

**RECREATIONAL USE OF PRESCRIPTION MEDICATIONS
AMONG CANADIAN YOUNG PEOPLE: IDENTIFYING
DEMOGRAPHIC AND GEOGRAPHIC DISPARITIES**

By

Ariel Pulver

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Abstract

BACKGROUND: The nonmedical use of prescription medications among young people has escalated substantially in recent years. Certain subgroups of adolescents are at greater risk than others, including rural youth, however this has yet to be adequately quantified in Canada, and risk and protective factors in rural communities remain understudied.

OBJECTIVES: The first objective of this thesis was to characterize the nonmedical use of prescription drugs in Canadian youth by age, gender, socioeconomic, immigrant and geographic statuses. The second objective was to examine time-use patterns among rural young people as they may relate to their risk of using prescription drugs recreationally.

METHODS: Data were obtained from 10,429 youth in grades 9 and 10 across Canada who participated in the 2009/2010 Cycle of the Health Behaviour in School-aged Children survey. Participants documented information about their nonmedical use of opioid pain relievers, stimulants and sedative or tranquilizer medications in the past year. Cross-tabulations and multi-level regression analyses were used to determine proportions and estimate risk by demographic subgroups, and among 2393 rural youth, to examine associations with time-use patterns

RESULTS: Females were 1.25 times more likely to report recreational use of pain relievers (95% CI: 1.04-1.51). Lower SES students were 2.41 times more likely to report recreational use of any type of medication (95% CI: 1.94-2.99). Pain reliever use was highest among rural youth living in close proximity to urban centres. Frequent peer time after school and in the evenings was associated with a 1.73 (95% CI: 1.10-2.73) and 2.16 times (95% CI: 1.30-3.60) increased risk of using prescription drugs recreationally, however associations were attenuated when adjusted for other risk factors. Non-

participation in extracurricular activities was associated with a 50% increase in risk for nonmedical use of prescription drugs, even when adjusted for other risk factors.

CONCLUSIONS: Females, those of low SES and some rural youth, especially those who do not participate in extracurricular activities, are at increased risk for using prescription drugs recreationally. Results from this thesis point to priority areas for public health and education in reducing harms associated with nonmedical use of prescription drugs.

Co-Authorship

This thesis is the work of Ariel Pulver done in collaboration with supervisors Dr. Colleen Davison and Dr. William Pickett. The study ideas for both manuscripts examining nonmedical use of prescription drugs among Canadian youth, with a specifically rural focus were developed collaboratively. Andrei Rosu extracted the Metropolitan Influenced Zone classifications for the schools. The writing, statistical analyses and interpretation of results were the work of Ariel Pulver, with frequent guidance and revisions provided by the two supervisors.

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Chapter 1

Introduction

1.1 General overview

The use of prescription medications such as opioid pain relievers, stimulants, sedatives or tranquilizers for the recreational purpose of eliciting intoxicating effects is recognized to be a growing and burdensome public health issue.(1) There has been a recent call to fill research gaps and identify areas for intervention.(2) Adolescents have been identified to be disproportionately vulnerable to nonmedical use of prescription drugs(3) and rates are increasing;(4) however, there remains a dearth of epidemiological studies on patterns of use among young people. This is troubling because adolescents in Canada report greater harms from substance use than adults, including harms to friendships, family, learning, development and mental health.(5) Patterns in recreational use of prescription medications may differ by individual and contextual risk factors, and may depend on the class of medication. Identification of existing disparities among subgroups of adolescents by age group, gender, socioeconomic status, geographic status or immigrant status is important, as previous research indicates that these factors may influence drug use and contribute to potentially amenable and unjust health differences.(6)

One particularly striking disparity with respect to recreational use of prescription medications is rural residence.(7-11) Typically, the abuse of illicit drugs is perceived to be an urban issue(12, 13) yet there is evidence that rates in rural areas may be converging with urban rates, and certain types of drugs are indeed more prevalent among subgroups

in rural populations.(13) Insufficient attention has been paid, however, to geographic disparities in the recreational use of prescription medications in Canadian young people and the underlying reasons for these disparities in rural and small town contexts. One potential area of exploration in the rural context is how youth spend their time. Engagement in pro-social activities and spending time in structured, supervised settings have been linked with positive health and developmental outcomes for youth,(14-16) and lower rates of problem behaviours.(17-19)

The association between recreational use of prescription drugs and adolescent's time-use has yet to be explored. This kind of study is particularly relevant for rural and small town communities where opportunities for extracurricular involvement and structured recreation may be more limited than in urban settings. There is a substantial need for research in this area to identify potentially troubling health disparities and also protective factors among potentially vulnerable populations.

1.2 Focus of this thesis

This thesis aims to examine associations between demographic factors, including geographic location, time-use and Canadian young people's recreational use of prescription medications. There are two manuscripts in this thesis. The first manuscript identifies disparities in the recreational use of prescription medications, including opioid pain relievers, stimulants and sedatives/tranquilizers. The second manuscript focuses on rural and small town adolescents, and examines the beneficial and harmful effects of patterns of time-use on the risk of recreational use of prescription medications. The two manuscripts are conceptually linked by the outcome of interest (the recreational use of

prescription drugs) and by their rural aspects—the first identifying disparities by geographic status and the second examining risk factors in the rural context.

1.3 Scientific and public health importance

Over the past few years, clinical associations, public health organizations, and governments alike have become increasingly concerned with the recreational use of prescription medications among young people.(1, 20, 21) This issue has garnered much attention in the media as well.(22, 23) In March 2013, the National Advisory Committee on Prescription Drug Misuse released a report recommending a multi-pronged, Pan-Canadian strategy to address this complex issue entitled “First Do No Harm: Responding to Canada’s Prescription Drug Crisis”. This was led by the Canadian Centre on Substance Abuse in collaboration with many stakeholders nationwide, including the Coalition on Prescription Drug Misuse and the Nova Scotia Department of Health and Wellness, and Health Canada’s First Nations and Inuit Health Branch’s Prescription Drug Abuse Coordinating Committee. The proposed strategy identifies many priority areas for further investigation and preventative intervention, including an emphasis on understanding the extent of harms associated with prescription drugs, and conducting research to address knowledge gaps with consideration paid to Canada’s diversity including geographic differences, multicultural groups and other potential inequities.(1)

This thesis helps to address these knowledge gaps, with particular respect to young people, by examining important relationships in a nationally-representative sample of adolescents using multi-level statistical modeling techniques. Knowledge of subgroups at particularly high risk for abuse of these medications is relevant for health care providers, who write and fill prescriptions for controlled medications for their patients.

The results from this thesis are also relevant for policy makers for whom this study will provide surveillance information and identify focal areas for the targeting of policy interventions. Finally, time-use patterns and how these relate to recreational use of prescription drugs are informative for education and community planners, to guide priority setting and mitigation efforts for our young people.

1.4 Study purpose and population

The purpose of this study is to identify patterns of recreational use of prescription medications by Canadian young people ages 14-16 with particular focus on the rural and small town experience. I was able to explore these relationships through a secondary analysis of data obtained from the nationally-representative 2009/2010 Canadian Health Behaviour in School-aged Children Survey (HBSC). The questions related to the recreational use of prescription medications were asked of students in secondary school (primarily grades 9 and 10). The sample size was 10,429.

1.5 Objectives and hypotheses

1. To describe recreational use of prescription medications among adolescents in Canada, in order to identify groups at particularly high risk. The focus here was the identification of subpopulation differences by age, gender, socioeconomic status, immigration status and geographic status. It was hypothesized that vulnerable subgroups such as females, those of low socioeconomic status, and those living in geographically rural and remote locations would be at elevated risk for recreational use of prescription medications. It was also hypothesized that due to the healthy immigrant effect,(24) those recently immigrated to Canada would

be at lower risk for the recreational use of prescription drugs than those who were born in Canada.

2. To identify how the time-use patterns of adolescents living in rural and small town environments contribute to engagement in recreational use of prescription medications. It was hypothesized that young people who spent more time in structured, monitored activities and settings, would be at decreased risk for recreational use of prescription medications.

1.6 Thesis organization

This thesis aligns with the requirements set out by the Queen's School of Graduate Studies "General Forms of Theses". The first chapter describes a general outline of the thesis. The second chapter provides a scoping review of the relevant scientific literature surrounding the recreational use of prescription medications in young people, associated risk factors with this type of drug use, other types of substance use and problematic behaviours. The third chapter of this thesis is the first manuscript, which is a descriptive study that identifies subgroup patterns and disparities in the recreational use of prescription medications by Canadian young people. The fourth chapter is the second manuscript, which is an etiological exploration of the association of time-use patterns among rural and small town youth and their risk for recreational use of prescription drugs. The final, fifth chapter of this thesis, is comprised of a summary of the findings, a reflection of findings in light of key epidemiologic concepts, directions for future research, public health implications, as well as conclusions and final summary. Detailed methods for the HBSC (e.g., specific survey items, details of the sampling methodology), ethics information and power calculations are included as appendices.

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Chapter 2

Literature review

2.1 General overview

Nonmedical use of prescription medications such as stimulants, pain relievers, and sedatives or tranquilizers is recognized to be a growing clinical and public health problem, creating a large burden for individuals, families, communities and the health care system.(1-3) Such drug use has been linked to increased risks for adverse cardiovascular and central nervous system events, dependence and addiction, co-morbid psychiatric issues, financial and legal difficulties, as well as criminal activity.(1, 2, 4)

This chapter begins by describing the methodology that was used to conduct the literature review. Then the terms that will be used throughout this thesis will be defined. Next, the issue of nonmedical prescription drug use and related harms will be briefly reviewed and existing studies of prevalence estimates for nonmedical use of prescription drugs among adolescents will be discussed. Risk factors for engagement in this type of drug use will be reviewed and knowledge gaps identified with an emphasis on the experiences of rural and small town youth as a vulnerable group. Following that, patterns of time-use among young people and their associations with substance abuse will be examined, and the lack of information about potential associations with nonmedical use of prescription drugs will be highlighted. Finally, rationales for both objectives in this thesis will be presented.

2.2 Literature review methodology

This section contains a scoping literature review about the nonmedical use of prescription drugs among adolescents, with a focus on rural youth. Common reasons for undertaking scoping reviews include summarizing and disseminating research findings and identifying research gaps in the existing literature. Rather than being guided by a strict research question with inclusion and exclusion criteria such as is the case for a systematic review, the purpose of this scoping review was to identify all relevant literature, utilizing wide definitions of terms to ensure broad coverage. Following the general framework of a scoping review, this process was iterative and search terms were not defined at the outset.⁽⁵⁾ The first stage was to identify the initial research question which was: What is known from existing literature about the nonmedical use of prescription medications among young people? The second stage was to identify relevant studies through electronic databases (Medline, PsycInfo and Google Scholar) and through reference lists of relevant articles identified. MeSH search terms initially included: prescription drug misuse; prescription drug abuse; adolescents; youth; opioids; Central Nervous System stimulants; sedatives. Criteria for inclusion initially related to the population under study, the substance use described and the examination of demographic determinants. Based on increasing familiarity with the literature,⁽⁵⁾ focus was then drawn to searching for citations focusing on rural youth, delinquency and structured and unstructured activity contexts. Search terms included: rural health; risk-taking; substance abuse; delinquency; peer influence, among others.

2.3 Definitions

Nonmedical use of prescription medications has been termed recreational use, inappropriate use, non-prescribed use, misuse, problem use, and abuse of prescription medications, and has been defined and measured in a number of ways.(6) This concept is frequently operationalized using precedents suggested by the National Household Survey on Drug Abuse in the United States, now called the National Survey on Drug Use and Health e.g., “using a drug that was not prescribed for (oneself) or taken only for the experience or feeling it caused” to identify people who took medication recreationally that was not prescribed for themselves, in order to get high, or those who may have taken medication from a friend or family for an actual physical or mental health issue they do not have a prescription for.(3) In this thesis, the terms “recreational use of prescription medications” and “nonmedical use of prescription drugs or medications” will be used interchangeably to describe only the use of prescription drugs to elicit intoxicating effects.

2.4 Describing the issue

Nonmedical use of prescription drugs is escalating so rapidly in some populations that the International Narcotics Control Board of the United Nations announced that it is beginning to surpass illicit drug use globally.(7) For example, in the United States, the nonmedical use of prescription drugs is more common than use of heroin, cocaine and methamphetamine, and is second only to marijuana.(7) At focus here are three types of medications: opioid pain relievers, central nervous system stimulants and central nervous system depressants. These medications are psychotropic or psychoactive in nature meaning they may alter mental functioning including cognition, emotion and behaviour.

They have a high potential for dependence or abuse and are thus controlled substances under the federal Controlled Drugs and Substances Act in Canada, and must be monitored.(8)

Opioid pain relievers are medications that contain opium, or opium derivatives and are typically used to relieve pain, suppress coughs, or induce anesthesia. They may elicit feelings of relaxation, as well as relieve anxiety and tension. Common opioid pain relievers include oxycodone (e.g., under the brand names Oxycontin, Percocet), codeine (e.g., Paramol, Tylenol 3), fentanyl (e.g., Actiq, Duragesic), hydrocodone (e.g., Vicodin), and meperidine (e.g., Demerol).(3)

Central nervous system stimulants include methylphenidate (e.g., Ritalin, Concerta) or amphetamine (e.g., Dexedrine, Adderall) medications commonly prescribed for the treatment of Attention Deficit Hyperactivity Disorder. They work by increasing the release of dopamine in the brain and when taken in high doses or in routes other than ingestion, can boost energy and produce feelings of euphoria.(3)

Central nervous system depressants (also known as *sedatives* and *tranquilizers*) are used to treat conditions such as anxiety, panic attacks, and sleep disorders. Substances such as benzodiazepines and barbiturates interrupt the GABA neurotransmitter, and produce drowsy or calming effects. Common sedatives/tranquilizers include diazepam (e.g., Valium), alprazolam (e.g., Xanax), zolpidem (e.g., Ambien), and lorazepam (e.g., Ativan).(3)

While nonmedical use of prescription drugs is widely recognized as a growing public health issue and there have been urgent calls for associated research and development towards interventions,(9) there are limited epidemiological studies on

patterns of use and related harms in Canada, particularly studies that identify populations at highest risk. Significant gaps in Canadian estimates may exist due to the fact that until very recently, national household surveys on substance use did not include survey items on nonmedical use of prescription drugs.(9) The Canadian Alcohol and Drug Use Monitoring Survey is a general population telephone survey of alcohol and illicit drug use among Canadians aged 15 and over. The three most recent versions of this survey (2008, 2009, 2010) have included items about medical and nonmedical controlled prescription drug use.(10) The most recent survey identified that while 26% of participants age 15 and over reported past year use of a controlled drug, only 1% report using the drug to get high or for the experience or feeling it caused.(10) However, this survey did not examine rates of nonmedical use within adolescents specifically, and therefore by combining two distinct age groups (both adolescents and adults), the true rates of use among adolescents may be underestimated.(10) The need to distinguish these two groups in reporting prevalence was most recently demonstrated in a study comparing rates of nonmedical prescription opioid use among high school and adult populations in Ontario using data from the 2011 Ontario Student Drug Use and Health Survey (n=3266) and the 2010/2011 Centre for Addiction and Mental Health Monitor (n=4023), respectively. Past-year prevalence of nonmedical opioid use was 15.5% in youth in grades 9 through 12 and 5.9% in adults 18 years and older.(11) In that study, nonmedical opioid use was defined as using pain relief medications without a prescription or doctor telling you to do so, not specifically for recreation or intoxication.

2.5 Recreational use of prescription medications among adolescents

Canadian adolescents are more likely than adults to use substances of abuse and are more likely to report experiencing subsequent harms.(12) Harms may fall on friendships, social lives, home lives, learning and physical and mental health.(12) Moreover, behaviours that are initiated during adolescence are frequent determinants of subsequent behaviours in adulthood.(13) Substance use during adolescence has been linked to poor academic achievement(14, 15) and is associated with future mental health issues.(14) For example, youth who drink, smoke and use marijuana are 1.2-2.5 times more likely to have poor academic performance than those who do not use these substances.(15)

2.5.1 A growing problem

Results from the National Survey on Drug Use and Health in the United States indicated a 212% increase in nonmedical use of prescription drugs in adolescents age 12-17 between 1992 and 2003.(3) This was 2.6 times the increase in individuals 18 years and older (an 81% increase), suggesting that adolescents are a particularly vulnerable group for this health issue. The rise in use has also been associated with a disconcerting 76% increase in calls made to Poison Control Centers in the US related to the nonmedical use of prescription stimulants among youth between 1998 and 2005. Calls concerning other forms of substance use experienced a 55% increase.(16) Of the calls about medications, 67% were related to drug exposures occurring at home, whereas 17% were related to exposures occurring at school.(16) Characterization of risk features at home and at school is necessary. The Youth Smoking Survey in Canada has similarly identified a substantial escalation in youth in grades 7 through 9 between the years 2002 and 2008 (rates increased from 3.0% to 6.7%).(17) Prevalence estimates of nonmedical opioid use

specifically from the Ontario Student Drug Use and Health Survey of students in grades 7 through 12 have increased from 6.2% to 15.5% between 2007 and 2011 survey cycles.(6)

It appears that young people today are at particular risk of nonmedical use of prescription drugs, more so than youth of the same age born in previous generations.(18) The major reason suggested for the increase in nonmedical use in recent years is the increased availability of opioid analgesics in the general population. In Canada, we have seen a 203% increase in the Standardized Defined Daily Doses of prescription opioids being consumed in 2008-2010 compared with in 2000-2002.(19)

While previous studies do seem to uniformly indicate an increase, prevalence estimates in Canadian young people are varied depending on the survey question and medication in focus. The Ontario Student Drug Use and Health Survey asked students if they have taken a prescription medication without a prescription or without a doctor telling them to do so. This question style is based on survey items from the long-standing Monitoring the Future Study from the United States.(20) The Youth Smoking Survey in Canada, however, uses a different question, narrowing in on recreational use by asking students if they have tried medications in the past 12 months to get high and not for medical purposes. These questions may distinguish between recreational users (e.g., sensation-seekers, with the purpose to get high) and self-treaters (e.g., to treat pain or other issues).(21) One study compared prevalence rates of nonmedical opioid use among adults using two Canadian surveys and demonstrated that there is considerable variability depending on the questions used (2.2% and 7.7%).(6) A recent study of the 2008/2009 cycle of the Youth Smoking Survey, found that 5.9% of Canadian adolescents in grades 7 through 12 have used prescription drugs to get high in the past year, 4.3% of students had

used pain relievers, 3.4% had used stimulants and 2.1% had used sedatives or tranquilizers.(22) This is in contrast to studies from the United States using questions from the Monitoring the Future Survey which have found that the lifetime prevalence of past-year nonmedical use of prescription drugs in adolescents ranges from 7-35% depending on the specific ages and medication under study.(21, 23, 24)

The recreational use of the above medications is commonly linked to poly-substance use in adolescents, meaning the use of multiple substances of abuse such as alcohol, other illicit drugs or other prescription drugs, either simultaneously or on separate occasions.(25) For example, a recently published study using web-based survey data from 2,744 students in grades 7 through 12 in the United States demonstrated through exploratory latent class analysis that the nonmedical use of prescription medications was grouped with high probabilities of alcohol use.(26) According to a report from the National Centre for Addiction and Substance Abuse in the United States, teenagers who report recreational use of prescription drugs are more likely to report also using marijuana (5 times), heroin (12 times), ecstasy (15 times) and cocaine (21 times more likely) than those who do not.(3)

2.5.2 Motivations and sources

Motivations for nonmedical use of prescription medications may include sensation-seeking or recreational use (17.9%), self-treatment for undiagnosed or undertreated medical or physical health issues (28.9%), both (31.5%) or other reasons, perhaps depending on the drug.(27) Nonmedical opioid use has been related to experimentation, relaxation, to get high, pain relief and emotional regulation.(28) Motivations for nonmedical stimulant use include weight loss, energy enhancement, to

stay awake, experimentation and affect regulation. Nonmedical tranquilizer use is also motivated by experimentation, to get high, relaxation/sleep and affect regulation.(28) Approximately 9% of adolescents using prescription drugs nonmedically report symptoms consistent with Diagnostic and Statistical Manual of Mental Disorders IV criteria for addiction.(3)

These drugs are obtained, in order of frequency, from a family member, a friend, a dealer or by theft.(29-31) However, more recent studies point to young people's own personal prescriptions as a central source for nonmedical use. Data from the Monitoring the Future Study in the United States estimated that 36.9% of students who report nonmedical prescription opioid use in the past year obtained them from their own leftover prescriptions and that their primary motivation was pain relief.(30) A longitudinal study from the same research group discovered that 20% of young people who reported taking prescription opioids for any reason had misused them (e.g., using too much, intentionally to get high, or to increase the effects of alcohol or other drugs).(32) Among those who used them exclusively medically, 8% reported misusing them in the following year.(32)

2.6 Demographic risk factors for nonmedical use of prescription drugs among adolescents

The nonmedical use of prescription medications has multifactorial etiologies, associated with differences in individual psychosocial or demographic risk factors, and may vary depending on the class of medication. The nonmedical use of prescription medications has multifactorial etiologies, associated with differences in individual psychosocial or demographic risk factors, and may vary depending on the class of medication. Identified psychosocial risk factors have included psychological distress,

suicidal ideation,(11) familial bonds (33), attention deficit hyperactivity disorder,(34) and self-treatment (27). This section will focus on reviewing the literature about demographic risk factors for this type of drug use in the United States and in Canada.

2.6.1 Age and gender

Recreational use of prescription drugs increases with age. Between the ages of 12-15, the risk of nonmedical use of prescription drugs increases between 81% and 230%.(22, 29, 33) The mean age for initial nonmedical use of prescription drugs may be as early as 13 years old,(34) which signifies the need to identify drug use patterns in this early adolescent age group.

Female gender is a second commonly identified determinant, however findings are somewhat inconsistent. In youth aged 12 to 17, combined data from the National Survey on Drug Use and Health from 2003 through 2009 revealed that females were 1.27 times more likely than males to have used opioids nonmedically for the first time within the past 2 years (95% CI 1.17-1.38).(25) Similarly, in a sample of 10 to 18 year olds in the Detroit area, girls reported significantly greater nonmedical use of pain medication in the past year (15% girls, 7% boys, $p<0.01$). (21) Using National Survey on Drug Use and Health data from 2005, while Ford did not find an effect of gender on opioid, tranquilizer or sedative use specifically, females were 1.25 and 1.96 times more likely to report nonmedical use of *any* prescription drug in the past year and stimulants in particular ($p<0.01$ and $p<0.001$). (35) In contrast to the above studies, among high school seniors in the 2002 Monitoring the Future Study, male gender posed a greater risk than female gender for any or frequent illicit Vicodin and OxyContin use in the past year (odds ratios ranging from 1.56-2.48). (36) Another study of 54,361 youth in grades 7 through 12 in the

Cincinnati area using the 2009-2010 PRIDE Questionnaire, demonstrated that males were slightly more likely to report lifetime nonmedical use of prescription medications than females (14.5% vs 12.4%, $p < 0.001$).⁽³⁷⁾

2.6.2 Socioeconomic status

Low socioeconomic status has been repeatedly associated with nonmedical use of prescription drugs in U.S. youth populations, with odds ratios ranging from 1.20-1.52.^(25, 33-35, 38) For example, using combined data from 2003 through 2009 cycles of the National Survey on Drug Use and Health ($n=126,764$) Nakawaki and Crano found that among youth aged 12-17, those from the lowest income households were 1.50 (95% CI: 1.22–1.84) times more likely to report *non-persistent* opioid use, and 1.40 (95% CI: 1.16–1.68) times more likely to report *persistent* opioid use than those from the wealthiest households. Students from the lowest income households were less likely to report *recent* nonmedical use of stimulants, however.⁽²⁵⁾ A second example comes from Wu, Pilowsky and Patkar's study using data from the 2005 National Survey on Drug Use and Health of youth aged 12-17. These researchers similarly found that females from the low income households were 1.52 (95% CI: 1.17–1.97) times more likely to report *lifetime* nonmedical pain reliever use than those in the highest household income group.⁽³⁴⁾ Other research exploring relationships between indicators of low SES (e.g. parental education, father's job, household income, and others) and smoking, alcohol and cannabis use among adolescents have suggested that peer norms⁽³⁹⁾ and depressive symptoms⁽⁴⁰⁾ may explain these associations. It is conceivable that youth living in poorer socioeconomic conditions may have fewer opportunities for structured recreation, less parental supervision, and experience more stressful life events, which all may

contribute to engagement in problematic behaviours such as substance use.(41-43) A recent systematic review demonstrated that psychosocial stressors play a large role in mediating the relationship between low socioeconomic conditions and physical health.(44) In sum, youth of low SES may confront greater barriers when faced with decisions about engaging in risk behaviours, which can contribute to elevated rates of nonmedical use of prescription drugs.

2.6.3 Canadian epidemiologic studies

To date, there have been few large epidemiologic studies in Canada describing nonmedical use of prescription drugs and associated risk and protective factors among adolescents. One Canadian study using data from the Youth Smoking Survey in 2008 demonstrated higher rates for females vs. males of past-year recreational use of pain relievers (4.3% vs. 3.8%; OR:1.15 95% CI: 1.14-1.16) and sedatives/tranquilizers (2.4% vs.1.9%; OR:1.25 95% CI: 1.23-1.27), however, rates for stimulant use were modestly higher among males (3.2% vs. 3.6%; OR:0.88, 95% CI: 0.87-0.90).(22) This same study demonstrated that students who use pain relievers, stimulants and sedatives or tranquilizers were 2.3 times (95% CI: 2.27-2.33), 1.58 times (95% CI: 1.56-1.60) and 1.75 times (95% CI: 1.72-1.78), respectively, more likely to be in grades 10-12 than in grades 7-9.(22) Poulin's study of 12,990 students in the Atlantic provinces of Canada in grades 7, 9, 10 and 12 revealed prevalence rates of 6.6% and 8.7% for nonmedical methylphenidate (e.g., Ritalin) and amphetamine (e.g., Dexedrine) use, respectively.(45) Following adjustment for alcohol, tobacco, cannabis use, screening for attention deficit hyperactivity disorder and depressive symptoms, there was no effect of age on the risk for the use of methylphenidate. The association did remain for the use of amphetamines

(RR: 1.91 in grade 12 students compared to grade 7 students). After adjustment for school grade, province, and academic achievement, nonmedical use of methylphenidate was associated with male gender (OR=1.35, $p<0.001$).⁽⁴⁵⁾ Another Canadian study focused on the use of opioid analgesics in young people ages 12-19 years, using data from the Ontario Student Drug Use and Health Survey.⁽²⁹⁾ This study found that 20.6% of students reported at least one medical or nonmedical use of opioid pain relievers during the past year, and that females were more likely than males to report both nonmedical and medical use (16.6% vs 12%). Proportions of exclusive nonmedical use were similar between genders (6.7% and 5.8%).⁽²⁹⁾

One recent Canadian study by Fischer and colleagues using data from the 2010-2011 cycle of the Ontario Student Drug Use and Health Survey (n=3266) reported higher rates of nonmedical opioid use among students in grades 12 vs. grade 9 (17.5% vs. 11.2%; $p<0.05$), however in analyses stratified by gender, they identified no clear pattern when it came to age after adjustment of other demographic factors as well as use of other substances, self-rated physical health, psychological distress and suicide ideation. Similarly, 22.4% of students with low subjective social status reported past year nonmedical opioid use as compared to 12.5% of students with high subjective social status ($p<0.001$), however adjusting for other sociodemographic, substance use and psychological variables attenuated these differences for males, but not for females.⁽¹¹⁾

2.6.4 Summary

No other epidemiologic studies examining nonmedical use of prescription drugs in Canadian adolescents have been identified. The existing studies about the epidemiology of recreational use of prescription drugs in Canada have content and

methodological limitations that leave some significant gaps in the current knowledge. Definitions of nonmedical prescription drug use have been inconsistent. Many of the aforementioned studies do not distinguish between taking medications to get high and taking medications that have not been prescribed to the person but which are used to treat a mental or physical health issue. This is an important distinction as they are two different behaviours that have dissimilar clinical and societal importance. Moreover, in the larger Canadian surveys, for each type of medication, associations with important potential social determinants such as socioeconomic or immigrant statuses have not been adequately quantified.

Canada is a country where immigrant youth comprise 9.2% of the population under 24 years of age.(46) It is unknown how nonmedical prescription drug use may vary by whether a young person is Canadian born or not, or by how long they have lived in Canada. One study from the United States demonstrated that while foreign-born youths display lower rates of substance use compared to U.S.-born youth, the risks for use increase as they become acculturated.(47) If drug use increases as a function of time residing in Canada, it might suggest that factors unique to the Canadian context and culture create this risk, such as normative substance use (e.g., the latest UNICEF Report Card using data from the Health Behaviour in School-aged Children study ranks Canada highest in terms of adolescent cannabis among wealthy countries—28% of youth ages 11-15 report use in the past year(48)). This information would be useful for targeting public health interventions towards groups susceptible to start using, who might otherwise not use.

2.7 Recreational use of prescription medications in rural and small town contexts

Patterns in adolescent recreational use of prescription medications may vary by geographic status. Substance use is often regarded as an urban issue, and consequently, similar problems in rural areas are neglected.(49) While among adults, rates of alcohol and most illicit drug use are indeed lower, drug use is still substantial in rural areas, and in fact, among adolescents, U.S research indicates that prevalence rates are similar to rates in urban communities.(50)

2.7.1 Nonmedical use of prescription drugs among rural adults

Nonmedical prescription drug use in adult populations is more prevalent in many rural areas than in urban areas, such as in the Appalachian region of the United States.(51-53) The nonmedical use of opioid pain relievers among rural populations has received recent special focus. In a comparison study of urban and rural adults who use drugs, even following adjustment for age, gender, and race, rural drug users have higher odds of lifetime and recent use of methadone, Oxycontin, and generic oxycodone.(51) Additionally, among rural people who use drugs, there is a significantly younger age of initiation for using the aforementioned pain relievers as compared to other illicit substances.(51) Reasons suggested for these disparities include the relative acceptability of nonmedical prescription drug use, so much so that in some areas it may be considered normative,(54) coupled with the greater reluctance of rural adults who use drugs to seek treatment for substance use issues as compared to urban adults.(55)

2.7.2 Nonmedical use of prescription drugs among rural youth

Unfortunately within many rural communities in the United States, the nonmedical use of prescription drugs has become increasingly more prevalent among youth. After adjusting for race, health and alcohol use, data from the National Survey on Drug Use and Health in 2008 suggest that rural young people are 1.26 times more likely than their urban counterparts to engage in nonmedical use of prescription drugs (95% CI:1.01, 1.57).(33) In both adult and adolescent rural populations, prescription pain relievers seem to be the preferred medication. Among high school seniors in the 2002 Monitoring the Future Study, rural youth were 3.32 times more likely to use OxyContin frequently than youth from cities or towns ($p<0.01$).(36) In another study, Wu and colleagues found that lifetime prevalence of nonmedical use of opioid pain relievers from the 2005-2006 National Survey on Drug Use and Health ($n = 36,992$) was higher in nonmetropolitan areas (11.0%) than metropolitan areas (8.6%, $p<0.001$), however, when stratified by gender, and adjusted by income, age and other variables, differences between metropolitan and non-metropolitan areas disappeared.(34) Another study of 18,678 youth ages 12-17 from the 2005 National Survey on Drug Use and Health found that those who live outside major urban areas (i.e., do not live in an urban-core statistical area or who live in an area with fewer than 1 million people) were more likely than those living in major urban areas to report use of pain relievers ($OR=1.22$, $p<0.05$) and sedatives ($OR=2.08$, $p<0.05$).(35)

To our knowledge, only one Canadian study has considered patterns of nonmedical use of prescription drugs by geographic status, using a dichotomous variable of urban/suburban as compared to rural and focusing solely on opioid pain relievers.

These researchers used the Ontario Student Drug Use and Health Survey from 2010-2011 (n=3266) and found a higher proportion of nonmedical opioid pain reliever use in rural areas as compared to urban/suburban areas (21% vs. 14.5%, $p<0.001$). In their regression analyses that was stratified by gender, female adolescents, who reported having used opioids nonmedically, were 1.95 times more likely to live in rural areas than in urban/suburban areas, as defined by population size (95% CI: 1.24-3.06). The same relationship was not observed for males.(11)

2.7.3 The importance of defining “rural”

The result from the above Canadian study must be interpreted with caution, as a frequently identified methodological issue in rural health literature is the “unidimensional” definition of rural and urban areas.(49) Definitions of rural are frequently based on spatial and density factors, specifically, population counts, potentially omitting important contextual elements that may be linked to health behaviours and health outcomes.(49, 56, 57) Depending on the chosen definition of “rural”, different total numbers of people are generated and different people and communities, with different characteristics, are included or excluded.(57) The importance of this is highlighted by recent research suggesting that drug use patterns may vary by type of rural residence or the degree of remoteness.(50, 58, 59) Recently, there have been a few studies from the United States that indicate some intra-rural variability in substance use patterns, and that examination of the rural experience simply by population counts, without considering context, may be overly simplistic.(58, 59) One study by Rhew and colleagues found that among rural high school students (from communities of 1,500 to

40,000 people), those who were living on farms were more likely than those living in rural towns to use alcohol (OR=1.33, p=0.004) and illicit drugs (OR=1.49, p=0.001).(58)

Some studies from the United States have used the Rural-Urban Continuum Codes from the United States Department of Agriculture Economic Research Service to look at drug use patterns in young people. These codes distinguish metropolitan counties by the population size of their metropolitan area, and nonmetropolitan counties by degree of urbanization (densely settled areas) and adjacency to metro areas.(60) In one such study using data from National Surveys on Drug Use and Health from 2000-2004 (n=68,611), Gfroerer, Larson and Colliver explored substance use patterns among youth aged 12-17 by metropolitan counties (inside a metropolitan statistical area), non-metropolitan counties (densely settled areas of $\geq 20,000$ people) and rural counties (non-metropolitan counties with densely settled areas of $\leq 19,999$ people).(50) Rates of illicit drug use were generally similar among county-types; however use of stimulant medications and methamphetamine were highest in rural counties. Interestingly, the nonmedical use of pain relievers was highest in non-metropolitan counties with densely settled areas $\geq 20,000$ (9.0%), as compared to metropolitan counties (7.3%, p=0.01) and was modestly higher than in non-metropolitan rural counties (8.2%, not significant).(50)

A second study using the same survey data as Gfroerer, Larson and Colliver also utilized the Rural-Urban Continuum Codes, and found a rural gradient with respect to alcohol and methamphetamine use in youth aged 12-17—that increasingly rural areas demonstrated increasingly prevalent use. For instance, rates of alcohol use were 3.7% in urban areas, 5.3% in non-metropolitan counties *adjacent* to a metro area, 6.1% in *large* non-metropolitan counties *not adjacent* to metro areas (densely settled areas of $\geq 20,000$

people), and 7.2% in *small or medium* non-metropolitan counties *not adjacent* to metro areas (densely settled areas of $\leq 19,999$ people).(59) The results from these studies suggest that characteristics of both population density and proximity to urban areas may affect the prevalence of substance use among youth. The proximity or remoteness of a community and rural residents' access to urbanized centres may be an important variable to consider in the Canadian context as Canadian research has demonstrated that this may reflect access to health care services.(61, 62) One way that is used to designate rural regions by proximity to urban centres in Canada is the Metropolitan Influenced Zone (MIZ). The MIZ is defined based on commuting patterns to urban centres from rural and small town areas and is intended to serve as a proxy for proximity and adjacency features. Areas with more commuting are Stronger MIZs and those with less commuting are Weak MIZs, and are presumed to therefore be more remote, and subject to less metropolitan influence than those with higher levels of commuting.(56)

2.7.4 Summary

The convergence in the prevalence of many types of drug use between urban and rural areas, and the higher rural rates of nonmedical use of prescription drugs, likely reflect contextual influences at the social and community level.(50) There are substantial gaps surrounding geographic variations with respect to the nonmedical use of prescription drugs among adolescents in Canada, particularly with consideration paid to contextual influences in geographic locations. Describing such patterns would be of value in informing efforts towards prescription diversion prevention and intervention strategies in environments and populations most vulnerable to recreational use of prescription drugs

2.8 Recreational use prescription drugs in adolescents: Associations with time-use

Most research on adolescent risk behaviours focuses on urban youth or populations of mixed geography, and thus issues specific to rural adolescents are often neglected.(63) Health resources for youth are commonly scarce in rural areas,(64) and an understanding of the needs and priority areas regarding substance use within rural contexts is essential. Rural adolescents report that activities, families and communities play a large role in their risk behaviours.(65) The physical isolation and a lack of leisure activities and recreational opportunities in rural areas may put youth at risk, while tight-knit communities and close relationships with family members may be protective.(65) How youth spend their time within these different contexts can contribute to engagement in delinquent behaviours including substance use. This section will review the extant literature surrounding time spent with family, time spent in structured activities, and time spent with friends and the affect this has on substance use among young people in rural areas.

2.8.1 Time with family

Time spent with family has been demonstrated as an important determinant of risk behavior.(66, 67) For example, using a representative household sample (n=616) in New York State, Barnes and colleagues examined the relationship between family time (as defined by a composite score based on hours per day engaged in the following activities: going to dinner with family; doing things with family for fun; going to church; family celebrations; eating dinner with family; overnight trips with parents) and frequency of binge drinking, cigarette smoking, illicit drug use (index score of total past year use of any drug), delinquency (6 point scale: staying out past curfew; fighting with parents;

running away from home; stealing; assaulting someone; or breaking and entering) and sexual activity. They found that after adjusting for gender, age, race and SES, and other time-use activities, time spent with family was associated with a decreased risk of binge drinking ($p<0.001$), cigarette smoking ($p<0.01$), illicit drug use ($p<0.05$), delinquency ($p<0.001$) and sexual activity ($p<0.01$). (66) Similarly, in a longitudinal study, Crouter and colleagues found that time spent with family was a strong determinant of involvement in risk behaviours two years later.(67) As families with higher levels of time spent together were viewed as warmer and more loving in that study(67), time spent with family may support relationship building between parents and children and promote family cohesion,(66) thereby reducing risky behaviour among adolescents.

Family meals specifically also provide insight into time spent with family. A recent systematic review identified a strong association between the frequency of family meals and the occurrence of risk behaviour.(68) For example, in a large national study of grade 6 through 12 students in the United States ($n=99,462$), when compared to infrequent family dinners (0-1 time per week), youth who had frequent family dinners (5-7 times per week) were at decreased risk of problem behaviours including illicit drug use three or more times in the past year (OR: 0.46; 95% CI: 0.42-0.51) and consuming three or more drinks in the past month (OR: 0.57; 95% CI:0.52-0.62).(69) Mealtimes can offer a time for parents to learn about their children's lives, facilitate communication and trust building and help parents to identify problem behaviours such as substance use.(68, 70)

A rural-specific understanding of time spent with parents and its relationship with substance use is lacking; however rural families recognize its importance in risk behaviour engagement. Rishel, Cottrell and Kingery asked 518 parent-adolescent dyads

and 440 adolescent service providers in rural West Virginia about adolescent risk behaviours and engagement and prevention strategies.(71) Youth reported that positive parental-adolescent communication was most strongly protective against engagement in risk behaviour ($r = -.36$, $p < 0.05$). Providers most frequently reported a lack of parental monitoring as a key contributor to youth risk behaviour (84% of providers).(71) These facets of parent-child relationships should be explored further with regards to prescription drug abuse in the unique context of rural environments.

Family structure and monitoring have been linked with substance use, with recent attention focusing on nonmedical use of prescription drugs. One study showed that students with parents who in the past year had not checked their homework (sometimes or frequently) and/or and had not given them positive encouragement (occasional or frequent) had 1.55 and 1.43 times the odds of nonmedical use of prescription opioids, respectively.(38) Compared to a single-parent household, rural youth who live in a two-parent household display a 32% reduction in nonmedical prescription drug use.(33) A few studies have demonstrated that living in a two-parent household reduces the risk of adolescent engagement in risky behaviours through increased parental monitoring.(72, 73) Data from the National Survey of Parents and Youth (N=4173) showed that youth from dual-parent households were monitored more closely than single-parented youth, and were less likely to use drugs. Using a path analysis, these researchers found that family structure affected parental monitoring ($\beta = -0.07$, $p < 0.001$ for single-mothers and $\beta = -0.04$, $p < 0.05$ for single-fathers), which predicted adolescents social and personal perceptions of drug use ($\beta = -0.27$ and $\beta = -0.26$, respectively, $p < 0.001$) and actual drug use one year later ($\beta = 0.37$ and $\beta = 0.24$, $p < 0.001$).(73) Parental monitoring has also been

shown in other studies to mitigate the effects of peer drug use.(72, 74)Time spent with family may increase parental supervision, which may be an important predictor of nonmedical or recreational use of prescription drugs, as with decreased supervision children may have more access to drugs, and more unsupervised, unstructured time opening opportunities for delinquency, including illicit drug use.

2.8.2 Time in structured activities

Academic and extracurricular activities are settings in which youth can create bonds with peers, teachers, and coaches, and to develop social roles. A large body of literature has examined the benefits of youth involvement in structured and supervised activities, focusing on organized activity contexts.(41, 75) For example, adolescent participation in extracurricular activities has been repeatedly linked with positive outcomes in academic performance, positive school-related affect,(76) promotion of new friendships,(77) and positive self-worth and self-concept.(78) Other findings show that extracurricular participation reduces the risk for adverse behaviours, such as adolescent smoking (RR: 0.4 and 0.3 for boys and girls respectively),(43) and reductions in violence.(79) This association may be particularly important for youth from lower socioeconomic status schools.(78) Schools with fewer opportunities for participation in high school extracurricular sports have displayed increased rates of “high-risk behaviours” including arrests, births and incidence of sexually transmitted disease.(80) The opportunity for extracurricular participation in rural schools or rural communities may be more limited than in larger communities. Qualitative interviews have indicated that rural adolescents may find a lack of available recreational opportunities in their communities,(65, 81, 82) and spend much of their leisure time with friends in

unstructured settings.(83) These experiences may contribute to increases in the recreational use of prescription medications.

School bonds,(15, 35, 84) *engagement*,(85) and/or *school connectedness*(22) are constructs that may protect against maladaptive adolescent behaviours such as substance use, and have been linked with the tendency to participate in extracurricular activities.(86, 87) Typically, measurements of school bonds, connectedness or engagement include items such as enjoying going to school, finding school work to be meaningful, classes are interesting, feeling well treated by teachers, feeling safe at school and feeling like you belong at school.(22, 35, 85) Associations with these low levels of these constructs have been made with nonmedical use of prescription drugs with odds ratios ranging from 1.31 to 2.7.(22, 35)

Taken together, these findings suggest that for young people in general, spending time engaging in structured and supervised activities helps to promote healthy adolescent development, and prevent maladaptive health behaviours including substance use. This has yet to be studied in a specifically rural context with regards to the recreational use of prescription medications for young people in Canada particularly.

2.8.3 Time with friends

Peer time may occur in structured or unstructured contexts, such as in school, in extracurricular activities, or in a young person's home or local neighborhood. Youth gain increasing independence throughout adolescence and begin to spend less time in structured contexts and more time unsupervised with friends.(88) Spending time with friends in unstructured contexts may put youth at increased risk for problem behaviour. For example, one study demonstrated that youth who spend most time with their friends

in unstructured settings (e.g., street, park settings) report higher rates of substance use than those who spend most time with friends in structured contexts (e.g., school).(74) Another study demonstrated that a high amount of unsupervised peer time after school was linked with externalizing behaviour problems (e.g., aggression, delinquency, hyperactivity) among early adolescents.(42) Similarly, earlier research from the Health Behaviour in School-aged Children Study indicated that one fifth of young people in the United States spend 5 or more evenings out with friends each week.(89) Following adjustment for grade, race, parental education, involvement and perception of neighborhood safety, compared with those who spent less than 2 evenings out, these boys and girls were 3.8 and 4.8 times more likely to consume alcohol at least once per month, and 3.3 and 7.2 times more likely to have smoked every day.(89) The degree to which peers use drugs has been demonstrated as an important predictor of young people's own substance use,(74, 90-92) and thus frequent unsupervised time with peers who use drugs may put youth at increased risk for nonmedical use of prescription drugs.

2.8.4 Theoretical framework

Adolescent delinquent behaviours such as substance use have been conceptualized through various theoretical frameworks including Hirschi's Control Theory of Delinquency.(93) Hirschi explains that conformity arises when an individual internalizes societal values and norms and integrates into prosocial groups. Bonds form between an individual and their environment that deter or encourage him or her from violating norms. Deviant behaviour such as drug use may jeopardize present and future conventional aspirations and therefore investment in conventional activities and goals limits deviant behaviour. Time and energy spent participating in conventional activities,

such as school and extracurricular activities, is important in creating or decreasing opportunities for deviant behaviour. Hirschi reminds us of the old adage that “idle hands are the devil’s workshop”. He explains that the degree to which a student will engage in problem behaviours, (e.g., substance use) varies by his or her involvement in more conventional behaviours such as academics, extracurricular sports or clubs.

2.8.5 Summary

As the rural environment changes and elevated rates of substance use are detected among rural youth, it is important that risk and protective factors in the rural environment be studied. Examining rural young people’s time-use as it relates to the recreational use of prescription drugs may have implications for education and community planning. A review of the relevant literature in June 2013 identified no existing studies examining the relationship between how a young person spends his or her time (e.g., whether they are involved in extracurricular activities, sports or clubs, how much time they spend with their family, or how much time they spend with friends outside of school) and the nonmedical use of prescription medications. Further, a specific rural analysis of these possible relationships does not exist. This kind of study is particularly relevant for rural and small town communities where recreational opportunities are often different, and perhaps more limited, than in urban settings. Particular time-use patterns may offer a protective effect for the nonmedical use of prescription drugs over others. Substance use rates remain problematic among rural youth. Therefore it is important that we understand more about the etiology, as well as potential avenues for intervention, to address this issue.

2.9 Rationale for objective 1

Although evidence suggests a rapidly escalating problem, there is limited epidemiological information about nonmedical use of prescription drugs among Canadian youth. While there are many reports describing risk and protective factors for alcohol, cannabis and tobacco use among young people in Canada, there is a significant dearth of information regarding patterns of nonmedical use of all three classes of controlled prescription drugs including pain relievers (opioid analgesics e.g., Oxycontin, Vicodin, etc.), stimulants (e.g., Adderall, Dexedrine), and central nervous system depressants (sedatives/tranquilizers; e.g., Ativan, Demerol, etc.) in this population and there are minimal studies examining geographic variations on risks for use.

As with many health issues facing Canadians today, there are often disproportionate effects among certain groups. Specific populations of adolescents are at disproportionately greater risk for using prescription drugs recreationally, such as females,(21, 25, 35) those of lower socioeconomic status,(25, 33-35, 38, 94) and young people living in rural areas.(33, 35, 94) These may signal health disparities, or unjust yet avoidable health differences,(95, 96) that should be further quantified and investigated in Canada. In this thesis, the definition of disparities follows from Braveman's definition, which defines a health disparity as a particular type of difference in health or influence on one's health (that could potentially be created or changed by policies); these differences systematically place socially disadvantaged groups at further disadvantage with respect to their health.(97) This definition of health disparities pertains to the issue at focus in this thesis. The nonmedical use of prescription drugs may differ based on different policies such as the availability of drugs or prescribing practices that exist among and for certain

subgroups. These practices may put certain groups of youth such as females, those of low SES, and those living rurally at greater health disadvantage from nonmedical use of prescription drugs.

The first objective of this thesis was to undertake a descriptive analysis of nonmedical use of stimulants, pain relievers and sedatives/tranquilizers among young adolescents Canadians from across the country by age, gender, socioeconomic, immigrant and geographic statuses. Identification of patterns among Canadian youth warrants exploration in order to provide foundational knowledge about the magnitude and nature of this public health problem. The results of this study could help to inform prevention efforts including the development of appropriate policy and intervention strategies at national, provincial and community levels.

2.10 Rationale for objective 2

While substance use generally has been perceived as an urban issue,(49, 50) certain types of drug use are indeed more prevalent among subgroups in rural populations.(50) In fact, in the United States, rural adolescents are at a significantly greater risk of using prescription drugs recreationally.(33, 94) Attention must be paid to the risk and protective factors eliciting such an increase in risk, particularly vulnerable subgroups, such as adolescents. Youth who participate in extracurricular activities and spend time in structured settings, with high levels of parental monitoring seem to be at lower risk for using substances. There is a substantial need for rural research in this area to identify health inequities and also protective factors for these potentially vulnerable populations. Therefore the second objective of this thesis was to examine associations between rural and small town adolescents' time-use and the nonmedical use of

prescription drugs. The results from this study could help to identify such factors and inform priority setting for educational and community planners.

2.11 Chapter 2 references

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Chapter 3

Recreational use of prescription medications among Canadian young people: Identifying disparities

3.1 Abstract

OBJECTIVES: While the recreational use of prescription medications is widely recognized as a growing public health issue, there are limited epidemiological studies on patterns of use in Canada, particularly studies identifying populations at highest risk. The objective of this study was to describe recreational prescription drug use among Canadian adolescents by age, gender, socioeconomic, immigration and geographic statuses.

METHODS: Data were obtained from grade 9 and 10 students participating in the 2009/2010 cycle of the nationally-representative Canadian Health Behaviour in School-aged Children Study (n=10,429). Students were asked about past-year recreational use of pain relievers, stimulants, and sedative/tranquilizer medications. Cross-tabulations and multi-level Poisson regression were conducted to evaluate the prevalence of use and to explore disparities.

RESULTS: Approximately 7% of students reported past-year recreational use of one or more prescription medication(s). Females reported 1.25 times the risk of recreational use of pain relievers as compared to males (95% CI: 1.04, 1.51). Lower SES students were 2.41 times more likely to report recreational use of any type of medication (95% CI: 1.94, 2.99). Recreational use of pain reliever medications was highest among rural youth living in close proximity to urban centres. Rates for all medications were similar between immigrant and non-immigrant students.

CONCLUSIONS: Recreational prescription drug use disproportionately affects certain subgroups of youth, including females, those of lower SES and those in some rural settings. These results provide foundational data to inform preventive efforts aimed at management of the nonmedical use and divergence of prescription medications.

3.2 Introduction

The nonmedical use of prescription medications is recognized as a pressing public health issue in Canada.(1) While there have been urgent calls for research and intervention development to manage this issue,(1) there are limited epidemiological studies on patterns of use in Canada, particularly studies that identify populations at highest risk, including adolescents.

To date, knowledge about the patterns of recreational use of prescription medications among sub-populations of Canadian youth is very limited. Results from an American survey indicate a 212% increase in nonmedical use of prescription drugs in adolescents ages 12-17 between 1992 and 2003.(2) This was 2.6-fold higher than the increase among adults, suggesting that adolescents are particularly vulnerable for nonmedical use of prescription drugs.(2) Reported rates of use among youth from grades 7 through 12 have varied from 5.9%,(3) to 15.5%.(4)

One established determinant of nonmedical use of prescription drugs among youth is older age. Between the ages of 12-15, the risk of engaging in nonmedical use of prescription drugs increases between 88%-130%.(5,6) Female gender is another commonly identified determinant, with females having 17%-50% greater risk.(7,8) Low socioeconomic status has also been significantly associated with nonmedical use of prescription drugs, with odds ratios ranging from 1.2-1.5.(5,7-9) Moreover, Canada is a country where immigrant youth comprise 9.2% of the population under 24 years.(10) While alcohol and illicit drug use studies indicate disparities,(11) it is unknown if nonmedical prescription drug use varies by whether a young person is Canadian born or not, or by length of residence in Canada.

The recently formed National Advisory Committee on Prescription Drug Misuse released a report in 2013 recommending a Pan-Canadian strategy, including an emphasis on conducting research to address knowledge gaps surrounding geographically remote and rural populations and the nonmedical use of prescription drugs.(1) The focus on rural and remote groups follows from studies from the United States that identify rurality as an important risk factor for opioid pain relievers in particular, with odds ratios ranging from 1.22 to 5.69.(5,8,12) Urban/rural patterns may be different, however when considering nonmedical stimulant or sedative use.(5,8)

A standard method for defining urban or rural areas for studies of geographic disparities in health does not exist. Population size and density are most commonly used, although there has been discussion and development of additional demarcation methods.(13) One study found that selected types of substance use increased with remoteness, for example, and not just with smaller or less dense rural populations.(14) A second study established farm and non-farm disparities showing that high school students residing on farms were at greater risk for using alcohol, smokeless tobacco, and illicit drugs than non-farm peers.(15) To our knowledge, only one Canadian study has examined the role of geography in the nonmedical use of prescription drugs among youth.(4) In that study, female adolescents who reported having used opioids nonmedically, had 1.95 times the odds of living in rural areas than in urban/suburban areas, as defined by population size.

A better understanding of differences in nonmedical use of prescription drugs among Canadian youth by age, gender, SES, immigrant status and geographic location is needed. Differences in use across population subgroups may represent unjust yet

avoidable differences,(16) that should be further quantified in the Canadian population. The aim of this study was to characterize recreational prescription drug use in subgroups of Canadian youth to help inform preventive strategies that focus on populations at higher risk. Findings may help identify directions for improving prescription practices, and highlight circumstances in which secure storage of medications is most warranted.

3.3 Methods

This was a descriptive epidemiological study employing cross-sectional analyses of the reported experiences of young adolescents in Canada. The primary focus was on variations in recreational use of prescription medications in a disaggregated analysis by age, gender, socioeconomic status, immigration status, and geographic status. These factors reflect important health determinants that underlie potential disparities in the nonmedical use of prescription medications. Medications of interest included pain relievers, stimulants and sedatives/tranquilizers.

Data source and sample

The Health Behaviour in School-aged Children study (HBSC) is a health survey of young people primarily ages 11 through 15 conducted in 43 countries or regions in collaboration with the World Health Organization. The purpose is to understand health behaviours and determinants of health in young people.(17) The data source for the present study was Cycle 6 of the Canadian HBSC conducted during the 2009-2010 school year in all Canadian provinces and territories except Prince Edward Island and New Brunswick. The Canadian HBSC sample was obtained using a two-stage cluster sample design, where schools were selected randomly and the class was the basic cluster.

Response rates were 84.6% at the province/territorial level and 57.0% at the school level; 77.0% of eligible students that were approached participated in the study. Active or passive consent was obtained depending on the school or school boards' policies for conducting classroom-based research. The final sample for this study was comprised of 10,429 Canadian students, primarily in grades 9-10. This study protocol received ethics approval from the Queen's University Research Ethics Board.

Study variables

Students indicated their birth year and month, the date of survey completion, and if they were male or female. A geographic location for each student was ascertained according to their school postal code. Their *geographic status* was then determined using Statistics Canada definitions.(13) Students were classified as living in *urban* areas if their school was in a census metropolitan (>100,000 population) or census agglomeration (>10,000 population) area. Students were identified to be living in *rural or small town* areas if their school was not in an urban area. Rural and small towns were then further classified into *Metropolitan Influenced Zones* (MIZ). These are founded upon principles of distance, adjacency and accessibility between urban centres and rural and small town areas.(13) They measure the degree to which urban centres influence rural and small town municipalities, as determined by commuting flows.(13) "Strong Metropolitan Influenced Zones" are census subdivisions where 30%-50% of the employed labour force commutes to work in an urban centre. "Moderate" MIZ (5.0% to 30% commuting flow) and "Weak" MIZ 0.1% to <5.0% were also identified. In a "No Metropolitan Influenced Zone", none of the employed labour force commuted to work. For the present study, Weak and No Metropolitan Influence Zones were combined into one group.

Socioeconomic status (SES) was determined at the individual student level using a 5-point student self-report Likert-like scale pertaining to how well off the student perceived their family to be. Responses were then categorized into three groups: (1) Low (not at all well off and not very well off), (2) Average, and (3) High (quite well off and very well off).

Immigrant status was determined using questions asking a student the country in which they were born and how long they have lived in Canada. Data corresponding to these items were categorized into: Born in Canada; immigrant > 5 years; or immigrant ≤ 5 years.

Recreational use of prescription medications. Using a categorical item with close-ended response categories, students were asked to indicate how frequently they have used pain relievers, stimulants and sedatives/tranquilizers “to get high” in the past year. Specific examples of drugs within each classification were provided. Response categories ranged from never to 40 times or more. Responses were subsequently grouped into ‘no use’ and ‘ever use’ for recreational purposes. Those who reported past-year recreational use of one or more medications ≥ 3 times were further categorized into frequent users, and those who reported using 1-2 times were categorized into infrequent users. This categorization has been previously used in the Ontario Student Drug Use and Health survey, which is a large Ontario-wide school-based survey that has produced reports on the drug use patterns of Ontario high school students every two years since 1977. In this survey, frequent drug use for all types of drugs is defined as use six or more times in the past year, however for some, potentially more harmful drugs, including prescription

medications they draw the distinction between using only one or twice from using three or more times in the past year.(18)

Survey weights and statistical analysis

Data were weighted by grade and province/territory to ensure the survey was nationally representative. If a specific grade group in a specific province or territory was overrepresented, those student responses were given a weight <1 while underrepresentation was corrected by weights of >1 (weights ranged from 0.017- 3.655). Cross-tabulations were conducted to estimate the proportion of youth within pre-defined subgroups who reported recreational use of medications. Proportions of infrequent and frequent users by subgroups were also estimated. Multilevel and multivariable Poisson regression was used to estimate the strengths of associations between the exposure variables of interest and reported prescription medication outcomes in a fully adjusted model. Adjusted relative risks (RR) as well as corresponding 95% confidence intervals were estimated. The model specified the hierarchical sampling design, accounting for the nested and clustered nature of the study sample, with students nested within schools. Random intercepts were assumed for schools, and fixed effects for the determinants of interest.

3.4 Results

Recreational use of prescription medications

A description of the study sample can be found in Table 1. Table 2 displays the proportion of youth who reported recreational use of any prescription medication in the past year, adjusted relative risk estimates and a p test for linear trend in variables with

more than two categories. Table 3 contains a breakdown of this information by specific medication types.

Older age was associated with increased risk for recreational use of prescription drugs. Proportions of past year use of any drug were 5.5%, 6.7% and 7.6% for students ≤ 14 years old, 15 years old and ≥ 16 years old, respectively ($p_{\text{trend}} < 0.01$). This difference was particularly notable for stimulant and sedative medications where risk of use among students 16 years and older was 1.7 and 2.0 times greater than for those in the youngest age group.

Girls report greater use of pain relievers than boys (5.5% vs. 4.6%; RR 1.24; 95% CI: 1.03, 1.48) whereas boys report slightly higher use of stimulant medications than girls (2.6% vs 2.2%). Sedative/tranquilizer use did not differ between genders.

Lower SES students report higher overall use as compared to high SES students (13.0% versus 5.5%, RR 2.43; 95% CI: 1.95, 3.02; $p_{\text{trend}} < 0.01$). For pain relievers, 10.0% of low SES students report past-year use, as compared to only 4.2% of high SES students (RR 2.32; 95% CI: 1.81, 2.98; $p_{\text{trend}} < 0.01$). Five and a half percent of low SES students report recreational use of stimulants, compared to 2.0% of their high SES counterparts (RR 2.70; 95% CI: 1.91, 3.81; $p_{\text{trend}} < 0.01$). Use of sedative/tranquilizer medications was least common; however, low SES students were 3.05 times more likely to report using them recreationally than high SES students (95% CI: 1.92, 4.88; $p_{\text{trend}} < 0.01$). Proportions of use were similar among those born in Canada, new immigrants, and those living in Canada for more than 5 years.

Compared to youth living in urban areas, those living in Strong Metropolitan Influenced Zones (with 30-50% commuting) were 2.39 times more likely to use any

prescription drug (95% CI: 1.03, 5.55) and 3.13 times more likely to use pain relievers (95% CI: 1.23, 8.01). Reports of recreational use of prescription drugs did not differ between the more remote geographic categories and urban areas.

Frequent recreational use of prescription medications

Approximately half of students who reported using prescription medications recreationally did so at least 3 times in the past year, operationally defined as “frequent use” (see Tables 4 and 5). Among medications used frequently, stimulants were most common (57.6%) followed by sedatives (53.4%) and pain relievers (43.5%). Age was not associated with frequent use of prescription medications. Boys were more likely to report frequent recreational use of prescription medications than girls (43% girls vs. 56% boys, adjusted RR 0.77; 95% CI: 0.61, 0.97). This gender-based pattern was most pronounced for stimulant medications (47% girls vs 68% boys; adjusted RR: 0.71; 95% CI: 0.49, 0.99). Due to the complete or quasi-separation of geographic and immigrant status variables for both frequent stimulant and frequent sedative use, they were excluded from these models.

3.5 Discussion

Our study provides foundational information about the recreational use of prescription medications by Canadians in their early adolescent years. Older age, female gender and lower SES were independently associated with increased risk for reported recreational use of prescription drugs. Recreational use of pain relievers was almost twice that of stimulants and three times that of sedatives/tranquilizers, with highest use among

girls, those of low SES, and among rural/small town youth living in rural areas with more metropolitan influence.

Increasing reports of recreational prescription drug use by age confirm findings from earlier studies.(3-6,8,19) However, the prevalence of recreational prescription drug use was slightly lower than levels reported by previous studies of Canadian youth.(4,6) This may be due to our younger adolescent sample. There is need to identify patterns specific to this young age group, as U.S. evidence suggests that the mean age for initial nonmedical prescription drug use may be as early as 13 years old.(9) Our examination of frequent use of these drugs was unique, however, and we did not identify strong age-related patterns. While age is an important predictor of drug experimentation,(20) the median age for substance abuse disorders may not be until early adulthood (19-21 years),(21) perhaps explaining why more problematic use was not apparent in our relatively youthful sample.

Reported patterns of recreational drug use by males and females differed by type of medication. Use of pain reliever medications was higher among females, while slightly higher use of stimulant medications was reported by males. Females are more likely to be prescribed opioid medications than males, (22) and therefore may use their own prescriptions recreationally more often.(23) Our gender-based finding for increased nonmedical stimulant use is consistent with that of a study conducted in the Atlantic provinces, where males reported more nonmedical use, regardless of their attention deficit hyperactivity disorder symptomatology.(24)

Geographic patterns of recreational use of prescription drugs highlighted in this study are also notable. Findings point to substantial intra-rural variability with respect to

nonmedical use of opioid medications. Students living in rural areas subject to strong urban influence appear to report use of these drugs most commonly. While these results build upon earlier findings that emphasize rural drug use patterns,(4,5,8) the patterns highlighted here emphasize a particular urban-rural pattern that possibly surrounds access to prescription medications in specific geographic areas. Contrary to a past study that suggested an urban-rural gradient,(14) we found the highest levels in rural areas that are more proximal and accessible to urban settings.

There is some evidence that health service access and utilization by people in rural areas proximal to urban centres is more similar to that of people living in urban centres, and different from those in other rural areas.(25,26) Others have reported that rural people living adjacent to urban centres are more likely to have a regular medical doctor, than those living more remotely (OR: 0.62 95% CI: 0.53, 0.74).(25) Rates of specialist physician consults are also higher among these rural areas than those further away (27.1%, 24.6% and 22.8% for Strong Metropolitan Influence, Moderate Metropolitan Influence and Weak/No Metropolitan Influence, respectively).(25) Access to prescriptions for controlled medications may follow this pattern, and be more readily available for rural residents living adjacent to urban cores. This may also relate to the number and influence of illicit suppliers in urban areas.(27)

There are other explanations for the excess recreational use of prescription medications in certain types of geographic communities. First, because use of some medical services is higher in these proximal rural areas, there may be a greater volume of unused medications in home medical cabinets.(25) Second, older adults are the most likely group to receive controlled medications due to chronic conditions and pain,(28)

and therefore a greater volume of controlled medications may be present in some rural areas due to relatively older population structures. Third, when rural residents do obtain prescriptions, they may be more likely to save or stockpile excess amounts for future use if they are concerned that future access may not be convenient or readily available, for example due to higher dispensing fees in rural areas.(29) Fourth, rural youth may spend more of their time in unstructured and unsupervised activities, and thus may be at greater risk for delinquent behaviour, including drug use.(30) All of these ideas are speculative, and further investigation into the root causes of this geographic pattern is clearly warranted.

Strengths of this study include its use of a nationally representative sample that was of adequate size to detect most sub-group differences, the uniqueness of our data, and our emphasis on disaggregation of the analysis by important sub-groups of youth. Limitations also warrant comment. Information about drug use was obtained through self-report, which may be subject to social desirability bias and result in some misclassification. We believe, however, that these possible biases would be non-differential among subgroups, thereby potentially underestimating, and not overestimating, effect estimates. Another limitation is that young people living on First Nations reserves, incarcerated youth, homeschooled students, students who did not have consent, those who were absent on the day of the survey and those attending private schools were excluded. This limits our comparisons of groups that may be particularly vulnerable to recreational use of these drugs. We also do not have any information about the method or dose of drug administration, information which would be helpful in signalling more problematic use. All of these limitations point to the need for more

refined study of this important and emerging public health issue for adolescent Canadians.

Conclusions

The nonmedical use of prescription medications is an important public health issue in Canada. Nearly 7% of Canadian youth reported recreational use of prescription medications in the past year, and approximately half reported use of them three or more times. Recreational use of pain relievers was most common, and was highest among youth living in rural areas proximal to urban centres. Findings from this study could help inform preventive interventions, such as efforts to promote parental vigilance and other strategies to restrict access to leftover medications particularly in rural settings. Future research should consider the diversity of rural communities and particularly the risk factors that may be in place in vulnerable rural locations.

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Table 1. Characteristics of the 2009-2010 cycle of the Canadian HBSC sample

	Characteristic	% (95% CI)
Age	<=14	35.0 (34.1, 36.0)
	15	45.9 (44.9, 46.8)
	>=16	19.1 (18.4, 19.9)
Gender	Boys	48.3 (47.3, 49.2)
	Girls	51.7 (50.8, 52.7)
SES	High	55.2 (54.2, 56.1)
	Average	35.7 (34.8, 36.7)
	Low	9.1 (8.6, 9.7)
Immigrant Status	Born in Canada	76.0 (75.2, 76.9)
	Immigrant > 5 yrs	19.7 (19.0, 20.5)
	Immigrant ≤ 5 yrs	4.3 (3.9, 4.7)
Geographic Status	Urban	77.1 (76.2, 77.9)
	Strong MIZ*	0.7 (0.6, 0.9)
	Moderate MIZ*	15.9 (5.2, 16.6)
	Weak or No MIZ*	6.3 (5.8, 6.8)

*MIZ is the acronym for Metropolitan Influenced Zones

Table 2. Proportions and results from multiple Poisson regression analysis for recreational use of any type of prescription medication by demographic characteristics from the 2009-2010 HBSC Survey

		Any medication %	RR (95% CI)
	Overall	6.5 (6.0, 7.0)	
Age	≤14	5.5 (4.6, 6.4)	1.00
	15	6.7 (6.0, 7.5)	1.23 (1.02, 1.49)
	≥16	7.6 (6.5, 8.9)	1.41 (1.12, 1.78)
	P trend		<0.01
Gender	Boys	6.1 (5.4, 6.8)	1.00
	Girls	6.8 (6.2, 7.5)	1.13 (0.96, 1.34)
SES	High	5.5 (4.9, 6.1)	1.00
	Average	6.2 (5.5, 7.1)	1.13 (0.95, 1.32)
	Low	13 (11.1, 15.6)	2.41 (1.94, 2.99)
	P trend		<0.01
Immigrant Status	Born in Canada	6.6 (6.1, 7.2)	1.00
	Immigrant > 5 yrs	6.5 (4.0, 8.8)	1.02 (0.83, 1.24)
	Immigrant ≤ 5 yrs	6.0 (5.4, 7.6)	1.06 (0.69, 1.61)
	P trend		0.79
Geographic Status	Urban	6.6 (6.1, 7.2)	1.00
	Strong MIZ**	14.2 (7.0, 24.0)	2.39 (1.03, 5.55)
	Moderate MIZ**	5.4 (4.4, 6.7)	0.9263 (0.66, 1.29)
	Weak /No MIZ**	6.5 (4.7, 8.7)	1.01 (0.67, 1.51)
	P trend		0.79

* MIZ is the acronym for Metropolitan Influenced Zone

† Model was adjusted for age, gender, SES, immigrant and geographic statuses

Table 3. Proportions and results of Poisson regression analysis for any recreational use of pain relievers, stimulants and sedative medications by demographic characteristics from the 2009-2010 HBSC Survey

		Pain relievers		Stimulants		Sedatives	
		% (95% CI)	RR (95% CI)	% (95% CI)	RR (95% CI)	% (95% CI)	RR (95% CI)
Age	Overall	5.1 (4.7, 5.5)		2.4 (2.1, 2.7)		1.4 (1.2, 1.7)	
	≤14	4.3 (3.7, 5.1)	1.00	2 (1.6, 2.5)	1.00	1.3 (1.0, 1.8)	1.00
	15	5.5 (4.8, 6.2)	1.37 (1.09, 1.72)	2.1 (1.7, 2.5)	0.96 (0.69, 1.34)	0.9 (0.6, 1.2)	0.64 (0.41, 0.99)
	≥16	5.5 (4.5, 6.6)	1.49 (1.11, 2.00)	3.9 (3.1, 4.9)	1.66 (1.17, 2.36)	2.9 (2.1, 3.7)	1.97 (1.28, 3.04)
	P trend		<0.01		<0.01		<0.01
Gender	Boys	4.6 (4.0, 5.2)	1.00	2.6 (2.1, 3.1)	1.00	1.4 (1.1, 1.8)	1.00
	Girls	5.5 (4.9, 6.2)	1.25 (1.04, 1.51)	2.2 (1.9, 2.7)	0.86 (0.66, 1.12)	1.4 (1.1, 1.8)	1.02 (0.72, 1.46)
SES	High	4.2 (3.7, 4.8)		2 (1.6, 2.5)	1.00	1.0 (0.8, 1.3)	1.00
	Average	5 (4.3, 5.8)	1.12 (0.91, 1.36)	2.2 (1.7, 2.5)	1.19 (0.89, 1.60)	1.5 (1.2, 2.0)	1.52 (1.03, 2.23)
	Low	10 (8.2, 12.3)	2.32 (1.81, 2.98)	5.4 (3.1, 4.9)	2.70 (1.91, 3.81)	3.1 (2.1, 4.5)	3.05 (1.92, 4.88)
	P trend		<0.01		<0.01		<0.01
Immigrant Status	Born in Canada	5.1 (4.6, 5.6)	1.00	2.4 (2.1, 2.8)	1.00	1.4 (1.1, 1.7)	1.00
	Immigrant > 5 yrs	5.1 (3.5, 8.2)	1.03 (0.82, 1.30)	2.4 (1.3, 4.7)	0.90 (0.64, 1.26)	1.4 (1.1, 4.3)	1.09 (0.71, 1.68)
	Immigrant ≤ 5 yrs	5.5 (4.2, 6.1)	1.27 (0.81, 1.98)	2.4 (1.8, 3.2)	1.14 (0.59, 2.22)	2.2 (0.9, 2.0)	1.71 (0.84, 3.47)
	P trend		0.74		0.74		0.39
Geographic Status	Urban	5 (4.6, 5.6)	1.00	2.5 (2.1, 2.9)	1.00	1.5 (1.2, 1.8)	1.00
	Strong MIZ*	14.2 (7.5, 24.7)	3.13 (1.23, 8.01)	1.8 (0.2, 8.4)	1.02 (0.14, 7.39)	1.8 (0.1, 8.4)	1.83 (0.24, 14.19)
	Moderate MIZ*	4.5 (3.6, 5.7)	1.03 (0.70, 1.52)	2.1 (1.4, 2.9)	1.07 (0.62, 1.84)	1.1 (0.6, 1.7)	0.73 (0.35, 1.52)
	Weak/ No MIZ*	5.7 (4.0, 7.8)	1.16 (0.73, 1.84)	2.2 (1.3, 3.8)	1.00 (0.51, 1.98)	1.5 (0.8, 3.0)	1.12 (0.49, 2.54)
	P trend		0.61		0.99		0.68

* MIZ is the acronym for Metropolitan Influenced Zone

† Model was adjusted for age, gender, SES, immigrant and geographic statuses

Table 4. Proportions and results of Poisson regression analysis for frequent recreational use of any prescription drug by demographic characteristics in the 2009-2010 HBSC Survey

		Frequent use of any prescription drug	
		% (95% CI)	RR (95% CI)
Age	Overall	51.1 (44.9, 52.8)	
	≤14	49.5 (42.3, 56.7)	1.00
	15	44.3 (28.9, 50.3)	0.79 (0.28, 2.22)
	≥16	57.8 (61.2, 81.3)	0.89 (0.68, 1.16)
	P trend		0.38
Gender	Girls	43.4 (38.4, 48.8)	0.77 (0.61, 0.97)
	Boys	55.6 (49.6, 61.4)	1.00
SES	High	43.8 (38.1, 49.6)	1.00
	Average	51.2 (44.6, 58.1)	1.21 (0.94, 1.57)
	Low	56.1 (46.5, 65.1)	1.34 (0.99, 1.81)
	P trend		0.04
Immigrant Status	Born in Canada	50.6 (46.1, 55.1)	1.00
	Immigrant > 5y	40.2 (36.9, 77.2)	0.77 (0.56, 1.05)
	Immigrant ≤ 5 y	56.7 (31.9, 49.6)	1.01 (0.58, 1.76)
	P trend		0.13
Geographic Status	Urban	48.7 (44.4, 53.3)	1.00
	Strong MIZ*	34.9 (13.7, 72.6)	0.79 (0.28, 2.23)
	Moderate MIZ*	54.6 (43.0, 64.6)	1.06 (0.77, 0.46)
	Weak/No MIZ*	42.1 (26.7, 57.8)	0.88 (0.54, 1.45)
	P trend		0.83

* MIZ is the acronym for Metropolitan Influenced Zone

† Model was adjusted for age, gender, SES, immigrant and geographic statuses

Table 5. Proportions and results of Poisson regression analysis of frequent recreational users of prescription drugs by demographic characteristics in the 2009-2010 HBSC Survey

		Pain relievers		Stimulants		Sedatives	
		% (95% CI)	RR (95% CI)	% (95% CI)	RR (95% CI)	% (95% CI)	RR (95% CI)
Overall		43.5 (39.1, 47.8)		57.6 (51.2, 64.0)		53.4 (45.0, 62.0)	
Age	≤14	45.1 (37.0, 53.3)	1.00	60.1 (46.9, 70.9)	1.00	55.7 (40.2, 69.5)	1.00
	15	41.5 (35.6, 48.0)	0.92 (0.67, 1.26)	48.3 (37.7, 58.3)	0.77 (0.49, 1.19)	52.4 (28.5, 56.7)	0.95 (0.52, 1.75)
	≥16	45.9 (35.9, 55.7)	1.00 (0.68, 1.48)	67.4 (55.6, 77.7)	1.01 (0.66, 1.55)	52.0 (38.8, 66.5)	0.72 (0.39, 1.33)
	P trend		0.97		0.51		0.52
Gender	Girls	39.9 (34.2, 45.8)	0.80 (0.60, 1.05)	46.6 (37.8, 56.4)	0.71 (0.49, 0.99)	49.2 (37.0, 60.5)	0.83 (0.51, 1.36)
	Boys	48.3 (41.5, 55.3)	1.00	68.3 (59.4, 76.6)	1.00	58.0 (46.3, 70.8)	1.00
SES	High	39.5 (33.1, 46.1)	1.00	56.5 (47.1, 66.2)	1.00	52.6 (38.0, 65.5)	1.00
	Average	47 (39.7, 54.8)	1.19 (0.88, 1.61)	55.6 (43.5, 66.3)	0.98 (0.65, 1.48)	57.3 (42.4, 69.9)	0.85 (0.47, 1.53)
	Low	46.9 (36.0, 57.5)	1.23 (0.84, 1.79)	63.8 (47.3, 75.7)	1.15 (0.74, 1.80)	45.7 (29.2, 67.7)	0.85 (0.42, 1.72)
	P trend		0.20		0.43		0.73
Immigrant Status	Born in Canada	46.3 (40.8, 51.0)	1.00	57.6 (50.2, 64.9)		51.5 (40.1, 59.9)	
	Immigrant > 5y	30.9 (28.8, 71.2)	0.69 (0.47, 1.03)	53.5 (44.2, 96.5)		44.8 (62.9, 1.00)	
	Immigrant ≤ 5 y	48.6 (22.6, 41.5)	0.99 (0.53, 1.86)	77.6 (38.2, 67.6)		100 (26.0, 64.4)	
	P trend		0.07				
Geographic Status	Urban	43.1 (38.1, 48.1)	1.00	58.5 (51.1, 65.4)		53.3 (43.9, 63.0)	
	Strong MIZ*	34.9 (13.7, 72.6)	0.84, 0.29, 2.39)	100 (9.5, 100.0)		100 (9.5, 100.0)	
	Moderate MIZ*	50.6 (38.1, 61.9)	1.09 (0.74, 1.59)	57.8 (39.4, 74.1)		49.5 (23.9, 71.5)	
	Weak/ No MIZ*	36.6 (21.3, 53.8)	0.89 (0.50, 1.58)	41.3 (18.8, 70.4)		55.2 (20.1, 79.9)	
	P trend		0.94				

* MIZ is the acronym for Metropolitan Influenced Zone

† Model was adjusted for age, gender, SES, immigrant and geographic statuses

Chapter 4

Time-use patterns and the recreational use of prescription medications among rural and small town youth

4.1 Abstract

Young people in rural and small town settings are at increased risk for recreational prescription drug use. Rural students in grades 9 and 10 (n=2,393) were asked about past-year recreational use of prescription medications and their time-use in structured and unstructured activity contexts in the 2009/2010 Cycle of the Canadian Health Behaviour in School-aged Children survey. Time-use patterns of rural and small town youth from across Canada were examined using multi-level, multivariate Poisson regression analyses to determine whether they may impact the risk of this kind of substance use. Peer time outside school hours and non-participation in extracurricular activities were significantly associated with rural youths' recreational use of prescription drugs. Peer drug use, unhappy home lives and frequent binge drinking explained most of these associations. Structured and unstructured activity contexts play a role in the nonmedical use of prescription medications. Results support interventions aimed at increasing structured time-use opportunities in addition to focusing on peer contexts and multiple risk-taking behaviors among rural youth.

4.2 Introduction

Substance use among adolescents is a serious public health concern overall, and this is particularly true for rural and small town communities across North America (Gfroerer et al., 2007). Prevalence rates of nonmedical use of prescription drugs in rural and small town settings have escalated well beyond urban areas (Leukefeld et al., 2007). A number of recent studies from both the United States and Canada have demonstrated increased risks in nonmedical use of prescription drugs among rural and small town youth, ranging from 1.26 to 3.32 times that of their urban peers, with opioid use receiving particular attention (Havens et al., 2011; Wu et al., 2008). While this is problematic, risk factors for this emerging type of substance use remain understudied in these contexts.

Over the past 40 years, social scientists have focused a great deal of effort on studying young people's familial, peer, school, and community experiences in order to understand risk behaviors such as substance use. Hirschi's Control Theory of Delinquency is one seminal theoretical perspective. This theory emphasizes the importance of social relationships and of social or community engagement in the prevention of, or participation in, risk behaviors. The degree to which a young person will exhibit problem behaviors, (e.g., substance use) varies by their engagement in more conventional behaviors such as academics or extracurricular activities. Deviant activities such as drug use may jeopardize healthy developmental trajectories, while strong commitment to conventional activities can limit deviant behavior (Hirschi, 2009).

Since Hirschi's influential work on the Control Theory of Delinquency, many researchers have quantified the relationships that he described. For example, much empirical work has examined structured activity contexts as opposed to unstructured

activity contexts in relation to deviant behavior (Bartko and Eccles, 2003; Blomfield and Barber, 2011; Jiang and Peterson, 2012). Structured activity contexts typically involve some degree of constraints, supervision, goal-setting, or skill-building. Conversely, unstructured activity contexts are usually characterized by leisure-time outside of school hours, may involve unsupervised time alone or with friends (Larson, 2000). The following section will briefly review the contribution of time-use in structured and unstructured contexts to adolescent problem behaviors, including substance use. At focus here is time with family, time with friends in afterschool and evening periods, and time spent participating in organized extracurricular activities.

Time with family

Familial relationships are highly influential in shaping youth behaviors with links being made to dual versus single parenthood (Havens et al., 2011; Hemovich et al., 2011), parental supervision and involvement (Kiesner et al., 2010; Pettit et al., 1999), and the amount of time spent with family (Barnes et al., 2007). In the latter case, time spent with family during meals specifically has been identified as a way to operationalize the measurement of parental closeness and monitoring (Skeer and Ballard, 2013). Mealtimes can offer opportunities for parents to learn about their children's lives, facilitate communication and trust-building, and help parents identify problematic behaviors such as substance use. (Skeer and Ballard, 2013) In a large national study of grade 6 through 12 students in the United States (n=99,462), as compared to infrequent family dinners (0-1 time per week), frequent family dinners (5-7 times per week) was inversely associated with the occurrence of high risk behaviors such as illicit drug use ≥ 3 times in the past year (OR=0.46, 95% CI: 0.42, 0.51) and consuming ≥ 3 drinks in the past month (OR:

0.57, 95% CI:0.52, 0.62) (Fulkerson et al., 2006). A recent systematic review identified strong associations between less frequent family meals and the occurrence of risk behavior (Skeer and Ballard, 2013). While a specifically rural analysis of substance use and the frequency of family meals has not yet been offered, parental monitoring is indeed a concern for rural families as cited in a recent study of rural parent-adolescent dyads and adolescent service providers (Rishel et al., 2012).

Time with friends

Time spent with friends may occur in structured contexts, such as at school, at home with adult supervision, or in organized recreational activities. However, between the ages of 10 to 18, youth gain increased independence and begin to spend less time with their family and in structured activities and more time with friends in unstructured activities (Larson et al., 1996). Youth who spend time in unstructured, unsupervised settings outside of school hours with their friends may be at an increased risk of problem behavior (Flannery et al., 1999; Gage et al., 2005; Pettit et al., 1999). In an often-cited study of 438 early adolescents in three mid-sized U.S. cities, Pettit and colleagues found that the amount of time spent unsupervised with peers in the *afterschool* period predicted externalizing behavioral problems (i.e., aggression, delinquency, and hyperactivity) (Pettit et al., 1999), while links have also been established with use of other substances (Flannery et al., 1999). Previous research using data from the Health Behaviour in School-aged Children Study indicated that following adjustment for grade, race/ethnicity, parental education, parental involvement with school, ease of talking with parents and perception of neighborhood safety, young people who spent five or more *evenings* out with friends each week were 3.8 and 4.8 times more likely to drink alcohol each month

and 3.3 and 7.2 times more likely to smoke daily, for boys and girls respectively (Gage et al., 2005). Other researchers asked youth where they spend most of their time with their friends; they found that youth who said they spend most time with their friends in street or park settings reported higher rates of substance use than those who said they spend most time with their friends at school (Kiesner et al., 2010).

Extracurricular participation

Extracurricular activity contexts differ from unstructured contexts because they are often characterized by the presence of adult supervision, rules, constraints and goals which emphasize skill-building (Larson, 2000). Extracurricular participation has been repeatedly linked with positive outcomes in academic performance, school-related affect (Knifsend and Graham, 2012), self-worth and self-concept (Blomfield and Barber, 2011). Extracurricular participation also may reduce the occurrence of adverse behaviors, including reductions in violence (Jiang and Peterson, 2012), and smoking (Simantov et al., 2000).

The opportunity for extracurricular participation in rural schools or rural communities may be more limited than in larger communities. Schools with fewer opportunities for participation in high-school extracurricular sports display increased signs of high-risk behaviors including arrests, births and the incidence of sexually transmitted infections (Cohen et al., 2007). A number of studies have indicated that rural adolescents often find a lack of structured recreational opportunities in their communities (Moreland et al., 2013; Quine et al., 2003), and spend much of their leisure time in the home with friends, where they report accessing and using substances and sharing them among peers (Pettigrew et al., 2012).

Recreational use of prescription drugs is disproportionately problematic among rural youth, and attention to the risk and protective factors eliciting such an increase is needed. Previous studies indicate that youth who spend time with their parents, and who spend time with peers in structured contexts, including those who participate in extracurricular activities, are at lower risk for using substances in general. This has yet to be specifically studied in a rural context with regards to the recreational use of prescription medications. Therefore, the aim of this study was to examine the relationship between four contexts of rural and small town adolescent's time-use (family meals; time with friends after school; time with friends in the evenings; and extracurricular participation) and the nonmedical use of prescription drugs. It is anticipated that results from this study may help to identify important time-use patterns and highlight how these may be affecting the recreational use of prescription medication. These findings can inform priority setting exercises for educational and community policy makers and planners in rural and small town contexts.

4.3 Methods

Data source. The Health Behaviour in School-aged Children Study (HBSC) is an international survey conducted in 43 countries in collaboration with the World Health Organization. Its overall aim is to understand the health and health behaviors of young people worldwide (Currie et al., 2010). The data source for this study was the 2009/2010 cycle of the Canadian HBSC.

Study sample. There were 10,429 secondary school students in grades 9 and 10 sampled in the Canadian HBSC. The students ranged in age typically from 14-16 years and were from all provinces across Canada except Prince Edward Island and New

Brunswick. The study used a two-stage cluster sample design where the school was the basic cluster. Active or passive consent was obtained depending on the school boards' policies for conducting classroom-based research. A geographic location for each student was ascertained by school postal code. The HBSC sample included 2,393 students living in rural and small towns as per Statistics Canada definitions (population <10, 000) (McNiven et al., 2000) who were selected for inclusion into this study.

Exposure variables. The current study focused on three different areas of young people's time-use: time with friends, time spent in extracurricular activities, and time with family. Students were asked to indicate how many days per week they spend time with friends right *after school*. Possible responses ranged from one to five days. Responses were categorized into few days (0-1), some days (2-3) and most days (4-5). Students also indicated the frequency to which they spend *evenings* out with friends. Possible responses ranged from one to seven evenings. Students were grouped into spending few evenings (0-1), some evenings (2-4) and most evenings (5-7) with friends per week. This categorization has been used previously in studies of unstructured peer time and substance use risk (Gage et al., 2005).

Time spent in extracurricular activities was determined by asking students whether or not they participate in sport teams, voluntary service, political organizations, church or religious groups, or other extracurricular activities. Separate yes/no questions were provided for each type of extracurricular involvement. Students were considered to be involved in extracurricular activities if they responded yes to at least one type of extracurricular activity, otherwise they were considered to be not involved.

For time spent with family, students specified the number of times per week their family sits down at the table together for dinner/supper (*family dinners*). Responses ranged from one to seven days, and were grouped into few (0-1), some (2-4) or most (5-7) dinners per week. This categorization has been used previously in a large cross-sectional survey of family meals and the occurrence of substance use and other risk behaviors among adolescents (Fulkerson et al., 2006).

Outcome variable. Nonmedical use of prescription drugs was ascertained by asking students if they have used either pain relievers, stimulants or sedative medications “to get high” in the past 12 months, and examples of each class of drug were given. If they indicated they had used at least one of the medications they were classified into ‘any use’, and otherwise ‘no use’.

Covariates and other potential explanatory variables. Demographic variables including age, gender, and socioeconomic status (low, average and high) have been identified as important determinants of the nonmedical use of prescription drugs and are thus included as covariates (Ford, 2009; Wu et al., 2008). Additionally, based on a review of pertinent literature, factors that have been associated with adolescent substance use and/or time-use were examined as explanatory factors in the relationships between the time-use variables and drug use outcome. These factors include items surrounding peer drug use or personal use of other substances (King et al., 2013), emotional factors (Currie and Wild, 2012), family structure (Havens et al., 2011) and cohesion (Ford, 2009), and community features (Quine et al., 2003).

The specific covariates that were assessed for this study related to other substance use were: peer drug use (never/rarely; sometimes; often; I don’t know); binge drinking

(never or rarely; \leq once per month; 2-4 times per month; $>$ twice per month); and past-year cannabis use (\geq once or no use). Emotional wellbeing covariates included life satisfaction (Cantril ladder from worst possible life to best possible life, ranked 0-10; low life satisfaction ≤ 6 ; high life satisfaction ≥ 7) (Cantril, 1965) and school connectedness (based on an eight-item scale of attitudes towards school categorized into low; medium; high). Family-related covariates included whether or not there were at least two adults living in the home and whether a student reported having a happy home life (happy; unhappy; or neither).

Previous research has shown variability in substance use by the distance between rural municipalities and urban centers (Rhew et al., 2011). For this study, students living in rural and small town locations were classified into living in *Metropolitan Influenced Zones* (MIZ) as first defined by the Geography Division of Statistics Canada (McNiven et al., 2000). MIZ classifications relate to the degree to which urban centers influence rural and small town municipalities. They are measured by examining commuting flows and are founded upon principles of distance, adjacency and accessibility. “Strong Metropolitan Influenced Zones” are rural and small town census subdivisions where 30%-50% of the employed labour force commutes to work in an urban centre. “Moderate” MIZ (5.0% to 30% commuting flow) and “Weak” MIZ 0.1% to $<5.0\%$ were also identified. In a “No Metropolitan Influenced Zone”, none of the employed labour force commuted to work (McNiven et al., 2000). For the present study, areas of Weak and No Metropolitan Influence were combined into one group.

Finally, because some young people who live in rural environments express feelings of boredom within their communities and claim a lack of recreational

opportunities (Quine et al., 2003), we investigated whether or not students' perceptions of whether there were places within their community in which to spend free time confounds the relationship between time-use and recreational prescription drug use. Answers were grouped into agree, neither agree nor disagree and disagree. A list of all variables used in the analyses is provided as part of Figure 1.

Survey weights and statistical analysis

Data were weighted by grade and province or territory at the analysis stage to ensure the sample remained nationally-representative. If a particular grade group in a specific province or territory was over-represented, those student responses were given a weight <1 while under-representation was corrected by weights of >1 (weights ranged from 0.017 to 3.655).

Multi-level, multivariate Poisson regression modeling was used to generate direct estimates of relative risk, employing generalized linear mixed models with a log link function. Figure 1 is a framework for the study analyses. All time-use predictors and covariates of interest were initially screened bivariately with the outcome variable of interest. We proceeded to investigate whether the bivariate relationships for our time-use predictors of interest and nonmedical use of prescription drugs persisted or changed when adjusted for sociodemographic covariates (age, gender and SES). Next, a multivariate regression model using a backwards selection criteria of $p < 0.2$ identified a parsimonious list of important risk factors related to the recreational use of prescription medications. Finally, we tested the contributions of each of the time-use predictors, through four explanatory models, while accounting for other important risk factors identified in the previous step, as well as age, gender and SES. Adjusted relative risk estimates and 95%

confidence intervals were generated to estimate the measures of effect. The regression models specified the hierarchical sampling design, accounting for the nested and clustered nature of the study sample, with students nested within schools. Random intercepts were assumed for schools, and fixed effects for the determinants of interest. All statistical procedures for this paper were performed using SAS software, Version 9.3 of the SAS System for Windows. (Copyright © 2012, SAS Institute Inc., Cary, NC)

4.4 Results

Participant characteristics:

Table 1 displays a description of the rural and small town study sample of youth, as well as proportions of nonmedical use of prescription drugs by four time-use variables, demographic variables and other potential explanatory risk factors or covariates.

Demographics. Approximately half of the study sample was 15 years of age, 35.6% were younger and 16.3% were older. The sample was 52.9% female, and 53.5% were of high socioeconomic status, 38.0% average and 8.5% low socioeconomic status. Most students lived in Moderate Metropolitan Influenced Zones (69%) where <30% of the working population commutes to an urban center.

Time-use variables. Twenty-three percent of young people from rural and small town settings reported spending most days (4-5 days) with their friends after school, 41.5% spend some days (2-3 days) and 35.3% spend few days (0-1 day) with friends right after school. With respect to time spent with friends in the evenings, 16.8% of rural and small town youth reported spending most evenings (5+ evenings) out with their friends; 50.3% spent some (2-4 evenings) and 32.8% spend few (0-1 evenings) out with their friends. Most rural and small town young people reported participating in at least

one extracurricular activity (74.5%). Over half of the sample ate dinner with their families most nights of the week (5+; 56.6%), and 16.5% reported eating dinners with their families only once or zero times per week.

Covariates. Twenty-seven percent of rural and small town youth reported past-year use of cannabis. Sixteen percent reported binge drinking 2-4 times per month, and 2.9% reported binge drinking multiple times per week. The large majority of youth reported having a happy home life (72.3%), and that they had high life-satisfaction (73.8%). Approximately 37.0% of the sample indicated that those in their peer group use drugs, either sometimes (24.6%) or often (13.4%). A greater proportion of youth reported feelings of low school connectedness (35.6%) than high school connectedness (23.6%). Most rural and small town youth reported living with at least two adults (80.2%). Twenty-nine percent of youth said good places to spend free time did not exist in their communities.

Regression analyses:

Following regression analyses using backwards selection, our parsimonious list of covariates included frequency of binge drinking, having a happy home life and peer drug use. Cannabis use, life satisfaction, school connectedness, living with two adults, places to spend free time and proximity to an urban center were not associated with recreational use of prescription drugs ($p>0.05$) after accounting for the other covariates. Age, gender and SES were kept in the regression models due to previous literature suggesting strong links with nonmedical prescription drug use (Ford, 2009; Wu et al., 2008).

Time with friends. Spending most afternoons with friends, as compared to few afternoons with friends, was associated with a 1.73 (95% CI: 1.10, 2.73) increase in the

risk of recreational use of prescription medications following adjustment for age, gender and SES. The association between spending most afternoons with friends did not remain after further adjustment for binge drinking, happy home life and peer drug use. Those who have peers who use drugs often were 6.74 (95% CI: 3.84, 11.82) times more likely to report past-year recreational use of prescription medications than those whose peers never or rarely use drugs. Students reporting an unhappy home life were 2.46 (95% CI: 1.52, 3.98) times more likely to report use. Frequent binge drinking (2+ times/week) was also associated with the recreational use of prescription drugs (RR: 2.22; 95% CI: 1.13, 4.38).

Spending most evenings out with friends was associated with a 2.16 times increase in recreational use of prescription drugs, compared to spending one or no evenings with friends per week, adjusted for age, gender and SES (95% CI: 1.30, 3.60). This association was no longer statistically significant, however, after further adjustment for peer drug use, happy home life and binge drinking. Frequent peer drug use predicted a 6.78 times increase in reports of past-year recreational use of prescription drugs than those students with rare or no peer drug use (95% CI: 3.86, 11.89). Students with unhappy home lives were 2.43 times more likely to report recreational use of prescription drugs (95% CI: 1.50, 3.93). Those who reported binge drinking two or more times per week had 2.26 times the risk of use than those who never or rarely binge drink.

Dinners with family. Students who ate dinner with their families never or only once per week reported higher rates of recreational use of prescription medications than those who ate most dinners with their family (8.5% vs. 5.5%). However this association was not apparent after adjusting for age, gender and SES (see Table 3).

Extracurricular participation. Youth who do not participate in extracurricular activities were more likely to report recreational use of prescription drugs, adjusted for age, gender and SES. This pattern remained even after adjusting further for peer drug use, happy home life and binge drinking (RR: 1.50; 95% CI: 1.03, 2.18).

4.5 Discussion

The aim of this study was to determine the relationship between rural and small town adolescents' time-use and their nonmedical use of prescription drugs. Time-use was measured by looking at time spent with friends after school, in the evenings, the frequency of family meals and time spent in extracurricular participation. Time spent in structured and unstructured activity contexts was identified as an important possible factor associated with nonmedical prescription drug use among rural and small town youth. The findings of this study suggest that time spent with friends after school and in the evenings is associated with nonmedical use of prescription drugs, following adjustment for age, gender and SES. It was also obvious, however, that peer drug use, having a unhappy home life, and frequent binge drinking are key elements behind the recreational use of prescription drugs among rural and small town youth in Canada. Young people who do not participate in extracurricular activities are also at greater risk, even after accounting for other central factors. We found no effect of the frequency of family dinners on rural youth's recreational use of prescription drugs, adjusted for demographic factors.

Contrary to previous studies of family dinners and adolescent risk behaviors (Fulkerson et al., 2006; Skeer and Ballard, 2013), we found no relationship between eating dinners with family frequently and the risk of nonmedical use of prescription

drugs, after accounting for SES, age, and gender in rural Canadian youth. These unexpected findings may be explained in a number of ways. Though family cohesion and closeness is a point of pride within many rural communities, it has also been described as a “double-edged sword”(Moreland et al., 2013). While rural communities are certainly not homogeneous, particular forms of substance use, such as prescription drugs, have been described as relatively socially accepted, or even normative in some rural communities in the United States (Leukefeld et al., 2007). Rural young people have cited that while close relationships with family members can be beneficial in avoiding risky situations, they can also have the opposite effect and explain that the first time they were offered a substance was often by an adult family member (Moreland et al., 2013; Pettigrew et al., 2012). It may also be that the frequency of family dinners may not be a sufficiently robust measurement of family time, and that if we used a different measure, an association may have been evident. Barnes and colleagues created a composite score of family time including items such as eating dinner with family, family celebrations, and going on overnight trips with parents and found a significant negative association with binge drinking, cigarette smoking, illicit drug use, delinquency and sexual activity (Barnes et al., 2007). However they did not adjust for peer drug use or not having a happy home, which we found to be significant predictors of substance use.

In our study, time with friends in both the afternoons and evenings was associated with recreational prescription drug use. These findings align with earlier research using HBSC data linking the frequency of evenings with friends with increased risk of smoking or alcohol use (Gage et al., 2005), as well as other studies identifying increased risk of behavioral problems and substance use in youth with high levels of peer time (Flannery et

al., 1999; Kiesner et al., 2010; Pettit et al., 1999). Our results indicated, however, that the amount of time spent with friends in the periods outside of school hours was no longer associated with the risk of recreational use of prescription drugs after accounting for peer substance use, not having a happy home life and binge drinking. These characteristics may therefore be more important in determining whether or not youth will use prescription drugs recreationally, regardless of how much time they spend with their friends. These results add to a large body of work linking substance use among youth to peer substance use (Borden et al., 2001; Kiesner et al., 2010) most recently, with the nonmedical use of prescription drugs (King et al., 2013). The context in which peers are spending time together unsupervised has also been shown to play a substantial part in what young people do with their discretionary time (Kiesner et al., 2010). This is likely true for rural settings as well; young people in rural and small town settings report spending much of their leisure time unsupervised at home with friends, and that the period between when they arrive home from school and parents arrive home from work provides a window to experiment with substances, as does spending time loitering outside in the community (Pettigrew et al., 2012).

While the effects of peer deviance on adolescent risk behavior appear strong, these may differ by socio-demographic context. Unsupervised time has also been shown to increase problem behaviors particularly in neighborhoods characterized by lower levels of safety (Pettit et al., 1999). Additionally, there is evidence suggesting that young people who grow up in unstable community environments (with lower levels of employment and less access to resources) may actually be less susceptible to deviant peer influences, because underprivileged adolescents face more risk factors, thus decreasing

peer influence comparatively (Snedker et al., 2009). Therefore, the effects of peer deviance on substance use may be higher in more disadvantaged rural communities, and lower in less disadvantaged rural communities.

In the present study we found that students who reported having an unhappy home life were at increased risk for nonmedical use of prescription drugs. Earlier studies have used slightly different measures to characterize family life and have found similar links. For example, Ford's research using data from the National Survey on Drug Use and Health identified weak familial bonds to be a significant predictor of nonmedical use of prescription drugs (Ford, 2009). Our result, specific to nonmedical use of prescription drugs, is expected given the strong links between relational aspects of family such as family cohesion, closeness and conflict and problem behaviors including other forms of substance use (Velleman et al., 2005).

In contrast to the other time-use contexts, even when accounting for other explanatory risk factors, rural teens' extracurricular participation remained a significant determinant for the risk of nonmedical prescription drug use. We found that those who did not participate in at least one extracurricular activity were at increased risk of using prescription drugs nonmedically. While one previous study showed no effect of extracurricular participation on smoking and illicit substance use (Barnes et al., 2007), our result is consistent with much research supporting the varied benefits of extracurricular participation in young people (Borden et al., 2001; Larson, 2000; Mahoney et al., 2005), some of which has focused on rural youth specifically (Linville and Huebner, 2005; Ludden, 2011). The results of our study point to the significance of structured activity contexts in rural settings in particular. This is relevant because there is

reason to believe there may be disparities in the availability and types of structured recreation in rural versus urban settings. Qualitative studies with rural youth have revealed concern over limited recreational opportunities. Rural participants reported a lack of recreational opportunities to be as a major contributor to mental health issues and engagement in risk behaviors (Moreland et al., 2013; Quine et al., 2003). In contrast, Stearns and Glennie found that in 258 North Carolina public high schools, suburban and urban schools did not offer more activities than rural schools. However, the types of activities offered at rural schools differed from those offered at urban schools; for example, urban schools tended to offer more academic and service activities and rural schools offered more vocational activities (Stearns and Glennie, 2010).

This indicates that in addition to non-participation in any extracurricular activity, the importance of *type* of activity may be particularly germane for rural youth. Ludden found no difference in problem behaviors between rural youth that participated in *community-based* civic activities (e.g., 4-H and Girl or Boy Scouts) and those who did not, but did find that participation in *school-based* civic activities (e.g., student council and Future Farmers of America) and *religious involvement* was associated with lower rates of problem behaviors such as smoking, alcohol and marijuana use (Ludden, 2011). A second study of rural Virginia youth demonstrated a positive relationship between participation in non-school clubs and physical fighting frequency, which authors attributed the potential heterogeneity of activities captured, and that the activities were not necessarily supervised (Linville and Huebner, 2005). Types of activity contexts and differential risk behavior engagement was similarly demonstrated in a study of 918 urban and suburban adolescents in Maryland using cluster analytic techniques to create activity

profiles from 11 domains (e.g., sports, reading for pleasure, homework, chores, time with friends, watching television, school clubs, volunteering, religion and paid work).

Analyses revealed six unique typologies: sports, school, uninvolved (below the mean involvement in each activity), volunteer, highly involved (above the mean involvement in most activities, particularly constructive, organized activities and less in passive unstructured leisure activities), and work. Sports, uninvolved and work-clustered students displayed higher mean problem behaviors, while school and highly involved groups showed lowest mean problem behaviors (Bartko and Eccles, 2003). Additional analyses could have ideally been done in the present study to examine recreational use of prescription drugs and different types of extracurricular activities, however the size of the sample did not allow this kind of disaggregation.

Our study was novel in that very few studies to our knowledge have specifically examined risk and protective factors among rural youth for the recreational use of prescription medications, and none focusing on time-use patterns. Other strengths of this study include a relatively large, representative sample size of rural and small town youth in Canada as well as the use of a multilevel modeling strategy to estimate population level risk while accounting for similarities of youth within schools.

Limitations . Our study also has a number of limitations that warrant comment. We were underpowered to examine differences across types of extracurricular activities. This may be important because previous studies have indicated that the likelihood of risk behavior can vary by type of activity (Bartko and Eccles, 2003; Linville and Huebner, 2005; Ludden, 2011). For activity participation to promote positive youth development, it must also involve motivation and concerted engagement, along with what Larson

describes as “a temporal arc of effort”, occurring over time directed toward a goal (Larson, 2000). We were unable to assess these factors, and therefore we expect some heterogeneity of the involved group, which would likely result in an underestimation of effect.

It is also conceivable that some participants who indicated spending time with friends in the afternoons or evenings may have indeed been in well-supervised settings. For this reason our results may have been attenuated and the true relationship may be even more disconcerting than the one we observed. More detail would have been ideally collected concerning the specific activities that were undertaken with peers, and the amount of structure and monitoring associated with these activities.

It is possible that there may be some diversity in time-use patterns unaccounted for by grouping rural and small town youth together. Youth who reside in the countryside (e.g., on farms) as compared to those who reside in towns may have differential time-use patterns such as working part-time or helping out on farms, with less frequent access to community centers or athletic facilities. In this study, however, proximity to urban centers and perceived availability of places to spend free time were not found to be important predictors of nonmedical prescription drug use or confounders of the focal relationships in this study. There is evidence though from the U.S. indicating that drug use patterns among rural youth may vary by farm or non-farm status (Rhew et al., 2011) which may reflect differences in time-use patterns. A future direction could include the examination of time-use patterns between farm and non-farm rural youth as a potential predictor of drug use.

Another limitation stems from the cross-sectional nature of our data, as we cannot infer a causal or a temporal relationship between time-use variables and reports of nonmedical use of prescription drugs. Moreover, our study sample does not include young people living on First Nations reserves, incarcerated youth, homeschooled students, students who did not have consent, those who were absent on the day of the survey and those attending private schools. These young people may be more vulnerable and thus we may be underestimating the true prevalence of nonmedical use of prescription drugs by excluding these groups.

Information about drug use was obtained through self-report, which may be subject to social desirability bias and recall error, resulting in some misclassification of our outcome variable. However it is arguable that self-report from self-administered questionnaires produces more accurate estimates of substance use among adolescents than other methods of data collection (Brenner et al., 2003).

Conclusions and implications. In summary, we found that time spent with friends after school and in the evenings was associated with nonmedical use of prescription drugs, following adjustment for age, gender and SES. However, there is indication that other factors such as peer substance use, having an unhappy home life and heavy binge drinking may explain this relationship. In addition, rural young people who do not participate in extracurricular activities seem to be at greater risk, even after accounting for other leading risk factors. We found no effect of the frequency of family dinners on rural youth's recreational use of prescription drugs, adjusted for demographic factors. The results of our study not only add to the literature on young people's time-use in structured and unstructured activity contexts and substance use risk, but provide a rural

lens through which to examine the issue of nonmedical use of prescription drugs. Effective interventions to reduce the increased risk of recreational use of prescription drugs in rural settings may include more emphasis on creating extracurricular opportunities and encouraging greater participation, particularly among youth displaying signs of problem behaviors or those from more unstable families. Moreover, strategies to make extracurricular participation more attractive to youth who might be most vulnerable could increase participation rates and decrease occurrence of problem behaviors including recreational use of prescription drugs.

A more detailed examination of structured and unstructured activity contexts in the rural setting, including adult supervision outside of school hours, as well as a disaggregated analysis of types of extracurricular activities and substance use risk would help to inform our understanding of nonmedical use of prescription drugs among rural youth and enable better tailoring of prevention efforts.

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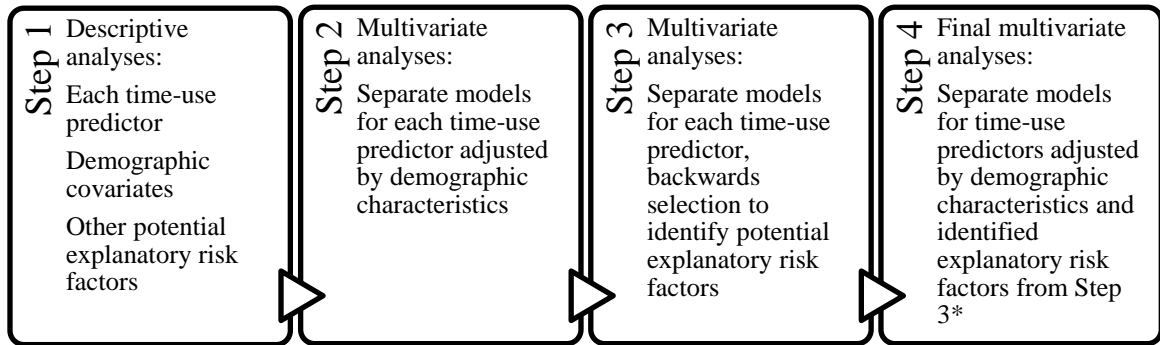
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Figure 1. Framework for analysis



Time-use predictors: frequency of spending time after school with friends per week; in the evenings with friends per week; family dinners per week; involvement in ≥ 1 extracurricular activities

Demographic covariates: age; gender; SES

Potential explanatory risk factors or confounders: peer drug use*; happy home life*; life satisfaction; family structure; cannabis use; binge drinking*; good places to spend free time in community; school connectedness; metropolitan influence

Table 1. Characteristics of student sample from rural and small towns in the 2009-2010 cycle of the Canadian HBSC survey (n=2393) and proportions of those who used prescription medications recreationally

			Total sample	Proportion of past-year recreational use
Variable			n (%*)	% (95% CI)
Demographics	Age	≤14	851 (35.6)	5.2 (3.8, 7.0)
		15	1153 (48.2)	6.2 (4.9, 7.9)
		≥16	389 (16.3)	7.0 (4.8, 10.3)
	Gender	M	1128 (47.1)	5.6 (4.3, 7.2)
		F	1265 (52.9)	6.3 (5.1, 7.9)
	SES	High	1251 (53.5)	4.3 (3.3, 5.7)
		Average	889 (38.0)	6.1 (4.7, 8.0)
		Low	200 (8.5)	15.8 (11.2, 22.2)
Potential explanatory risk factors/confounders	There are good places to spend free time	Agree	1134 (49.6)	4.6 (3.5, 6.0)
		Neither	493 (21.6)	7.9 (5.8, 10.8)
		Disagree	658 (28.8)	7.0 (5.2, 9.3)
	Past year cannabis use	Never	1690 (73.4)	3.2 (2.4, 4.2)
		At least once	614 (26.7)	13.5 (11.0, 16.6)
	Binge drinking	Never	1077 (47.3)	3.6 (2.6, 5.0)
		≤1 x /month	762 (33.4)	5.6 (4.2, 7.7)
		2-4 x/month	373 (16.4)	11.2 (8.3, 15.1)
		2+ x/week	66 (2.9)	22.6 (13.1, 34.8)
	Life Satisfaction	High	1735 (73.8)	4.5 (3.6, 5.6)
		Low	616 (26.2)	10.6 (8.2, 13.3)
	Peer drug use	Never/rarely	1309 (55.9)	2.1 (1.4, 3.1)
		Sometimes	577 (24.6)	8.4 (6.4, 11.2)
		Often	313 (13.4)	18.9 (14.6, 23.8)
		Don't know	143 (6.1)	5.2 (2.2, 10.3)
	School connectedness	High	538 (23.6)	4.5 (3.0, 6.7)
		Middle	935 (40.9)	4.2 (3.0, 5.8)
		Low	814 (35.6)	8.7 (6.9, 11.0)
	Adults in the home	<2	468 (19.8)	9.6 (4.1, 6.2)
		2+	1899 (80.2)	5.1 (7.2 12.9)
	Happy home life	Agree	1660 (72.3)	4.2 (3.3, 5.3)
		Neither	421 (18.3)	6.8 (4.6, 9.7)
		Disagree	216 (9.4)	18.2 (13.3, 24.1)
	Proximity to urban center	Weak/No MIZ	656 (27.4)	6.5 (4.7, 8.7)
		Moderate MIZ	1660 (69.4)	5.4 (4.4, 6.7)
		Strong MIZ	77 (3.2)	14.2 (7.0, 23.9)
Time-use variables	After school with friends	Few	827 (35.3)	4.3 (3.1, 6.0)
		Some	973 (41.5)	6.0 (4.6, 7.7)
		Most	544 (23.2)	8.4 (6.2, 11.1)
	Evenings with friends	Few	770 (32.8)	3.7, (2.6, 5.5)
		Some	1182 (50.3)	6.3, (5.1, 8.0)
		Most	395 (16.8)	9.1 (6.5, 12.6)
	Dinners per week	Most	1285(56.6)	5.5 (4.3, 6.9)
		Some	610 (26.9)	5.5 (3.9, 7.7)
		Few	375 (16.5)	8.4 (5.9, 11.8)
	Extracurriculars	Involved	1790 (74.8)	4.7 (3.7, 5.8)
		Not involved	603 (25.2)	9.8 (7.7, 12.7)

*Proportions are accurate within ±3 percentage points, 19 times out of 20.

Table 2. Multilevel, multivariable Poisson regression for the association between each of the four time-use contexts and the recreational use of prescription drugs from the rural and small town sample of the 2009/2010 Cycle 6 of the Canadian HBSC adjusted by age, gender and SES

Time-Use Variable			Recreational use of prescription drugs	
			RR 95% CI	p
<i>Adjusted for age, gender, SES only and no other potential explanatory risk factors or confounders</i>				
Model 1	Evenings with friends (ref: few)	Some evenings	1.74 (1.12, 2.72)	0.01
		Most evenings	2.16 (1.30, 3.60)	<0.01
Model 2	Afternoons with friends (ref: few)	Some afternoons	1.46 (0.95, 2.24)	0.08
		Most afternoons	1.73 (1.10, 2.73)	0.02
Model 3	Family dinners (ref: most)	Some dinners	1.06 (0.70, 1.62)	0.78
		Few dinners	1.34 (0.86, 2.10)	0.20
Model 4	Extracurricular (ref: involved)	Not involved	1.86 (1.30, 2.65)	<0.01

Table 3. Multilevel, multivariable Poisson regression for the association between four time-use variables and the recreational use of prescription drugs from the rural and small town sample of the 2009/2010 Cycle 6 of the Canadian HBSC, adjusted by age, gender, SES and explanatory risk factors.

		Model 1 Evenings with Friends (ref: few)		Model 2 Afternoons with Friends (ref: few)			Model 3 Family dinners (ref: most)		Model 4 Extracurriculars (not involved vs. involved)	
		RR (95% CI)	p	RR (95% CI)	p		RR (95% CI)	p	RR (95% CI)	p
	Some	1.31 (0.81, 2.11)	0.26	1.29 (0.83, 2.01)	0.26	Some	0.93 (0.60, 1.44)	0.75	1.50 (1.03, 2.18)	0.03
	Most	1.09 (0.62, 1.91)	0.77	1.14 (0.70, 1.85)	0.60	Few	0.92 (0.57, 1.49)	0.72		
	15	1.20 (0.79, 1.81)	0.39	1.18 (0.78, 1.79)	0.43		1.21 (0.79, 1.84)	0.38	1.17 (0.78, 1.76)	0.46
	≥16	1.31 (0.76, 2.25)	0.33	1.32 (0.76, 2.26)	0.32		1.36 (0.78, 2.35)	0.27	1.24 (0.72, 2.12)	0.44
Age (ref:≤14)										
Gender (ref: male)	Female	1.19 (0.81, 1.73)	0.38	1.20 (0.82, 1.75)	0.35		1.17 (0.80, 1.72)	0.41	1.14 (0.78, 1.66)	0.49
SES (ref: high)	Low	1.59 (0.93, 2.74)	0.09	1.60 (0.93, 2.76)	0.09		1.50 (0.85, 2.65)	0.16	1.57 (0.91, 2.70)	0.10
	Average	0.93 (0.61, 1.40)	0.72	0.91 (0.61, 1.38)	0.67		0.91 (0.60, 1.38)	0.67	0.88 (0.58, 1.32)	0.53
Peer drug use (ref: never/rarely)	Often	6.78 (3.86, 11.89)	<.01	6.74 (3.84, 11.82)	<0.01		6.39 (3.63, 11.24)	<.01	6.37 (3.66, 11.09)	<0.01
	Sometimes	3.54 (2.11, 5.96)	<.01	3.48 (2.07, 5.86)	<0.01		3.38 (2.01, 5.68)	<.01	3.42 (2.05, 5.72)	<0.01
Happy home life (ref: happy)	Neither	1.20 (0.75, 1.92)	0.45	1.19 (0.74, 1.90)	0.48		1.17 (0.72, 1.89)	0.53	1.15 (0.72, 1.84)	0.55
	Unhappy	2.43 (1.50, 3.93)	<.01	2.46 (1.52, 3.98)	<0.01		2.44 (1.49, 4.02)	<.01	2.22 (1.37, 3.60)	<0.01
Binge drinking (ref: never/rarely)	≤1/month	1.04 (0.64, 1.68)	0.89	1.06 (0.66, 1.71)	0.80		1.13 (0.70, 1.81)	0.63	1.12 (0.70, 1.79)	0.63
	2-4/month	1.22 (0.70, 2.11)	0.487	1.25 (0.74, 2.13)	0.40		1.33 (0.78, 2.26)	0.297	1.28 (0.76, 2.17)	0.35
	2+ /week	2.26 (1.14, 4.48)	0.019	2.22 (1.13, 4.38)	0.02		2.22 (1.08, 4.58)	0.030	2.22 (1.13, 4.36)	0.02

Chapter 5

General discussion

5.1 Study summary

The purpose of this thesis project was two-fold. First, it was to characterize the nonmedical use of prescription drugs by subgroups of adolescents in Canada by age, gender, socioeconomic status, immigrant status and geographic status. A growing body of evidence supports associations between rural residence and increased risk of nonmedical use of prescription drugs,(1-3) as well as the importance of patterns of time-use among young people as it relates to substance use.(4-8) The second purpose of this thesis, therefore, was to focus on the experience of rural youth and identify time-use patterns that may contribute to, or may protect from, engagement in the recreational use of prescription drugs. The study sample was derived from the 2009/2010 Cycle of the Health Behaviour in School-aged Children survey, which is a nationally-representative sample of Canadian youth, and provides information about demographic characteristics, social behaviours, and health behaviours of young people across the country. Participants reported their past-year nonmedical use of prescription drugs as well as other demographic, emotional/relational and behavioural measures that were determinants or covariates in the two studies that comprised this thesis. Based upon school locations, geographic statuses were assigned to each student. Multilevel Poisson regression analyses were used to examine the relationships of interest, while controlling for individual and school level effects.

5.2 Key findings

Recreational prescription drug use disproportionately affects certain subgroups of youth. Reports of past-year use of any medication(s) were highest among older adolescent age groups and students of low SES. Recreational pain reliever use was highest among females (RR:1.25 95% CI: 1.04, 1.51), older teenagers (RR:1.49 95% CI: 1.11, 2.00), and rural youth living in close proximity to urban centres (RR: 3.13 95% CI: 1.23, 8.01). Proportions of use for all types of medication were similar between immigrant and non-immigrant students and did not change depending on length of residence in Canada. Frequent use of stimulant medications was slightly higher among males than females. Age was not associated with frequent recreational use of medications. Findings from the second study of this thesis, focusing solely on rural and small town youth, indicated that time spent with friends after school and in the evenings was significantly associated with recreational use of prescription drugs. Peer drug use, not having a happy home life and co-participation in binge drinking largely explained these associations. Youth who did not participate in at least one extracurricular activity were significantly more likely to report use (RR: 1.50 95% CI: 1.03, 2.18). Frequency of family meals was not associated with recreational prescription drug use.

5.3 Key epidemiologic concepts

5.3.1 Internal validity

Internal validity refers to the degree to which a study is free from bias or systematic error and depends on the methods used to select the study subjects, collect information and conduct analyses.(9) Issues surrounding selection bias, information bias

and other sources of confounding that may threaten the internal validity of the two studies in this thesis are discussed in this section.

Selection bias occurs when there is a systematic difference between people who are included in a study and those who are not, or when study and comparison groups are selected inappropriately or using different criteria thereby biasing the estimated effect of an exposure on an outcome.(10) Youth who live on First Nations reserves, incarcerated youth, homeschooled students, students who did not have consent, those who were absent on the day of the survey and those attending private schools were not included in the HBSC survey. It is possible that a greater proportion of excluded students, or students who did not participate, were of lower SES, resulting in underrepresentation of low SES youth in our sample. If excluded youth were more likely to use prescription drugs recreationally, then prevalence values may not be representative in both studies, which will be discussed in a later section in terms of external validity.

Exclusion of these youth may have introduced some selection bias into the first study which aimed to characterize the nonmedical use of prescription drugs among Canadian young people. Because students who are incarcerated or who live on First Nations reserves may be more likely in the low SES group, and at highest risk for drug use, excluding them from the sample may have underestimated the effect of low socioeconomic status. The exclusion of these youth may have also introduced some selection bias into the second project as well. If excluded youth are more likely to spend increased time in unstructured activity contexts (e.g., more time with friends after school and in the evenings, fewer family dinners, and lower rates of participation in

extracurricular activities), had they been included in our study sample, we may have observed a greater effect of unstructured time in the risk of use.

Another source of selection bias may have been introduced when school principals decided whether or not to have their students participate in the survey. Perhaps principals of schools with higher rates of health issues or problem behaviours among students would be more inclined to participate, which may have overestimated prevalence rates in certain subgroups. Alternatively, rates may have been underestimated if principals of schools such as these may have been less inclined, so not to interrupt regular classroom activities or to not draw attention to issues within their school, or being schools with fewer resources for facilitating the survey, which would lead to underrepresenting prevalence estimates in some subgroups. This issue of selection may have therefore affected prevalence values but did not necessarily affect the relationships estimated in these studies.

Information bias can be a major threat to the internal validity of a study, and is a result of flaws in measuring exposure, covariate or outcome variables resulting in different quality of information between comparison groups, thereby biasing effect estimates.(9) There remains some potential for misclassification within the various MIZ groups. For example, if an otherwise highly remote rural or small town area did not have a local industry or any business opportunity present, thereby requiring much of the working population to commute to an urban centre, it would be classified as a Strong MIZ, even though it may be quite far from the urban centre. Conversely, another rural area that is relatively close to an urban centre and has local economic opportunities may

be classified as a weak MIZ. Because this misclassification may have been non-differential, it may have attenuated the observed effect estimates.

A second source of misclassification within the geographic location is that each student was assigned a geographic location based on the location of their school and not the location necessarily of their homes. It is possible that some children may be required to travel to school in a different census subdivision, which may potentially be a different type of geographic area. This may be a greater issue for those living in Strong MIZs who could be travelling to school in more proximal urban areas. We therefore may anticipate that if there was some misclassification of Strong MIZ students into urban students, that the difference between urban and Strong MIZ students may actually be more pronounced than the one we observed in this study.

Another type of information bias is *recall bias* which can result from *recall error*. Recall error occurs when participants are asked to recall their exposures. This is unlikely to be an issue for the first study in this thesis where ‘exposures’ are demographic variables. However, recall error may be an issue with regards to the outcome variable for both thesis objectives. Participants are asked to recall their drug use over the past 12 months. This can be challenging because it requires participants to remember their behaviour, within a specified time period, when they were under the influence of drugs or alcohol.(11) For this reason, thirty-day recall periods may be more accurate than 12-month recall periods, and shorter recall periods tend to elicit higher rates of alcohol and drug use.(12) This issue with recall may have underestimated the prevalence of nonmedical prescription drug use. It is not expected that recall error of the outcome

variable would introduce recall bias to the effect estimates as it is anticipated that it would be nondifferential among exposure groups in both studies.

Recall bias may have been introduced from other sources of recall error. For example, it is possible that youth who use prescription drugs nonmedically, particularly those who use them frequently or are under the influence of a substance while completing the survey (prescription drugs or otherwise), may not accurately complete the survey, including their time-use patterns, and covariates resulting in misclassification of exposure and covariates.

Social desirability bias may also pose a threat to the internal validity of the studies in this thesis because information about both independent and dependent variables was obtained through self report. In both studies, social desirability might result in an underreporting of nonmedical use of prescription drugs, with regards to either any past-year use, or the frequency of use. However alternate measurements of substance use among adolescents do not necessarily demonstrate considerable advantages.(11) For example, many studies have used what is called a “bogus-pipeline” approach, which leads participants to believe that their true behaviour will be revealed even though it cannot be (e.g., detecting substance use through a saliva test).(13) Adolescents who are asked to provide saliva samples report similar rates of substance use as those who are not required to.(14) While again, there is a chance of underreporting of nonmedical use of prescription drugs in the first study, we do not expect it to have been differential.

It is plausible however that social desirability resulting in underreporting of nonmedical may be differential among the exposure groups in the second study of this thesis. Young people who spend more time in unstructured activity contexts may be more

likely to underreport substance use because they may be more likely to engage in delinquent behaviours that involve lying (e.g., such as disobeying parents and stealing from others).(8) If the outcome was misclassified in this way, it would bias the effect sizes of time spent with peers towards the null. At the same time, youth who spend more of their time in structured settings, may underreport due to fear of reprisal, which may bias the effect sizes away from the null.(11)

The exposure category of participating in extracurricular activities likely contains considerable heterogeneity. Some students that indicated participation in an activity may actually spend very little time in that activity. This would have again biased our estimates towards the null, meaning that the true effect of non-participation may be greater than the one we observed. A possible validation study could compare the results of a small subsample of youth by utilizing a more detailed activity schedule to specifically measure unsupervised peer time, such as that employed by Pettit and colleagues(15) and compare the results to the frequency of time spent with friends after school or in the evenings.

5.3.2 Confounding

Confounding occurs when the measure of an effect of an exposure on an outcome is distorted due to the association of the exposure with other factors that influence the occurrence of the outcome. By using a multivariate analytic strategy, a number of known and potential risk factors were accounted for. However it is possible that measurement error of these covariates occurred, resulting in uncontrolled or *residual confounding*, i.e., confounding that is still present after adjustment.(16) The peer drug use variable is one covariate that may have introduced some residual confounding as a result of poor measurement. The referent category included peers who never or rarely use drugs. An

item distinguishing never and rarely may have identified an even stronger effect of peer drug use in the regression models than the ones we observed, and altered the estimates of time-use exposures accordingly.

Another covariate, our question asking students if they believe there are good places to spend free time in their community, may not have been an adequate measure of the availability of structured recreation. An objective measure of places to spend free time in the community including identifying the presence/absence of a movie theatre, sports facilities, community centers, restaurants or coffee shops, parks, beaches, etc., may have been more strongly associated with the exposure and outcome, and included in the final models.

It is also possible that there are additional unmeasured potential confounders that if included, may have affected the results of this thesis. Family structure (having <2 adults in the home) was found not be a confounder of the relationship between each time-use variable and the nonmedical use of prescription drugs, after accounting for binge drinking, peer drug use and having a happy home life, which was unexpected given research linking single parent households with adverse adolescent outcomes.(1, 17) More direct measures of parental monitoring were not included in our analyses as covariates and this may have resulted in some unmeasured confounding. Similarly, for the exposure variable of frequency of family meals per week, it is possible that exclusion of a confounding variable such as parental closeness or communication may have masked a true association. Saying this, however, having an unhappy home life reflects the quality of family relationships, which could account for some confounding here.

5.3.3 Chance

It is possible that due to multiple comparisons in both studies of this thesis it is more likely that the exposure groups may have appeared to be different due to chance. This would be a Type I error, arising from the fact that the greater the number of tests of significance conducted on a data set, the greater the probability that at least one or more tests will falsely reject the null hypothesis solely by chance.(9)

It was also recognized that due to the sampling strategy of the HBSC, where participants are nested within schools, the observations in the sample are not independent, thus resulting in smaller standard errors. By employing a multilevel modeling strategy, school effects were accounted for and the chance of a type I error occurring, as compared to when traditional single-level modeling is used, was reduced.

Some of the null associations identified in the two studies of this thesis may have also occurred a result of Type II error. This type of error occurs when one is unable to reject the null hypothesis due to a lack of statistical power, when in truth there was an association. A priori power analyses were conducted and determined the studies were sufficiently powered for the majority of associations evaluated and are presented in Appendix E. The sample size of the HBSC participants eligible for inclusion into the first study was 10,429. Due to the clustered nature of the data, a design effect of 1.2 was applied to reduce the effective sample size to 8,960 for the power calculations for the first manuscript. Statistical power to detect these differences within subgroups ranged from 72.24% (Canadian born youth) to 99.98% (females) which reflects an outcome prevalence of 7.0% and an effect size of 1.5. It is possible that this study was insufficiently powered to detect differences in the less prevalent medications

(sedatives/tranquilizers), and for some groups in the subanalyses of frequent vs infrequent use.

For the second manuscript of this thesis, the sample size was 2,393 rural and small town youth. This was reduced by 20% (to 1,994) after accounting for the design effect of the clustered study sample. Measures of effect for power calculations ranged from 1.5 to 2.0, resulting in 56.5% to 94.4% power for frequent time with friends outside of school hours and few family dinners. Power for nonparticipation in extracurricular activities ranged from 62.0% to 100% for effect sizes of 1.5 to 2.0. To ensure maximum power, the outcome variable was nonmedical use of any type of prescription medications.

5.3.4 External validity

External validity or generalizability refers to the validity of inferences as they pertain to people outside the population under study,(16) and whether relationships observed can be generalized to different measures, persons, settings, and times.(18) The associations observed in this thesis are reasonably internally valid estimates of psychosocial effects, therefore, it is expected that the findings are also generalizable to similar youth populations outside of the study sample, such as youth across North America and some parts of Europe with similar time-use patterns.(19)

The HBSC is intended to be a representative sample of Canadian youth, and has an average to high participation rate for large epidemiologic studies.(20) Until now, research on geographic patterns of nonmedical prescription drug use in Canada has focused on youth in Ontario only,(2) therefore the results from this thesis make generalizations across Canada more reasonable.

5.3.5 Causation

There are a number of criteria that should be considered prior to inferring causation in epidemiologic studies. The components discussed here include temporality, strength of association, consistency, dose-response relationship, and plausibility.(21)

Temporality. For an exposure to cause an outcome, it must precede that outcome. In cross-sectional studies, both exposure and outcome information are ascertained at the same time. For the first study in this thesis, temporality is not an issue because its purpose was to describe the nonmedical use of prescription drugs by demographic factors, not to infer an etiologic relationship between the exposure and outcome variables. For the second study, concerns around temporality may be relevant. While spending unstructured time socializing with peers may facilitate opportunities conducive to deviance,(22) there is contention as to whether youth are subject to peer influence or whether they self-select into deviant peer groups. Many social psychological theories agree that normative influence from delinquent peers is the key causal process in eliciting adolescents' own delinquency. However, other theorists argue that delinquent youth are limited to befriending other delinquent youth given their shared tendency toward subversive behaviours.(23) Youth may self-select into deviant peer groups and certain time-use patterns based on their individual delinquent habits; therefore caution should be taken when interpreting cause and effect relationships with time-use, peer drug use and adolescents' own drug use. Longitudinal studies have also demonstrated peer relationship pathways from initial substance use to co-occurring delinquent behaviours.(24) Initiation into drug use may therefore lead to greater delinquency, perhaps reflected in a reduced

desire to spend time with family, participate in extracurricular activities, and an increasing tendency for unsupervised peer time.

No studies were identified that specifically looked at having a happy home life as a covariate in the relationship between time-use patterns and substance use, although parental monitoring, closeness, and family cohesion have been identified as important factors in this pathway and places parental influence as a preceeding factor to subsequent deliquent behaviour patterns.(4, 17, 25-27)

Strength of association. In the second study, weak associations were identified between time spent with friends in the afternoons and evenings and nonmedical use of prescription drugs, and this is consistent with a growing body of literature linking peer time with other forms of substance use and risk behaviours.(8, 15, 25) This relationship was explained partially by strong associations with peer drug use, which closely aligns with the literature as well.(4, 24, 28, 29)

Consistency. The finding that participation in extracurricular activities is associated with a reduction in risk for recreational use of prescription medication is also highly consistent with earlier work surrounding risk behaviours and the use of other substances.(5, 30-32) However few studies have focused on rural youth specifically,(6, 33) and more research is needed in this area to confirm this relationship. Our results about family meal frequency and risk of use are inconsistent with the research of others.(7, 8, 34) To our knowledge, this association has not yet been examined in the rural context, and there may be some question about the use of family meals as a proxy for family time, or parental closeness or influence, more generally.

Dose-response. Another evaluative criterion for causation is a dose-response relationship. After adjustment for other important risk factors, no dose-response relationship was identified between frequency of evenings or afternoons with friends, or family dinners and the nonmedical use of prescription drugs, suggesting that more time with friends and less time with family may not necessarily result in increased risk for use. The covariates did generally show a dose-response relationship, however.

Plausibility. Research examining these variables as potential pathways between time-use and nonmedical use of prescription drugs would support the psychosocial plausibility of these associations. As extracurricular responses were bivariate (yes/no) information to assess a dose-response relationship for extracurricular participation and risk for nonmedical use of prescription drugs was not available.

5.4 Future directions

There are many exciting research projects that could arise from the results of the two studies in this thesis project. In the first study, disparities in the nonmedical use of prescription drugs were identified in subgroups of rural youth. More specifically, rural youth living in closer proximity to urban centres were at greatest risk for recreational use of any type of medication and pain reliever medications in particular. Because there is some evidence suggesting health care service utilization differs by rural status in Canada,(35, 36) it would be interesting to examine whether patterns of written prescriptions or filled prescriptions for these controlled medications differ in this way as well. This information may indicate greater access to these medications for divergence and nonmedical use in these areas.

Identifying sources of these medications for young people in rural settings may also be important (e.g., whether they obtain them from family members' prescriptions, friends or their own prescriptions, etc.). Information garnered from a study such as this would facilitate implementation of strategies presented by the National Advisory Committee on Prescription Drug Misuse,(37) to prevent prescription drug diversion such as safe storage of medication, safe return or disposal of unused medications, and appropriate prescribing practices by health care professionals.

In the second study of this thesis, rural youths' time-use patterns were associated with engagement in nonmedical use of prescription drugs. Research may be warranted comparing time-use patterns between rural and urban youth and how they uniquely may contribute to the risk for nonmedical use of prescription drugs in different geographic settings. If time-use patterns among youth differed by urban/rural status, it could identify factors in rural settings that contribute to the relatively higher prevalence of nonmedical use.

Extracurricular participation was highlighted as particularly important for the prevention of nonmedical use of prescription drugs among rural youth. Because other studies suggest heterogeneity in the protection offered by different types of extracurricular participation,(5, 6) a disaggregated analysis characterizing risk for nonmedical use of prescription drugs by types of activity (e.g., sports, music, community services etc.) in rural settings or otherwise, would highlight which activities might be most protective in terms of this type of substance use. Further study into time and motivation directed towards different extracurricular activities(38) and their influence on the nonmedical use of prescription drugs could also be conducted.

5.5 Implications and conclusions

There are several implications for public health policy and intervention arising from the results of this thesis project. The results add to the growing body of research highlighting rural youth as an at-risk group for the nonmedical use of prescription medications,(1-3) and in particular subgroups of rural youth living in closer proximity to urban centres. Public health efforts to promote parental awareness of nonmedical use of prescription drugs in rural settings in particular may be valuable. Evidence suggests that personal prescriptions and the prescriptions of family members are central sources through which youth access medications for recreational use.(39, 40) Therefore, parents, grandparents, and other adult family members should be encouraged to safely secure their medications and restrict access to youth. If young people receive prescriptions for controlled medications for an acute or chronic health problem, parents and health care providers should closely monitor the amount of pills, and excess medications should not be prescribed or kept after intended use.(37)

In rural settings, school administrators, teachers and community leaders should increase efforts to promote extracurricular participation among all youth and at-risk youth in particular, as well as increase other opportunities for structured recreation in rural communities. Based on evidence from earlier studies and this thesis linking peer drug use and family factors to substance use among youth,(4, 17, 24, 26, 28, 29) a multi-pronged strategy that simultaneously addresses the promotion of positive peer and familial relationships as well as strategies to reduce other forms of substance use such as binge drinking would be most useful.

The results of this thesis project add to the literature characterizing the nonmedical use of prescription drugs among Canadian youth, and uniquely add a detailed rural perspective, that until now remained largely unexamined. Females, those of low socioeconomic status and youth living in rural settings in close proximity to urban centres seem to be at greatest risk of use. Time-use patterns among rural youth that seem to be associated with the nonmedical use of prescription drugs may vary substantially by other individual factors such as having an unhappy home life, having peers who use drugs, as well as heavy use of other substances such as alcohol. Results support interventions aimed at specific groups of youth including females, older teenagers and rural youth, including increasing structured time-use opportunities, in extracurricular activities, as well as interventions focusing on positive peer relationships, and reducing binge drinking behaviours among rural youth.

5.6 Chapter 5 references

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Appendix A

HBSC Survey methodology

Sampling strategy

Schools throughout Canada with students ages 11-15 are randomly selected. Schools in the sample were selected for study from a list of schools within school jurisdictions. Classes were ordered according to school jurisdiction, language of instruction, public/Catholic designation, community size, and location within a province. Classes were proportionally distributed according to these characteristics. The number of selected classes within a school was estimated based on the grades within the school, and the number of children enrolled by grade and in general, one or two classes per grade in each school were randomly selected by the school administrator to participate. In Nunavut, the Northwest Territories and the Yukon, all students in grades 6 through 10 in the territories were invited to participate in order to obtain a census for the entire public school student population in this age range. The study sample includes students from all provinces except for Prince Edward Island and New Brunswick. Private schools and schools on First Nations reserves were not included.

Student questionnaire

Teachers administered the questionnaires to students during one class session (ranging from 45-75 minutes). The questionnaire was available in English, French and Inuktitut. Students completed surveys individually, and at their own pace. If literacy was a concern for a particular classroom, teachers had the option to read through survey question by question and have students follow along at the same pace. The items used in

this survey are all closed response answers. Surveys were kept anonymous by having students seal their unsigned survey in an envelope. Schools in the Yukon underwent a slightly different process; the Yukon Bureau of Statistics administered the survey in each community. For students in grades 9 and 10, students filled in the surveys at their own pace under the researcher's supervision.

Consent

For a student to participate in the survey, three levels of consent were obtained. First, permission to invite schools was obtained from their respective school jurisdictions. Second, school principals were asked to allow their schools to participate. Third, either active or passive parent consent was obtained for student participation depending on the school or school board's policies.

Response rate

Approximately 77% of estimated number of eligible students participated in the study overall study. Only 10% of students refused participation, other reasons students did not participate in the survey included failure to return consent forms, failure to receive parental consent or school absence on the day the survey was administered.

Survey weights

The data from each province or territory is weighted so the responses from a certain province/territory contribute to the national results proportionally to the actual student population within the national grade group population. Each grade has weights calculated independently. For example, if a province or territory is over represented, they are thus given a weight <1 . Under-represented provinces are given a weight >1 .

Appendix B

Key survey items

Variable	Question	Possible Responses
Exposure items		
Socioeconomic status	How well off do you think your family is?	Not at all well off; Not very well off; Average; Quite well off; Very well off
Immigrant status	In what country were you born? How many years have you lived in Canada?	Canada ; Other I was born in Canada; 1-2 years; 3-5 years; 6-10 years; 11 or more years
Geographic status	Postal code of school	Urban; Strong MIZ; Moderate MIZ; Weak MIZ; No MIZ
After school with friends	How many days a week do you spend time with your friends right after school?	0; 1; 2; 3; 4; 5
Evenings with friends	How many evenings per week do you normally spend out with your friends?	0; 1; 2; 3; 4; 5; 6; 7
Family meals	On average, how many times per week does your family sit down at the table together for dinner/supper?	0; 1; 2; 3; 4; 5; 6; 7
Extracurricular participation	Are you involved in any of these kinds of clubs/organizations? Yes or no for each	Not involved; Sports club or team; Volunteer service; Political organization; Cultural association (music, science or other); Church or religious group; Youth club; Other club
Outcome items		
Nonmedical use of prescription medications	Have you ever taken one or several of these drugs in the <u>last 12 months</u> ? Pain relievers (e.g. Percodan, Demerol, Oxycontin; Codeine) Stimulants (e.g., Ritalin, Concerta, Adderall) Sedatives/tranquillizers (e.g., Valium, Ativan, Xanax)	Never; 1-2; 3-5; 6-9; 10-19; 20-39; 40+ Never; 1-2; 3-5; 6-9; 10-19; 20-39; 40+ Never; 1-2; 3-5; 6-9; 10-19; 20-39; 40+
Covariate items		
Good places to spend free time	There are good places to spend your free time (e.g., recreation centres, parks, shopping centres)	Strongly agree; Agree; Neither agree nor disagree; Disagree; Strongly disagree

Cannabis use	Have you ever taken cannabis in the last 12 months?	Never; 1-2; 3-5; 6-9; 10-19; 20-39; 40+
Peer drug use	Most of the friends in my group have used drugs to get stoned	Never or rarely; sometimes; often; I don't know
Binge drinking	In the past 12 months, how often have you had 5 or more drinks (4 or more for females) on one occasion?	Daily or almost daily; 2-5x/week; Once a week; 2-3x/month; Once a month; Less than once a month; No I have never drank 5 or more drinks in the past 12 months (4 for females); No I have not drank in the past 12 months
Happy home life	I have a happy home life.	Strongly agree; Agree; Neither agree nor disagree; Disagree; Strongly disagree
School connectedness	8-item scale: How do you feel about school at present? My teachers are interested in me as a student. The rules in this school are fair. Most of my teachers are friendly. Our school is a nice place to be. I feel I belong at this school. I am encouraged to express my own views in my class(es). Our teachers treat us fairly.	I like it a lot; I like it a bit; I don't like it very much; I don't like it at all Strongly agree; Agree; Neither agree nor disagree; Disagree; Strongly disagree
Adults in the home	All families are different (for example, not everyone lives with both their parents, sometimes people live with just one parent, or they have two homes or live with two families) and we would like to know about yours. Please answer this first question for the home <u>where you live all or most of the time</u> and mark the people who live there.	Mother; Father; Stepmother; Stepfather; Grandmother; Grandfather; I live in a foster home or children's home; Someone or somewhere else
Life satisfaction	The top of the ladder '10' is the best possible life for you and the bottom '0' is the worst possible life for you. In general, where on the ladder do you feel you stand at the moment? Mark the box next to the number that best describes where you stand.	10 Top 9 8 7 6 5 4 3 2 1 0 Bottom

Appendix C

Sample sizes

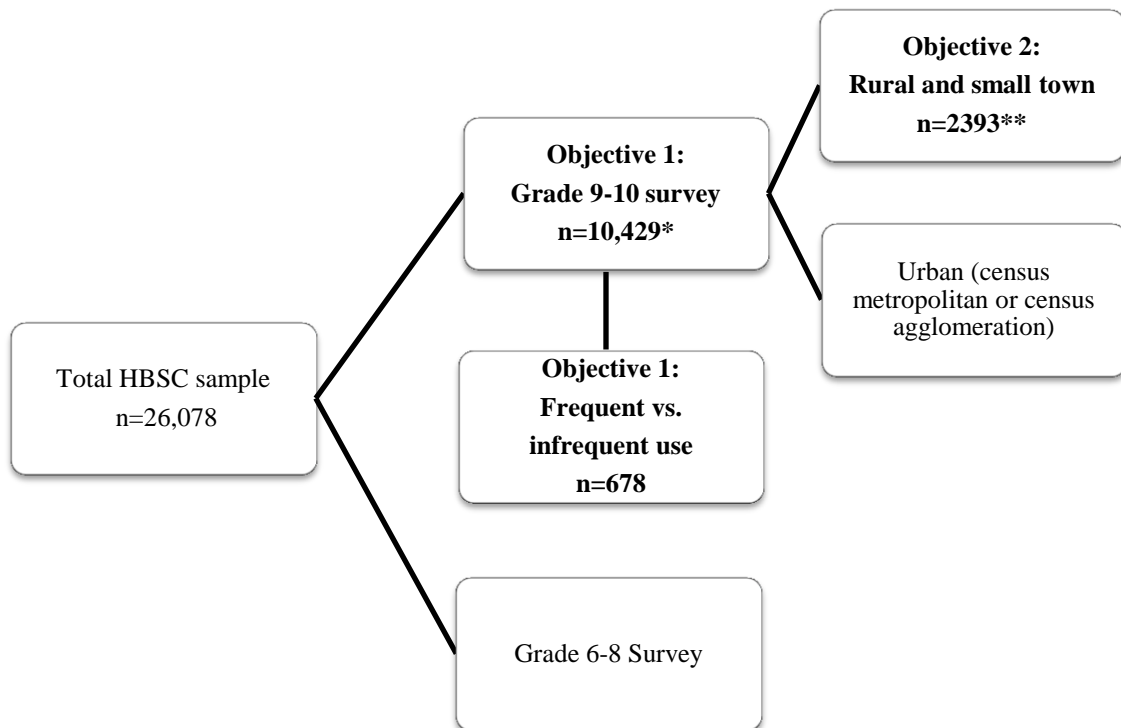


Figure 1. Derivation of samples for each objective in this thesis.

*4.2% missing data

**3% missing data

Appendix D

Intraclass correlation coefficients

Outcome	Covariance Parameter Estimate	Residual	Variance at school level
Any Use	0.00050	0.0626	0.007921
Pain Relievers	0.00051	0.0516	0.009793
Stimulants	0.00024	0.0241	0.009868
Sedatives	0.00002	0.0135	0.001402
Frequent any use	0.01176	0.2382	0.047048
Frequent pain reliever use	0.01477	0.2319	0.059878
Frequent use stimulants	0.01560	0.2280	0.064039
Frequent use sedatives	0.06647	0.1836	0.265806
Rural only- Any use	0.00083	0.0577	0.014116

A null model using PROC MIXED was used to determine the amount of variance attributable to the school level, using the intraclass correlation coefficient. The first set of models, where the outcome was any use vs. no use, area level factors accounted for less than 1% of the total variance. For frequent use however, area level factors accounting for 5-6% of the total variance, and for 26% of the variance for frequent use of sedatives. In the second study focused on rural and small town youth, school level factors contributed 1.4% of the total variance.

Appendix E

Power calculations

n adjusted is the sample size adjusted for non-respondents and the design effect

n_{exp} is the number of students exposed

r is the ratio of unexposed to exposed

RR is the detectable relative risk

p is the proportion of students who have the outcome (i.e. any nonmedical prescription drug use)

p_0 is the prevalence of outcome in the unexposed

p_1 is the prevalence of outcome in the exposed

d is the difference between p_1 and p_0

$z_{\alpha/2}$ is the level of significance

$$\text{Power} = \Phi(Z(1-\beta)) = \Phi\left\{\frac{(d)^2 nr}{p(1-p)(1+r)}\right\}^{1/2} - Z_{\alpha/2}$$

	N adj	%exp	%unexp	N exp	n unexp	r	RR	p	p0	p1	d	z(1-b)	Power%
Manuscript 1													
Any use													
16+ years of age	8690	0.19	0.36	1659.80	3093.60	1.86	1.50	0.07	0.06	0.09	0.03	1.84	96.80
Low SES	8690	0.09	0.55	790.80	4796.90	6.07	1.50	0.07	0.07	0.10	0.03	1.38	91.60
Female	8690	0.51	0.49	4431.90	4258.10	0.96	1.50	0.07	0.06	0.08	0.03	3.41	99.90
Born in Canada	8690	0.76	0.04	6604.40	373.70	0.06	1.50	0.07	0.05	0.07	0.02	0.59	72.20
Weak no MIZ	8690	0.07	0.77	559.60	6691.33	11.96	1.50	0.07	0.07	0.10	0.03	0.71	76.10
Manuscript 1													
Frequent use													
16+ years of age	608	0.19	0.36	115.50	216.40	1.87	1.50	0.30	0.26	0.38	0.13	3.68	100.00
Low SES	608	0.09	0.55	54.72	335.62	6.13	1.50	0.30	0.28	0.42	0.14	0.13	55.00
Female	608	0.51	0.49	310.10	297.90	0.96	1.50	0.30	0.24	0.36	0.12	1.26	90.00
Born in Canada	608	0.76	0.04	6604.40	373.30	0.06	1.50	0.30	0.20	0.31	0.10	2.26	99.00
Weak no MIZ	608	0.07	0.77	41.95	468.20	11.16	1.50	0.30	0.29	0.43	0.14	1.44	93.00
Manuscript 2													
Rural and small towns													
Many	1994	0.33	0.33	658.02	658.02	1.00	1.50	0.07	0.06	0.08	0.03	0.174	56.80
afternoons/evenings	1994	0.33	0.33	658.02	658.02	1.00	1.75	0.07	0.05	0.09	0.04	0.89	81.30
with friends	1994	0.33	0.33	658.02	658.02	1.00	2.00	0.07	0.05	0.09	0.05	1.59	94.40
Few family	1994	0.33	0.33	658.02	658.02	1.00	1.50	0.07	0.06	0.08	0.03	0.174	56.80
dinners	1994	0.33	0.33	658.02	658.02	1.00	1.75	0.07	0.05	0.09	0.04	0.89	81.30
	1994	0.33	0.33	658.02	658.02	1.00	2.00	0.07	0.05	0.09	0.05	1.59	94.40
Extracurricular	1994	0.25	0.75	498.50	1495.50	3.00	1.50	0.07	0.06	0.09	0.03	0.31	62.00
participation	1994	0.25	0.75	498.50	1495.50	3.00	1.75	0.07	0.06	0.10	0.04	1.07	86.00
	1994	0.25	0.75	498.50	1495.50	3.00	2.00	0.07	0.06	0.11	0.06	2.60	100.00

Appendix F

Ethics approval



QUEEN'S UNIVERSITY HEALTH SCIENCES & AFFILIATED TEACHING HOSPITALS RESEARCH ETHICS BOARD-DELEGATED REVIEW

November 09, 2012

Ms. Ariel Pulver
Department of Community Health and Epidemiology
Queen's University

Dear Ms. Pulver
Study Title: EPID-401-12 Nonmedical use of prescription drugs in Canadian adolescents: equity and etiologic analyses
File # 6007527
Co-Investigators: Dr. C. Davison, Dr. W. Pickett

I am writing to acknowledge receipt of your recent ethics submission. We have examined the protocol for your project (as stated above) and consider it to be ethically acceptable. This approval is valid for one year from the date of the Chair's signature below. This approval will be reported to the Research Ethics Board. Please attend carefully to the following listing of ethics requirements you must fulfill over the course of your study:

Reporting of Amendments: If there are any changes to your study (e.g. consent, protocol, study procedures, etc.), you must submit an amendment to the Research Ethics Board for approval. Please use event form: HSREB Multi-Use Amendment/Full Board Renewal Form associated with your post review file # 6007527 in your Researcher Portal (https://eservices.queensu.ca/romeo_researcher/)

Reporting of Serious Adverse Events: Any unexpected serious adverse event occurring locally must be reported within 2 working days or earlier if required by the study sponsor. All other serious adverse events must be reported within 15 days after becoming aware of the information. Serious Adverse Event forms are located with your post-review file 6007527 in your Researcher Portal (https://eservices.queensu.ca/romeo_researcher/)

Reporting of Complaints: Any complaints made by participants or persons acting on behalf of participants must be reported to the Research Ethics Board within 7 days of becoming aware of the complaint. Note: All documents supplied to participants must have the contact information for the Research Ethics Board.

Annual Renewal: Prior to the expiration of your approval (which is one year from the date of the Chair's signature below), you will be reminded to submit your renewal form along with any new changes or amendments you wish to make to your study. If there have been no major changes to your protocol, your approval may be renewed for another year.

Yours sincerely,

A handwritten signature in black ink that reads "Albert L. Clark".

Chair, Research Ethics Board
November 09, 2012

Investigators please note that if your trial is registered by the sponsor, you must take responsibility to ensure that the registration information is accurate and complete