.02 (1.89,2.16)**	1.03 (0.94,1.13)	0.89 (0.78,1.03)
	12	**4.09 (3.91,4.28)**	**1.84 (1.72,1.97)**	**1.16 (1.06,1.27)**	**1.18 (1.04,1.35)**
Region	British Columbia[a]	1.00	1.00	1.00	1.00
	Atlantic Canada	**0.83 (0.50,1.38)**	1.13 (0.62,2.05)	0.71 (0.24,2.12)	2.09 (0.60,7.35)
	Quebec	**0.04 (0.02,0.08)**	**0.02 (0.01,0.06)**	**0.02 (0.01,0.10)**	**0.01 (0.00,0.13)**
	Ontario	**0.21 (0.13,0.35)**	**0.21 (0.11,0.39)**	**0.28 (0.08,0.96)**	1.09 (0.28,4.22)
	Prairies	**1.77 (1.06,2.94)**	1.72 (0.96,3.08)	2.41 (0.81,7.21)	**5.25 (1.53,17.98)**
Spending Money Per Week	$0[a]	1.00	1.00	1.00	1.00
	$1-20	**1.33 (1.29,1.37)**	**1.47 (1.40,1.54)**	**0.51 (0.47,0.56)**	**0.42 (0.37,0.47)**
	$21-100	**1.65 (1.60,1.69)**	**1.28 (1.22,1.35)**	**1.24 (1.15,1.34)**	**0.37 (0.33,0.41)**
	$100+	**1.71 (1.66,1.76)**	**1.34 (1.27,1.41)**	**1.26 (1.16,1.36)**	**0.69 (0.62,0.76)**
	I do not know	**1.15 (1.11,1.19)**	**0.67 (0.63,0.71)**	0.90 (0.82,1.00)	**0.43 (0.38,0.41)**
Smoking Status	Never Smoker[a]	1.00	1.00	N/A	N/A
	Former Smoker	**6.40 (6.11,6.70)**	**2.08 (1.86,2.30)**	N/A	N/A
	Current Smoker	**10.35 (10.1,10.60)**	**12.76 (12.3,13.24)**	N/A	N/A
Quit Attempt	No[a]	N/A	N/A	1.00	1.00
	Yes	N/A	N/A	0.97 (0.93,1.02)	**0.76 (0.71,0.81)**
Participation in Sports Teams	No[a]	1.00	1.00	1.00	1.00
	Yes	**1.97 (1.93,2.01)**	**3.50 (3.38,3.62)**	**1.69 (1.61,1.77)**	**2.14 (2.00,2.29)**
Physical Activity Guideline Met	No[a]	1.00	1.00	1.00	1.00
	Yes	**1.03 (1.01,1.05)**	**0.94 (0.91,0.97)**	**1.13 (1.08,1.18)**	**0.93 (0.87,0.99)**

Notes:
Odds ratios adjusted for all other variables in the table.
Bold: p<0.05
[a] Reference group
Model 1(for entire youth population): 1 = Ever use of ST (n = 80,200), 0 = Has never used ST (n =1,445,300)
Model 2 (for entire youth population): 1 = Currently uses ST (n = 29,000), 0 = Does not currently use ST (n =1,496,500)
Model 3 (for current smokers in youth population): 1 = Ever use of ST (n = 27,600), 0 = Has never used ST (n =92,000)
Model 4 (for current smokers in youth population): 1 = Currently uses ST (n =11,800), 0 = Does not currently use ST (n = 107,700)

5.3 Multiple Regression to Establish Mediation

Six logistic regression models were developed to examine the mediation effects of both participation in sports teams and meeting Canada's guideline for vigorous physical activity on attempting to quit and ST use among current youth smokers. A summary of these analyses are shown in **Figures 12 and 13** as well as in **Appendix G** and complete models can be found in **Appendix G**.

5.3.1 Mediation Effects of Sports Team Participation

Figure 12 depicts the mediation analysis of sports team participation on attempting to quit and ST *ever* and *current* use among current youth smokers. Initially, an association between attempting to quit and ST ever use was established ($\beta = -0.07$, $p = 0.0034$) as well as an association between attempting to quit and current ST use ($\beta = -0.3222$, $p < 0.0001$). However, attempting to quit was not a significant predictor of participation in sports teams. Given that attempting to quit was not correlated with the potential mediator, mediation of sports team participation of the association between attempting to quit and ST use cannot be established.
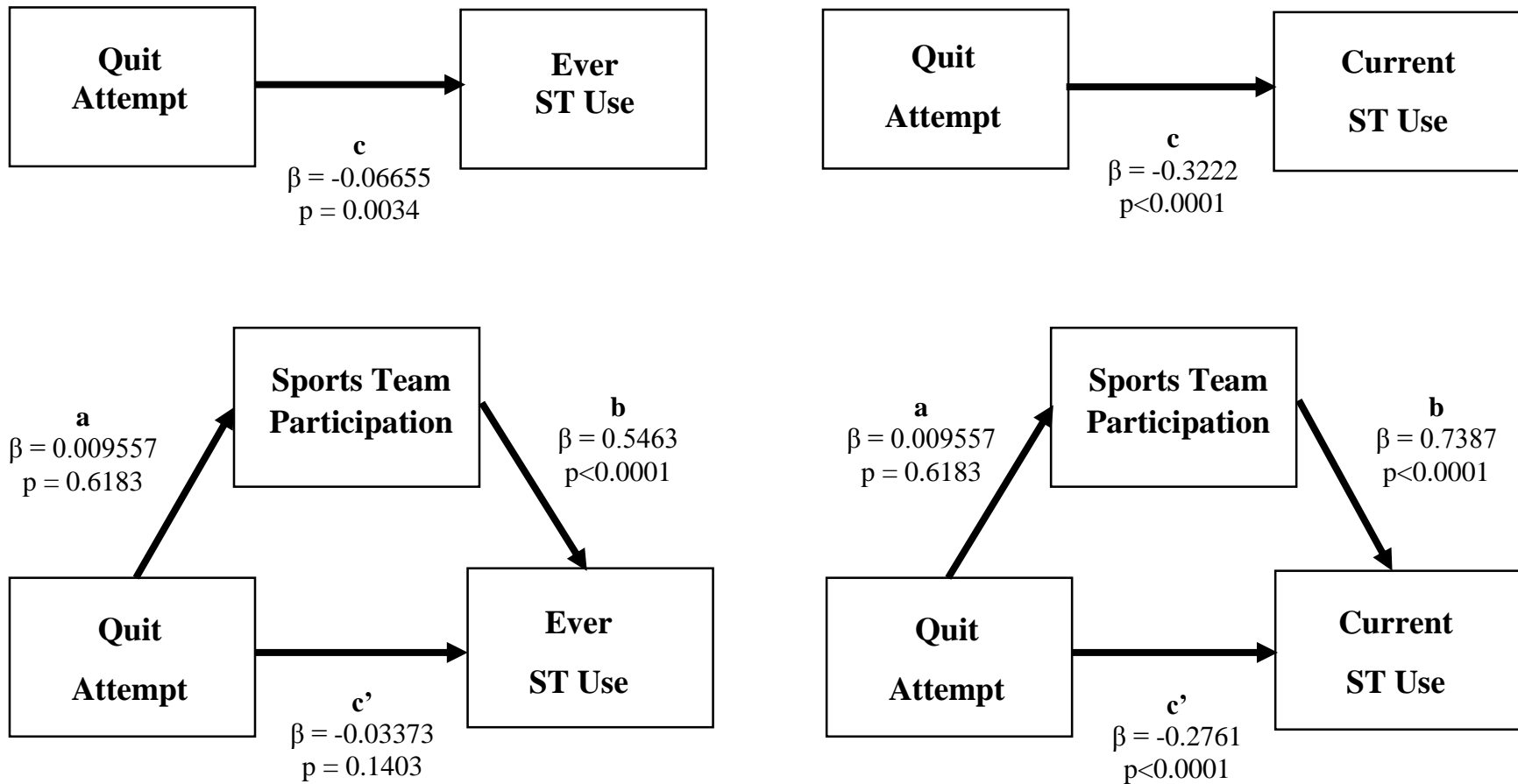
Figure 12: Mediation analysis of sports team participation on associations between attempting to quit smoking and ST among youth smokers.

5.3.2 Mediation Effects of Physical Activity

Figure 13 shows the mediation analysis of meeting Canada's physical activity guideline on attempting to quit smoking and ST ever and current use among current youth smokers. As mentioned in section *5.3.1*, there were significant associations between attempting to quit and both ST ever and current use. Next, an association between attempting to quit smoking and physical activity was established (β = -0.4507, p <0.0001).

Physical activity proved to be a predictor of ST ever (β = 0.2093, p<0.0001) and current use (β = 0.1289, p<0.0001), when controlling for the quit attempt variable. There continued to be a significant association and an increase in effect between attempting to quit and ST ever (β = -0.5249, p<0.0212) use. Therefore meeting Canada's physical activity guideline does not mediate the association between attempting to quit and trying ST among youth smokers. When controlling for the mediator, there was a decrease in effect (β = -0.3134, p <0.0001) between attempting to quit and current ST use. However since this association remained significant, it can be concluded that meeting Canada's physical activity guideline *partially mediates* the association between attempting to quit smoking and current ST use among youth smokers. However, it appears that controlling for the mediator (physical activity) does not affect the risk of using ST among youth smokers who have made a quit attempt, where smokers who have attempted to quit continued to have 26% reduced odds of currently using ST.
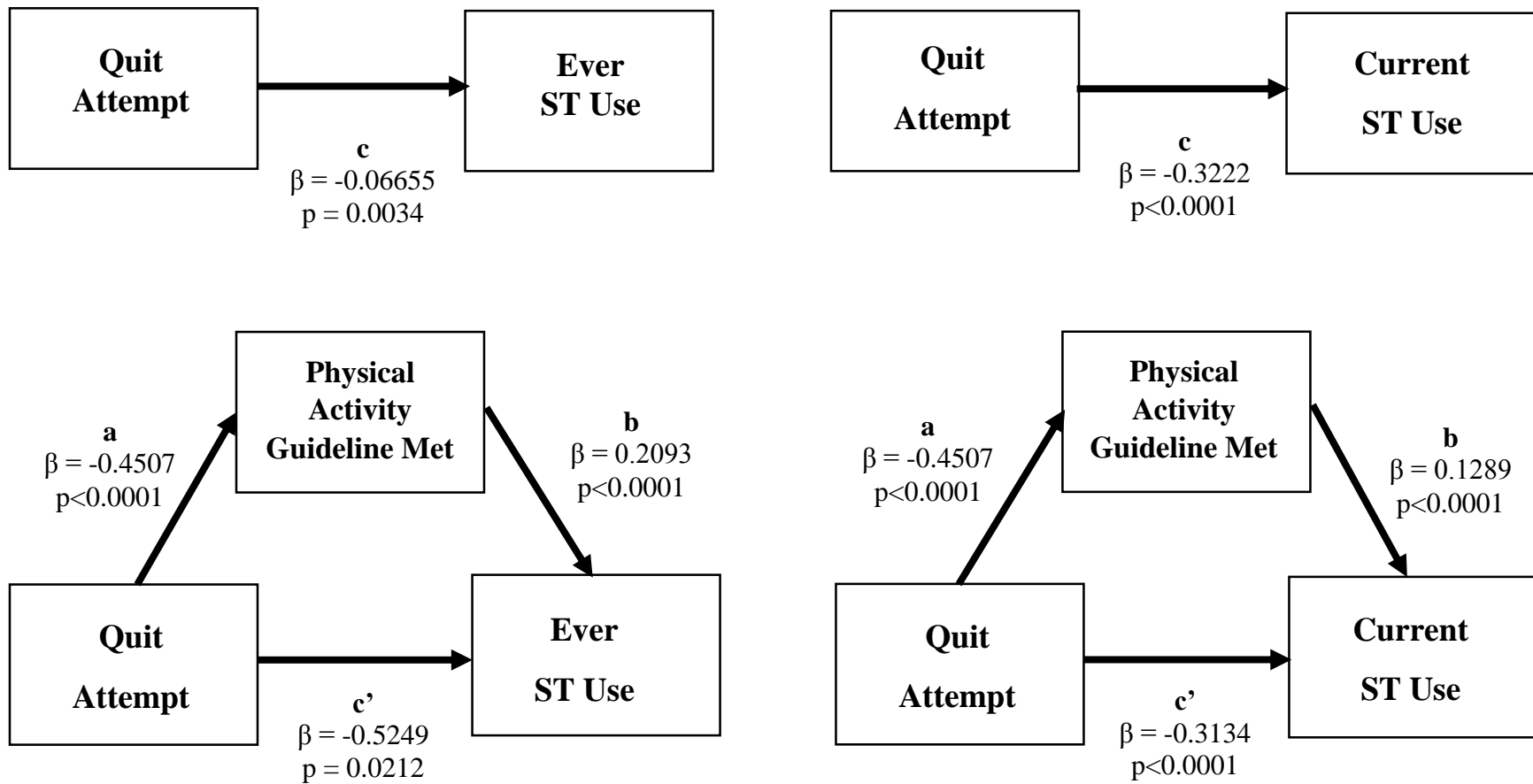
Figure 13: Mediation analysis of physical activity on associations between attempting to quit smoking and ST among youth smokers.

Chapter 6: Discussion

The primary objectives of this study were to examine prevalence of ST ever and current use among Canadian youth in grades 9-12 in 2010-2011 and to identify socio-demographic characteristics associated with ST use in this population. It was also investigated whether an association exists between ST use and physical activity and athletic team participation. Other objectives were to examine the role of physical activity and sports team participation among ST use and attempting cessation among Canadian youth smokers.

6.1 Prevalence of ST Use among Canadian Youth in Grades 9-12

According to results from the present study, 5.3% of Canadian youth had ever used ST and 1.9% were current ST users in 2010-2011. Prevalence of ever and current ST use was unchanged from 2008-2009 YSS results reported by Kennedy et al. (2011). However, Kennedy et al. (2011) examined ST use among youth in grades 6-12, therefore direct comparisons between YSS waves cannot be made as grades 6-8 were excluded from the current study population. As hypothesized, prevalence of ST use was not expected to deviate from that in 2008-2009 as ST use has remained relatively stable among Canada's high school-aged population from 2003-2010 (Reid, Hammond, Burkhalter & Ahmed, 2012). In addition, prevalence of both ever and current ST use was similar to that reported in by CTUMS in 2011 among Canadian youth aged 15-19 (Health Canada, 2012). Results indicate that prevalence of current use among high school youth is double of that among the general population. This is important considering youth represent a smaller proportion of Canada's ageing population and therefore continued monitoring among youth should be a public health priority.

Prevalence of ST use among Canadian high school students was lower compared to several other regions around the world. In 2011, the Youth Risk Behaviour Survey reported

7.7% of high school student in the United States had used ST in the past 30 days (CDCP, 2012). Similar to Canada, ST prevalence among American youth has not changed significantly since 2003.

In addition, ST prevalence (particularly snus) is much higher among youth in Sweden compared to youth in Canada. According to Rodu and colleagues (2005), regular snus use was 13% among a sample of males aged 15 and 16 in 2003. Snus is widely used in Sweden, especially among young adult males (Engstrom, K., Magnusson, C. & Galanti, MR, 2010). Furthermore, snus was only recently introduced into Canada in 2007 which may account for the lower prevalence of ST among Canadian youth (OTRU, 2007).

In Finland, a neighbouring country of Sweden, 12% of 16-year old boys and 14% of 18-year-old boys were current snus users in 2011 (Mattila, et al. 2012). While snus sales have been banned in Finland since 1995, use among young males has increased (Mattila, et al., 2012). It is interesting to note that despite the ban, youth in Finland are mainly accessing snus through social sources. In a sample of 12-18 year-old Finnish youth, 84% of daily or occasional snus users acquired snus through friends or acquaintances (Huhtala, Rainio & Rimpela, 2006). While the current YSS does not address access of ST among Canadian youth, it would be interesting to examine the influence of the social environment on ST use.

Prevalence of current ST use is also higher among many regions in South-East Asia (Gupta, Ray, Sinha & Singh, 2011). Findings from the Global Tobacco Surveillance System indicate that current ST use among youth aged 13-15 is highest in Bhutan (9.4%) and India (9%) (Gupta et al., 2011). However, the majority of ST used among countries in the South-East Asia region are chewing tobacco products known as *khaini* and betel quid, which are not widely available in Canada (Gupta et al., 2011).

While prevalence of ST among youth may be lower in Canada compared to other regions, prevalence among Canadian youth is higher compared to the adult population. Therefore it is important to continue monitoring of ST use among sub-populations were use is highest.

6.2 Prevalence of Ever Using Flavoured Tobacco Products and Current use of Flavoured ST

Results of the current study indicate that almost a quarter of youth in grades 9-12 have tried a flavoured tobacco product. Furthermore, the majority of current youth smokers have also used flavoured tobacco. It is interesting to note that as of 2010 the sale of cigarettes and little cigars that contain additives, including most flavouring agents, was prohibited in Canada (Health Canada, 2010). Therefore, the prevalence of trying flavoured tobacco products may be attributed to products not included in the ban (such as ST) or youth may be accessing flavoured tobacco products from non-retail sources. However, since the ban came into effect during the data collection period of the 2010-2011 YSS, results of the current study may not fully capture the effect of these changes to the *Tobacco Act.*

Among youth who reported currently using ST, 88% reported ever trying flavoured tobacco products and 69.8% were also currently using flavoured ST. Similarly, the majority of Canadian males aged 15-19 who were current ST users also reported using flavoured ST in the 2010 CTUMS (PSFC, 2011). These findings support the arguments that the initiation and continued use of ST among youth may be attributed to the flavouring of ST products and the marketing of ST products to attract youth.

6.3 Factors associated with ST use among Canadian Youth

The present study sought to understand factors associated with ST use among grade 9-12 youth including sociodemographic factors, smoking status, and physical activity.

6.3.1 Sociodemographic Factors

The purpose of *Research Question 3* was to examine socio-demographic factors associated with ST use. Gender was significantly associated with ST use among the population of grade 9-12 youth as well as among current youth smokers, where males had increased odds of trying or currently using ST relative to females. This association is consistent with findings from Kennedy, et al. (2011), as well as findings among U.S. youth (CDC, 2012), Swedish youth (Engstrom, et al., 2010), and Finnish youth (Matilla, et al., 2012).

Also consistent with results from 2008-2009 YSS data (Kennedy, et al., 2012), grade was a significant predictor of ST use, where youth in grades 10, 11 and 12 had increased odds of ST use compared to grade 9 students. This finding is also consistent among U.S. youth (CDP, 2012). Similarly, as age increased, so did the prevalence of both ever and current ST use among grade 9-12 students. While youth represent greater proportion of ST users, young adults between the ages of 20-24 actually have the highest prevalence in Canada (Health Canada, 2010). This may suggest that youth are experimenting with ST in high school and continuing use into adulthood.

Youth with more spending money per week had increased odds of ST use. Consistent with Kennedy et al. (2012), youth with over $100 of weekly spending money had the highest odds of ST use compared to youth with no spending money. Typically, youth with more disposable income are more likely to partake in risk behaviours including cigarette, alcohol and marijuana use (Leatherdale & Ahmed, 2010).

Also consistent with 2008-2009 YSS data, ST use was highest in the Western provinces, with the Prairies having the highest prevalence of ever and current use. One reason for this finding may be that the Prairies represent a more rural region of Canada. Generally, Aboriginal youth in rural northern regions of Canada have had a higher ST use and higher tobacco use

overall (Orisatoki, 2013). Given that youth residing in Yukon Territory, Nunavut, and the Northwest Territories were excluded from the YSS, the Prairies may represent the next most rural region in Canada.

6.3.2 Smoking Status

Research Question 4 sought to understand if an association exists between ST use and smoking status. As hypothesized, current and former youth smokers had an increased odds of trying or currently using ST relative to never smokers which is consistent with 2008-2009 YSS data (Kennedy et al., 2012), as well as among U.S youth (Tomar et al., 2009), young adult males in Finland (Hamari, Toljamo, Kinnula & Nieminen, 2012), and among Swedish adolescents (Post, Gilljam, Rosendahl, Bremberg & Galanti, 2010). Almost a quarter of current youth smokers had tried ST and nearly one in ten were dual users. Prevalence of dual use was higher than that reported by the 2009 U.S. National Youth Tobacco Survey (3.8%) and concurrent cigarette and ST use is more common among adolescent and young adult males compared to the entire population (Tomar et al., 2009). Dual use was also higher than among adolescents in Finland (6.9%) and Sweden (2.2%) (Hamari et al., 2012). There is debate among the public health community as to whether initiation of ST use could lead to cigarette smoking or update of more harmful substances. For example, a prospective study of adolescent males in Finland revealed that young men who only used snus had an increased risk of being future dual users (Grøtvedt, Forsén, Stavem 7 Graff-Iversen, 2012). On the contrary, some researchers argue that ST has the potential to reduce smoking related harm (Foulds et al., 2003). Given the lack of temporality in the current study, it is unclear whether ST or cigarette smoking initiated first and the extent to which ST use may lead to smoking. Future studies may want to consider a prospective design to follow youth over time so that temporal relationships can be established.

6.3.3 Physical Activity and Participation in Sports Teams

In keeping with *Research Question 5*, both meeting Canada's physical activity guidelines and participation in sports teams were associated with ST use among grade 9-12 students. Engaging in physical activity only marginally increased odds of trying ST and resulted in reduced odds of current use both among the entire population of youth as well as among current smokers. Similarly, Terry-McElrath and colleagues (2011) found that daily exercise was associated with lower prevalence of current ST use among U.S. middle and high school students.

Alternatively, grade 9-12 youth who participated in sports teams had nearly doubled odds of trying ST and 3.5 increased odds of currently using ST. This finding is consistent with U.S. high school and middle school youth (Terry-McElrath et al., 2011), young males in Finland (Mattila et al., 2012), and Norwegian adolescents (Martinsen & Sundgot-Borgen, 2012). One explanation for the association between athletic team participation and ST use may be the peer relationships and social environment components of team sports. As described in section *2.6,* social norms are an important predictor of individual behaviour, where if youth perceive ST use to be common among peers and teammates, they are more likely to engage in using ST (Bandura, 2001). Use of chewing tobacco and snus have been found to be higher among male-dominated sports, such as baseball in the U.S. (Eaves, 2011) and ice hockey in Finland and Sweden (Rolandsson et al., 2006; Mattila et al., 2012). This may help to explain the overall gender difference in ST use, where ST may be perceived as more masculine as they are related to more male-dominated sports.

Additionally, ST may be perceived as a less harmful form of tobacco use among youth in team sports and may be believed as less hindering to oxygen uptake relative to smoking (Mattila, et al., 2012). In a study of the use of snus among young males in Finland, Matilla and colleagues

(2012) found that sports requiring more individual performance and maximal oxygen intake (e.g. running, swimming, cycling, etc.) were not associated with any tobacco product use (including snus), yet use of snus was associated with physical activity organized by sports teams or clubs. Given that the YSS and results of the current study do not differentiate between sports teams, further research is required to determine which youth sports teams in Canada are using ST and which subcultures of these sports may be encouraging use.

6.4 ST Use among Canadian Youth Smokers Who Have Made a Quit Attempt

Research Question 6, sought to determine if an association exists between ST use and making a quit attempt among current youth smokers. Among current smokers, making at least one quit attempt was not a predictor of trying ST and making a cessation attempt resulted in reduced odds of currently using ST.

It was originally hypothesized that youth smokers who have attempted to quit may be more likely to use ST as a quit aid, largely based on the theory that decreased cigarette smoking among adult males in Sweden has been attributed to smokers 'switching' from cigarettes to snus (Foulds et al., 2003). However, results of the current study appear to be more consistent with characteristics of dual use adult men in the United States. In a study by McClave-Regan & Berkowitz (2010), the majority of dual users were using ST in environments when they could not smoke, rather than as a quit aid. The majority of dual users (75.1%) also did not believe that using ST would aid in quitting and were less likely to intend to quit within the next 6 month compared to exclusive cigarette smokers (McClave-Regan & Berkowitz, 2010). It is also possible that use of ST among current youth smokers actually hinders attempts to quit smoking by maintaining nicotine dependence. For example, among a sample of young adult males in Northern Finland, Hamari and colleagues (2012) found that dual use did not significantly

decrease the number of cigarettes smoked per day among daily smokers and that dual users appeared to have higher nicotine dependence relatively to daily smokers who did not also used snus. Additionally, very few exclusive snus users (3.2%) were ex-smokers (Hamari et al., 2012).

Further research is needed to clarify the role of ST as a quit aid among youth smokers in Canada, especially if using ST is maintaining cigarette addiction among youth. It would also be helpful to explore reasons for youth ST use, such as when it is not possible to smoke or as a quit aid.

6.5 Physical Activity and Athletic Team Participation as a Mediator

Research Question 7 sought to understand if (a) sports team participation or (b) physical activity mediated an association between attempting to quit and ST use among youth smokers. It appears that sports team participation did not mediate the association and physical activity partially mediated the association between attempting to quit and current ST use among youth smokers. Consistent with complete models of ST use among current youth smokers (Models 3 & 4), attempting to quit smoking resulted in reduced odds of both ever and current ST use, devoid of both potential mediators. However, testing an association between attempting to quit and each mediator brought about different results. As discussed in *5.3.1*, making a cessation attempt was not associated with sports team participation among youth smokers. A possible explanation for this finding may be the increased use of ST among sports teams which may hinder attempts to quit smoking by maintaining nicotine dependence. Another explanation may be the increased influence of the social environment and peer pressure among sports teams which may lead to an increased likelihood to conform to substance use norms within teams (Terry-McElrath et al., 2011).

In addition, making a quit attempt was associated with reduced odds of meeting Canada's physical activity guidelines among youth smokers. An explanation for this finding may be that sports team participation was highly correlated with meeting Canada's physical activity guidelines and was not controlled for in the mediation models testing physical activity.

While Barron and Kenny's (1986) "causal steps" approach has been the dominant strategy to test for mediation, it does have its limitations. An important limitation to this approach is that it does not allow the effects of multiple mediators to be tested and/or compared against each other in a single model (Preacher & Hayes, 2008). Since physical activity and sports team participation are highly correlated, it is likely that these potential mediators would not function independent of one another. Future research examining the relationship between these variables may want to consider a more sophisticated test of mediation that could examine the total effect of multiple mediators or the relative influence of each mediator while controlling for other potential mediators. For example, Preacher & Hayes (2008) have developed a formal approach for contrasting two or more mediators in a single model using a non-parametric bootstrapping procedure that may be a more effective strategy to assess the mediation effects of physical activity and sports team participation in future research.

6.6 Study Strengths and Limitations

The present study has several limitations that should be noted when interpreting the above findings. An important limitation was the extent and scope of data collected by the 2010-2011 Youth Smoking Survey. For example, the YSS questionnaire did not differentiate between the different forms of ST (i.e. chewing tobacco, snuff, snus) therefore, a preference for a specific type of ST among high school youth cannot be identified. Moreover, the YSS did not ask students questions regarding how youth are accessing ST or their reasons for using. Therefore,

findings from this study cannot describe these components of ST use and explore beyond student level characteristics to include social and environmental influences. Additionally, more detailed classifications of ST use beyond the *basic* ever or *current* use would assist in developing a better understanding of ST use patterns among youth. Furthermore, the YSS questionnaire did not differentiate between various sports teams to determine which types of sports youth are participating in. This information would assist in determining which sports teams have the highest risk of ST use among youth which would be important for stakeholders planning ST related policies and programs so that specific sports teams could be targeted. Another limitation of the YSS survey is that it only asks students about vigorous physical activity, which only captures part of the Canadian guidelines for physical activity among youth. Canada's Physical Activity Guidelines for youth 12-17 also recommends 60 minutes of moderate- to vigorous-intensity physical activity daily (including vigorous-intense activities at least 3 days per week) (Canadian Society for Exercise Physiology, 2012). Therefore, the prevalence of students meeting Canada's complete guideline for physical activity is likely underestimated in this study and may also result in an underestimated or undetected effect when examined in associations between meeting the guideline and ST use.

Given that the YSS utilizes a cross-sectional design, it does not allow for causal inferences regarding associations between ST use and descriptive measures of interest in this study. Longitudinal data are required to establish temporal relationships and determine the sequence of the onset of use. For example, it would be important to understand whether using ST caused youth to initiate smoking cigarettes or vice versa. However, it is impossible to determine the direction of this relationship from these data.

Common to the limitations of survey research, the current study utilized self-report data from high school students and therefore data may be subjective. A social desirability bias may have been introduced by using self-report data where youth may be less likely to report socially undesirable behaviours such as ST use or more likely to report more socially desired behaviour, such as physical activity.

Despite its limitations, the present study also has several strengths and makes important contributions to Canadian youth ST use literature. The YSS data used in this study are from a nationally representative sample of Canadian youth. Therefore, inferences drawn from the current study regarding ST use can be applied to the entire population of Canadian youth in grades 9-12.

To the best of this researcher's knowledge, this was the first study in Canada to examine associations between ST and both meeting Canada's physical activity guidelines and sports team participation using a nationally representative sample. This provides valuable insight for stakeholders and researchers concerned with developing or implementing policies and programs aimed at reducing ST use among youth.

Additionally, the models of ST ever and current use developed in this study identified a number of characteristics significantly associated with ST use among Canadian youth while controlling for a variety of student characteristics. Understanding how these characteristics predict ST use while controlling for important variables can provide insight to policy planners attempting to target ST interventions or ST restrictions to groups with higher prevalence of users.

6.7 Implications for Policy and Programs

Results of the present study have several implications for policy and program development in Canada. Findings demonstrate that youth represent a greater proportion of ST

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users than the population average despite restrictions on the sale of tobacco products to minors. In Canada, it is illegal for retailers to sell tobacco products to anyone under the age of 18 under the Tobacco Sales to Young Persons Act (Health Canada, 2009). Therefore, policy makers may need to strengthen current tobacco strategies to reduce youth access of ST. Identifying how youth are accessing ST by adding questions to the YSS regarding sources of ST would also provide insight to policymakers looking to advance youth tobacco access restrictions.

The current study also highlights the extent to which youth in grades 9-12 have tried flavoured tobacco. Furthermore, this study identifies that the majority of youth who are currently using ST are using flavoured brands. Therefore, attention should be paid to prohibiting flavourings in ST and similar policies regarding flavourings in cigarettes and cigars should be applied to ST products.

This study identified several student characteristics associated with ST use among youth. Public health practitioners and school boards looking to advance programs and interventions to reduce ST use should aim to target high risk groups such as males, current smokers, or youth who participate in sports teams. For example, school boards or community youth sports authorities may want to begin by encouraging coaches to take a more active role in ST prevention. In a survey of coaches of Ontario youth sports teams, the majority indicated they would be interested in receiving information on the health effects of ST and prevention among young athletes (Skinner & Bobbili, 2012). Given that this study was the first to identify increased risk of ST among youth who participate in sports teams, findings can provide insight to the public health community looking to advance policy and programs in tobacco-free sport and recreation among youth.

6.8 Implications for Research

While this study was able to add to the rather limited literature that exists on ST use among youth in Canada, research on more thorough and comprehensive patterns of use are required to inform policy and program development. Future studies should consider differentiating between the different types of ST (chewing tobacco, snuff, snus, etc.) to determine preference for a specific form. Future research should also explore how youth are accessing ST and reasons for use. This would provide the opportunity to explore influences of the physical and social environment which has been proven to influence tobacco use (including ST) among youth (Edvarsson, Lendahls, Andersson & Ejlertsson, 2012). Identifying reasons for use would also provide insight as to whether youth are using ST as a cessation aid or in environments where it is not possible to smoke, for example.

Given that youth represent a greater proportion of users among the entire Canadian population, continued monitoring of ST use is encouraged, especially among high risk groups identified in this study. Future studies should also consider using a prospective design to follow youth over time so that causal relationships between descriptive measures and ST can be established. For example, following youth over time can aid in establishing the relationship between ST and smoking cigarettes (e.g. clarify sequence of the onset of use).

This was the first study to identify an increased risk of ST among Canadian youth who participate in sports teams using a nationally representative sample. Future research should identify which sports youth are participating in, which would assist in identifying which sports would have the highest risk of ST use among youth. This would provide the opportunity to explore subcultures of different teams that may be promoting or encouraging use and provide insight for program planning and intervention to reduce and prevent ST use among youth athletes.

Chapter 7: Conclusion

Prevalence of ST use is higher among youth in Canada compared to the general population (Kennedy et al., 2011; Health Canada, 2011). There is reason to believe that youth are at higher risk of ST use due to marketing of ST by adding flavourings that enhance the appeal of these products to youth and also as a result of peer influence particularly among sports teams (Terry-McElrath et al., 2011; Mattila et al., 2012). The goal of this study was to determine the prevalence of ever and current ST use among Canadian youth in grades 9-12 as well as factors associated with its use.

Findings from this study indicate that a variety of characteristics influence ST use among Canadian high school students. Males, older grades, youth with more spending money, youth in Western provinces and current smoking youth are at greater risk of experimenting with or currently using ST. Additionally, current smoking youth who had previously attempted cessation had reduced odds of concurrently using ST. This was the first study to identify an increased risk of trying or currently using ST among Canadian high school students who participate in sports teams. While more detailed data on patterns of ST are required to fully understand why youth are at greater risk for using ST in Canada, findings from the current study contribute to existing literature on ST use among youth and advances knowledge of factors related to use.

References

Alberta Alcohol and Drug Abuse Commission (AADAC). (2008). Tobacco basics handbook: Third edition. Edmonton, AB.

American Psychological Association. (2004). *Report of the APA Task Force on Advertising and Children.* Retrieved Jan 22, 2012 from http://www.apa.org/news/press/releases/index.aspx

Asplund, K. (2003) Smokeless tobacco and cardiovascular disease. *Progress in Cardiovascular Diseases, 45(5),* 383-394.

Audrain-McGovern, J., Rodriguez, D. & Moss, H.B. (2003). Smoking progression and physical activity. *Cancer Epidemiology, Biomarkers & Prevention, 12,* 1121-1129.

Bandura, A. (2001). Social cognitive theory: an agentic perspective. *Annual Review of Psychology, 52*, 1-26.

Bandura, A. (1986). *A Social Foundations of Thought and Action: A Society Cognitive Theory.* Englewood Cliffs, NJ: Prentice Hall.

Baron, R.M., & Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173-1182.

Beck, P. (2011). Compendium of 100% smoke-free municipal bylaws (Winter 2011 update). Retrieved Jan 12, 2012 from http://www.nsra-adnf.ca/cms/page1421.cfm

Bill C-32 (2009). *An act to amend the Tobacco Act.* 1st Reading, May 26, 2009. Second Session, Fortieth Parliament, 57-58 Elizabeth II, 2009. (Online). Ottawa: Public Works and Government Services Canada. Retrieved Mar 3, 2012 from http://www.parl.gc.ca/Content/LOP/LegislativeSummaries/40/2/c32-e.pdf

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Boffetta, P., Hecht, S., Gupta, P. & Straif, K. (2008). Smokeless tobacco and cancer. *The Lancet Oncology*, 9, 667-75.

Bouquot, J.E. & Meckstroth, R.L. (1998). Oral cancer in a tobacco-chewing US population: no apparent increased incidence or mortality. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, 86(6)*, 697-706.

Brofenbrenner, U. (1979). *The Ecology of Human Development*. Cambridge, MA: Harvard University Press.

Callery, W.E., Hammond, D., O'Connor, R.J. & Fong, G.T. (2011). The appeal of smokeless tobacco products among young Canadian smokers: the impact of pictorial health warnings and relative risk messages. *Nicotine & Tobacco Research, 13(5),* 373-383.

Centers for Disease Control and Prevention (CDCP). (2012). CDC Youth Risk Behavior Surveillance for 2011. *Morbidity and Mortality Weekly Report*, *61(4).*

Centers for Disease Control and Prevention (CDCP). (2003). Use of smoking cessation methods among smokers aged 16-24 years – United States, 2002. *Morbidity and Mortality Weekly Report, 55(50),* 1351-1354.

Centers for Disease Control and Prevention (CDCP). (2011). Smokeless tobacco facts. Retrieved Jan 21, 2012 from http://www.cdc.gov/tobacco/data_statistics/fact_sheets/smokeless/smokeless_facts/#effec ef

Cogliano, V., Straif, K., Baan, R., Grosse, Y., Secretan, B., El Ghissassi, F. & WHO IARC. (2004). Smokeless tobacco and tobacco-related nitrosamines. *The Lancer Oncology, 5(17),* 708.

Colilla, S.A. (2010) An epidemiologic review of smokeless tobacco health effects and harm reduction potential. *Regulatory Toxicology and Pharmacology. 56*, 197-211.

Connolly, G.N., Orleans, C.T., Blum, A. (1992). Snuffing tobacco out of sport. *American Journal of Public Health, 82(3),* 351-353.

Critchley, J.A. & Unal, B. (2003). Health effects associated with smokeless tobacco: A systematic review. *Thorax, 58(5),* 435-443.

deRuiter, W.K., Faulkner, G., Cairney, J. & Veldhuizen, S. (2008). Characteristics of physically active smokers and implications for harm reduction. *American Journal of Public Health, 98,* 925-931.

Eaves, T. (2011). The relationship between spit tobacco and baseball. *Journal of Sport and Social Issues, 35(4)*, 437-442.

Edvardsson, I., Lendahls, L., Andersson, T. & Ejlertsson, G. (2012). The social environment is most important for not using snus or smoking among adolescents. *Health, 4(12),* 1247-1255.

Elton-Marshall, T., Leatherdale, S.T., Ahmed, R., Manske, S.R. & Burkhalter, R. (2010). Tobacco use, exposure, access and other related risk behaviours among secondary school students in Canada: results of the 2008-2009 National Youth Smoking Survey. 2011 Society for Research on Nicotine and Tobacco (SRNT) Annual Meeting, Toronto, ON.

Elton-Marshall, T., Leatherdale, S.T., Manske, S.R., Wong, K., Ahmed, R. & Burkhalter, R. (2011). Research methods of the Youth Smoking Survey (YSS). *Chronic Diseases and Injuries in Canada, 32(1)*, 47-54.

Engstrom, K., Magnusson, C. & Galanti, M.R. (2010). Socio-demographic, lifestyle and heath characteristics among snus users and dual tobacco users in Stockholm County, Sweden. *BMC Public Health, 10,* 619.

Escher, S.A., Tucker, A.M. & Lundin, T.M. (1998). Smokeless tobacco, reaction time and strength in athletes. *Medicine and Science in Sports and Exercise, 30,* 1548-1551.

Euromonitor International. (2012). Country Report: Smokeless Tobacco in Canada – Executive Summary. Retrieved June 26, 2013 from http://www.euromonitor.com/smokeless-tobacco-in-canada/report

Everett, S.A., Malarcher, A.M., Sharp, D.J., Husten, C.G. & Goivino, G.A. (2000). Relationship between cigarette, smokeless tobacco, and cigar use, and other health risk behaviours among U.S. high school students. *Journal of School Health, 70(6)*, 234-240.

Everson, E.S., Daley, A.J. & Ussher, M. (2007). Brief report: The theory of planned behaviour applied to physical activity in young people who smoke. *Journal of Adolescence, 30,* 347-351.

Federal Trade Commission (2003). Federal Trade Commission Smokeless Tobacco Report for the Years 2000 and 2001. Retrieved Jan 13, 20012 from http://www.ftc.gov/os/2003/08/2k2k1smokeless.pdf

Fiore, M.C., Jaen, C.R., Baker, T.B., Bailey, W.C., Benowitz, N.L., Curry, S.J. … Wewers, M.E. (2008). Clinical Practice Guideline: Treating Tobacco Use and Dependence, 2008 Update. Rockville, MD: U.S. Department of Health and Human Services.

Foulds, J., Ramstrom, L., Burke, M. & Fagerström, K. (2003). Effect of smokeless tobacco (snus) on smoking and public health in Sweden. *Tobacco Control, 12,* 349-359.

Gartner, C.E., Hall, W.D., Chapman, S. & Freeman, S. (2007). *PLoS Medicine, 4(7),* e185. doi:10.1371/journal.pmed.0040185

Gilbert, E. (2009). Manufacturer claims new tobacco product encourages harm reduction. *Canadian Medical Association Journal, 180(8),* E18.

Glanz, K., Rimer, B.K., & Viswanath, K. (2008). *Health Behaviour and Health Education: Theory, Research, and Practive, 4th edition.* San Fransisco, CA. Jossey, Bass.

Gottlieb, N.H., Gingiss, P.L. & Weinstein, R.P. (1992). Attitudes, subjective norms and models of use for smokeless tobacco among college athletes: implications for prevention and cessation programming. *Health Education Research, 7(3),* 359-368.

Green, G.A., Uryasz, F.D., Petr, T.A. & Bray, C.D. (2001. NCAA study of substance use and abuse habits of college student-athletes. *Clinical Journal of Sport Medicine, 11(1),* 51-56.

Grøtvedt, L., Forsén, L., Stavem, K. & Graff-Iversen, S. (2012). Patterns of snus and cigarette use: a study of Norwegian men followed from age 16 to 19. *Tobacco Control* (in press).

Gupta, P.C., Ray, C.S., Sinha, D.N. & Singh, P.K. (2011). Smokeless tobacco: A major public health problem in the SEA region: A review. *Indian Journal of Public Health, 55(3),* 199-209.

Haddock, C.K., Weg, M.V., BeBon, M., Klesges, R.C., Talcott, G.W., Lando, H. & Peterson, A. (2001). Evidence that smokeless tobacco use is a gateway for smoking initiation in young adult males. *Preventive Medicine, 23(3),* 262-7.

Hamari, A.K., Toljamo, T.I., Kinnula, V.L. & Nieminen, P.A. (2012). Dual use of cigarettes and Swedish snuff (snus) among young adults in Northern Finland. *European Journal of Public Health* (in press).

Health Canada (2012). Canadian Tobacco Use Monitoring Survey (CTUMS): Summary of
    Annual results 2011. Tobacco Control Program, Ottawa. Retrieved May 29, 2013 from
    http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/_ctums-
    esutc_2011/ann_summary-sommaire-eng.php

Health Canada (2011). Canadian Tobacco Use Monitoring Survey (CTUMS): Summary of
    Annual results 2010. Tobacco Control Program, Ottawa. Retrieved Jan 22, 2012 from
    http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/_ctums-
    esutc_2010/ann_summary-sommaire-eng.php

Health Canada. (2011). Tobacco product labelling. Retrieved Mar 12, 2012 from http://www.hc-
    sc.gc.ca/hc-ps/tobac-tabac/legislation/label-etiquette/index-eng.php#info

Health Canada. (2010). Smokeless tobacco products: A chemical and toxicity analysis. Health
    Canada. Ottawa. Retrieved Jan 13, 2012 from http://www.hc-sc.gc.ca/hc-
    ps/alt_formats/hecs-sesc/pdf/pubs/tobac-tabac/smokeless-sansfumee/smokeless-
    sansfumee-eng.pdf

Health Canada (2010). An act to amend the tobacco act (2009). Retrieved June 24, 2013 from
    http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/legislation/federal/2009_fact-renseignements-
    eng.php

Horn, K.A., Gao, X., Dino, G.A. & Kamal-Bahl, S. (2000). Determinants of youth tobacco use in
    West Virginia: a comparison of smoking and smokeless tobacco use. *American Journal
    of Drug and Alcohol Abuse, 26(1),* 125-138.

Huhtala, H.S., Rainio, S.U. & Rimpela, A.H. (2006). Adolescent snus use in Finland in 1981-
    2003: trend, total sales ban and acquisition. *Tobacco Control, 15(*5), 392-397.

International Agency for Research on Cancer (IARC) (2007). Smokeless tobacco and tobacco-specific nitrosamines. In: *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*. Volume 89. Lyon, France.

Judd, C.M, & Kenny, D.A. (1981). Process analysis: Estimating mediation in treatment evaluations. *Evaluation Review, 5*, 601-619.

Kennedy, R.D., Leatherdale, S.T., Burkhalter, R. & Ahmed, R. (2011). Prevalence of smokeless tobacco use among Canadian youth between 2004 and 2008: Findings from the Youth Smoking Survey. *Canadian Journal of Public Health, 102(5)*, 358-63.

Kury, S.P., Rodrique, J.R. & Perri, M.G. (1998). Smokeless tobacco and cigarettes: differential attitudes and behavioural intentions of young adolescents toward a hypothetical new peer. *Journal of Clinical Child Psychology, 27*, 415-422.

Leatherdale, S.T. (2008). What modifiable factors are associated with cessation intentions among smoking youth? *Addictive Behaviours, 33,* 217-223.

Leatherdale, S.T. & Ahmed, R. (2010). Alcohol, marijuana, and tobacco use among Canadian youth: Do we need more multi-substance prevention programming? *Journal of Primary Prevention, 31(3),* 99-108.

Leatherdale, S.T. & McDonald, P.W. (2005). Youth smokers' beliefs about different cessation approaches: are we providing cessation interventions they never intend to use? *Cancer Causes and control, 18,* 783-791.

Luo, J., Ye, W., Zendehdel, K., Adami, J., Adami H.O., Boffetta, P. & Nyrén, O. (2007) Oral use of Swedish moist snuff (snus) and risk for cancer of the mouth, lung, and pancreas in male construction workers: A retrospective cohort study. *Lancet, 369(9578),* 2012-20.

Martinsen, M. & Sundgot-Borgen, J. (2012). Adolescent elite athletes' cigarette smoking, use of snus, and alcohol. *Scandinavian Journal of Medicine & Science in Sports* (in press).

Mattila, V.M., Raisamo, S., Pihlajamäki, H., Mäntyssari, M. & Rimpelä., A. (2012). Sports activity and the use of cigarettes and snus among young males in Finland in 1999-2010. *BMC Public Health, 12*, 230.

McClave-Regan, A.K. & Berkowitz, J. (2011). Snokers who are also using smokeless tobacco products in the US: a national assessment of characteristics, behaviours and beliefs of 'dual users'. *Tobacco Control, 20*, 239-242.

Melnick, M.J., Miller, K.E., Sabo, D.F., Farrell, M.P. & Barnes, G.M. (2001). Tobacco use among high school athletes and nonathletes: Results of the 1997 Youth Risk Behaviour Survey. *Adolescence, 36(144),* 727-747.

Morrell, H., Cohen, L., Bacchi, D. & West, J. (2005). Predictors of smoking and smokeless tobacco use in college students: A preliminary study using web-based survey methodology. *Journal of American College Health, 42(2),* 108-115.

Morrison, M.A., Krugman, D.M. & Park, P. (2008). Under the radar: smokeless tobacco advertising in magazines with substantial youth readership. *American Journal of Public Healh, 98(3)*, 543-8.

National Survey on Drug Use and Health. (2009). Smokeless tobacco use, initiation, and relationship to cigarette smoking: 2002 to 2007. Retrieved Jan 9, 2012 from http://www.oas.samhsa.gov/2k9/smokelessTobacco/smokelessTobacco.pdf

Nelson, M.C. & Gordon-Larsen, P. (2006). Physical activity and sedentary behaviour patterns are associated with select adolescent health risk behaviours. *Pediatrics, 117(4),* 1281-1290.

Non-Smokers' Rights Association, (2011). Provincial and Territorial Smoke-Free Legislation
    Summary. Retrieved April 3, 2012 from http://www.nsra-
    adnf.ca/cms/file/Summary_Table_March_2011.pdf

Ontario Tobacco Research Unit. (2010). The tobacco control environment: Ontario and beyond.
    Monitoring and Evaluation Series, 16(1). Retrieved June 26, 2013 from
    http://otru.org/wp-content/uploads/2012/06/16mr_youth_access.pdf

Ontario Tobacco Research Unit (OTRU) (2007). Smokeless tobacco and snus: The current
    evidence for health risks. Retrieved Jan 13, 2012 from
    http://www.otru.org/pdf/updates/update_june2007.pdf

Orisatoki, R. (2013). The public health implication of the use and misuse of tobacco among the
    Aboriginals in Canada. Canadian Center of Science and Education, 5(1), 28-34.

Patja, K., Hakala, S.M., Bostrom, G., Nordgren, P. & Haglund, M. (2009). Trends of tobacco use
    in Sweden and Finland: Do difference in tobacco policy relate to tobacco use?
    Scandinavian Journal of Public Health, 37, 153-160.

Physicians for a Smoke-Free Canada (PSFC). (2009). Smokeless tobacco: Candy-coating
    carcinogens. Ottawa. Retrieved Jan 21, 2012 from http://www.smoke-
    free.ca/pdf_1/2009/smokeless.pdf

Physicians for a Smoke-Free Canada (PSFC). (2009). Flavoured tobacco: How the industry baits
    its prey. Ottawa. Retrieved Jan 13, 2012 from http://www.smoke-
    free.ca/pdf_1/2009/Flavoured-Jun2.pdf

Physicians for a Smoke-Free Canada (PSFC). (2007). The snus experience: Lessons learned from
    Norway, Sweden and Canada on the public health consequences of widespread oral
    tobacco use. Ottawa. Retrieved May 29, 2013 from http://www.smoke-
    free.ca/pdf_1/snus-comparative-experiences.pdf

Physicians for a Smoke-Free Canada (PSFC). (2010). Smokeless tobacco: New trends for an old product. Ottawa. Retrieved Jan 13, 2012 from http://www.smoke-free.ca/pdf_1/smokeless-2011b.pdf

Preacher, K. J. & Hayes, A. F. (2008). Asymptotic and Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40(3),* 879-891.

Post, A., Gilljam, H., Rosendahl, I., Bremberg, S. & Galanti, M.R. (2010). Symptoms of nicotine dependence in a cohort of Swedish youths: a comparison between smokers, smokeless tobacco users and dual tobacco users. *Addiction, 105(4),* 740-746.

Reid, J.L., Hammond, D., Burkhalter, R., Rynard, V.L. & Ahmed, R. (2013). Tobacco Use in Canada: Patterns and Trends, 2013 Edition. Waterloo, ON: Propel Centre for Population Health Impact, University of Waterloo.

Robertson, P.B., DeRouue, T.A. & Ernster, V. (1995). Smokeless tobacco use: How it affects the performance of major league baseball players. *Journal of American Dental Association, 126,* 115-119.

Rodu, B. & Cole, P. (2010). Evidence against a gateway from smokeless tobacco use to smoking. *Nicotine & Tobacco Research, 12(5),* 530-4.

Rodu, B., Nasic, S. & Cole, P. (2005). Tobacco use among Swedish schoolchildren. *Tobacco Control, 14*, 405-408.

Savitz, D.A., Meyer, R.E., Tanzer, J.M., Mirvish, S.S., & Lewin, F. (2006). Public health implications of smokeless tobacco use as a harm reduction strategy. *American Journal of Public Health, 93*, 1934-9.

Seidenberg, A.B., Rodgers, E.J., Rees, V.W. & Connolly, G.N. (2012). Youth access, creation, and content of smokeless tobacco ("dip") videos in social media. *Journal of Adolescent Health, 50*, 334-338.

Severson, H.H., Klein, K., Lichtensein, E., Kaufman, N. & Orleans, C.T. (2005). Smokeless tobacco use among professional baseball players: Survey results, 1998-2003. *Tobacco Control, 14*, 31-36.

Skinner, J.H.C. & Bobbili, S.J. Coaches' knowledge and awareness of spit tobacco use among youth athletes: results of a 2009 Ontario survey. *Chronic Diseases and Injuries in Canada, 32(3),* 149-155.

Smoke-Free Ontario Act (2010). Retrieved Jan 12, 2012 from http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_94t10_e.htm

Spence, J.C. & Gauvin, L. (1996). Drug and alcohol use by Canadian university athletes: A national survey. *Journal of Drug Education, 26(3)*, 275-287.

Substance Abuse and Mental Health Services Administration (2011). *Results from the 2010 National Survey on Drug Use and Health: Summary of National Findings*. Rockville, MD. Retrieved Jan 21, 2012 from http://www.samhsa.gov/data/NSDUH/2k10NSDUH/2k10Results.htm

Terry-McElrath, Y., O'Malley, P. & Johnston, L.D. (2011). Exercise and substance use among American youth, 1991-2009. *American Journal of Preventive Medicine, 40(5),* 530-40.

Tomar, S.L., Alpert, H.R. & Connolly, G.N. (2010). Patterns of dual use of cigarettes and smokeless tobacco among US males: findings from national surveys. *Tobacco Control, 19,* 104-109.

University of Waterloo. (2011). Youth Smoking Survey (YSS): 2010/2011 YSS Microdata User Guide. Waterloo: Propel Centre for Population Health Impact, 1-50.

U.S. Department of Health and Human Services, Public Health Service. (1986). *The health consequences of using smokeless tobacco: Report of the Advisory Committee to the Surgeon General.* NIH Publication No. 86-2874. Bethesda, MD.

U.S. Department of Health and Human Services. (1994). *Preventing tobacco use among young people: A report of the surgeon general.* Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office of Smoking and Health; 1994.

Vuckovic, N., Polen, M.R. & Hollis, J.F. (2003). The problem is getting us to stop. What teens say about smoking cessation. *Preventive Medicine, 37*, 209-218.

Wong, S.L., Leatherdale, S.T., & Manske, S.R. (2006). Reliability and validity of a school-based physical activity questionnaire. *Medicine & Science in Sports & Exercise, 38(9),* 1593-1600.

World Health Organization (WHO) (2009). WHO study group on tobacco product regulation: report on the scientific basis of tobacco product regulation: third report of a WHO study group. World Health Organization, Switzerland.

Winn, D.M. (1997) Epidemiology of cancer and other systemic effects associated with the use of smokeless tobacco. *Advances in Dental Research, 11(3),* 313-321.

Wyckham, R.G. (1999). Smokeless tobacco in Canada: deterring market development. *Tobacco Control, 8,* 411-420.

Yatsuya, H. & Folsom, A.R. (2010). Risk of incident cardiovascular disease among users of smokeless tobacco in the Atherosclerosis Risk in Communities (ARIC) study. *American Journal of Epidemiology, 172(5),* 600-605.

Zhu, J., Michaud, D.S., Langevin, S.M., McClean, M.D., Eliot, M. &Kelsey, K.T. (2013). Smokeless tobacco and risk of head and neck cancer: Evidence from a case-control study in New England. *International Journal of Cancer, 132,* 1911-1917.

Appendix A

Types of Smokeless Tobacco

Figure 1. Lose-leaf chewing tobacco (PSC, 2011).

Figure 2. Moist chewing tobacco ("plug") (PSC, 2011).

Figure 3. Moist snuff ("pinch") (PSC, 2011).

Figure 4. Moist snuff (snus) pouch (PSC, 2011).

Appendix B

Du Maurier Snus in Canada

2010-2011 Youth Smoking Survey Questionnaire (Module B)

Module B

YOUTH SMOKING
SURVEY 2010/2011

PLEASE READ INSTRUCTIONS BEFORE YOU BEGIN THE SURVEY

- **This is NOT a test**. All of your answers will be kept **confidential**. No one, not even your parents or teachers, will ever know what you answered. So, please be honest when you answer the questions.

- Mark only **one option per question** unless the instructions tell you to do something else.

- Choose the option that is the **closest** to what you think/feel is true for you.

- **If you do not smoke**, you will need to answer "I do not smoke" to many of the questions. We ask you to do this so that both smokers and non-smokers will take about the same amount of time to complete the questionnaire and **teachers will not know which students smoke**.

Please, use an HB pencil

● ○ ○ ○   ⊗ ⊘ ⨀ ◉
Proper Mark   Improper Marks

Thousands of students across Canada, just like you, have been asked to take part in this survey. Most of the questions are about smoking, but there are also questions about exercise, eating habits, and alcohol and drugs. This important survey will help **Health Canada** to better understand smoking, alcohol, and other drug use among young people in Canada. **Your help today is very important.**

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[SERIAL]

About You

1. What grade are you in?
- Grade 6
- Grade 7
- Grade 8
- Grade 9
- Grade 10
- Grade 11
- Grade 12

Quebec students only
- Grade 6
- Secondary I
- Secondary II
- Secondary III
- Secondary IV
- Secondary V

2. How old are you today?
- 11 years or younger
- 12 years
- 13 years
- 14 years
- 15 years
- 16 years
- 17 years
- 18 years
- 19 years or older

3. Are you...
- Female?
- Male?

4. How would you describe yourself? *(Mark all that apply)*
- White
- Black
- Asian
- Aboriginal (First Nations, Métis, Inuit)
- Latin American/Hispanic
- Other _____

5. What language do you speak <u>most often</u> at home?
- English
- French
- Other

6. On average, about how many hours a day do you do the following in your free time?

	None	Less than 1 hour a day	1 to 2 hours a day	More than 2 but less than 5 hours a day	5 or more hours a day
a) Text or talk on a phone	○	○	○	○	○
b) E-mail or instant message	○	○	○	○	○
c) Play video games	○	○	○	○	○
d) Play/surf on a computer	○	○	○	○	○
e) Watch TV or movies	○	○	○	○	○
f) Read for fun	○	○	○	○	○

7. For the next 3 questions, choose the answer that describes how you feel about the statement.

	True	Mostly True	Neutral	Mostly False	False
a) In general, I like the way I am.	○	○	○	○	○
b) When I do something, I do it well.	○	○	○	○	○
c) I like the way I look.	○	○	○	○	○

Your Experience with Smoking

8. Are you a smoker?
- ○ Yes
- ○ No

9. Have you <u>ever</u> tried cigarette smoking, even just a few puffs?
- ○ Yes
- ○ No

10. How old were you when you first tried smoking cigarettes, even just a few puffs?
- ○ I have never done this
- ○ I do not know

○ 8 years or younger	○ 14 years
○ 9 years	○ 15 years
○ 10 years	○ 16 years
○ 11 years	○ 17 years
○ 12 years	○ 18 years or older
○ 13 years	

11. Do you think in the future you <u>might try smoking</u> cigarettes?
- ○ Definitely yes
- ○ Probably yes
- ○ Probably not
- ○ Definitely not

12. If one of your best friends was to offer you a cigarette, would you smoke it?
- ○ Definitely yes
- ○ Probably yes
- ○ Probably not
- ○ Definitely not

13. At any time during the <u>next year</u> do you think you will smoke a cigarette?
- ○ Definitely yes
- ○ Probably yes
- ○ Probably not
- ○ Definitely not

14. Do you think it would be difficult or easy for you to get cigarettes if you wanted to smoke?
- ○ Difficult
- ○ Easy
- ○ I do not know

15. Have you ever smoked a <u>whole</u> cigarette?
- ○ Yes
- ○ No

○○○○○○○○○○○○○○○○○○○○○○○○○○○○○ [SERIAL]

16. How old were you when you smoked your first <u>whole</u> cigarette?
- ○ I have never smoked a whole cigarette
- ○ I do not know

○ 8 years or younger	○ 14 years
○ 9 years	○ 15 years
○ 10 years	○ 16 years
○ 11 years	○ 17 years
○ 12 years	○ 18 years or older
○ 13 years	

17. Have you ever smoked 100 or more <u>whole</u> cigarettes in your life?
- ○ Yes
- ○ No

18. Have you ever smoked <u>every day</u> for at least 7 days in a row?
- ○ Yes
- ○ No

19. On how many of the last 30 days did you smoke one or more cigarettes?
- ○ None
- ○ 1 day
- ○ 2 to 3 days
- ○ 4 to 5 days
- ○ 6 to 10 days
- ○ 11 to 20 days
- ○ 21 to 29 days
- ○ 30 days *(every day)*

20. Thinking back over the last 30 days, on the days that you smoked, how many cigarettes did you <u>usually</u> smoke each day?
- ○ None
- ○ A few puffs to one whole cigarette
- ○ 2 to 3 cigarettes
- ○ 4 to 5 cigarettes
- ○ 6 to 10 cigarettes
- ○ 11 to 20 cigarettes
- ○ 21 to 29 cigarettes
- ○ 30 or more cigarettes

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Sun	Mon	Tue	Wed	Thur	Fri	Sat

21. Think back over the <u>last 7 days</u>.

Find yesterday on the wheel and fill in the number of <u>whole</u> cigarettes you smoked.

Then, follow the wheel backwards and fill in the number of <u>whole</u> cigarettes you smoked on each of the last 7 days.

If you have not smoked, mark <u>one</u> of the circles below.

- ○ I have never smoked
- ○ I did not smoke over the last 7 days

Sunday   Monday   Tuesday   Wednesday   Thursday   Friday   Saturday

22a. When you smoke, how often do you share a cigarette with others?
- ○ I do not smoke
- ○ Never
- ○ Sometimes
- ○ Usually
- ○ Always

22b. When you first tried smoking cigarettes, were you drinking alcohol at the same time?
- ○ I have never tried smoking
- ○ Yes
- ○ No

23. What brand of cigarettes do you <u>usually</u> smoke? *(Mark only one)*
- ○ I do not smoke
- ○ I do not have a regular brand

- ○ Accord
- ○ Avanti
- ○ Belmont
- ○ Belvedere
- ○ Benson & Hedges
- ○ Canadian Classics
- ○ Craven
- ○ D.K.
- ○ Du Maurier
- ○ Export "A"

- ○ John Player's
- ○ Legend
- ○ MacDonald
- ○ Mark Ten
- ○ Matinee
- ○ Number 7
- ○ Peter Jackson
- ○ Player's
- ○ Putter's
- ○ Quebec Classics

- ○ Rothmans
- ○ Viceroy
- ○ Viscount
- ○ Vogue
- ○ American brands (e.g. Camel, Marlboro)
- ○ Other cigarettes from First Nations/Native brands
- ○ I roll my own cigarettes
- ○ Other

24. For the cigarette brand that you indicated, what size cigarette do you <u>usually</u> smoke? *(Mark all that apply)*
- ○ I do not smoke
- ○ I do not have a regular size
- ○ King Size
- ○ Regular Size
- ○ Slim (super slim)
- ○ 100s
- ○ Other

25. Why do you smoke the brand of cigarettes that you do? *(Mark all that apply)*
- ○ I do not smoke
- ○ I do not have a usual brand
- ○ My friends smoke the same brand
- ○ My parents smoke the same brand
- ○ I like the packaging
- ○ This brand costs less than other brands
- ○ I like the image of this brand
- ○ I like the taste
- ○ They are the only ones that I can get
- ○ They have less tar
- ○ For the nicotine buzz
- ○ Other

26. Where do you <u>usually</u> get your cigarettes? *(Mark only one)*
- ○ I do not smoke
- ○ I buy them myself at a store
- ○ I buy them from a friend
- ○ I buy them from someone else
- ○ I ask someone to buy them for me
- ○ My brother or sister gives them to me
- ○ My mother or father gives them to me
- ○ A friend gives them to me
- ○ Someone else gives them to me
- ○ I take them from my mother, father, or siblings
- ○ Other

○○○○○○○○○○○○○○○○○○○○○○○○○○ [SERIAL]

27. In the <u>last 12 months</u>, how often did you smoke the following kinds of cigarettes?

	Never	Less than once a month	1 to 3 times a month	Once a week	2 to 5 times a week	Daily or almost daily
a) Unbranded cigarettes from a plastic bag	○	○	○	○	○	○
b) American brands such as Camel or Marlboro	○	○	○	○	○	○
c) Chinese brands such as Jin Ling	○	○	○	○	○	○
d) First Nations/Native brands D.K.'s, Putters, or Sago	○	○	○	○	○	○
e) Other First Nations/Native brands such as Chiefs, Natives, Discount, or others	○	○	○	○	○	○

28. Within the <u>last 6 months</u>, has a store clerk ever suggested a particular brand when you were buying cigarettes?
- ○ I did not buy cigarettes from a store in the last 6 months
- ○ Yes, a store clerk suggested a brand
- ○ No, a store clerk did not suggest a brand

29. In the last 30 days, have you ever been asked for ID when <u>buying</u> cigarettes in a store?
- ○ I did not buy or try to buy cigarettes in a store in the last 30 days
- ○ Yes, I was asked for ID
- ○ No, I was not asked for ID

30. Thinking about the last time you bought cigarettes in the <u>last 12 months</u>, what did you buy?
- ○ I did not buy cigarettes in the last 12 months
- ○ A pack of 20 cigarettes
- ○ A pack of 25 cigarettes
- ○ A bag of 200 cigarettes
- ○ A single cigarette
- ○ A can or pouch of tobacco (loose tobacco)
- ○ A carton (200 cigarettes)
- ○ Another amount

31. Thinking about the last time you bought cigarettes in the <u>last 12 months</u>, about how much did you pay for each single cigarette, pack, bag, or carton?
- ○ I did not buy cigarettes in the last 12 months
- ○ I do not remember the price
- ○ Less than 10 cents
- ○ 10 cents to 50 cents
- ○ 51 cents to $6.00
- ○ $6.01 to $10.00
- ○ $10.01 to $20.00
- ○ $20.01 to $40.00
- ○ $40.01 to $60.00
- ○ $60.01 to $80.00
- ○ $80.01 or more

32. Have you <u>ever</u> tried to quit smoking cigarettes?
- ○ I have never smoked
- ○ I have only smoked a few times
- ○ I have never tried to quit
- ○ I have tried to quit once
- ○ I have tried to quit 2 or 3 times
- ○ I have tried to quit 4 or 5 times
- ○ I have tried to quit 6 or more times

33. Have you <u>ever</u> tried any of the following? *(Mark all that apply)*
- Smoking pipe tobacco
- Smoking cigarillos or little cigars *(plain or flavoured)*
- Smoking cigars (not including cigarillos or little cigars, *plain or flavoured*)
- Smoking roll-your-own cigarettes (tobacco only)
- Smoking bidis (little cigarettes that are hand-rolled in leaves, tied with a string at the ends, and come in different flavours)
- Using smokeless tobacco (chewing tobacco, pinch, snuff, or snus)
- Using nicotine patches, nicotine gum, nicotine lozenges, or nicotine inhalers
- Using a water-pipe to smoke tobacco (also known as a hookah, sheesha, narg-eelay, hubble-bubble, or gouza)
- Using blunt wraps (a sheet or tube made of tobacco used to roll cigarette tobacco)
- I have not tried any of these things

34. In the last 30 days, did you use any of the following? *(Mark all that apply)*
- Pipe tobacco
- Cigarillos or little cigars *(plain or flavoured)*
- Cigars (not including cigarillos or little cigars, *plain or flavoured*)
- Roll-your-own cigarettes (tobacco only)
- Bidis (little cigarettes that are hand-rolled in leaves, tied with a string at the ends, and come in different flavours)
- Smokeless tobacco (chewing tobacco, pinch, snuff, or snus)
- Nicotine patches, nicotine gum, nicotine lozenges, or nicotine inhalers
- Water-pipe to smoke tobacco (also known as a hookah, sheesha, narg-eelay, hubble-bubble, or gouza)
- Blunt wraps (a sheet or tube made of tobacco used to roll cigarette tobacco)
- I have not used any of these things in the last 30 days

35. In the last 30 days, where did you <u>buy</u> cigarillos or little cigars *(plain or flavoured)*? *(Mark all that apply)*
- I did not buy cigarillos or little cigars
- I bought cigarillos or little cigars at a store
- I bought them from my brother or sister
- I bought them from a friend
- I bought them from someone else
- I asked someone else to buy them for me

36. In the last 30 days, how often did you smoke cigarillos or little cigars *(plain or flavoured)*?
- I have never done this
- I did not smoke any cigarillos or little cigars in the last 30 days
- Once in the last 30 days
- Less than once a week
- Once a week
- 2 to 6 times a week
- Once a day
- More than once a day

37. The last time you bought/got cigarillos or little cigars *(plain or flavoured)*, how many did you buy/get?
- I have never bought/got cigarillos nor little cigars
- A single cigarillo or little cigar
- A pack of 5
- A pack of 10
- A pack of 20
- Another amount

38. Have you ever used flavoured tobacco products (menthol, cherry, strawberry, vanilla, etc.)?
- Yes
- No

39. In the last 30 days, did you use any of the following flavoured tobacco products? *(Mark all that apply)*
- Menthol cigarette
- Flavoured cigarillo or little cigar
- Flavoured cigar
- Flavoured bidi
- Flavoured smokeless tobacco
- Flavoured tobacco in a water-pipe
- I did not use any of these things in the last 30 days

You, Your Family, and Your Friends

40. Do any of your parents, step-parents, or guardians smoke cigarettes?
- Yes
- No
- I do not know

41. Do any of your brothers or sisters smoke cigarettes?
- Yes
- No
- I do not know
- I have no brothers or sisters

42. What are the rules about smoking in your home?
- No one is allowed to smoke in my home
- Only special guests are allowed to smoke in my home
- People are allowed to smoke only in certain areas in my home
- People are allowed to smoke anywhere in my home

43. During the last 7 days, on how many days did you ride in a car with someone who was smoking cigarettes?
- 0 days
- 1 or 2 days
- 3 or 4 days
- 5 or 6 days
- All 7 days
- I did not ride in a car in the last 7 days
- I do not know

44. Your closest friends are the friends you like to spend the most time with. How many of your closest friends smoke cigarettes?
- None
- 1 friend
- 2 friends
- 3 friends
- 4 friends
- 5 or more friends

[SERIAL]

45. In your family, you are....(Mark only one)
- ○ The only daughter
- ○ The oldest daughter
- ○ A middle daughter
- ○ The youngest daughter
- ○ The only son
- ○ The oldest son
- ○ A middle son
- ○ The youngest son

Don't forget this question ➤

46. About how much money do you usually get each week to spend on yourself or to save?
(Remember to include all money from allowances and jobs like babysitting, delivering papers...)
- ○ Zero
- ○ $1 to $5
- ○ $6 to $10
- ○ $11 to $20
- ○ $21 to $40
- ○ $41 to $100
- ○ More than $100
- ○ I do not know how much money I get each week

Your School and You

47. How strongly do you agree or disagree with each of the following?

	Strongly Agree	Agree	Disagree	Strongly Disagree
a) I feel close to people at my school.	○	○	○	○
b) I feel I am part of my school.	○	○	○	○
c) I am happy to be at my school.	○	○	○	○
d) I feel the teachers at my school treat me fairly.	○	○	○	○
e) I feel safe in my school.	○	○	○	○
f) Getting good grades is important to me.	○	○	○	○

48. In the last 4 weeks, how many days of school did you miss because of your health?
- ○ 0 days
- ○ 1 or 2 days
- ○ 3 to 5 days
- ○ 6 to 10 days
- ○ 11 or more days

49. In the last 4 weeks, how many classes did you skip when you were not supposed to?
- ○ 0 classes
- ○ 1 or 2 classes
- ○ 3 to 5 classes
- ○ 6 to 10 classes
- ○ 11 to 20 classes
- ○ More than 20 classes

50. How many students at this school smoke on school property?
- ○ A lot
- ○ Some
- ○ A few
- ○ None

51. Which of the following best describes your marks during the past year?
- ○ Mostly A's / above 85% / level 4
- ○ Mostly A's and B's / 70 - 84% / level 3 - 4
- ○ Mostly B's and C's / 60 - 69% / level 3
- ○ Mostly C's / 50 - 59% / level 2
- ○ Mostly letter grades below C's / below 50% / level 1

Exercise and Eating

52. How tall are you without your shoes on?
(Please write your height on the line and then fill in the appropriate numbers for your height in feet and inches OR centimetres)

"My height is _____ "

○ I do not know how tall I am

Example: 6 ft 7in

Height Feet	Inches	OR	Height Feet	Inches	OR	Height Centimetres

53. How much do you weigh without your shoes on? (Please write your weight on the line and then fill in the appropriate numbers for your weight in pounds OR kilograms)

"My weight is _____ "

○ I do not know how much I weigh

Example: 127 lbs

Weight Pounds	OR	Weight Pounds	OR	Weight Kilograms

54. On how many of the last 7 days did you eat breakfast?
- ○ 0 days
- ○ 1 day
- ○ 2 days
- ○ 3 days
- ○ 4 days
- ○ 5 days
- ○ 6 days
- ○ 7 days (every day)

Don't forget this column ➤

55. On a usual day, how many servings of fruits and/or vegetables do you eat?
(*Include* fresh, frozen, canned, and cooked items like apple, banana, carrot, salads, and 100% juice. *Do not include* chips, french fries, or other fried potatoes)
- ○ 0 servings
- ○ 1-2 servings
- ○ 3-4 servings
- ○ 5 servings
- ○ 6 servings
- ○ 7 servings
- ○ 8 or more servings

56. At your school, do you participate in intramural or school team sports?
- ○ Yes
- ○ No

57. How do you usually get to and from school?
- ○ Actively (e.g. walk, bike, skateboard)
- ○ Inactively (e.g. car, bus, public transit)
- ○ Mixed (actively and inactively)

58. Mark how many minutes of HARD physical activity you did on each of the last 7 days. This includes physical activity during physical education class, lunch, recess, after school, evenings, and spare time.

HARD physical activities are jogging, team sports, fast dancing, jump-rope and any other physical activities that increase your heart rate and make you breathe hard and sweat.

For example: If you did 1 hour and 45 minutes of hard activity on Monday, you will need to fill in the 1 hour circle and the 45 minute circle, as shown below:

	Hours					Minutes			
Monday	○	●	○	○	○	○	○	○	●

	Hours					Minutes			
Monday	○	○	○	○	○	○	○	○	○
Tuesday	○	○	○	○	○	○	○	○	○
Wednesday	○	○	○	○	○	○	○	○	○
Thursday	○	○	○	○	○	○	○	○	○
Friday	○	○	○	○	○	○	○	○	○
Saturday	○	○	○	○	○	○	○	○	○
Sunday	○	○	○	○	○	○	○	○	○

○○○○○○○○○○○○○○○○○○○○○○○○○○○○

[SERIAL]

Alcohol and Marijuana Use

"A drink" means: 1 regular sized bottle, can, or draft of beer; 1 glass of wine; 1 bottle of cooler; 1 shot of liquor (rum, whiskey, etc); or 1 mixed drink (1 shot of liquor with pop, juice, energy drink).

59. In the last 12 months, how often did you have a drink of alcohol that was more than just a sip?
- ○ I have never drank alcohol
- ○ I did not drink alcohol in the last 12 months
- ○ I have only had a sip of alcohol

- ○ Less than once a month
- ○ Once a month
- ○ 2 or 3 times a month
- ○ Once a week
- ○ 2 or 3 times a week
- ○ 4 to 6 times a week
- ○ Every day
- ○ I do not know

60. How old were you when you first had a drink of alcohol that was more than a sip?
- ○ I have never drank alcohol
- ○ I have only had a sip of alcohol
- ○ I do not know

- ○ 8 years or younger   ○ 14 years
- ○ 9 years   ○ 15 years
- ○ 10 years   ○ 16 years
- ○ 11 years   ○ 17 years
- ○ 12 years   ○ 18 years or older
- ○ 13 years

61. In the last 12 months, how often did you have 5 drinks of alcohol or more on one occasion?
- ○ I have never done this
- ○ I did not have 5 or more drinks on one occasion in the last 12 months

- ○ Less than once a month
- ○ Once a month
- ○ 2 to 3 times a month
- ○ Once a week
- ○ 2 to 5 times a week
- ○ Daily or almost daily
- ○ I do not know

62. How old were you when you first had 5 drinks or more of alcohol on one occasion?
- ○ I have never done this
- ○ I do not know

- ○ 8 years or younger   ○ 14 years
- ○ 9 years   ○ 15 years
- ○ 10 years   ○ 16 years
- ○ 11 years   ○ 17 years
- ○ 12 years   ○ 18 years or older
- ○ 13 years

63. In the last 12 months, have you had alcohol mixed or pre-mixed with an energy drink such as Red Bull, Rock Star, Monster, or another brand?
- ○ I have never done this
- ○ I did not do this in the last 12 months
- ○ Yes
- ○ I do not know

64. In the last 12 months, how often did you use marijuana or cannabis? (a joint, pot, weed, hash...)
- ○ I have never used marijuana
- ○ I have used marijuana but not in the last 12 months
- ○ Less than once a month
- ○ Once a month
- ○ 2 or 3 times a month
- ○ Once a week
- ○ 2 or 3 times a week
- ○ 4 to 6 times a week
- ○ Every day
- ○ I do not know

65. How old were you when you first used marijuana or cannabis?
- ○ I have never used marijuana
- ○ I do not know

- ○ 8 years or younger   ○ 14 years
- ○ 9 years   ○ 15 years
- ○ 10 years   ○ 16 years
- ○ 11 years   ○ 17 years
- ○ 12 years   ○ 18 years or older
- ○ 13 years

Other Drug Use

66. This chart asks about your drug use. If you have ever used or tried any of the following drugs, mark the age at which you first used or tried. Then mark if you have used or tried the drug in the last 12 months.

	If you have ever used or tried, how old were you when you first used or tried this?								Have you used or tried this in the last 12 months?	
	I have never done this	11 years or younger	12	13	14	15	16	17 years or older	Yes	No
a) Amphetamines (speed, crystal meth or ice, meth...)	○	○	○	○	○	○	○	○	○	○
b) MDMA (ecstasy, E, X...)	○	○	○	○	○	○	○	○	○	○
c) Hallucinogens (LSD, PCP, acid, magic mushrooms, mesc...)	○	○	○	○	○	○	○	○	○	○
d) DACS (links...)	○	○	○	○	○	○	○	○	○	○
e) Heroin (smack, junk, crank...)	○	○	○	○	○	○	○	○	○	○
f) Cocaine (crack, blow, snow...)	○	○	○	○	○	○	○	○	○	○
g) Ketamine (special k, kit-kat...)	○	○	○	○	○	○	○	○	○	○
h) GHB (G, liquid X, goop...)	○	○	○	○	○	○	○	○	○	○
Medication used to get high and NOT for medical purposes										
i) Sedatives or tranquillizers such as Ativan, Xanax, Valium (tranqs, downers, etc.)	○	○	○	○	○	○	○	○	○	○
j) Sleeping medicine from a drugstore such as Nytol, Unisom	○	○	○	○	○	○	○	○	○	○
k) Stimulants such as diet pills and stay awake pills (uppers, bennies) or medicine that is usually used to treat ADHD such as Ritalin, Concerta, Adderall, Dexedrine	○	○	○	○	○	○	○	○	○	○
l) Pain relievers such as Demerol, Percocet, Percodan, Oxycontin, or any pain reliever with codeine	○	○	○	○	○	○	○	○	○	○
m) Dextromethorphan such as cold or cough medicine like Robitussin DM, Benylin DM (robos, dex, DXM)	○	○	○	○	○	○	○	○	○	○
Other substances used to get high										
n) Glue, gasoline, or other solvents	○	○	○	○	○	○	○	○	○	○
o) Salvia (Divine Sage, Magic Mint, Sally D)	○	○	○	○	○	○	○	○	○	○
p) Jimson weed (locoweed, stinkweed, mad apple) [this is not marijuana or cannabis]	○	○	○	○	○	○	○	○	○	○

○○○○○○○○○○○○○○○○○○○○○○○○○   [SERIAL]

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Appendix D

Study variables and coding definitions

Table 2: Study Variables

STUDY VARIABLE	YSS QUESTION #	VARIABLE TYPE	CODING
Dependent Measures			
Ever ST Use	33. Have you <u>ever</u> tried any of the following? (Mark all that apply) *Includes:* Smokeless tobacco (chewing tobacco, pinch, snuff, or snus)	Nominal	0 – No (unselected) 1 – Yes
Current ST Use	34. In the last 30 days, did you use any of the following? (Mark all that apply) *Includes:* Smokeless tobacco (chewing tobacco, pinch, snuff, or snus)	Nominal	0 – No (unselected) 1 – Yes
Ever Use of Flavoured Tobacco Products	38. Have you ever used flavoured tobacco products (menthol, cherry, strawberry, vanilla, etc.?)	Nominal	0 – No 1 – Yes
Current Flavoured ST Use	39. In the last 30 days, did you use any of the following flavoured tobacco products? (Mark all that apply) *Includes*: Flavoured smokeless tobacco	Nominal	0 – No (unselected) 1 – Yes
Independent Measures			
School grade	1. What grade are you in?	Ordinal	0 – Grade 9 1 – Grade 10 2 – Grade 11 3 – Grade 12
Gender	3. Are you… Female? Male?	Nominal	0 – Female 1 – Male
Spending Money per Week	46. About how much money do you usually get <u>each week</u> to spend on yourself or to save? *(Remember to include all money from*	Ordinal	0 – $0 1 – $1-$20 2 – $21-$100

			3 – More than $100
Geographic Region	N/A	Nominal *Note:* Do to small cell sizes provinces may be collapsed into regions (i.e. Prairies, Atlantic Provinces, etc.)	0 – Newfoundland & Labrador 1 – Prince Edward Island 2 – Nova Scotia 3 – Quebec 4 – Ontario 5 – Manitoba 6 – Saskatchewan 7 – Alberta 8 – British Columbia *Note:* New Brunswick data not available.
Current Smoking Status	17. Have you ever smoked 100 or more whole cigarettes in your life? 19. On how many of the last 30 days did you smoke one or more cigarettes?	Nominal	0 – Never smoker 1 – Former smoker 2 – Current smoker *Note: Current smoker* is defined as having smoked 100 or more whole cigarettes AND having smoked in the last 30 days; *Former smoker* is defined as having smoked 100 or more whole cigarettes but have NOT smoked in the past 30 days.
Quit Attempt	32. Have you <u>ever</u> tried to quit smoking cigarettes?	Nominal	0 – No quit attempt 1 – Past quit attempt
Participation in Sports Teams	56. At your school, do you participate in intramural or school team sports?	Nominal	0 – No 1 – Yes
Physical Activity Guideline Met	58. **Mark how many minutes of <u>HARD</u> physical activity you did on <u>each of the last 7 days</u>. This includes physical activity during physical education class, lunch, recess, after school, evenings, and spare time.** **<u>HARD</u> physical activities are jogging, team sports, fast dancing, jump-rope and <u>any</u>**	Nominal	0 – No 1 – Yes

	<u>other</u> physical activities that increase your heart rate and make you breathe hard and sweat.	

Impact of missing values in logistic regression models of ST use

Table 3: Analysis of missing variables in logistic models

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Total n	1,606,100	1,606,100	131,800	131,800	131,800	131,800	131,800	131,800	131,800	131,800
n in model	1,525,500	1,525,500	119,500	119,500	119,500	119,500	119,500	119,500	119,500	119,500
n students with missing values for following variables:										
Spending money per week	41,800	41,800	4,700	4,700	4,700	4,700	4,700	4,700	4,700	4,700
Quit attempt	-	-	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700
Participation in sports teams	38,800	38,800	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900
Total missing n from model	80,600	80,600	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500

Notes:
"-" variable not included in model

Table 4: Impact of missing values on logistic models of ST use among the entire Canadian youth population (Models 1 & 2)

Parameters		Ever ST Use		Current ST Use	
		Model 1a: Standard (n=1,525,500)	**Model 1b:** Including missing (n=1,606,100)	**Model 2a:** Standard (n=1,525,500)	**Model 2b:** Including missing (n=1,606,100)
Gender	Female[a]	1.00	1.00	1.00	1.00
	Male	**6.81 (6.65,6.97)**	**6.81 (6.66,6.97)**	**11.10 (10.59,11.64)**	**9.11 (8.74,9.50)**
Grade	9[a]	1.00	1.00	1.00	1.00
	10	**1.57 (1.50,1.64)**	**1.69 (1.62,1.76)**	**1.62 (1.52,1.73)**	**2.01 (1.89,2.13)**
	11	**3.30 (3.15,3.45)**	**3.04 (2.91,3.17)**	**2.02 (1.89,2.16)**	**1.98 (1.86,2.11)**
	12	**4.09 (3.91,4.28)**	**3.88 (3.71,4.06)**	**1.84 (1.72,1.97)**	**2.14 (2.01,2.28)**
Region	British Columbia[a]	1.00	1.00	1.00	1.00
	Atlantic Canada	**0.83 (0.50,1.38)**	0.98 (0.60,1.59)	1.13 (0.62,2.05)	1.37 (0.77,2.46)
	Quebec	**0.04 (0.02,0.08)**	**0.04 (0.02,0.09)**	**0.02 (0.01,0.06)**	**0.02 (0.01,0.07)**
	Ontario	**0.21 (0.13,0.35)**	**0.22 (0.14,0.37)**	**0.21 (0.11,0.39)**	**0.25 (0.14,0.46)**
	Prairies	**1.77 (1.06,2.94)**	**1.99 (1.21,3.27)**	1.72 (0.96,3.08)	**1.99 (1.12,3.53)**
Spending Money Per Week	$0[a]	1.00	1.00	1.00	1.00
	$1-20	**1.33 (1.29,1.37)**	**1.24 (1.21,1.28)**	**1.47 (1.40,1.54)**	**1.33 (1.27,1.39)**
	$20-100	**1.65 (1.60,1.69)**	**1.58 (1.53,1.63)**	**1.28 (1.22,1.35)**	**1.24 (1.18,1.30)**
	$100+	**1.71 (1.66,1.76)**	**1.72 (1.66,1.77)**	**1.34 (1.27,1.41)**	**1.36 (1.30,1.43)**
	I do not know	**1.15 (1.11,1.19)**	**1.10 (1.07,1.14)**	**0.67 (0.63,0.71)**	**0.60 (0.57,0.64)**
	Missing	N/A	**1.08 (1.03,1.14)**		**3.02 (2.82,3.23)**
Smoking Status	Never Smoker[a]	1.00	1.00	1.00	1.00
	Former Smoker	**6.40 (6.11,6.70)**	**7.00 (6.70,7.32)**	**2.08 (1.86,2.30)**	**2.44 (2.22,2.67)**
	Current Smoker	**10.35 (10.1,10.60)**	**10.7 (10.43,10.92)**	**12.76 (12.3,13.24)**	**12.98 (12.53,13.44)**
Participation in Sports Teams	No[a]	1.00	1.00	1.00	1.00
	Yes	**1.97 (1.93,2.01)**	**1.94 (1.90,1.97)**	**3.50 (3.38,3.62)**	**3.09 (2.99,3.19)**
	Missing	N/A	**2.16 (2.06,2.26)**		**4.92 (4.60,5.25)**
Physical Activity Guideline Met	No[a]	1.00	1.00	1.00	1.00
	Yes	**1.03 (1.01,1.05)**	**1.03 (1.01,1.05)**	**0.94 (0.91,0.97)**	**0.93 (0.90,0.96)**

Notes:
Odds ratios adjusted for all other variables in the table.
Bold: p<0.05
[a] Reference group

Table 5:Impact of missing values on logistic models of ST use among Canadian youth who are current smokers (Models 3 & 4)

Parameters		Ever ST Use		Current ST Use	
		Model 3a: Standard (n=119,500)	**Model 3b:** Including missing (n=131,800)	**Model 4a**: Standard (n=119,500)	**Model 4b:** Including missing (n=131,800)
Gender	Female[a]	1.00	1.00	1.00	1.00
	Male	**6.89 (6.57,7.23)**	**6.52 (6.23,6.82)**	**13.75 (12.50,15.12)**	**13.05 (11.96,14.24)**
Grade	9[a]	1.00	1.00	1.00	1.00
	10	**1.13 (1.03,1.24)**	**0.84 (0.77,0.92)**	**1.51 (1.33,1.73)**	**1.19 (1.05,1.35)**
	11	1.03 (0.94,1.13)	**0.77 (0.71,0.84)**	0.89 (0.78,1.03)	**0.79 (0.69,0.90)**
	12	**1.16 (1.06,1.27)**	0.98 (0.89,1.07)	**1.18 (1.04,1.35)**	0.99 (0.87,1.12)
Region	British Columbia[a]	1.00	1.00	1.00	1.00
	Atlantic Canada	0.71 (0.24,2.12)	0.76 (0.25,2.33)	2.09 (0.60,7.35)	2.04 (0.59,7.10)
	Quebec	**0.02 (0.01,0.10)**	**0.02 (0.00,0.06)**	**0.01 (0.00,0.13)**	**0.01 (<0.01,0.12)**
	Ontario	**0.28 (0.08,0.96)**	0.48 (0.14,1.66)	1.09 (0.28,4.22)	1.57 (0.41,5.98)
	Prairies	2.41 (0.81,7.21)	2.48 (0.81,7.61)	**5.25 (1.53,17.98)**	**4.86 (1.42,16.57)**
Spending Money Per Week	$0[a]	1.00	1.00	1.00	1.00
	$1-20	**0.51 (0.47,0.56)**	**0.59 (0.55,0.64)**	**0.42 (0.37,0.47)**	**0.54 (0.49,0.61)**
	$20-100	**1.24 (1.15,1.34)**	**1.33 (1.23,1.43)**	**0.37 (0.33,0.41)**	**0.48 (0.44,0.54)**
	$100+	**1.26 (1.16,1.36)**	**1.35 (1.25,1.46)**	**0.69 (0.62,0.76)**	**0.85 (0.77,0.94)**
	I do not know	**0.90 (0.82,1.00)**	1.00 (0.91,1.09)	**0.43 (0.38,0.41)**	**0.52 (0.46,0.59)**
	Missing	N/A	1.10 (0.97,1.24)	N/A	**0.59 (0.49,0.71)**
Quit Attempt	No[a]	1.00	1.00	1.00	1.00
	Yes	0.97 (0.93,1.02)	**0.90 (0.87,0.94)**	**0.76 (0.71,0.81)**	**0.72 (0.67,0.76)**
	Missing	N/A	0.88 (0.75,1.03)	N/A	**0.37 (0.29,0.47)**
Participation in Sports Teams	No[a]	1.00	1.00	1.00	1.00
	Yes	**1.69 (1.61,1.77)**	**1.50 (1.43,1.56)**	**2.14 (2.00,2.29)**	**2.09 (1.96,2.23)**
	Missing	N/A	**1.18 (1.06,1.32)**	N/A	**3.85 (3.34,4.42)**
Physical Activity Guideline Met	No[a]	1.00	1.00	1.00	1.00
	Yes	**1.13 (1.08,1.18)**	**1.24 (1.19,1.29)**	**0.93 (0.87,0.99)**	1.01 (0.95,1.07)

Notes:

Odds ratios adjusted for all other variables in the table.

Bold: p<0.05

[a] Reference group

Appendix F

Weighted descriptive statistics by ever and current ST use, gender, and smoking status among Canadian youth in grades 9 to 12

Table 6: Weighted descriptive statistics by ST ever use and current use among Canadian youth in grades 9-12, 2010-2011.

Parameters	ST Ever Use % (n=80,200)	Chi-square	p-value	ST Current Use % (n=29,000)	Chi-square	p-value
Gender						
Male	85.77	χ^2 (1) = 41,101.2	<0.0001	91.16	χ^2 (1) = 19,110.3	<0.0001
Female	14.23			8.84		
Grade						
9	11.62	χ^2 (3) = 16,365.0	<0.0001	12.92	χ^2 (3) = 3,902.1	<0.0001
10	17.74			21.53		
11	34.08			29.65		
12	36.55			35.90		
Province						
Newfoundland & Labrador	1.21	χ^2 (8) = 17,900.7	<0.0001	1.44	χ^2 (8) = 7,475.2	<0.0001
Prince Edward Island	0.52			#		
Nova Scotia	3.18			3.11		
Quebec	#			#		
Ontario	37.94			44.57		
Manitoba	3.92			3.69		
Saskatchewan	7.91			9.05		
Alberta	18.27			14.35		
British Columbia	21.17			20.62		
Region						
Atlantic Canada[a]	4.91	χ^2 (4) = 14,393.8	<0.0001	4.98	χ^2 (4) = 5,158.9	<0.0001
Quebec	#			#		
Ontario	37.94			44.57		
Prairies[b]	30.10			27.09		
British Columbia	21.17			20.62		

Parameters	ST Ever Use % (n=80,200)	Chi-square	p-value	ST Current Use % (n=29,000)	Chi-square	p-value
Spending Money per Week						
$0	12.12	$\chi^2 (4) = 11,507.3$	<0.0001	12.36	$\chi^2 (4) = 4,527.1$	<0.0001
$1-$20	22.34			27.36		
$21-100	30.97			27.03		
$100+	24.62			26.13		
I do not know	9.95			7.12		
Smoking Status						
Never Smoker	59.26	$\chi^2 (2) = 95,446.0$	<0.0001	55.97	$\chi^2 (2) = 45,221.7$	<0.0001
Former Smoker	5.72			#		
Current Smoker	35.02			41.35		
Participation in Sports Teams						
Yes	53.40	$\chi^2 (1) = 3,555.1$	<0.0001	64.59	$\chi^2 (1) = 5,479.5$	<0.0001
No	46.60			35.41		
Physical Activity Guideline Met						
Yes	46.67	$\chi^2 (1) = 1,966.1$	<0.0001	48.46	$\chi^2 (1) = 1,070.5$	<0.0001
No	53.33			51.54		
Ever Use of Flavoured Tobacco Products						
Yes	84.53	$\chi^2 (1) = 164,558.0$	<0.0001	88.02	$\chi^2 (1) = 64,238.0$	<0.0001
No	15.47			11.98		
Current Use of Flavoured ST						
Yes	30.38	$\chi^2 (1) = 401,309.0$	<0.0001	69.83	$\chi^2 (1) = 791,651.0$	<0.0001
No	69.62			30.17		

Notes:
estimate not reportable due to small cell size (n < 30)
[a]New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland & Labrador
[b]Alberta, Saskatchewan, Manitoba

Table 7: Weighted descriptive statistics by gender for sample of Canadian youth in grades 9-12, 2010-2011

Parameters		Grade 9-12 Students in Canada %		
		Females (n =748,300)	Males (n =777,200)	Total (n =1,525,500)
Outcome Measures				
Ever ST Use	Yes	1.5	8.9	5.3
	No	98.5	91.2	94.7
Current ST Use	Yes	0.3	3.4	1.9
	No	99.7	96.6	98.1
Independent Measures				
Gender	Male	-	-	50.9
	Female	-	-	49.1
Grade	9	24.7	24.7	24.7
	10	25.8	26.4	26.1
	11	25.5	25.3	25.4
	12	24.0	23.7	23.9
Province	Newfoundland & Labrador	1.7	1.4	1.5
	Prince Edward Island	0.5	0.5	0.5
	Nova Scotia	2.9	2.8	2.8
	Quebec	17.0	17.2	17.1
	Ontario	44.0	43.9	43.9
	Manitoba	4.2	4.0	4.1
	Saskatchewan	3.3	3.1	3.2
	Alberta	12.0	11.8	11.9
	British Columbia	14.5	15.2	14.9
Region	Atlantic Canada[a]	5.0	4.7	4.9
	Quebec	17.0	17.2	17.1
	Ontario	44.0	43.9	43.9
	Prairies[b]	19.5	19.0	19.2
	British Columbia	14.5	15.2	14.9

		Grade 9-12 Students in Canada		
Parameters		**%**		
		Females (n =748,300)	**Males** (n =777,200)	**Total** (n =1,525,500)
Spending Money Per Week	$0	17.5	20.8	19.2
	$1-$20	29.4	27.8	28.6
	$21-$100	26.4	25.2	25.8
	More than $100	12.8	15.1	14.0
	I do not know	14.0	11.1	12.5
Smoking Status	Current Smoker	6.9	9.1	8.0
	Former Smoker	1.1	2.1	1.6
	Never Smoker	92.0	88.9	90.4
Participation in Sports Teams	Yes	37.6	48.7	43.3
	No	62.4	51.3	56.8
Physical Activity Guideline Met	Yes	31.9	46.2	39.2
	No	68.1	53.8	60.8
Ever Use of Flavoured Tobacco Products	Yes	22.1	26.9	24.5
	No	77.9	73.1	75.5
Current Use of Flavoured ST	Yes	0.3	3.1	1.8
	No	99.7	96.9	98.2

Notes:
estimate not reportable due to small cell size (n < 30)
[a]New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland & Labrador
[b]Alberta, Saskatchewan, Manitoba

Table 8: Weighted descriptive statistics by smoking status for sample of Canadian youths in grades 9-12, 2010-2011

Parameters		Grades 9-12 Students in Canada %		
		Current Smokers (n =121,800)	Former Smokers (n =24,500)	Never Smokers (n =1,379,100)
Outcome Measures				
Ever ST Use	Yes	23.1	18.7	3.5
	No	76.9	81.3	96.6
Current ST Use	Yes	9.8	#	1.2
	No	90.2	96.8	98.8
Independent Measures				
Gender	Male	57.7	65.7	50.1
	Female	42.3	34.3	49.9
Grade	9	14.3	5.0	26.0
	10	21.9	21.2	26.5
	11	27.4	24.4	25.2
	12	36.3	49.6	22.3
Province	Newfoundland & Labrador	2.9	1.8	1.4
	Prince Edward Island	0.5	#	0.5
	Nova Scotia	4.2	3.0	2.7
	Quebec	17.9	#	17.1
	Ontario	33.6	39.4	44.9
	Manitoba	3.7	2.4	4.2
	Saskatchewan	7.3	#	2.9
	Alberta	13.0	16.6	11.7
	British Columbia	17.3	20.0	14.6
Region	Atlantic Canada[a]	7.7	5.2	4.6
	Quebec	17.5	#	17.1
	Ontario	33.6	39.4	44.9
	Prairies[b]	23.9	22.1	18.8
	British Columbia	17.3	20.0	14.6

Parameters		Grades 9-12 Students in Canada %		
		Current Smokers (n =121,900)	Former Smokers (n =24,500)	Never Smokers (n =1,379,100)
Spending Money Per Week	$0	10.4	13.1	20.1
	$1-$20	24.0	12.3	29.3
	$21-$100	31.6	45.0	24.9
	More than $100	24.1	21.7	13.0
	I do not know	9.8	7.9	12.8
Smoking Status	Current Smoker	-	-	-
	Former Smoker	-	-	-
	Never Smoker	-	-	-
Participation in Sports Teams	Yes	29.2	40.5	44.6
	No	70.9	59.5	55.5
Physical Activity Guideline Met	Yes	38.3	27.2	39.5
	No	61.7	72.8	60.6
Ever Use of Flavoured Tobacco Products	Yes	88.7	86.0	17.8
	No	11.4	14.0	82.2
Current Use of Flavoured ST	Yes	7.8	#	1.2
	No	91.2	99.3	98.9

Notes:
estimate not reportable due to small cell size (n < 30)
[a]New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland & Labrador
[b]Alberta, Saskatchewan, Manitoba

Table 9: Weighted descriptive statistics of Age by ST ever use and current use among Canadian youth in grades 9-12, 2010-2011.

Age	Grade 9-12 Students in Canada %	
	ST Ever Use (n = 78,500)	ST Current Use (n = 28,200)
≥14	7.3	9.0
15	18.9	20.7
16	26.3	23.9
17	32.0	33.1
≤18	15.5	13.3

Table 10: Weighted descriptive statistics of Age by ST ever use and current use among Canadian youth in grades 9-12 who participate in sports teams, 2010-2011

Age	Grade 9-12 Students in Canada who Participate in Sports Teams %	
	ST Ever Use (n = 42,200)	ST Current Use (n = 18,500)
≥14	8.3	9.2
15	19.4	21.0
16	27.7	23.8
17	33.1	32.1
≤18	11.5	13.9

Table 11: Weighted descriptive statistics by ST ever use and current use among Canadian youth smokers in grades 9-12, 2010-2011.

Parameters	ST Ever Use % (n=27,800)	Chi-square	p-value	ST Current Use % (n=11,800)	Chi-square	p-value
Gender						
Male	83.0	χ^2 (1) = 9,786.5	<0.0001	91.5	χ^2 (1) = 6,319.7	<0.0001
Female	17.0			8.5		
Grade						
9	13.2	χ^2 (3) = 1,130.6	<0.0001	12.8	χ^2 (3) = 524.7	<0.0001
10	15.5			17.8		
11	27.6			23.0		
12	43.7			46.4		
Province						
Newfoundland & Labrador	#	χ^2 (8) = 4,438.0	<0.0001	#	χ^2 (8) = 2,735.5	<0.0001
Prince Edward Island	#			#		
Nova Scotia	4.3			3.3		
Quebec	#			#		
Ontario	36.4			41.8		
Manitoba	5.1			5.5		
Saskatchewan	10.5			10.2		
Alberta	18.4			20.3		
British Columbia	17.1			12.7		
Region						
Atlantic Canada[a]	6.7	χ^2 (4) = 4,309.4	<0.0001	5.9	χ^2 (4) = 2,716.3	<0.0001
Quebec	#			#		
Ontario	36.4			41.8		
Prairies[b]	34.0			36.0		
British Columbia	17.1			12.7		

Parameters	ST Ever Use % (n=27,800)	Chi-square	p-value	ST Current Use % (n=11,800)	Chi-square	p-value
Spending Money per Week						
$0	8.8	$\chi^2(4) = 1,567.7$	<0.0001	#	$\chi^2(4) = 2,110.0$	<0.0001
$1-$20	18.5			20.3		
$21-100	34.7			21.9		
$100+	30.6			40.2		
I do not know	7.4			#		
Quit Attempt						
Yes	67.5	$\chi^2(1) = 0.3$	0.6073	59.6	$\chi^2(1) = 383.2$	<0.0001
No	32.5			40.4		
Participation in Sports Teams						
Yes	39.0	$\chi^2(1) = 1,927.3$	<0.0001	51.4	$\chi^2(1) = 3,362.1$	<0.0001
No	61.0			48.6		
Physical Activity Guideline Met						
Yes	43.5	$\chi^2(1) = 360.5$	<0.0001	48.6	$\chi^2(1) = 549.8$	<0.0001
No	56.5			51.4		
Ever Use of Flavoured Tobacco Products						
Yes	94.9	$\chi^2(1) = 1,391.7$	<0.0001	95.2	$\chi^2(1) = 555.8$	<0.0001
No	5.1			#		
Current Use of Flavoured ST						
Yes	32.0	$\chi^2(1) = 28,738.4$	<0.0001	65.2	$\chi^2(1) = 59,409.4$	<0.0001
No	68.0			34.8		

Notes:

estimate not reportable due to small cell size (n < 30)

[a]New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland & Labrador

[b]Alberta, Saskatchewan, Manitoba

Table 12: Weighted descriptive statistics by gender for Canadian youth who are current smokers in grades 9-12, 2010-2011.

Parameters		Grade 9-12 Students in Canada %		
		Females (n =51,200)	Males (n =68,300)	Total (n =119,500)
Outcome Measures				
Ever ST Use	Yes	9.1	33.5	23.1
	No	90.9	66.5	77.0
Current ST Use	Yes	2.0	15.8	9.9
	No	98.1	84.2	90.1
Independent Measures				
Gender	Male	-	-	57.2
	Female	-	-	42.9
Grade	9	16.4	13.0	14.5
	10	20.2	22.9	21.7
	11	23.8	29.5	27.0
	12	39.7	34.7	36.8
Province	Newfoundland & Labrador	3.1	2.8	2.9
	Prince Edward Island	0.5	0.5	0.5
	Nova Scotia	4.1	4.3	4.2
	Quebec	17.2	17.6	17.4
	Ontario	30.4	35.5	33.3
	Manitoba	3.2	4.1	3.7
	Saskatchewan	7.6	7.3	7.4
	Alberta	15.2	11.5	13.1
	British Columbia	18.8	16.5	17.5
Region	Atlantic Canada[a]	7.7	7.6	7.7
	Quebec	17.2	17.6	17.4
	Ontario	30.4	35.5	33.3
	Prairies[b]	25.9	22.8	24.2
	British Columbia	18.8	16.5	17.5

Parameters		Grade 9-12 Students in Canada %		
		Females (n =51,200)	**Males** (n =68,300)	**Total** (n =119,500)
Spending Money Per Week	$0	8.3	11.7	10.2
	$1-$20	21.5	26.4	24.3
	$21-$100	36.4	28.8	32.1
	More than $100	20.9	25.8	23.7
	I do not know	13.0	7.4	9.8
Quit Attempt	Yes	72.3	64.2	67.6
	No	27.7	35.9	32.4
Participation in Sports Teams	Yes	20.6	34.4	28.5
	No	79.4	65.6	71.5
Physical Activity Guideline Met	Yes	31.9	43.7	38.6
	No	68.1	56.3	61.4
Ever Use of Flavoured Tobacco Products	Yes	87.2	89.8	88.7
	No	12.8	10.2	11.3
Current Use of Flavoured ST	Yes	#	12.9	7.9
	No	98.8	87.1	92.1

Notes:

estimate not reportable due to small cell size (n < 30)

[a]New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland & Labrador

[b]Alberta, Saskatchewan, Manitoba

Appendix G

Mediation analysis of (a) sports seam participation and (b) physical activity on quit attempt and ST use

Table 13: Logistic Regression Analyses Testing Meditation Effects of Participation in Sports Teams [a,b]

	Outcome Variable	Predictor Variable	β	Standard Error	p value
ST Ever Use					
Step 1	ST ever use	Quit attempt	-0.06655	0.02269	0.0034
Step 2	Participation in sports teams	Quit attempt	0.009557	0.01918	0.6183
Step 3	ST ever use	Participation in sports teams	0.5463	0.02298	<0.0001
Step 4	ST ever use	Quit attempt	-0.03373	0.02286	0.1403
ST Current Use					
Step 1	ST current use	Quit attempt	-0.3222	0.03302	<0.0001
Step 2	Participation in sports teams	Quit attempt	0.009557	0.01918	0.6183
Step 3	ST current use	Participation in sports teams	0.7387	0.03267	<0.0001
Step 4	ST current use	Quit attempt	-0.2761	0.03335	<0.0001

Notes:
[a] Gender, grade, region, and spending money per week were included as covariates in all analyses.
[b] Step 1 represents the regression analysis testing path c; step 2 represents the regression analysis testing path a; and step 3 represents the regression analysis testing path c'.

Table 14: Logistic Regression Analyses Testing Mediation Effects of Physical Activity [a,b]

	Outcome Variable	Predictor Variable	β	Standard Error	p value
ST Ever Use					
Step 1	ST ever use	Quit attempt	-0.06655	0.02269	0.0034
Step 2	Physical activity	Quit attempt	-0.4507	0.01766	<0.0001
Step 3	ST ever use	Physical activity	0.2093	0.02121	<0.0001
Step 4	ST ever use	Quit attempt	-0.5249	0.02276	0.0212
ST Current Use					
Step 1	ST current use	Quit attempt	-0.3222	0.03302	<0.0001
Step 2	Physical activity	Quit attempt	-0.4507	0.01766	<0.0001
Step 3	Current ST use	Physical activity	0.1289	0.03215	<0.0001
Step 4	Current ST use	Quit attempt	-0.3134	0.03310	<0.0001

Notes:

[a] Gender, grade, region, and spending money per week were included as covariates in all analyses.

[b] Step 1 represents the regression analysis testing path c; step 2 represents the regression analysis testing path a; and step 3 represents the regression analysis testing path c'.

Appendix H

Estimates for logistic regression models of ST use by Canadian youth

Table 15: Parameter estimates, standard errors and adjusted odds ratios for predictors of ST ever use among Canadian youth in grades 9-12 (Model 1).

Parameter	Estimate	Standard Error	Adjusted Odds Ratio[a] (95% C.I.)
Intercept	-7.6444	0.2127	
Gender			
Female[b]	-	-	1.00
Male	1.9178	0.01226	6.81 (6.65,6.97)***
Grade			
9[b]	-	-	1.00
10	0.4509	0.02291	1.57 (1.50,1.64)***
11	1.1923	0.02300	3.30 (3.15,3.45)***
12	1.4084	0.02344	4.09 (3.91,4.28)***
Region			
British Columbia[b]	-	-	1.00
Atlantic Canada	-0.1832	0.2566	0.83 (0.50,1.38)
Quebec	-3.2336	0.3767	0.04 (0.02,0.08)***
Ontario	-1.5657	0.2613	0.21 (0.13,0.35)***
Prairies	0.5687	0.2596	1.77 (1.06,2.94)**
Spending Money per Week			
$0[b]	-	-	1.00
$1-$20	0.2844	0.01578	1.33 (1.29,1.37)***
$21-$100	0.4976	0.01518	1.65 (1.60,1.69)***
$100+	0.5354	0.01610	1.71 (1.66,1.76)***
I do not know	0.1380	0.01853	1.15 (1.11,1.19)***
Smoking Status			
Never Smoker[b]	-	-	1.00
Former Smoker	1.8558	0.02323	6.40 (6.11,6.70)***
Current Smoker	2.3366	0.01213	10.35 (10.1,10.60)***
Participation in Sports Teams			
No[b]	-	-	1.00
Yes	0.6768	0.01006	1.97 (1.93,2.01)***
Physical Activity Guideline Met			
No[b]	-	-	1.00
Yes	0.03191	0.009546	1.03 (1.01,1.05)**

Notes:
[a] Odds ratios adjusted for all the variables in the table
[b] Referent Group
*p<0.1, **p<0.05, ***p<0.0001

Table 16: Parameter estimates, standard errors and adjusted odds ratios for predictors of current ST use among Canadian youth in grades 9-12 (Model 2).

Parameter	Estimate	Standard Error	Adjusted Odds Ratio[a] (95% C.I.)
Intercept	-9.7834	0.2477	
Gender			
Female[b]	-	-	1.00
Male	2.4073	0.02398	11.10 (10.59,11.64)***
Grade			
9[b]	-	-	1.00
10	0.4834	0.03225	1.62 (1.52,1.73)***
11	0.7032	0.03396	2.02 (1.89,2.16)***
12	0.6113	0.03458	1.84 (1.72,1.97)***
Region			
British Columbia[b]	-	-	1.00
Atlantic Canada	0.1176	0.3066	1.13 (0.62,2.05)
Quebec	-3.9303	0.5400	0.02 (0.01,0.06)***
Ontario	-1.5634	0.3118	0.21 (0.11,0.39)***
Prairies	0.5397	0.2990	1.72 (0.96,3.08)*
Spending Money per Week			
$0[b]	-	-	1.00
$1-$20	0.3816	0.02453	1.47 (1.40,1.54)***
$21-$100	0.2498	0.02481	1.28 (1.22,1.35)***
$100+	0.2898	0.02600	1.34 (1.27,1.41)***
I do not know	-0.4049	0.03253	0.67 (0.63,0.71)***
Smoking Status			
Never Smoker[b]	-	-	1.00
Former Smoker	0.7341	0.05107	2.08 (1.86,2.30)***
Current Smoker	2.5465	0.01876	12.76 (12.3,13.24)***
Participation in Sports Teams			
No[b]	-	-	1.00
Yes	1.2515	0.01716	3.50 (3.38,3.62)***
Physical Activity Guideline Met			
No[b]	-	-	1.00
Yes	-0.05967	0.01566	0.94 (0.91,0.97)**
Notes: [a] Odds ratios adjusted for all the variables in the table [b] Referent Group *p<0.1, **p<0.05, ***p<0.0001			

Table 17: Parameter estimates, standard errors and adjusted odds ratios for predictors of ST ever use among Canadian youth smokers in grades 9-12 (Model 3).

Parameter	Estimate	Standard Error	Adjusted Odds Ratio[a] (95% C.I.)
Intercept	-3.4557	0.4892	
Gender			
Female[b]	-	-	1.00
Male	1.9299	0.02446	6.89 (6.57,7.23)***
Grade			
9[b]	-	-	1.00
10	0.1205	0.04702	1.13 (1.03,1.24)**
11	0.02637	0.04695	1.03 (0.94,1.13)
12	0.1488	0.04589	1.16 (1.06,1.27)**
Region			
British Columbia[b]	-	-	1.00
Atlantic Canada	-0.3428	0.5584	0.71 (0.24,2.12)
Quebec	-3.8868	0.7870	0.02 (0.01,0.10)***
Ontario	-1.2589	0.6212	0.28 (0.08,0.96)**
Prairies	0.8795	0.5590	2.41 (0.81,7.21)
Spending Money per Week			
$0[b]	-	-	1.00
$1-$20	-0.6679	0.04114	0.51 (0.47,0.56)***
$21-$100	0.2143	0.03791	1.24 (1.15,1.34)***
$100+	0.2285	0.03900	1.26 (1.16,1.36)***
I do not know	-0.1063	0.04800	0.90 (0.82,1.00)**
Quit Attempt			
No[b]	-	-	1.00
Yes	-0.02665	0.02291	0.97 (0.93,1.02)
Participation in Sports Teams			
No[b]	-	-	1.00
Yes	0.5223	0.02336	1.69 (1.61,1.77)***
Physical Activity Guideline Met			
No[b]	-	-	1.00
Yes	0.1235	0.02166	1.13 (1.08,1.18)***

Notes:
[a] Odds ratios adjusted for all the variables in the table
[b] Referent Group
*p<0.1, **p<0.05, ***p<0.0001

Table 18: Parameter estimates, standard errors and adjusted odds ratios for predictors of current ST use among Canadian youth smokers in grades 9-12 (Model 4).

Parameter	Estimate	Standard Error	Adjusted Odds Ratio[a] (95% C.I.)
Intercept	-6.2751	0.5589	
Gender			
Female[b]	-	-	1.00
Male	2.6209	0.04848	13.75 (12.50,15.12)***
Grade			
9[b]	-	-	1.00
10	0.4148	0.06800	1.51 (1.33,1.73)***
11	-0.1127	0.07010	0.89 (0.78,1.03)
12	0.1673	0.06653	1.18 (1.04,1.35)**
Region			
British Columbia[b]	-	-	1.00
Atlantic Canada	0.7381	0.6407	2.09 (0.60,7.35)
Quebec	-4.4821	1.2349	0.01 (0.00,0.13)**
Ontario	0.08627	0.6905	1.09 (0.28,4.22)
Prairies	1.6588	0.6275	5.25 (1.53,17.98)**
Spending Money per Week			
$0[b]	-	-	1.00
$1-$20	-0.8718	0.05929	0.42 (0.37,0.47)***
$21-$100	-1.0010	0.05451	0.37 (0.33,0.41)***
$100+	-0.3762	0.05459	0.69 (0.62,0.76)***
I do not know	-0.8444	0.06891	0.43 (0.38,0.41)***
Quit Attempt			
No[b]	-	-	1.00
Yes	-0.2811	0.03342	0.76 (0.71,0.81)***
Participation in Sports Teams			
No[b]	-	-	1.00
Yes	0.7606	0.03405	2.14 (2.00,2.29)***
Physical Activity Guideline Met			
No[b]	-	-	1.00
Yes	-0.07801	0.03384	0.93 (0.87,0.99)**

Notes:
[a] Odds ratios adjusted for all the variables in the table
[b] Referent Group
*p<0.1, **p<0.05, ***p<0.0001

Table 19: Parameter estimates, standard errors and adjusted odds ratios for predictors of ST ever use among Canadian youth smokers in grades 9-12, excluding participation in sports teams and physical activity (Model 5).

Parameter	Estimate	Standard Error	Adjusted Odds Ratio[a] (95% C.I.)
Intercept	-3.2297	0.4886	
Gender			
Female[b]	-	-	1.00
Male	1.9935	0.02427	7.34 (7.00,7.70)***
Grade			
9[b]	-	-	1.00
10	0.1635	0.04669	1.18 (1.08,1.29)**
11	0.06570	0.04665	1.07 (0.98,1.17)
12	0.1758	0.04566	1.19 (1.09,1.30)**
Region			
British Columbia[b]	-	-	1.00
Atlantic Canada	-0.3995	0.5579	0.67 (0.23,2.00)
Quebec	-3.9431	0.7879	0.02 (0.01,0.09)***
Ontario	-1.2900	0.6204	0.28(0.08,0.93)**
Prairies	0.8935	0.5585	2.44 (0.82,7.31)
Spending Money per Week			
$0[b]	-	-	1.00
$1-$20	-0.7216	0.04068	0.49 (0.45,0.53)***
$21-$100	0.1775	0.03750	1.19 (1.11,1.29)***
$100+	0.2263	0.03859	1.25 (1.16,1.35)***
I do not know	-0.1759	0.04747	0.84 (0.76,0.92)**
Quit Attempt			
No[b]	-	-	1.00
Yes	-0.06655	0.02269	0.94 (0.90,0.98)**

Notes:
[a] Odds ratios adjusted for all the variables in the table
[b] Referent Group
*p<0.1, **p<0.05, ***p<0.0001

Table 20: Parameter estimates, standard errors and adjusted odds ratios for predictors of ST current use among Canadian youth smokers in grades 9-12, excluding participation in sports teams and physical activity (Model 6).

Parameter	Estimate	Standard Error	Adjusted Odds Ratio[a] (95% C.I.)
Intercept	-5.9667	0.5602	
Gender			
Female[b]	-	-	1.00
Male	2.6699	0.04814	14.44 (13.14,15.87)***
Grade			
9[b]	-	-	1.00
10	0.3703	0.06698	1.45 (1.27,1.65)***
11	-0.1460	0.06891	0.86 (0.76,0.99)**
12	0.09023	0.06564	1.09 (0.96,1.25)
Region			
British Columbia[b]	-	-	1.00
Atlantic Canada	0.6647	0.6425	1.94 (0.55,6.85)
Quebec	-4.5603	1.2456	0.01 (<0.001,0.12)**
Ontario	0.08837	0.6917	1.09 (0.28,4.24)
Prairies	1.6761	0.6294	5.34 (1.56,18.37)**
Spending Money per Week			
$0[b]	-	-	1.00
$1-$20	-0.9487	0.05804	0.39 (0.35,0.43)***
$21-$100	-1.0369	0.05399	0.36 (0.32,0.39)***
$100+	-0.3561	0.05346	0.70 (0.63,0.78)***
I do not know	-0.8670	0.06847	0.42 (0.37,0.48)***
Quit Attempt			
No[b]	-	-	1.00
Yes	-0.3222	0.03302	0.73 (0.68,0.77)***
Notes:			
[a] Odds ratios adjusted for all the variables in the table			
[b] Referent Group			
*p<0.1, **p<0.05, ***p<0.0001			

Table 21: Parameter estimates, standard errors and adjusted odds ratios for predictors of participation in sports teams among Canadian youth smokers in grades 9-12 (Model 7).

Parameter	Estimate	Standard Error	Adjusted Odds Ratio[a] (95% C.I.)
Intercept	-2.0849	0.05347	
Gender			
Female[b]	-	-	1.00
Male	0.8891	0.01967	2.43 (2.34,2.53)***
Grade			
9[b]	-	-	1.00
10	0.09224	0.03719	1.10 (1.02,1.18)**
11	-0.02515	0.03748	0.98 (0.91,1.05)
12	0.05432	0.03788	1.06 (0.98,1.14)
Region			
British Columbia[b]	-	-	1.00
Atlantic Canada	-0.1990	-0.6074	0.82 (0.25,2.70)
Quebec	-0.9664	0.7773	0.38 (0.08,1.75)
Ontario	-0.2773	0.6719	0.76 (0.20,2.83)
Prairies	0.4602	0.6120	1.58 (0.48,5.26)
Spending Money per Week			
$0[b]	-	-	1.00
$1-$20	-0.6772	0.03405	0.51 (0.48,0.54)***
$21-$100	-0.5074	0.03188	0.60 (0.57,0.64)***
$100+	0.01843	0.03264	1.02 (0.96,1.09)
I do not know	-0.2269	0.03929	0.80 (0.74,0.86)***
Quit Attempt			
No[b]	-	-	1.00
Yes	0.009557	0.01918	1.01 (0.97,1.05)

Notes:
[a] Odds ratios adjusted for all the variables in the table
[b] Referent Group
*p<0.1, **p<0.05, ***p<0.0001

Table 22: Parameter estimates, standard errors and adjusted odds ratios for predictors of physical activity among Canadian youth smokers in grades 9-12, (Model 8).

Parameter	Estimate	Standard Error	Adjusted Odds Ratio[a] (95% C.I.)
Intercept	-0.3642	0.4939	
Gender			
Female[b]	-	-	1.00
Male	0.8485	0.01752	2.34 (2.26,2.42)***
Grade			
9[b]	-	-	1.00
10	0.06860	0.03618	1.07 (1.00,1.15)*
11	-0.2527	0.03644	0.78 (0.72,0.83)***
12	-0.4523	0.03650	0.64 (0.59,0.68)***
Region			
British Columbia[b]	-	-	1.00
Atlantic Canada	-0.2074	0.5612	0.74 (0.25,2.23)
Quebec	-2.1974	0.7266	0.11 (0.03,0.46)**
Ontario	-1.2215	0.6264	0.30 (0.09,1.01)*
Prairies	0.1055	0.5665	1.11 (0.37,3.38)
Spending Money per Week			
$0[b]	-	-	1.00
$1-$20	-0.1801	0.03061	0.84 (0.79,0.89)***
$21-$100	-0.3101	0.02910	0.73 (0.69,0.78)***
$100+	-0.3444	0.03080	0.71 (0.67,0.75)***
I do not know	-0.7947	0.03639	0.45 (0.42,0.49)***
Quit Attempt			
No[b]	-	-	1.00
Yes	-0.4507	0.01766	0.64 (0.62,0.66)***

Notes:
[a] Odds ratios adjusted for all the variables in the table
[b] Referent Group
*p<0.1, **p<0.05, ***p<0.0001

Table 23: Parameter estimates, standard errors and adjusted odds ratios for predictors of ST ever use among Canadian youth smokers in grades 9-12, excluding physical activity (Model 9).

Parameter	Estimate	Standard Error	Adjusted Odds Ratio[a] (95% C.I.)
Intercept	-3.4094	0.4889	
Gender			
Female[b]	-	-	1.00
Male	1.9405	0.02441	6.96 (6.64,7.30)***
Grade			
9[b]	-	-	1.00
10	0.1332	0.04702	1.14 (1.04,1.25)**
11	0.03670	0.04700	1.04 (0.95,1.14)
12	0.1529	0.04594	1.17 (1.07,1.28)**
Region			
British Columbia[b]	-	-	1.00
Atlantic Canada	-0.3484	0.5581	0.71 (0.24,2.11)
Quebec	-3.9054	0.7867	0.02 (0.00,0.09)***
Ontario	-1.2738	0.6209	0.28 (0.08,0.95)**
Prairies	0.8763	0.5587	2.40 (0.80,7.19)
Spending Money per Week			
$0[b]	-	-	1.00
$1-$20	-0.6760	0.04107	0.51 (0.47,0.55)***
$21-$100	0.2119	0.03785	1.24 (1.15,1.33)***
$100+	0.2157	0.03888	1.24 (1.15,1.34)***
I do not know	-0.1230	0.04781	0.88 (0.81,0.97)**
Quit Attempt			
No[b]	-	-	1.00
Yes	-0.03373	0.02286	0.97 (0.92,1.01)
Participation in Sports Teams			
No[b]	-	-	1.00
Yes	0.5463	0.02298	1.73 (1.65,1.81)***

Notes:
[a] Odds ratios adjusted for all the variables in the table
[b] Referent Group
*p<0.1, **p<0.05, ***p<0.0001

Table 24: Parameter estimates, standard errors and adjusted odds ratios for predictors of current ST use among Canadian youth smokers in grades 9-12, excluding physical activity (Model 10).

Parameter	Estimate	Standard Error	Adjusted Odds Ratio[a] (95% C.I.)
Intercept	-6.2980	0.5583	
Gender			
Female[b]	-	-	1.00
Male	2.6168	0.04846	13.69 (12.45,15.06)***
Grade			
9[b]	-	-	1.00
10	0.4000	0.06769	1.49 (1.31,1.70)***
11	-0.1264	0.06979	0.88 (0.77,1.01)*
12	0.1544	0.06623	1.17 (1.03,1.33)**
Region			
British Columbia[b]	-	-	1.00
Atlantic Canada	0.7423	0.6401	2.10 (0.60,7.37)
Quebec	-4.4684	1.2336	0.01 (0.00,0.13)**
Ontario	0.09595	0.6900	1.10 (0.28,4.26)
Prairies	1.6608	0.6270	5.26 (1.54,18.00)**
Spending Money per Week			
$0[b]	-	-	1.00
$1-$20	-0.8646	0.05923	0.42 (0.38,0.47)***
$21-$100	-0.9965	0.05447	0.37 (0.33,0.41)***
$100+	-0.3638	0.05433	0.70 (0.63,0.77)***
I do not know	-0.8358	0.06878	0.43 (0.38,0.50)***
Quit Attempt			
No[b]	-	-	1.00
Yes	-0.2761	0.03335	0.76 (0.71,0.81)***
Participation in Sports Teams			
No[b]	-	-	1.00
Yes	0.7387	0.03267	2.09 (1.96,2.23)***
Notes:			
[a] Odds ratios adjusted for all the variables in the table			
[b] Referent Group			
*p<0.1, **p<0.05, ***p<0.0001			

Table 25: Parameter estimates, standard errors and adjusted odds ratios for predictors of ST ever use among Canadian youth smokers in grades 9-12, excluding participation in sports teams (Model 11).

Parameter	Estimate	Standard Error	Adjusted Odds Ratio[a] (95% C.I.)
Intercept	-3.3234	0.4892	
Gender			
Female[b]	-	-	1.00
Male	1.9708	0.02434	7.18 (6.84,7.53)***
Grade			
9[b]	-	-	1.00
10	0.1405	0.04667	1.15 (1.05,1.26)**
11	0.04780	0.04657	1.05 (0.96,1.15)
12	0.1690	0.04558	1.18 (1.08,1.30)**
Region			
British Columbia[b]	-	-	1.00
Atlantic Canada	-0.3859	0.5584	0.68 (0.23,2.03)
Quebec	-3.9099	0.7884	0.02 (0.00,0.09)***
Ontario	-1.2631	0.6211	0.28 (0.08,0.96)**
Prairies	0.8979	0.5591	2.45 (0.82,7.35)
Spending Money per Week			
$0[b]	-	-	1.00
$1-$20	-0.7028	0.04082	0.50 (0.46,0.54)***
$21-$100	0.1847	0.03763	1.20 (1.12,1.30)***
$100+	0.2473	0.03876	1.28 (1.19,1.38)***
I do not know	-0.1430	0.04779	0.87 (0.79,0.95)**
Quit Attempt			
No[b]	-	-	1.00
Yes	-0.5249	0.02276	0.95 (0.91,0.99)**
Physical Activity Guideline Met			
No[b]	-	-	1.00
Yes	0.2093	0.02121	1.23 (1.18,1.29)***

Notes:
[a] Odds ratios adjusted for all the variables in the table
[b] Referent Group
*p<0.1, **p<0.05, ***p<0.0001

Table 26: Parameter estimates, standard errors and adjusted odds ratios for predictors of current ST use among Canadian youth smokers in grades 9-12, excluding participation in sports teams (Model 12).

Parameter	Estimate	Standard Error	Adjusted Odds Ratio[a] (95% C.I.)
Intercept	-6.0239	-0.5598	
Gender			
Female[b]	-	-	1.00
Male	2.6612	0.04820	14.31 (13.02,15.73)***
Grade			
9[b]	-	-	1.00
10	0.3477	0.06722	1.42 (1.24,1.62)***
11	-0.1683	0.06909	0.85 (0.74,0.97)**
12	0.07497	0.06568	1.08 (0.95,1,23)
Region			
British Columbia[b]	-	-	1.00
Atlantic Canada	0.6748	0.6417	1.96 (0.56,6.91)
Quebec	-4.5348	1.2436	0.01 (<0.01,0.12)**
Ontario	0.1046	0.6911	1.11 (0.27,4.31)
Prairies	1.6790	0.6287	5.36 (1.56,18.39)**
Spending Money per Week			
$0[b]	-	-	1.00
$1-$20	-0.9302	0.05830	0.37 (0.35,0.44)***
$21-$100	-1.0262	0.05406	0.36 (0.32,0.40)***
$100+	-0.3347	0.05377	0.72 (0.64,0.80)***
I do not know	-0.8528	0.06855	0.43 (0.37,0.49)***
Quit Attempt			
No[b]	-	-	1.00
Yes	-0.3134	0.03310	0.73 (0.69,0.78)***
Physical Activity Guideline Met			
No[b]	-	-	1.00
Yes	0.1289	0.03215	1.14 (1.07,1.21)***

Notes:
[a] Odds ratios adjusted for all the variables in the table
[b] Referent Group
*p<0.1, **p<0.05, ***p<0.0001