

Cannabis use among Canadian university students: Norm perceptions and interest in online supports

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science

in

Epidemiology

School of Public Health

University of Alberta

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## **Abstract**

Cannabis is one of the most widely used and misused substances, yet research on plausible intervention targets and strategies to reduce cannabis use is underdeveloped. This thesis addressed these issues in two secondary analyses of population survey data in the 2018 *Campus Experiences with Cannabis* survey conducted at the University of Alberta ( $N = 3,562$ ).

*Study 1 background and hypotheses:* Research on cannabis-related social norm perceptions among young adults is limited because no studies have examined whether norm perceptions differ between cannabis users who do and do not meet screening criteria for hazardous and harmful use. We hypothesized that problematic cannabis users would be more likely than non-problematic users to (1) mistakenly believe that social reference groups use about the same amount of cannabis as they do, (2) adjust private approval of peer cannabis use to match mistaken public approval norms, and (3) believe that behavioral and social consequences are less definitive of problematic cannabis use. *Analyses:* Secondary analyses of data collected from 753 young adult cannabis users (57% female;  $M$  age = 22.6). Parametric and non-parametric ANOVAs examined respondents' perceptions and beliefs regarding the cannabis use of same-sex friends, peers, and average Albertans. *Results:* Contrary to prediction, problematic cannabis users were more likely than those not meeting criteria for cannabis problems to (accurately) believe that all social reference groups use cannabis less frequently than they do. However, problematic cannabis users were more likely than non-problematic users to adjust private approval of fellow students' cannabis use to match perceived public approval, and to believe that several sociobehavioral consequences are less definitive of problematic use. *Conclusion:* Interventions may reduce cannabis misuse by correcting norm misperceptions.

*Study 2 background and hypotheses:* Only a fraction of cannabis users who experience problems with this substance ever seek help or access specialty treatment. Although this treatment gap could be reduced by implementing online brief interventions and self-help resources, it is not clear whether cannabis users would be interested in accessing those tools. We examined whether cannabis-related problems, motives for using cannabis, and protective behavioral strategies predicted interest in accessing online self-help materials. We hypothesized that (1) problematic cannabis use will be positively associated with interest in accessing brief online self-help materials, (2) using cannabis to cope (but not other motives), will be positively associated with interest in self-help materials, and (3) cannabis-related protective behaviors will be inversely associated with interest in self-help. *Analyses:* Secondary analyses of 649 cannabis-using Canadian University students (58% female; *M* age = 22.5) participating in a population survey. Two setwise hierarchical multiple linear regression models were fit to predict interest in (a) cannabis-specific support resources and (b) general addiction and mental health supports, from objective risk status, motives, and protective behaviors. *Results:* Most (59%) respondents were interested in accessing one or more online supports. Objective risk status, coping, enhancement and expansion motives, and protective behaviors were all positively associated with interest in accessing online resources, each accounting for unique variance in the outcomes. *Conclusion:* Problematic cannabis users are interested in accessing brief, online, public health interventions.

## **Preface**

This thesis is an original work by Alexandra Loverock. No part of this thesis has been previously published. No ethics approval was required as the data used in this thesis were secondary data.

I dedicate this thesis to my parents.

Mom and dad, words cannot express how grateful I am for your love and support.

Thank you for everything.

## **Acknowledgements**

I would like to thank my amazing supervisor, Cam Wild. I'm so grateful to have had the opportunity to learn from you. Your constant support, book recommendations, and positive work environment have been fundamental to my thesis completion.

My dedicated committee members, thank you for taking the time to review my thesis and help me through this process.

My sister, my friends, and my partner, thank you for your unconditional love and support.

I also want to express my gratitude to several organizations that provided financial support throughout my master's degree. I was supported by the School of Public Health (Public Health Distinction Scholarship), the Government of Alberta (Queen Elizabeth II Graduate Scholarship and Graduate Student Scholarship), and Alberta Innovates (2017 Alberta SPOR Graduate Studentship and the 2018 Graduate Studentship).

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## Chapter 1: Background

Cannabis is a plant material produced by drying the flower buds, leaves, stems, and seeds from the *Cannabis sativa* plant (Canadian Centre on Substance Use and Addiction; CCSA, 2018). Cannabis is typically rolled in paper and smoked as a joint or cigarette, smoked from a bong or pipe, or vaporized (United Nations Office on Drugs and Crime, 2007). The literature has demonstrated that vaporizers produce less harmful by-products for users compared to cannabis cigarettes (Pomahacova, Van der Kooy, & Verpoorte, 2009). Smoking cannabis is the most popular method of use in Canada (Statistics Canada, 2018a). Cannabis may also be mixed into baked goods, teas, sodas, or cannabis oil and consumed orally (CCSA, 2018), and edibles are the second most popular way to use cannabis in Canada (Statistics Canada, 2018b).

After consumption, cannabis users typically experience feelings of euphoria (Ashton, 2001; CCSA, 2018), relaxation (CCSA, 2018), and altered perceptions of space and time (Ashton, 2001; Morrison et al., 2009; CCSA, 2018). In addition to these intoxicating effects, other effects of cannabis use can include anxiety (Ashton, 2001; Hall & Degenhardt, 2009), changes in cardiovascular physiology, such as increased heart rate and decreased blood pressure (Pacher, Steffens, Haskó, Schindler, & Kunos, 2018), and respiratory changes such as bronchodilation (Tetrault, 2007). Cannabis intoxication is also reliably associated with altered cognition, including impaired memory (specifically, verbal learning), attention, psychomotor functioning, and executive functioning (specifically, inhibition; Broyd, Van Hell, Beale, Yücel, & Solowij, 2016). Effects are experienced within a few seconds if cannabis is smoked, whereas psychoactive effects are delayed by 30 to 120 minutes if consumed orally, since the liver must first metabolize the psychoactive ingredients of the plant; Agurell et al., 1986; United Nations Office on Drugs and Crime, 2007). Depending on amount consumed and user histories, the psychoactive effects of cannabis use generally last for about 1 to 2 hours (Iversen, 2009), but are dose dependent (Ashton, 2001; Hall & Degenhardt, 2009).

There are hundreds of chemical components (termed cannabinoids) in cannabis, but the main psychoactive component is delta-9-tetrahydrocannabinol (THC), which binds to CB<sub>1</sub> and CB<sub>2</sub> cannabinoid receptors in the brain (Ben Amar, 2006; Devane, Dysarz, Johnson, Melvin, & Howlett, 1988; Munro, Thomas, & Abu-Shaar, 1993). Another type of cannabinoid is Cannabidiol (CBD), which does not produce the psychoactive effects experienced by users but rather is being studied for its therapeutic properties (Ibeas Bih et al., 2015; Perucca, 2017). The potency of cannabis is determined by the percent of THC by weight contained within the product and varies depending on the source and preparation (Ashton, 2001). The potency of THC has drastically changed over time, with modern day potency about 15 times higher today than in the 1960's (see Ashton, 2001 for a review).

## Epidemiology of Cannabis Use

### Prevalence and Patterns of Use

Prior to its legalization in October 2018, cannabis was the illicit substance used most often by Canadians (Statistics Canada, 2018b). In the 3 months prior to legalization in October 2018, about 15% of Canadians over the age of 15 reported using cannabis (Statistics Canada, 2018b), and there is great interest in understanding whether population-level cannabis use increases following legalization. Early post-legalization survey data indicates that cannabis use is still reported to be 15% in the 3-months following this regulatory change (Statistics Canada, 2018a); however, ongoing surveillance is required to describe longer term trends.

Demographic characteristics including age, sex, race, and socioeconomic status, are all reliably associated with different patterns of cannabis use and cannabis-related problems. Developmentally, cannabis use begins in adolescence, increases rapidly through young adulthood, and trails off sharply thereafter. For example, 19.4%, 33.2%, and 12.7% of Canadians aged 15-19, 20-24, and 25+, reported using cannabis in the past year, respectively (Statistics Canada, 2017). In school-based samples, about 5.5% of youth in grades 7 to 9 reported using cannabis in the past year, compared to 27.8% of students in grades 10 to 12 (Statistics Canada, 2016). Given these age-related trends, post-secondary students are an important

subpopulation for monitoring and intervention. A recent estimate indicated that 17.8% of Canadian post-secondary students used cannabis in the past 30 days, with 4.1% using daily or almost daily (American College Health Association, 2016). Overall in Canada, the average age of first use is 18.6 years old (including men and women; Statistics Canada, 2017).

In addition to age-related trends, there are consistent sex differences in cannabis use. A national Canadian survey of adults over the age of 15 indicated that Canadian men were more likely to report ever using cannabis than Canadian women (52.1% versus 37.2%, respectively); 18.7% of men endorsed past year use (versus 11.1% of women; Statistics Canada, 2017). Among Canadian youth in grades 7 to 12, slightly more men used cannabis in the past year compared to women (17.6% versus 15.8; Statistics Canada, 2016). These sex-related trends have also been observed internationally: several longitudinal studies suggest that men are also more likely to use cannabis (Brook, Kessler, & Cohen, 1999; Fitzgerald, Mac Giollabhui, Dolphin, Whelan, & Dooley, 2018; Von Sydow, Lieb, Pfister, Hofler, & Wittchen, 2002) and experience cannabis abuse (Palmer et al., 2009; Von Sydow et al., 2002), and dependence (Lopez-Quintero et al., 2011; Palmer et al., 2009; Von Sydow et al., 2002). For example, compared to women, men are about two times as likely to develop a cannabis use disorder by age 21 (Hayatbakhsh, Najman, Bor, O'Callaghan, & Williams, 2009) and by age 24 (Swift, Coffey, Carlin, Degenhardt, & Patton, 2008). Similarly, American men followed from age 16 to age 30 were more likely to experience a cannabis use disorder than women at any time interval (Farmer et al., 2015). American youth in grade 8 and grade 10, also show a sex difference with men being more frequent, regular cannabis users than women (Chen, Martins, Strain, Mojtabai, & Storr, 2017). In sum, men seem to use more cannabis than women and this trend is consistent within Canada.

There are limited data on patterns of cannabis use and cannabis-related problems among Canadian ethnic groups. One recent study completed in Ontario reported that most ethnic groups (i.e., Canadian, East Asian, South Asian, African, East European, South European, North European, and Central West European) were equally likely to report past year cannabis use, whereas only those of Caribbean ethnicity had

significantly higher past year use and those of South East Asian background had significantly lower past year use (Tuck, Hamilton, Agic, Ialomiteanu, & Mann, 2017). Conversely, data collected in the United States indicates that White populations report more cannabis dependence than Black or Hispanic populations (Compton, Grant, Colliver, Glantz, & Stinson, 2004), while other studies indicate that ethnic minority groups (including Blacks, Native Hawaiians/Pacific Islanders and American Indians or Alaskan Natives) are more likely to transition from cannabis use to cannabis dependence (Lopez-Quintero et al., 2011; Schulenberg et al., 2015).

Socioeconomic status (SES) is also associated with different patterns of cannabis use. Canadian national cross-sectional survey data suggests that those with high school education (versus university education) and those with a household income below \$40,000 dollars (versus a household income of \$120,000 or more) are about twice as likely to use cannabis weekly compared to other SES subgroups (Hango & LaRochelle-Cote, 2018). In other countries such as Germany and the United States, SES indicators are consistently associated with different cannabis use patterns. A German study reported that low SES predicted development of cannabis use disorders after 3.5 years of follow-up (Von Sydow et al., 2002). Similarly, an American study that followed male children for two decades reported that lower family SES during childhood increased risk of adolescent cannabis use disorders later in life (Buu et al., 2009). In another study, SES moderated the relationship between cannabis use and the development of cannabis problems among Black men: those with lower SES experienced more frequent cannabis problems than Black men with higher SES (Kogan, Cho, Brody, & Beach, 2017). Overall, low SES may influence cannabis use but the extent of this influence is not clear in Canada.

### Public Health Significance

At a population level, cannabis is the third most costly substance in Canada, incurring over \$2.8 billion dollars in annual costs to health care, lost productivity, criminal justice costs, and other costs directly and indirectly related to cannabis misuse (Canadian Substance Use Costs and Harms Scientific Working Group, 2018). Although cannabis is associated with lower risks to health than other psychoactive

substances such as tobacco and alcohol (Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2016; Mchale & Goddard, 2016; Okaneku, Vearrier, McKeever, LaSala, & Greenberg, 2015) and is less harmful and less addictive than tobacco products, heroin, cocaine, binge drinking, and LSD (Berg et al., 2015; Lipari & Jean-Francois, 2016), there are still notable public health harms associated with heavy, frequent consumption that a minority of cannabis users will experience, as reviewed in sections below (Fischer et al., 2010; Perkonigg et al., 2008).

## Problematic Cannabis Use

### Definitions and Criteria

There are several ways that researchers have differentiated between non-problematic, risky, and problematic cannabis use. One approach uses frequency of consumption to distinguish between recreational (e.g., less than weekly) and problematic (e.g., weekly or greater) consumption patterns (Casajuana et al., 2016). Other operational definitions refer to one or more of the diagnostic criteria presented in the Diagnostic and Statistics Manual 5<sup>th</sup> edition (DSM-5) to define problematic cannabis use (American Psychiatric Association, 2013). In the DSM-5, Cannabis Use Disorder (CUD) is diagnosed by a clinician using a set of objective criteria including the presentation of at least two of the following 11 symptoms within a one-year period: using cannabis in larger amounts than intended, a persistent desire to cut down on use, a large amount of time devoted to acquiring cannabis, cravings, failure to fulfill social role obligations, persistent social or interpersonal problems, interference with important social or occupational activities, use in physical hazardous situations, use despite physical or psychological problems caused or exacerbated by cannabis tolerance (i.e., the need to use increasing amounts to achieve the same psychoactive effects), and withdrawal (i.e., unpleasant feelings such as irritability, nervousness, and depressed mood which occur when cannabis use is discontinued; American Psychiatric Association, 2013). The DSM-5 combined the abuse and dependence criteria discussed in the DSM-IV-R (American Psychiatric Association, 2000), to create one category for use (cannabis use disorder; CUD) that may be classified as mild, moderate, or

severe (American Psychiatric Association, 2013), depending on severity and number of symptoms that are present.

Contrary to a popular belief held by Canadians that cannabis is not addictive (Spackman et al., 2017), many Canadians experience symptoms of problematic cannabis use using these DSM criteria; for example, 32% of past-year cannabis users endorsed a strong desire to use, 7% reported failure to meet social role expectations, 5% reported that cannabis use led to health, social or legal problems (Begin, Weekes, & Thomas, 2004), and 5% used cannabis daily, which sometimes is used as a proxy measure for cannabis-related problems (Statistics Canada, 2018a). International studies suggest that about 10% of regular cannabis users will eventually develop dependence (Hall, 2015; Lopez-Quintero et al., 2011). Those who use cannabis when they are young are at elevated risk of developing substance use disorder later in life (Fergusson & Boden, 2008). Moreover, it is estimated that 1.3% of the general Canadian population, or approximately 380,000 Canadians will experience cannabis use disorders (DSM-IV abuse or dependence) each year (Fischer, Imtiaz, Rudzinski, & Rehm, 2016). These epidemiologic findings suggest that an effective public health approach to mitigating problematic cannabis use should include (a) routine population surveillance of cannabis use and the related harms, (b) screening for cannabis-related problems among those who might benefit or want this (c) and clinical diagnoses when warranted.

#### Cannabis, Other Substance Use and Substance Use Disorders

Cannabis is often used with other psychoactive drugs. For example, alcohol use (Fitzgerald et al., 2018) and regular tobacco smoking (Stronski, Ireland, Michaud, Narring, & Resnick, 2000), are associated with lifetime and past-month cannabis use. There is debate in the literature about the temporal sequence of cannabis use in relation to other substances. Some research indicates that nearly all cannabis users report using either alcohol or nicotine prior to using cannabis for the first time (Behrendt et al., 2012). Use of other substances in adolescence predicts cannabis use and cannabis use disorder in later life. For example, a longitudinal study reported that illicit drug use during adolescence (age 14 to 24) predicted greater frequency of cannabis use and cannabis dependence 3.5 years later (Von Sydow et al., 2002). Smoking



cigarettes or drinking alcohol by age 14 also predicted subsequent cannabis use and cannabis use disorders at age 21 (Hayatbakhsh et al., 2009). Early tobacco use (but not alcohol use) prior to age 12, predicted cannabis use disorder at age 19 (Prince van Leeuwen et al., 2014). As well, those with continued use of tobacco throughout adolescence had two times the odds of a cannabis use disorder than those that did not continue use (Prince van Leeuwen et al., 2014). Consistently, tobacco and cannabis use during adolescence (age 14 to 17) predicted weekly cannabis use and dependence at age 24 (Swift et al., 2008).

Although these studies suggest that other substance use *per se* is a cause of later cannabis problems, an alternative explanation is that associations between early alcohol and tobacco use and later cannabis use may reflect the influence of other variables influencing substance use generally (e.g., externalizing disorders, parental substance dependence; Behrendt et al., 2012). Behrendt and colleagues (2012) reported that there was no relationship between early alcohol and tobacco use in adolescence (age 14 -24) and increased risk of cannabis use disorder 8 years later after adjusting for externalizing disorders, early onset of cannabis use, and parental substance dependence (Behrendt et al., 2012). Therefore, it is possible that other factors including behavioral disorders are associated with substance use.

Cannabis use is also associated with experiencing other substance use disorders (Blanco et al., 2016; Guttmanova et al., 2017; Winters & Lee, 2008). For example, according to the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), past-year adult cannabis users 18 years or older had 6.2 times the odds of developing any substance use disorder (abuse or dependence), 2.7 times the odds of developing any alcohol use disorder (abuse or dependence), 9.5 times the odds of developing any cannabis use disorder (abuse or dependence), and 2.6 times the odds of developing any other drug disorder (abuse or dependence) after 3 years in comparison to non-cannabis users (Blanco et al., 2016).

## Other Health Impacts of Cannabis Use

### *Impaired Driving/Injury*

Beyond cannabis-related problems and other substance use, one of the most prominent public health issues surrounding cannabis use is impaired driving. From a financial perspective, the cost attributed to

cannabis impaired driving in Canada was estimated to be \$1.09 billion dollars in 2012 and was associated with 75 and 4407 estimated fatalities and injuries, respectively (Wettlaufer et al., 2017). Although impaired driving is very costly and may be directly responsible for injury and death, many Canadians still drive while under the influence of cannabis. For example, 14% of Canadian cannabis users 15 years and older (i.e., those who endorsed use in past 3 months and had a valid drivers license) stated that they drove within 2 hours of consuming cannabis and, unfortunately, this percent increased to 23% for daily or weekly cannabis users (Statistics Canada, 2018b). Converging evidence from roadside testing of biological samples, self-report, and experimental studies suggest that cannabis use prior to driving may inhibit driving ability. Cannabis is often found in the blood following non-fatal (Asbridge, Hayden, & Cartwright, 2012; Brubacher et al., 2016) and fatal (Asbridge et al., 2012; Brady & Li, 2014) motor vehicle collisions. Cannabis use may especially increase the risk of a collision for younger drivers (compared to older drivers), single drivers (compared to married), and frequent drivers (compared to non-frequent drivers; Mann et al., 2010). Evidence from experimental studies demonstrates that cannabis intoxication impairs driving ability. For example, increases in blood THC levels result in more lane weaving and increased reaction time (Hartman et al., 2016; Ronen et al., 2008), and the combined effect of concurrent alcohol and cannabis intoxication results in more severe driving impairments (Downey et al., 2013; Hartman et al., 2016). The influence of cannabis intoxication may be dose-dependent with higher doses resulting in greater impairment in driving than lower doses (Ronen et al., 2008). Thus, biological samples, self-report, and experimental studies of blood THC levels suggest that cannabis should be avoided prior to or during driving.

### *Lung Effects*

The inhalation of cannabis smoke may negatively impact lung function. Several studies have suggested that cannabis exposure may lead to chronic bronchitis (Aldington et al., 2007; Mehra, Moore, Crothers, Tetrault, & Fiellin, 2006; Tashkin, 2001; Tashkin et al., 1987; Tetrault, 2007), the development of lung cancer (Hall & Degenhardt, 2009; Mehra et al., 2006; Zhang et al., 2016), increased respiratory illness (sore throat, shortness of breath with exercise, sinus problems and colds; Brook, Stimmel, Zhang, & Brook,

2008) and severe lung impairment (e.g., hemoptysis; Hashmi, Duncalf, & Khaja, 2016). Within Canada, it is estimated that 1-2% of the cases of lung cancer can be attributed to cannabis use (Fischer et al., 2016). However, a recent review has suggested that more research is needed to clarify the long-term effects of cannabis use on the lungs (Ribeiro & Ind, 2016).

### *Cognition*

There is evidence to suggest that some aspects of cognition may be impaired with frequent, long-term cannabis use. A recent review of 105 articles that explored cognitive impairment associated with cannabis use found strong evidence of impaired memory and attention and mixed evidence of impaired psychomotor and executive functioning with acute and chronic cannabis use (Broyd et al., 2016). Following cannabis cessation, there was mixed evidence for persistent, lasting impairment in memory, attention, psychomotor function, and executive functioning with some research suggesting that cognitive impairments may persist even after a 3-week period of sustained abstinence (Broyd et al., 2016).

### *Psychosis*

A recent estimate indicated between 2 to 3% of the cases of psychosis in Canada can be attributed to cannabis use (Fischer et al., 2016). Two meta-analyses have suggested that cannabis use results in earlier age of psychosis onset and, in some cases, is causally related to the development of psychosis (Large, Sharma, Compton, Slade, & Nielssen, 2011; Myles, Newall, Nielssen, & Large, 2012), especially for those with family histories of severe mental disorder. In addition, high cannabis potency (Di Forti et al., 2015; Murray, Quigley, Quattrone, Englund, & Di Forti, 2016), frequent daily use (Di Forti et al., 2015) and using before age 15 (Di Forti et al., 2015) has been shown to increase the risk of experiencing psychosis. However, it is very challenging to attribute psychosis solely to cannabis use: many studies are cross-sectional, do not have a control group, and are unable to establish whether associations reflects influences of other variables (e.g., genetic liability) on both cannabis use and psychosis (Volkow, Baler, Compton, & Weiss, 2014). As such, there is some evidence to suggest that cannabis use may be linked to psychosis, but it is difficult to understand the intricacies in relation to the causal path of psychosis.

## Benefits

There is growing interest in the use of cannabis in the treatment and symptom management of other diseases and health conditions. Newly released guidelines for the prescription of cannabis in Canada (and endorsed by the College of Family Physicians of Canada) suggested that cannabis may be prescribed for chronic pain, nausea and vomiting, and spasticity but cited a lack of scientific evidence for the efficacy of cannabis for other conditions (Allan et al., 2018a; Allan et al., 2018b). According to this review, medical cannabinoids are associated with at least a 30% reduction in chronic pain, compared to placebo conditions although this relationship was not statistically significant (Allan et al., 2018a). A meta-analysis of seven randomized control-trials suggested that those taking medical cannabis have 3.60 times the odds of not experiencing nausea and vomiting compared to placebo controls (Allan et al., 2018a). Moreover, for the management of spasticity, a meta-analysis of four randomized control trials demonstrated a significant change in spasticity for those taking medical cannabis versus controls (Allan et al., 2018a). While this is an important area for review, an in depth discussion of the medical benefits of cannabis use is beyond the scope of this thesis.

## Risk and Protective Factors for Cannabis Use and Cannabis Problems

Consistent with a multifactorial view on predictors of cannabis use and cannabis use disorder (Meier et al., 2016), risk and protective factors for cannabis use and cannabis use disorder will be briefly reviewed at social and family levels.

### Social and family influences

Several correlates of cannabis use and problems have been consistently identified at the community, family and peer level. At the community level, cannabis use is associated with low neighborhood attachment, community disorganization, laws and norms favorable to substance use, and perceived availability of drugs (Hemphill et al., 2011). Risk factors at the family level include poor family management, family conflict, family history of substance use, and parental attitudes favorable toward drug use or antisocial behavior (Cleveland, Feinberg, Bontempo, & Greenberg, 2008; Hemphill et al., 2011). At

the peer level, interaction with antisocial or deviant peers (Beyers, Toumbourou, Catalano, Arthur, & Hawkins, 2004; Cleveland et al., 2008; Hemphill et al., 2011; Van Ryzin, Fosco, & Dishion, 2012) and friends' use of drugs (Beyers et al., 2004; Bryant & Zimmerman, 2002; Cleveland et al., 2008; Hemphill et al., 2011; Schwinn, Schinke, Hopkins, & Thom, 2016), strongly predict cannabis use and misuse.

Social factors at school, family, and community levels may also protect against cannabis use. For example, school connectedness (e.g., commitment to school; Bond et al., 2007), happiness with school (Piko & Kovács, 2010), prosocial school peers (Hodder et al., 2016), having friends with positive school experiences (Bryant & Zimmerman, 2002), and having the ability to talk to teachers about problems (Piko & Kovács, 2010) are protective of cannabis use. Family factors, including having a quality family relationship (Van Ryzin et al., 2012), family support (Bryant & Zimmerman, 2002; Hodder et al., 2016; Moore et al., 2018) and parental monitoring (Piko & Kovács, 2010; Rai et al., 2003; Wright & Fitzpatrick, 2004) are consistently suggested to be protective factors against cannabis use. Furthermore, in a study that developed index scores to measure school protective factors (e.g., school commitment), community protective factors (e.g., neighborhood attachment, laws and norms favorable to drug use) and family protective factors (e.g., family attachment, family supervision), demonstrated that school, community, and family protective factors are negatively associated with lifetime cannabis use (Cleveland et al., 2008). As such, protective factors at the school, community, and family level act to reduce problematic cannabis use.

#### Comorbid/premorbid psychopathology

Problematic cannabis use and cannabis use disorders may reflect broader dimensions of psychopathology. Externalizing disorders refer to a range of disruptive behaviors (e.g., conduct disorder; Farmer et al., 2015). Experiencing an externalizing disorder during childhood or adolescence consistently predicts early substance use (King, Iacono, & McGue, 2004; Pedersen, Mastekaasa, & Wichstrøm, 2001), cannabis abuse and dependence (Charach, Yeung, Climans, & Lillie, 2011; Farmer et al., 2015; Fergusson, Horwood, & Ridder, 2007; King et al., 2004), cannabis use (Fergusson et al., 2007; King et al., 2004; Wittchen et al., 2007), and increased risk of experiencing other substance use disorders (Lopez-Quintero et

al., 2011; Sung, Erkanli, Angold, & Costello, 2004; Wittchen et al., 2007). These findings suggest that externalizing disorders are a risk factor for cannabis use and related problems. Internalizing disorders include mood (e.g., depression, bipolar), anxiety, and post-traumatic disorders (Farmer et al., 2015). These disorders are also associated with cannabis use and cannabis use disorders (Crippa et al., 2009; Degenhardt, Hall, & Lynskey, 2003; Hunt, Malhi, Cleary, Lai, & Sitharthan, 2016; Kedzior & Laeber, 2014; Weinstock, Gaudiano, Wenzel, Epstein-Lubow, & Miller, 2016; Wilkinson et al., 2016; Wittchen et al., 2007). There is also high co-morbidity of cannabis use disorder and internalizing disorders in clinical and community settings (Hunt et al., 2016; Weinstock et al., 2016). Although the majority of the evidence suggests internalizing disorders are risk factors, other studies have found no relationship between these disorders and cannabis use/problems (Brook, Brook, Zhang, Cohen, & Whiteman, 2002; Goodwin, Fergusson, & Horwood, 2004; King et al., 2004). In sum, externalizing and internalizing disorders are risk factors for cannabis use and related problems.

### Psychological Models of Cannabis Use and Cannabis Problems

Psychological approaches have focused on three domains of constructs in the prediction of cannabis use and cannabis-related problems: norm perceptions, personality traits, and motives for using this substance. Each domain was originally investigated to develop psychological models of alcohol consumption; however, recent research has begun to apply them to cannabis use, as reviewed in the subsections below.

#### Norm Perceptions

At the interpersonal level, social influences on substance use, including cannabis, can be conceptualized as active or passive influence in nature (Graham, Marks, & Hansen, 1991). Active social influences refer to explicit offers, invitations, or pressure to use substance delivered by social networks (Graham et al., 1991) which require an immediate response (Wood, Read, Palfai, & Stevenson, 2001). In contrast, passive social influences refer to perceptions and observations of substance use among social reference groups (Graham et al., 1991; Oostveen, Knibbe, & De Vries, 1996). This thesis will investigate

one important component of passive social influences: norm perception, defined as beliefs about substance use behavior among social reference groups including friends and peers.

Social norms theory proposes that perceptions and beliefs about behavior in social reference groups can influence individual behavior (Berkowitz, 2004; Perkins, 2002). Two types of norm perceptions have been shown to influence substance use: descriptive and injunctive norms. Descriptive norms refer to beliefs about the frequency and quantity of others' substance use, while injunctive norms refer to beliefs about others' approval or disapproval of substance use (Borsari & Carey, 2001). Injunctive norms are assessed by measuring beliefs about how approving or disapproving reference groups (e.g., same-sex friends or peers) are toward substance use. These norm perceptions help individuals to determine what is acceptable (or unacceptable behavior) in relation to social reference groups (Cialdini, Kallgren, & Reno, 1991).

Descriptive norm perceptions may be especially relevant for young adults transitioning into college, as this is a high-risk age group for substance use (Cho et al., 2015; Derefinko et al., 2016; Skidmore, Kaufman, & Crowell, 2016). Several studies indicate that young adults overestimate the frequency of cannabis use among peer and friend groups. Mistaken beliefs about the frequency of cannabis use in social reference groups is associated with greater personal cannabis use (Arbour-Nicitopoulos, Kwan, Lowe, Taman, & Faulkner, 2010; Blevins, Walker, Stephens, Banes, & Roffman, 2018; Dempsey, McAlaney, & Bewick, 2018; Kilmer et al., 2006; Neighbors, Geisner, & Lee, 2008; Page & Roland, 2004), cannabis related problems (Blevins et al., 2018; Neighbors et al., 2008), and cannabis abuse/dependence symptoms (Blevins et al., 2018). Mistaken beliefs that cannabis use is more common or more frequent than it actually is can perpetuate cannabis use by 'normalizing' use of this substance. Perceived frequency of *friends'* use may be most relevant in the prediction of personal cannabis use rather than beliefs about other social reference groups. For example, in a college sample, only misperceived descriptive norms regarding friends' cannabis use (not other students in general) were associated with respondents' own cannabis use and problems (Buckner, 2013). In another related study, perceived frequency of friends' cannabis use

longitudinally predicted frequency of cannabis use, in young adults (Patrick, Kloska, Vasilenko, & Lanza, 2016).

Another common finding in this area is that people mistakenly believe that others in social reference groups approve of substance use more than they actually do, a phenomenon known as pluralistic ignorance (Pedersen, 1993; Prentice & Miller, 1993). For example, in a large sample of European University students ( $N=4,131$ ) most respondents mistakenly believed that their peers held more permissive attitudes toward cannabis use than they actually did (Dempsey et al., 2016). Misperceived social approval is also associated with personal cannabis use. For example, recent cannabis users (i.e., those that used cannabis 40 or more times in the past year), demonstrated greater approval of their own use, and perceived that their close friends and their parents were more permissive toward cannabis use (LaBrie, Hummer, & Lac, 2011), compared to those who used cannabis more infrequently. In a related study, heavy high-school cannabis users believed that their close friends approved more of cannabis use than other same aged teens (Blevins et al., 2018).

A less studied aspect of norm perceptions emphasizes how substance users perceive sociobehavioural criteria defining problematic substance use. For example, heavy alcohol users rated certain criteria (e.g., drinking alone, frequency of intoxication) as less definitive of problem drinking, compared to lighter drinkers (Danko et al., 1988; Wild, 2002). Whether this finding would be replicated for cannabis use has not yet been examined, but is an important consideration because discrepancies in personal ‘thresholds’ for attributing problems to oneself or others may perpetuate hazardous use, and may contribute to cannabis-related problems.

### Personality Traits

Castellanos-Ryan and Conrod (2012) proposed a four-factor model of vulnerability to substance use problems wherein four personality trait dimensions – impulsivity, sensation seeking, hopelessness, and anxiety sensitivity - are important individual differences that confer vulnerability to substance use and related problems.



*Impulsivity* is characterized by an inability to control behavior (especially in the presence of rewards or punishment (Woicik, Stewart, Pihl, & Conrod, 2009) and is associated with increased risk of harm to self and others (Stanford, Greve, Boudreaux, Mathias, & Brumelow, 1996), risky driving (e.g., aggressive driving, driving under the influence, and traffic related accidents; Bıçaksız & Özkan, 2016), ineffective communication styles (Tan, Jarnecke, & South, 2017), antisocial behavior (Maneiro, Gómez-Fraguela, Cutrín, & Romero, 2017) and substance use (Hamdan-Mansour, Mahmoud, Al Shibi, & Arabiat, 2018). Impulsivity is positively associated with lifetime cannabis use among adolescents (Lee-Winn, Mendelson, & Johnson, 2018), frequency of cannabis use in adolescence (Feldstein Ewing, Filbey, Loughran, Chassin, & Piquero, 2015), frequency of use in adults (Schlauch et al., 2015), and lifetime history of cannabis abuse (Liraud & Verdoux, 2000).

*Sensation seeking*, shares several behavioral similarities to impulsivity but is a distinct personality trait (Arnett, 1994) and is expressed as preferences to seek out new, novel and exciting experiences (Zuckerman, 1994). Sensation seeking is associated with dangerous driving (e.g., risky driving, accident involvement, aggressive driving; Zhang, Qu, Tao, & Xue, 2019; Zuckerman, 2007b), risky sexual behavior (Gullette et al., 2016; Zuckerman, 2007c), substance use (Hamdan-Mansour et al., 2018; Zuckerman, 2007d), and delinquent behavior (Zuckerman, 2007a). People with high scores on this trait dimension tend to be disinhibited and engage in risky behavior, including substance use. Research indicates that sensation seeking is positively associated with frequency of cannabis use (Crawford, Pentz, Chou, Li, & Dwyer, 2003; Gerra et al., 2004; Lee-Winn et al., 2018; Malmberg & Overbeek, 2010), past year cannabis use (Krank et al., 2011), and increases the likelihood of starting cannabis use at an earlier age (Malmberg & Overbeek, 2010; Zuckerman, 2007d). Theoretically, sensation seeking should also be associated with heavy, frequent, episodic cannabis use, as sensation seeking also predicts heavy episodic drinking (Cooper, Agocha, & Sheldon, 2000; Gerra et al., 2004).

*Hopelessness/introversion* refers to recurrent feelings of despair and pessimism toward the future and is a risk factor for depression (Joiner, 2001; Stewart et al., 2011). Hopelessness is also positively

associated with substance use including alcohol and cannabis (Malmberg & Overbeek, 2010). Individuals with high scores on this trait dimension have a greater likelihood of starting cannabis use at an earlier age and lifetime cannabis use (Malmberg & Overbeek, 2010), and hopelessness predicts future cannabis use in young adults (Krank et al., 2011).

Finally, *anxiety-sensitivity* is characterized by recurrent fears that internal (anxiety-related) sensations may lead to negative health outcomes (Reiss, Peterson, Gursky, & McNally, 1986). Anxiety-sensitivity predicts psychopathology such as posttraumatic stress disorder (Naragon-Gainey, 2010), agoraphobia (Naragon-Gainey, 2010), generalized anxiety disorder (Naragon-Gainey, 2010), and depression (Zavos, Rijdsdijk, & Eley, 2012) and is linked to problematic substance use (Bonn-Miller, Zvolensky, Marshall, & Bernstein, 2007; Chavarria et al., 2015; Guillot, Leventhal, Raines, Zvolensky, & Schmidt, 2016; Paulus, Manning, Hogan, & Zvolensky, 2017a; Paulus et al., 2017b). However, there is mixed evidence regarding associations between anxiety-sensitivity and cannabis use. Some studies report that this trait is associated with cannabis dependence (Johnson, Mullin, Marshall, Bonn-Miller, & Zvolensky, 2010), cannabis problems (Guillot, Blumenthal, Zvolensky, & Schmidt, 2018; Johnson et al., 2010), and cannabis withdrawal symptoms (Johnson et al., 2010). In contrast, other research has not demonstrated that anxiety-sensitivity is associated with increased frequency of cannabis use (Buckner et al., 2011; Stewart, Karp, Pihl, & Peterson, 1997), cannabis dependence (Farris, Metrik, Bonn-Miller, Kahler, & Zvolensky, 2016), cannabis problems (Farris et al., 2016), or cannabis cravings (Farris et al., 2016).

These personality liabilities for substance use and related problems are measured using the Substance Use Risk Profile Scale (SURPS; Woicik et al., 2009), a 23-item self-report instrument that measures impulsivity, sensation seeking, anxiety sensitivity, and introversion/hopelessness. The SURPS has been shown to have strong psychometric properties, including very good test retest reliability, construct validity, concurrent validity, predictive validity, and incremental validity (Castellanos-ryan, Leary-barrett, Sully, & Conrod, 2013; Krank et al., 2011; Woicik et al., 2009).

## Motivational models

Another prominent psychological approach to understanding substance use focuses on motives, i.e., self-reported reasons for using different psychoactive substances. Cox and Klinger (1998) proposed an influential motivational model of alcohol use, which has subsequently been applied to other substances. This approach proposes that distal factors (e.g., availability, social factors, personality) influence substance use via motives, theorized to be the ‘final common pathway’ to substance use and related problems. Cox and Klinger (1988) proposed that positive and negative incentives play a role in drinking behaviour and proposed that an individual’s perceived readiness to achieve desired outcomes, via alcohol (or other substances), influences decision making about whether or not to consume alcohol (Cooper, Frone, Russell, & Mudar, 1995; Cox & Klinger, 1988, 2002). Their model portrays individuals as deciding whether or not to drink based on whether the positive affective outcomes that they expect from drinking will outweigh the outcomes that they expect from not drinking (1988). Cooper et al. (1995) demonstrated that motives mediate the relationships between expectancies, emotions and other individual differences in predicting alcohol use and abuse.

Cooper (1994) incorporated Cox and Klinger’s views on anticipated affective outcomes into an influential motivational approach, proposing that drinking motives differ in the nature of the reinforcement sought from alcohol use (positive or negative) and the source (internal or external) of the desired consequences of alcohol consumption. This conceptualization identifies four drinking motives, each of which represents qualitatively different forms of drinking behaviour: drinking to be *social*, drinking to *conform*, drinking to *cope* with negative affect, and drinking to *enhance* experience. Socially-motivated drinking is a form of externally motivated positive reinforcement, such that people use alcohol in order to obtain desired social rewards. Conformity-motivated drinking is a form of negative reinforcement, where people use alcohol to avoid censure from others. Enhancement-motivated drinking is a positively reinforcing form of internally motivated drinking that seeks to improve one’s positive mood state. Finally,

coping-motivated drinking refers to negatively reinforcing internally-motivated alcohol use in order to reduce negative affect.

The Drinking Motives Questionnaire (DMQ) was developed to operationalize the four-factor motivational model (Cooper, 1994) and assesses each of the four motives (social, coping, enhancement, and conformity) through responses to 5-items. The DMQ is the most used assessment tool for measuring these constructs and has been validated among adolescents (e.g., Cooper, 1994; Hauck-Filho, Teixeira, & Cooper, 2012), university students (e.g., Martens, Rocha, Martin, & Serrao, 2008; Simons, Correia, & Carey, 2000), and adults (e.g., Gilson et al., 2013) cross-culturally (Fernandes-Jesus et al., 2016; Mackinnon et al., 2017; Martin, Ferreira, Haase, Martins, & Coelho, 2016). Across age groups and cultures, a four-factor model is consistently the most appropriate to measure these constructs. Motives for drinking are also highly predictive of the extent of alcohol use and alcohol problems. For example, those drinking to cope are shown to experience more alcohol problems than those drinking for enhancement motives (Cooper et al., 1995).

Recent work has adapted the DMQ for cannabis use. The Marijuana Motives Measure (MMM; Simons, Correia, Carey, & Borsari, 1998), includes the four subscales (social, coping, enhancement, and conformity motives) but adds an additional subscale; expansion. The expansion motive was added for cannabis to accommodate the consciousness-altering properties of cannabis (e.g., using cannabis to expand awareness and creativity; Cooper, Kuntsche, Levitt, Barber, & Wolf, 2015). The MMM includes 25-items and has been validated among young adults and adolescents (Chabrol, Ducongé, Casas, Roura, & Carey, 2005; Simons, Correia, Carey, & Borsari, 1998; Zvolensky et al., 2007). These five motives have been associated with varying levels of cannabis use and cannabis problems. For example, social motives tend to be associated with less problematic substance use (Kuntsche, Knibbe, Gmel, & Engels, 2005). Social cannabis users (compared to solitary users), used cannabis less frequently (Creswell, Chung, Clark, & Martin, 2015; Tucker, Ellickson, Collins, & Klein, 2006), experienced less symptoms of cannabis use disorders (Creswell et al., 2015), used lower quantities of cannabis (Tucker et al., 2006), and reported higher health (Tucker et al., 2006). Conversely, other studies have shown an association between social

motives and using greater quantities (Bonar et al., 2017; Norberg, Olivier, Schmidt, & Zvolensky, 2014), past-30 day use (Bonn-Miller, Zvolensky, & Bernstein, 2007; Foster, Allan, Zvolensky, & Schmidt, 2015), and self-reported cannabis problems (Foster et al., 2015). Coping motives are associated with increased frequency of cannabis use (Bravo, Anthenien, Prince, & Pearson, 2017), increased self-reported consequences of use (Bravo et al., 2017; Lee, Neighbors, Hendershot, & Grossbard, 2009), using greater quantities of cannabis (Bonar et al., 2017; Norberg et al., 2014), greater frequency of use (Foster et al., 2015) and cannabis dependence (Benschop et al., 2015; Bonn-Miller et al., 2007a; Simons et al., 1998). Coping motives also predicted the transition from non-dependent to dependent cannabis use in heavy cannabis users 3 years later (van der Pol et al., 2013). Enhancement motives are consistently associated with increased frequency of cannabis use (including daily use; Bravo et al., 2017; Foster et al., 2015), past 30-day use (Bonn-Miller et al., 2007a), using greater quantities (Bonar et al., 2017; Norberg et al., 2014), and self-reported cannabis problems (Foster et al., 2015). Conformity motives are not associated with past 30-day cannabis use in young adults (Bonn-Miller et al., 2007a) or frequency of use (Foster et al., 2015) but have been associated with self-reported cannabis problems (Bravo et al., 2017; Foster et al., 2015). Expansion motives are associated with higher frequency of cannabis use (Bravo et al., 2017), past-30 day use (Bonn-Miller et al., 2007a; Foster et al., 2015), using greater quantities (Norberg et al., 2014) and self-reported cannabis problems (Foster et al., 2015). These studies indicate that expansion motives may contribute to the prediction of cannabis use in addition to the four basic motives proposed by Cooper (1994).

Integration of norm perceptions, personality, and motivational factors and applications to cannabis

Contemporary research has attempted to integrate the psychological perspectives reviewed earlier, by modeling cognitive and motivational mechanisms underlying associations between personality traits and cannabis use. This section reviews the relevant literature, with special emphasis on applications to cannabis use and related problems.

One line of research has examined whether the link between personality and cannabis use is mediated by cognitive factors. Previous research on alcohol use has shown that descriptive and injunctive norms mediate the effects of personality on alcohol outcomes (Hustad, Pearson, Neighbors, & Borsari, 2014; Pearson & Hustad, 2014). Extending this research to cannabis, Pearson, Hustad, Neighbors, Conner, and Bravo (2018) conducted path analysis to determine whether associations between impulsivity, sensation seeking, hopelessness, and anxiety sensitivity and cannabis use and problems were mediated by norm perceptions. Norm perceptions were shown to fully mediate the effects of sensation seeking and impulsivity (and partially mediate the effects of hopelessness and anxiety-sensitivity) on cannabis use and consequences, suggesting that cognitions and traits should both be considered in the prediction of cannabis use (Pearson et al., 2018). Consistent with this approach, more recent research has shown that both norm perceptions and risk appraisal in adolescents and young adults each separately mediate the relationship between sensation seeking and cannabis use (Barnum & Armstrong, 2019).

Another line of research has examined the role of motives in explaining personality-substance use associations, with a limited evidence base and mixed findings to date. Regarding sensation seeking, one study reported a positive association between this trait and enhancement motives for alcohol use but not for cannabis use (Comeau, Stewart, & Loba, 2001). Another study demonstrated that sensation seeking was positively associated with expansion motives in cannabis users but not coping, conformity, and availability motives (although enhancement motives were not measured; Hecimovic, Barrett, Darredeau, & Stewart, 2014). Research on hopelessness suggests that this trait is associated with coping rather than conformity, expansion or availability motives for cannabis use (Hecimovic et al., 2014). More consistent findings on cannabis have emerged for anxiety sensitivity, with positive associations reported between this trait and conformity motives (Comeau et al., 2001; Guillot, Blumenthal, Zvolensky, & Schmidt, 2018; Hecimovic et al., 2014; Zvolensky et al., 2009) and coping motives (Bonn-Miller et al., 2007a; Farris et al., 2016; Guillot et al., 2018; Paulus et al., 2017a; Zvolensky et al., 2009). Impulsivity appears to be associated with all four basic motives for use (e.g., coping, social, enhancement, conformity; Schlauch et al., 2015) and has been

described as an availability motive for cannabis (e.g., cannabis being used because it was easier to get than other drugs; Hecimovic et al., 2014).

Research comparing the relative influence of motives and cognitive factors (expectancies and norm perceptions), has demonstrated that all three aspects predict cannabis outcomes (including frequency and problems; Buckner, 2013). Although all three factors contributed the prediction of use and problems, norm perceptions were the strongest predictor of frequency of cannabis use (compared to expectancies or motives) and coping motives were the strongest predictor of cannabis use problems. It has also been proposed that coping motives mediate the relationship between negative expectancies and cannabis use (Foster, Jeffries, Zvolensky, & Buckner, 2016).

#### Knowledge gaps

The major psychological approaches to understanding cannabis use and related problems include norm perceptions, personality traits, and motives for use. Although many studies have been completed within each of these domains, much of the existing literature focuses on alcohol use. There is very limited research examining whether misperceived descriptive norms and injunctive norms predict cannabis use and related problems. Preliminary research suggests that overestimating descriptive norms about the frequency of cannabis use among friends and peer groups is associated with greater personal cannabis use (Arbour-Nicitopoulos et al., 2010; Blevins et al., 2018; Dempsey et al., 2018; Kilmer et al., 2006; Neighbors et al., 2008; Page & Roland, 2004), more cannabis related problems (Blevins et al., 2018; Neighbors et al., 2008), and cannabis abuse/dependence symptoms (Blevins et al., 2018). Injunctive norms may also influence cannabis use, with heavier users more likely to believe that other's approval of cannabis use matches their own approval of cannabis use (Blevins et al., 2018; LaBrie et al., 2011). One limitation of extant research that no research to date has examined descriptive or injunctive norm perceptions of cannabis use in social reference groups among cannabis users who do and do not meet criteria for cannabis problems. Another limitation is that only one study to date has documented descriptive norm misperceptions for cannabis use among students attending a Canadian University (i.e., Arbour-Nicitopoulos et al., 2010) and no studies have

been completed to examine injunctive norm misperceptions of cannabis use within a Canadian sample. As such, it is unclear whether these results are replicable among students attending other Canadian Universities.

A less studied aspect of norm perceptions emphasizes how substance users perceive sociobehavioural criteria for problematic substance use. That is, heavy alcohol users tend to rate socio-behavioral criteria (e.g., drinking alone, frequency of intoxication) as less definitive of problem drinking, compared to lighter drinkers (Danko et al., 1988; Wild, 2002). This has not yet been investigated in the context of cannabis related problems, but it is an important consideration because discrepancies in personal ‘thresholds’ for attributing problems may perpetuate hazardous use, and may contribute to cannabis-related problems.

## Intervention Strategies

### Prevention

#### Primary prevention

The goals of primary prevention are to promote abstinence or to delay the onset of substance use. Many primary prevention interventions consist of exposure to passive educational materials (e.g., media or public relations campaigns that aim to create negative attitudes toward substance use), targeting all youth and young adults through community and school-based programs. There is limited evidence for the success of mass media interventions (e.g., TV, internet, radio, newspapers; Ferri et al., 2013) with some primary prevention interventions actually resulting in increased intentions to use substances (Werb et al., 2011). A review that explored universal prevention in non-school settings (e.g., youth clubs, primary care centers), found that there was no evidence to suggest that these interventions were effective at preventing or delaying the onset of drug use in young people (Gates, McCambridge, Smith, & Foxcroft, 2006). While school-based primary prevention programs have occasionally demonstrated success at reducing alcohol and cannabis use (e.g., Newton, Andrews, Teesson, & Vogl, 2009), the overwhelming majority of evidence suggests that knowledge-based primary preventions do not work in the school setting (Faggiano et al., 2008; Foxcroft &



Tsertsvadze, 2011; Lemstra et al., 2010). Although knowledge-only primary prevention programs are not supported empirically, there is some support for more comprehensive primary interventions, including those that focus on substance-related refusal skills (Lemstra et al., 2010; Porath-Waller, Beasley, & Beirness, 2010). One key limitation of this intervention approach is that primary prevention programs are not appropriate for those who have already started cannabis use, but are interested in reducing or stopping their use, or in reducing the risks associated with cannabis consumption.

### Secondary prevention

The objective of secondary prevention is to prevent problematic substance use by intervening with those who are not yet using substances problematically but who are exposed to risk factors for substance use problems. Secondary prevention may range from brief interventions that consist of short sessions delivered in person or online or more rigorous, extensive interventions that include multiple, manualized sessions. Although there is demonstrated success for both brief and extensive secondary interventions, brief interventions may have the ability to reach a greater number of people and are often more cost effective.

There are several existing brief interventions that allow cannabis users to ‘check-up’ on their own cannabis use. In a Canadian study, Fischer et al. (2013) demonstrated the feasibility and efficacy of brief oral or written interventions in reducing cannabis use practices in University students. Some brief interventions target non-treatment seeking adolescents. For example, the Adolescent Cannabis Check-up randomly assigned non-treatment seeking adolescent cannabis users from the community to a brief intervention which was comprised of two sessions (i.e., one brief motivational enhancement session and one cognitive behavioral session) or a control condition (Martin & Copeland, 2008). This brief intervention successfully reduced cannabis use at the 3-month follow-up (Martin & Copeland, 2008). In another study, high school students were randomized to Motivational Enhancement Therapy (MET), Educational Feedback Control (EFC) or Delayed Feedback Control (DFC; Walker et al., 2011). The MET and EFC session consisted of two 45-50 minute sessions (with 4 –optional Cognitive Behavioral Therapy (CBT) sessions; Walker et al., 2011). Relative to the DFC, both MET and EFC resulted in reductions in cannabis

use even 12-months after the intervention, suggesting support for ‘check-up’ models (Walker et al., 2011). Brief interventions are also shown to be successful in primary care settings. For example, CANnabis and Adolescents, a Brief Intervention to Reduce Their Consumption (CANABIC) was successful in primary care settings in reducing the number of joints smoked, especially in nondaily users and users under the age of 18 (Laporte et al., 2017). Other brief interventions such as access to self-help tools have been shown to successfully reduce the frequency and quantity of cannabis used, reduce symptoms of abuse and dependence, and even result in complete cannabis abstinence (Bonn-Miller, Zvolensky, & Moos, 2011; Rooke, Copeland, Norberg, Hine, & McCambridge, 2013; Schaub et al., 2015). Some evidence suggests that more problematic users may be more willing than others to access self-help tools (Cunningham, 2005; Cunningham, Wild, & Walsh, 1999; Wild, Roberts, Cunningham, Schopflocher, & Pazderka-Robinson, 2004). Following cannabis legalization, the development of novel, online interventions have been identified as a priority (due to accessibility and cost considerations; Sahlem, Tomko, Sherman, Gray, & McRae-Clark, 2018). Brief interventions have been successfully delivered online for substance use in general (Boumparis, Karyotaki, Schaub, Cuijpers, & Riper, 2017) and for cannabis use (Tait, Spijkerman, & Riper, 2013). A review and meta-analysis of four studies found similar results and demonstrated that brief internet and computerized interventions that combined MET and CBT techniques, effectively reduced problematic cannabis use in the short term (Hoch, Preuss, Ferri, & Simon, 2016). In addition, adult community members who completed a brief online intervention including personalized feedback on use, motives, and harms reported reductions in the quantity, frequency, and severity of cannabis dependence in the one month follow-up (Copeland, Rooke, Rodriguez, Norberg, & Gibson, 2017). Brief web-based secondary interventions may be an important area for further development.

The personality traits reviewed earlier (i.e., impulsivity, sensation seeking, hopelessness, and anxiety sensitivity (Hecimovic et al., 2014; Johnson et al., 2010; Malmberg & Overbeek, 2010) have been a target of more extensive school-based interventions. The overall goal of these interventions are to target the most dominant personality liability for substance use and provide a multicomponent psychoeducational,

motivational, and cognitive behavioral intervention to reduce the risk of substance use associated with that personality subtype, delivered through two 90-minute, manualized sessions (Conrod, Castellanos-Ryan, & Strang, 2010; Conrod et al., 2013; Mahu, Doucet, O’Leary-Barrett, & Conrod, 2015; O’Leary-Barrett, MacKie, Castellanos-Ryan, Al-Khudhairy, & Conrod, 2010). In this school-based approach, thousands of students are screened in order to identify those who have elevated risk on one of the personality scales; those students are subsequently enrolled in the intervention. Although this program has demonstrated efficacy at delaying onset and frequency of substance use, shown from several randomized-control trials (e.g., Conrod et al., 2010, 2013), this selective approach only offers support to the relatively few people who have elevated personality subtypes. That is, a large number of people who (may also) benefit from some kind of substance intervention program, are screened out. Furthermore, as this intervention is completed during school hours, it detracts from valuable class time and requires support by school personnel. Overall, while extensive secondary interventions have great potential to reduce substance use for the people enrolled in these programs, these programs are relatively time consuming and miss a number of people who may also benefit from substance use help.

## Treatment

Treatments for cannabis use include structured psychosocial and pharmacotherapeutic treatments for cannabis users seeking specialty addiction treatment. Many treatment programs use techniques derived from motivational enhancement therapy (MET), cognitive behavioral therapy (CBT), and contingency management (CM). Motivational enhancement therapy aims to resolve ambivalence toward quitting substance use and increase motives for change (Copeland & Swift, 2009). Cognitive behavioral therapy teaches strategies to reframe and cope with negative thoughts and skills to reduce cannabis use (Copeland & Swift, 2009). Contingency management draws on behavioral principles and includes rewarding abstaining behavior to reduce substance use and promote abstinence (Copeland & Swift, 2009). These therapeutic practices often involve working with a trained clinician in outpatient or residential treatment settings.

In adult and adolescent populations experiencing cannabis use disorders, the most effective psychosocial interventions include MET, CBT, and CM as an adjunct to either MET or CBT (Copeland & Swift, 2009; Davis et al., 2015; Dennis et al., 2004; Gates, Sabioni, Copeland, Le Foll, & Gowing, 2016; Sabioni & Le Foll, 2018). Gates et al. (2016) reviewed 23 randomized controlled studies published prior to 2015 on psychosocial interventions for cannabis use disorder. This review suggested that at least 4 in-person sessions of MET or CBT, especially when combined, produced the greatest reduction in cannabis use frequency and reductions in cannabis dependence (Gates et al., 2016). Adding CM as an adjunct to MET or CBT also improved outcomes in several of the reviewed studies (Gates et al., 2016). The authors identified several weaknesses with the published studies including failure to blind the participants and researchers to treatment group, failure to verify self-report data of cannabis use, and failure to consider other substance use or prior treatment attendance before the trial period began (Gates, et al., 2016). Adolescents with cannabis use disorders, may also benefit from structured family based interventions (Copeland & Swift, 2009) including family therapy (family support network intervention; Dennis et al., 2004) and functional family therapy (Barrett Waldron, Slesnick, Brody, Turner, & Peterson, 2001).

Psychosocial interventions have been adapted to be administered online and have some demonstrated success. For example, a rigorous computer based intervention consisting of 9 sessions of CBT, MET, and CM was just as successful as therapist delivered sessions at reducing days of cannabis use and increasing abstinence rates (Budney et al., 2015). The computer version was also much more cost effective (about \$130 dollars less per person) than the therapist delivered intervention (Budney et al., 2015). The success of online interventions in reducing substance use has led to the development of mobile phone apps. For example, an app that integrated CBT techniques successfully reduced cannabis dependence in veterans (Babson, Ramo, Baldini, Vandrey, & Bonn-Miller, 2015). Therefore, psychosocial interventions such as MET, CBT, and CM are successful at reducing cannabis frequency and dependence in treatment seeking individuals and may be adapted to be administered online.

Stand-alone pharmacotherapeutic treatments or pharmacotherapeutic adjuncts to therapy, may successfully reduce cannabis use disorders in treatment seeking populations especially since this has been shown to be an effective intervention strategy for other substances of abuse (including alcohol and opioids; National Collaborating Centre for Mental Health [UK], 2008, 2011). To date, however, there are no approved pharmacotherapeutic treatments for cannabis use disorders (Nielsen, Gowing, Sabioni, & Le Foll, 2019). While research in this area is continuously growing in an effort to find effective drug therapies including cannabis antagonists (that act to block the effects of cannabis), cannabis agonists (a substitution for cannabis to reduce withdrawal symptoms), or other drugs types (e.g., anti-depressants, anxiolytics, opioid antagonists), there is minimal evidence to support the efficacy of any drug at this time point (Brezing & Levin, 2018; Budney, Roffman, Stephens, & Walker, 2007; Danovitch & Gorelick, 2012; Sabioni & Le Foll, 2018). For example, a recent Cochrane review of 21 randomized-control trials indicated that there is currently no evidence to support selective serotonin reuptake inhibitors, antidepressants, mixed action antidepressants, bupropion, or atomoxetine in the treatment of cannabis dependence (Nielsen et al., 2019). There is some, albeit weak, evidence supporting the experimental effectiveness of anticonvulsant gabapentin, oxytocin, and N-acetylcysteine in treating cannabis dependence, but further investigation of these drugs is recommended (Nielsen et al., 2019). The Nielsen et al. (2019) review included randomized control trials up to March 2018, and current, more recent, investigations are underway to evaluate the effectiveness of the agonist replacement medication nabiximol (Bhardwaj et al., 2018) and the  $\mu$ -opioid receptor antagonist, naltrexone (Benjamin, Grant, & Pohorecky, 1993; Notzon et al., 2018; Sabioni & Le Foll, 2018). At this time, there are many drugs that have the potential to improve cannabis use disorder outcomes, but this is an area of research that is still under development.

Although problematic cannabis users may benefit from treatment interventions, these interventions are underutilized (Agosti & Levin, 2004; Kessler et al., 1996; Swift, Hall, & Copeland, 2000), especially among young adults and college students (Caldeira et al., 2009; Kessler, 2001). In Canada, the number of people experiencing cannabis use disorders is greater than the number seeking treatment (Jutras-Aswad et

al., 2019). Low levels of treatment seeking may be a result of several barriers including lack of motivation, peer substance use, experiencing other mental health problems, lack of space in treatment and stigma associated with treatment seeking (Breda & Heflinger, 2007; Gates, Copeland, Swift, & Martin, 2012; Hammarlund, Crapanzano, Luce, Mulligan, & Ward, 2018; Kertesz et al., 2006; Rapp et al., 2007). Concerns surrounding confidentiality may also prevent treatment seeking in addiction programs (Sterling, Weisner, Hinman, & Parthasarathy, 2010).

### Harm reduction

The priority of harm reduction is to reduce the risk of negative effects of substance use, through the incorporation of several strategies that range from safer use to abstinence (Marlatt & Witkiewitz, 2010).

### Protective behaviors for cannabis users

There are several behavioral strategies that can be used to reduce the risk of becoming a problematic user or experiencing adverse effects for those who decide to use cannabis. Pedersen et al. (2016) developed a 17-item Protective Marijuana Behavioral Strategies scale to assess protective cannabis use behavior. In general these protective behavioral recommendations fall into 3 broad categories (a) harm reduction (e.g., use marijuana only among trusted peers), (b) manner of cannabis use (e.g., avoid methods of using marijuana that promote more intoxicated than desired) and (c) limiting cannabis use (e.g., limit use to weekends). Individuals endorsing high levels of protective behavior experience fewer cannabis related negative consequences (Bravo et al., 2017; Pedersen, Huang, Dvorak, Prince, & Hummer, 2017; Pedersen et al., 2016). Moreover, protective behaviors moderate the impact of risk factors, including gender and motives (Bravo et al., 2017). Although the protective behavioral strategies discussed in Pedersen et al. (2016) are a good starting point, they almost entirely focus on the process of using cannabis and fail to measure protective behaviors associated with preventing physical harm (i.e., avoiding smoking to protect the lungs) and other considerations beyond use *per se* that may increase risk of adverse outcomes (e.g., early onset of use, family history of substance use). As such, more expansive recommendations were recently released by the Canadian Research Initiative in Substance Misuse

(CRISM) and include 10 evidence-based recommendations that aim to promote safe cannabis use and reduce harmful cannabis risk behaviors (Fischer et al., 2017). The recommendations include abstinence, avoiding early initiation of use, avoiding highly potent products, limiting the frequency of use, avoiding synthetic cannabinoids, using safer methods of use, avoiding deep inhalation, abstaining from impaired driving, understanding predispositions relating to family history, and avoiding a combination of problematic risk behaviors (Fischer et al., 2017). Each recommendation is based on the best existing evidence to date. In brief, it is recommended to avoid early initiation of use (especially prior to age 16), because there is evidence to suggest that the developing brain is more susceptible to the psychotropic effects of cannabis (see review; Jacobus & Tapert, 2014). As well, early cannabis use (especially frequent use) is associated with more poor social and health outcomes including greater risk of use disorders (Sung et al., 2004), and experiencing psychosis (Di Forti et al., 2015). Avoiding highly potent products and limiting the frequency of use, are both recommendations that aim to minimize the risk of cannabis use disorders and risk of experiencing adverse effects such as psychosis. Indeed, one case-control study indicated that high cannabis potency and frequent daily use increased the risk of experiencing a first episode of psychosis by a factor of three compared to never using controls (Di Forti et al., 2015). Avoiding synthetic cannabinoids is also recommended because these substances are linked to problematic health outcomes including adverse cardiovascular events (Pacher et al., 2018), psychosis (Murray et al., 2016), and death (Kasper et al., 2019). Using safer methods of use and avoiding deep inhalations are both recommendations aimed to reduce the risk of experiencing adverse respiratory effects such as chronic bronchitis (Aldington et al., 2007; Mehra et al., 2006; Tashkin, 2001; Tashkin et al., 1987; Tetrault, 2007) and lung cancer (Hall & Degenhardt, 2009; Mehra et al., 2006; Zhang et al., 2016). Impaired driving should be avoided as it disproportionately increases the risk of injury and death associated with motor vehicle collisions (Asbridge et al., 2012; Brady & Li, 2014; Brubacher et al., 2016; Mann et al., 2010). Next, some individuals may be at an increased risk of experiencing psychological disorders based on family history (such as maternal or paternal substance use disorder or psychosis; Kosty, Seeley, Farmer,

Stevens, & Lewinsohn, 2017; Large, Sharma, Compton, Slade, & Nielssen, 2011), so cannabis use should be avoided to reduce this risk. Finally, engaging in a combination of the listed risk behaviors, may increase the risk of experiencing adverse events associated with cannabis use, so this should be avoided. Moreover, the only overlap between the protective behavioral strategies discussed in Pedersen et al. (2016) and the LRCUG's discussed by Fischer et al. (2017) include minimizing frequency of use. Therefore, the 10 LRCUG's may uniquely contribute to the promotion and prediction of safe cannabis use.

### Knowledge gaps

It is estimated that 1.3% of the general Canadian population will experience problematic cannabis use (Fischer et al., 2016). Although problematic cannabis users may benefit from speciality addiction treatment, the prevalence of cannabis use disorders is far greater than the number seeking treatment (Jutras-Aswad et al., 2019). This treatment gap reflects a number of factors, including stigma, concerns about confidentiality, and lack of space and capacity in treatment programs (Breda & Heflinger, 2007; Gates et al., 2012; Hammarlund et al., 2018; Kertesz et al., 2006; Rapp et al., 2007; Sterling et al., 2010). Young adults and college students are especially unlikely to seek treatment for substance use (Caldeira et al., 2009; Kessler, 2001); this is problematic considering that young adults are most likely to use cannabis (Statistics Canada, 2017) and therefore most likely to experience cannabis-related problems and harms.

To address these problems in accessing effective intervention strategies, this thesis will explore young cannabis users' interest in accessing publicly available, online self-help tools. Online interventions are desirable because they are easily accessible, affordable (Sahlem et al., 2018) and because users of those resources do not have to present to health services in person, which may minimize stigma associated with help-seeking. Exposure to printed self-help resources has been shown to successfully reduce frequency and quantify of cannabis use, reduce symptoms of abuse and dependence, and can assist in promoting abstinence (Bonn-Miller et al., 2011; Rooke et al., 2013; Schaub et al., 2015). However, little research has examined the potential for offering similar online self-help supports to cannabis users.



While online access to self-help resources may, in theory, improve the uptake of interventions designed to reduce cannabis related harm, it is not clear if cannabis users are interested in accessing these types of materials. A second knowledge gap in this area is that it is unclear whether cannabis users meeting criteria for problematic (i.e., hazardous and/or harmful) use are more or less likely than other cannabis users to express interest in accessing such material online. Evidence from people who drink alcohol indicates that those meeting criteria for alcohol problems are more likely than non-problematic drinkers to be interested in accessing supports (including brief self-help materials; Cunningham, 2005; Cunningham et al., 1999; Wild et al., 2004), but this has not to our knowledge been examined for cannabis. Next, considering that a major predictor of cannabis-related problems are motives for use, and that using cannabis to cope with negative life events predicts cannabis related problems over and above other motives (i.e., social, enhancement, conformity, and expansion motives; Benschop et al., 2015; Bonn-Miller et al., 2007b; Simons et al., 1998; van der Pol et al., 2013), it is possible that coping motives may be associated with increased interest in accessing cannabis-related supports and resources. This issue has not yet been examined in the literature to our knowledge. Finally, the utilization of protective behaviors may also contribute to the prediction of interest in accessing supports, as protective behavioral strategies can be used to reduce the risk of developing cannabis-related problems. Therefore, cannabis users who spontaneously engage in protective behavioral strategies may have little reason to access online supports and resources, and may subsequently express less interest in self-help, but this has not yet been examined in the literature to date.

## Chapter 2: Study 1 - Cannabis Norm Perceptions Among Canadian University Students

### Introduction

Social norms theory proposes that perceptions and beliefs about behavior in social reference groups can influence individual behavior (Berkowitz, 2004; Perkins, 2002). Two types of norms have been shown to influence substance use: descriptive and injunctive norms. Descriptive norms refer to beliefs about the frequency and quantity of others' substance use while injunctive norms refer to beliefs about others' approval or disapproval of substance use (Borsari & Carey, 2001). These norm perceptions help individuals to determine what is acceptable (or unacceptable) behavior in relation to social reference groups (Cialdini et al., 1991).

Descriptive norm perceptions may be especially relevant for young adults transitioning into college, as this is a high-risk age group for substance use (Cho et al., 2015; Derefinko et al., 2016; Skidmore et al., 2016). Several studies indicate that young adults overestimate the frequency of cannabis use among peer and friend groups. Mistaken beliefs about the frequency of cannabis use in social reference groups is associated with greater personal cannabis use (Arbour-Nicitopoulos et al., 2010; Blevins et al., 2018; Dempsey et al., 2018; Kilmer et al., 2006; Neighbors et al., 2008; Page & Roland, 2004), cannabis related problems (Blevins et al., 2018; Neighbors et al., 2008), and cannabis abuse/dependence symptoms (Blevins et al., 2018). Perceived frequency of *friends'* use may be most relevant in the prediction of personal cannabis use rather than beliefs about other social reference groups. For example, in a college sample, only misperceived descriptive norms regarding friends' cannabis use (not other students in general) were associated with respondents' own cannabis use and problems (Buckner, 2013). In another related study, perceived frequency of friends' cannabis use longitudinally predicted frequency of cannabis use in young adults (Patrick et al., 2016). One limitation of extant research is that no research to date has compared perceptions of cannabis use in social reference groups among cannabis users who do and do not meet criteria for cannabis problems. Another limitation is that only one study to date has documented descriptive norm misperceptions for cannabis use among students attending a Canadian University (i.e., Arbour-

Nicitopoulos et al., 2010). It is unclear whether those results are replicable among students attending other Canadian Universities.

Another well-documented finding in this area is that people mistakenly believe that social reference groups approve of substance use more than they actually do, a phenomenon known as pluralistic ignorance (Pedersen, 1993; Prentice & Miller, 1993). For example, in a large sample of European University students ( $N = 4,131$ ) most respondents mistakenly believed that their peers held more permissive attitudes toward cannabis use than they actually did (Dempsey et al., 2016). Misperceived social approval is also associated with personal cannabis use. For example, frequent cannabis users (i.e., those that used cannabis 40 or more times in the past year) demonstrated greater approval of their own use, and perceived that their close friends and their parents were more permissive toward cannabis use (LaBrie et al., 2011), compared to those who used cannabis more infrequently. In another study, heavy high-school cannabis users mistakenly believed that their close friends approved more of cannabis use than other same aged teens (Blevins, Walker, Stephens, Baner, & Roffman, 2018). Although existing studies have primarily explored these injunctive norms in relation to close friends, parents, or peers (Barnum & Armstrong, 2019; Blevins et al., 2018; Buckner, 2013; Dempsey et al., 2016; LaBrie et al., 2011; Neighbors et al., 2008; Pearson et al., 2018), no research to date has examined perceived approval of more distal social groups (i.e., the ‘average’ community member). Moreover, despite the recent change in cannabis legal status in Canada, no studies have been completed within a Canadian sample to examine injunctive norm perceptions. Finally, as with research on descriptive norms, comparisons of injunctive norm perceptions between cannabis users who do and do not meet criteria for problematic consumption have not been undertaken.

A less studied aspect of norm perceptions emphasizes how substance users perceive sociobehavioural criteria defining problematic substance use. For example, heavy alcohol users rated certain criteria (e.g., drinking alone, frequency of intoxication) as less definitive of problem drinking, compared to lighter drinkers (Danko et al., 1988; Wild, 2002). Whether this finding would be replicated for cannabis use has not yet been examined, but is an important consideration because discrepancies in personal

‘thresholds’ for attributing problems to oneself or others may perpetuate hazardous use, and may contribute to cannabis-related problems.

The present study addressed all of these limitations in a secondary analysis of data obtained from a sample of young adult cannabis users attending a Canadian university. Our objectives were to compare current cannabis users who do and do not meet criteria for problematic cannabis use in relation to descriptive norm perceptions (objective 1), injunctive norm perceptions (objective 2), and beliefs about sociobehavioral criteria that might define whether or not someone has a problem with cannabis (objective 3). We hypothesized that problematic cannabis users, i.e., those meeting DSM screening criteria for harmful and hazardous use would be more likely than non-problematic cannabis users to (1) overestimate perceived prevalence of cannabis use in social reference groups (Hypothesis 1); (2) exhibit pluralistic ignorance, by adjusting private approval of the cannabis using habits of others to match mistaken perceptions of public approval in social reference groups (Hypothesis 2); and (3) believe that behavioral and social consequences are less definitive of problematic cannabis use (Hypothesis 3).

## Methods

### Participants and procedures

A secondary analysis of cross-sectional data collected from a large sample of University students was completed. The original study protocol invited University of Alberta (UA) students to complete an online survey in exchange for \$5.00 credit on their student services card. The UA Office of the Registrar randomly selected 12,000 students to receive the invitation to participate through email and 3,562 students completed the survey, which was conducted from April – May, 2018, prior to legalization of cannabis across Canada. The study protocol received approval from the UA Health Research Ethics Board.

All of the study hypotheses focused on current users of cannabis. Of 3,562 survey respondents, 1,073 (30%) were current cannabis users, i.e., reported using cannabis one or more times in the 6 months preceding the survey; these respondents formed the analytic subsample for our analyses. Of this subsample, 320 survey respondents were removed from the dataset because they were missing a value on one or more

of the study variables (sex, age, cannabis use, or norm perceptions), resulting in a final sample of 753<sup>1</sup>. Among current (past 6-month) cannabis users, 432 (57%) were women and the mean (SD) age of the sample was 22.58 (4.52).

## Measures

### Cannabis use and cannabis problems

Current cannabis users were identified by their response to the Cannabis Use Disorders Identification Test revised (CUDIT-R; Adamson et al., 2010) screening question (i.e., *Have you used any cannabis over the past six months?*). Respondents who reported past 6-month cannabis use were administered the 8-item CUDIT-R which assess possible cannabis use problems. The CUDIT-R was developed based on DSM-IV diagnostic criteria for abuse, dependence and psychological features with each item scored on a 5 point Likert scale with 0 (never), 1 (monthly or less), 2 (2-4 times a month), 3 (2-3 times a week), 4 (4 or more times a week), and a maximum score of 32 (Adamson et al., 2010). Using DSM-5 criteria, the following cut-offs are used to establish whether the pattern of cannabis use is non-problematic (scores of 0 to 8) or problematic (scores of 9 or greater which suggest mild, moderate or severe cannabis use disorders; Marshall, 2012). About three-quarters of the sample 579 (77%) were classified as non-problematic cannabis users.

### Descriptive norms: Perceived prevalence

Three survey items measured perceived prevalence of respondents' own cannabis use in comparison to same-sex friends, fellow same-sex UA students, and average same-sex Albertans. Each of these three items were scored on a 5-point scale with 1 (They use much less cannabis than I do), 2 (They use less

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<sup>1</sup> The percentage of respondents scoring positive on the CUDIT-R was equivalent when those with a valid sex value were compared to (a) respondents reporting 'other' sex, and (b) non-responders to the sex question [ $\chi^2(1, N = 1035) = 0.30, p > .05$ ]. Non-respondents and 'other' sex were removed from the analytic sample in order to enhance interpretability of our findings.

cannabis than I do), 3 (They use about as much cannabis as I do), 4 (They use more cannabis than I do), 5 (They use much more cannabis than I do).

#### Injunctive norms: Pluralistic ignorance

Two items assessed injunctive norm perceptions. First, respondents were asked how much they personally approve or disapprove of cannabis use among their same-sex friends, fellow students, and the average Albertan man or woman, which was scored on a scale from 1 (I completely disapprove) to 7 (I completely approve). Second, respondents were asked how much their close same-sex friends, fellow students, and the average Alberta man or woman approved of their own cannabis habits, which was scored on a 7-point scale, ranging from 1 (they completely disapprove) to 7 (they completely approve).

#### Criteria for defining problematic cannabis use

A series of 7 items asked respondents to indicate how important social and behavioural indicators were in defining whether or not someone has a cannabis-related problem, including: (1) using cannabis while alone, (2) growing up in a family where cannabis was abused, (3) the total amount of cannabis that a person uses on any given occasion, (4) negative effects on a person's job (e.g., showing up late, missing work), (5) the type of cannabis a person consumes, (e.g., marijuana versus hash), (6) covering up one's cannabis habits, (e.g., lying, or sneaking cannabis), (7) the number of times a person gets stoned on cannabis in a given week. Each item was scored on a 7-point scale, with 1 (Not at all important in defining whether a person has cannabis problems) to 7 (Extremely important in defining whether a person has cannabis problems).

#### Analyses

Hypothesis tests were completed using a combination of parametric and non-parametric tests in SPSS (version 25). To test the first hypothesis, multivariate analyses of variance (MANOVAs) was used to test for the predicted main effect of cannabis subgroup (i.e., non-problematic vs. problematic use as per the CUDIT-R) across the three social reference groups (perceived frequency of cannabis use by same-sex friends, students, and average Albertans). Using a MANOVA adjusts for inflated Type-1 error rates in

subsequent univariate tests (Harris, 1975). The MANOVA also examined the cannabis group X sex interaction term in order to determine whether respondent sex moderated the effect of cannabis group. This was followed by parametric ANOVAs (or non-parametric ANOVAs for measures exhibiting violations in homogeneity of variance).

To test the second hypothesis, a mixed-model MANOVA was completed to examine the main effect of approval, two-way interactions (approval X sex and approval X cannabis subgroup), and three-way interactions (approval X sex X cannabis subgroup) across the three social reference groups. MANOVAs were followed by three mixed-model analyses of variance (ANOVA) for same-sex friends, fellow students, and the average Albertan. Cannabis subgroup (non-problematic or problematic use) was treated as a between-subjects factor and the two approval ratings (personal approval versus perceived approval of the reference group) was treated as a within-subject factor. Pluralistic ignorance is demonstrated by a significant within-subject effect, such that respondents are privately less approving of the cannabis use of social reference groups compared to their beliefs about the approval of those groups per se.

Finally, Hypothesis 3 was tested via MANOVA to identify the predicted main effect of cannabis group across the seven problematic cannabis criteria, followed by a series of parametric or non-parametric ANOVAs as appropriate. All significance tests were two-sided and set at an alpha level of 0.05.

## Results

### Descriptive norms: Perceived prevalence of cannabis use

A significant multivariate effect of respondent subgroup on prevalence estimates for same-sex friends, students, and the average Albertan,  $F(2/749) = 76.11, p < .001$ , was observed. There were no significant sex by respondent group interactions, so univariate analysis of variance (ANOVAs) analyses were appropriate and did not include sex, or a sex interaction term. ANOVAs were then conducted for each dependent measure (i.e., perceived cannabis use by friends, students, and the average Albertan). ANOVAs are robust to violations of normality (Blanca, Alarcón, Arnau, Bono, & Bendayan, 2017), but the assumption of equal variance must be confirmed. Non-significant results on Levene's test confirmed equal

variance for the same-sex friends and same-sex student measures. A significant result was found for the average Albertan measure ( $p < .001$ ), so we reported results from the Welch test (which corrects for unequal variance and is robust to type I error; Derrick & White, 2016; Ruxton, 2006; Welch, 1947), for this outcome variable.

As shown in Table 1, there was a significant association between CUDIT status and descriptive norm perceptions for each reference group (same-sex friends, students, the average Albertan). Contrary to Hypothesis 1, problematic cannabis users were more likely than non-problematic cannabis users to accurately estimate that other's use is less than their own (i.e., "they use less cannabis than I do").

**Table 1**  
Descriptive norm perceptions among young adult cannabis users ( $N = 753$ ).

Reference group	Subgroup		<i>F</i>
	Non-problematic users (CUDIT-; $n = 579$ )	Problematic users (CUDIT+; $n = 174$ )	
Closest friends	3.31 (1.10)	2.75 (1.16)	34.50***
Students	3.35 (0.94)	2.22 (0.93)	193.74***
Average Albertan	3.21 (1.03)	2.16 (0.92)	166.20 $\phi$ ***

*Notes:* Shown as mean (standard deviation) unless otherwise specified. Response scale was: "If you compare (*your closest same-sex friends/ same-sex students/the average Alberta man or woman (as appropriate)*) with yourself, do you think that they normally use more or less cannabis than you do? They use much less cannabis than I do (=1), they use less cannabis than I do (=2), they use about as much cannabis as I do (=3), they use more cannabis than I do (=4), they use much more cannabis than I do (=5)." \* $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ . *F* value is reported from oneway ANOVAs with  $df = 1, 751$ .  $\phi$  Results reported from the Welch test, with  $df = 1, 314$ .

In a supplementary analysis, descriptive norm perceptions were examined for trichotomized frequency of cannabis use; low (never, monthly or less), moderate (2-4 times a month, 2-3 times a week), and heavy (4 or more times a week). Among each social reference group, heavy users were more likely to accurately estimate that social reference groups use cannabis less frequently than they do [closest friends -  $M(\text{low}) = 3.42$ ,  $M(\text{moderate}) = 3.07$ ,  $M(\text{heavy}) = 2.55$ ,  $F(2, 750) = 30.60$ ,  $p < .001$ ; students -  $M(\text{low}) = 3.56$ ,  $M(\text{moderate}) = 2.78$ ,  $M(\text{heavy}) = 1.98$ ,  $F(2, 750) = 174.96$ ,  $p < .001$ ; average Albertan -  $M(\text{low}) = 3.44$ ,  $M(\text{moderate}) = 2.58$ ,  $M(\text{heavy}) = 1.98$ ,  $F(2, 306) = 140.75$ ,  $p < .001$ ; see Supplementary Table 1].



Injunctive norms: Pluralistic ignorance

MANOVAs indicated a significant multivariate between subjects effect of cannabis subgroup,  $F(3/749) = 8.31, p < 0.001$ , a significant within-subjects effect of approval,  $F(3/749) = 29.35, p < 0.001$ , and a significant within-subjects approval rating X cannabis subgroup interaction,  $F(3/749) = 6.94, p < 0.001$ . There were no significant within-subject one- or two-way interactions involving respondent sex for closest friends, students, or average Albertans, so univariate mixed-model ANOVA analyses did not include sex, or a sex interaction term.

Mixed-model ANOVAs indicated a significant within-subject effect of approval rating for judgements of closest friends,  $F(1,751) = 7.43, p = .007$ , students  $F(1/751) = 68.75, p < .001$ , and the average Albertan  $F(1/751) = 25.12, p < .001$ . Within-subject means for private approval vs. perceived public approval of cannabis use are presented in Table 2.

**Table 2**

Within-subject differences between private and perceived public approval of cannabis use.

Reference group	Private approval	Perceived public approval
Closest friends	5.21 (1.48)	5.03 (1.41)
Students	4.93 (1.43)	5.83 (1.32)
Average Albertan	5.58 (1.28)	5.40 (1.36)

Notes: Shown as mean (standard deviation) unless otherwise specified. Private approval rating: “How much do you approve or disapprove of your (*closest same-sex friends/fellow students/the average Alberta man or woman’s (as appropriate)*) cannabis habits?” The scale ranged from 1 = I completely disapprove to 7 = I completely approve. Public approval rating: “How much do you think your (*closest same-sex friends/fellow students/the average Albertan man or woman*) approve(s) of their own cannabis habits? The scale ranged from 1 = They completely disapprove to 7 = They completely approve.

Respondents were privately more approving of the cannabis use of closest friends and average Albertans, compared to their beliefs about how approving those reference groups were about their own cannabis use (Table 2). These associations were not moderated by respondent subgroup, i.e., whether or not respondents met criteria for problematic cannabis use. However, we observed a significant approval rating by cannabis subgroup interaction for approval ratings in relation to fellow students,  $F(1/751) = 20.34, p < .001$ . Figure 1 presents the interaction.

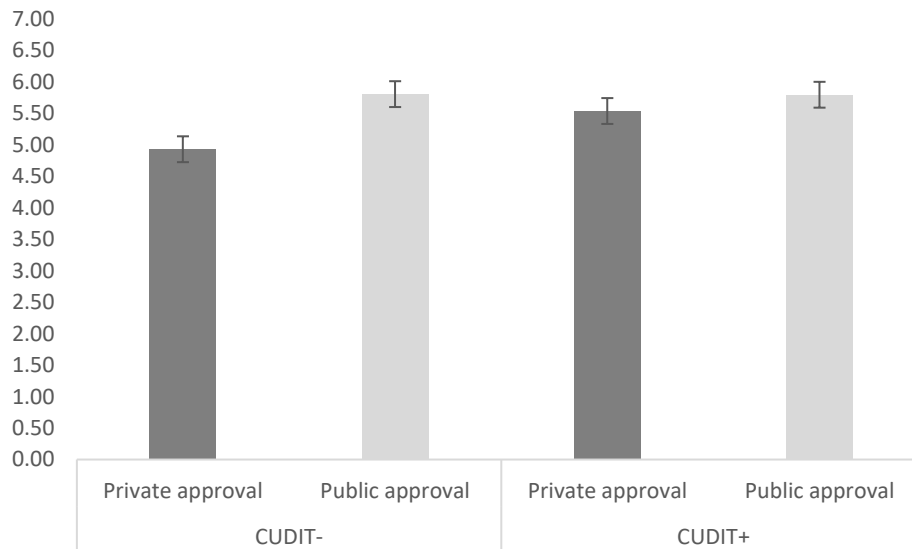


Fig. 1. The interaction between approval and cannabis subgroup. Error bars are based on the standard error.

Consistent with Hypothesis 2, non-problematic users displayed pluralistic ignorance in reference to their fellow students. In contrast, problematic users adjusted their private approval of fellow students' use upwards to match perceived student approval.

#### Criteria for defining problem cannabis use

The initial MANOVA indicated a significant cannabis subgroup effect across the seven problematic cannabis use items,  $F(7/743) = 5.89, p < .001$ , a significant sex effect,  $F(7/743) = 6.09, p < .001$ , and a significant interaction effect between cannabis subgroup and sex,  $F(7/743) = 2.33, p = .02$ . As such, results are reported separately for men and women. Non-significant results on Levene's test confirmed the assumption of equal variance for 4 of the 7 items (i.e., using alone, family history of cannabis, type of cannabis, number of times stoned per week). A significant Levene's test was found for three items (total amount, negative effects on work, lying about use), so results from the HC0 method are reported (which produces robust standard errors and is an appropriate method when the equal variance assumption is violated; Hayes & Cai, 2007).

Consistent with Hypothesis 3, cannabis users meeting DSM criteria for hazardous/harmful (problematic) use were more likely to believe that consequences of cannabis use are less definitive of

problematic cannabis use than non-problematic cannabis users (Table 3). That is, problematic users were less likely report that using cannabis alone,  $F(1,749) = 9.76, p = .002$ , a family history of cannabis problems,  $F(1,749) = 7.27, p = .007$ , type of cannabis used,  $F(1,749) = 6.09, p = .01$ , and number of times stoned/week,  $F(1,749) = 35.23, p < .001$ , are important in defining whether a person has cannabis problems compared to non-problematic users, after accounting for sex effects. There were no significant difference between problematic and non-problematic users in the items corresponding to total amount used, the negative effect on work, and lying about cannabis use in defining whether a person has cannabis problem, accounting for sex effects, however, the means were in the predicted direction (with higher means for non-problematic versus problematic cannabis uses for all items).

Although there was no prediction made regarding a sex effect, a main effect of sex was found for three items. That is, women were significantly more likely to say that a family history of cannabis problems,  $F(1,749) = 3.71, p = .05$ , type of cannabis used,  $F(1,749) = 5.02, p = .03$ , and that number of times stoned/week,  $F(1,749) = 4.05, p = 0.05$ , are important in defining whether a person has cannabis problems, compared to men after accounting for cannabis effects (shown in Table 3). There were no significant difference observed between men in women toward using cannabis alone, the total amount used, the negative effect on work, and lying about cannabis use in defining whether a person has cannabis problem, accounting for cannabis effects, although women consistently rated each item as being more important in defining whether a person has a cannabis problem (with the exception of number of times stoned/week).

**Table 3**

Main effects of cannabis subgroup and sex on sociobehavioral criteria defining problematic cannabis use.

	Cannabis subgroup		F/t	Sex		F/t
	CUDIT -	CUDIT +		Males	Females	
Using cannabis alone	3.91 (2.06)	3.31 (2.06)	9.76**	3.59 (2.05)	3.90 (2.09)	1.45
Family history of cannabis problems	4.98 (1.77)	4.52 (1.89)	7.27**	4.67 (1.84)	5.02 (1.77)	3.71*
Total amount used <sup>ϕ</sup>	4.85 (1.73)	4.11 (2.01)	0.27	4.44 (1.91)	4.86 (1.73)	0.26
Negative effects on work <sup>ϕ</sup>	6.32 (1.37)	6.19 (1.50)	0.52	6.12 (1.57)	6.42 (1.25)	1.58
Type of cannabis used	3.37 (1.82)	2.93 (1.91)	6.09**	3.02 (1.80)	3.45 (1.86)	5.02*
Lying about use <sup>ϕ</sup>	5.54 (1.71)	5.17 (1.85)	-0.90	5.02 (1.83)	5.78 (1.62)	1.33
Number of times stoned per week	5.21 (1.81)	4.26 (2.00)	35.23***	4.97 (1.90)	5.01 (1.90)	4.05*

*Notes.* Shown as mean (standard deviation) unless otherwise specified. Behavioral and social consequences of cannabis use rating scale: “Some people who use cannabis become problem users and damage their own lives and the lives of others around them through cannabis use. For the next 7 items, rate each one based on how important it is in defining whether or not a person might have a problem with cannabis. Use the following scale to make your ratings: 1 = not at all important in defining whether a person has cannabis problems to 7 = Extremely important in defining whether a person has a cannabis problem”. \* $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ . F-statistics reported for each ANCOVA, with  $df=1, 749$ . <sup>ϕ</sup> Indicates results from the HC0 method and t-statistic, with  $df=1, 749$ . N.S.: Not significant,  $p > 0.05$ .

In addition to the between-subject effects shown in Table 3, we observed a significant interaction between sex and cannabis category for one item: number of times stoned per week (Fig. 2.). Female users meeting DSM criteria for hazardous/harmful (problematic) use were significantly less likely than female cannabis users not meeting criteria for problems to believe that frequency of being stoned matters in defining whether or not a person has a problem with cannabis. In contrast, there was no sex difference among non-problematic cannabis users.

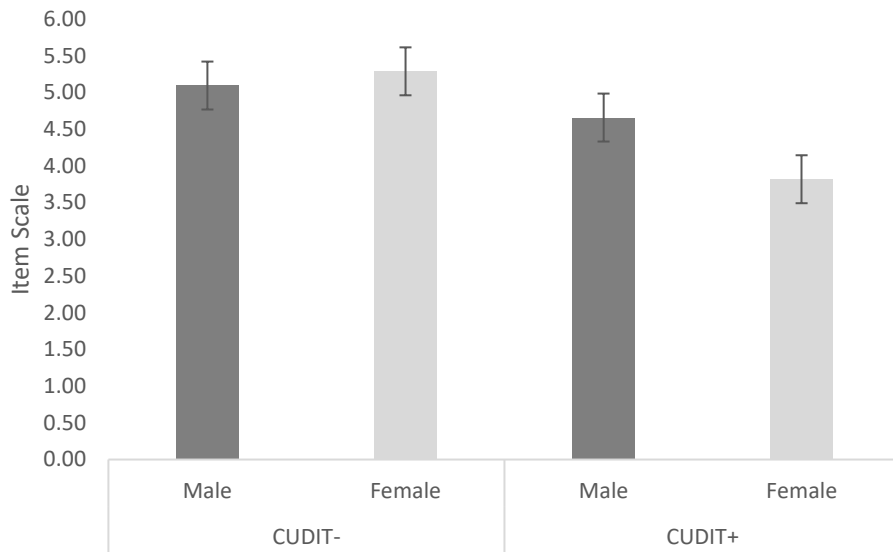


Fig. 2. Perceived importance of ‘number of times stoned per week’ in defining cannabis-related problems. Error bars are based on the standard error.

## Discussion

The current study examined the relationship between cannabis risk status and norm perceptions among current cannabis using UA students. Our first objective was to examine descriptive norm perceptions among current cannabis users who did and did not meet criteria for problematic cannabis use. Contrary to previous research suggesting that cannabis related problems are associated with overestimating cannabis use among social reference groups (e.g., Arbour-Nicitopoulos, Kwan, Lowe, Taman, & Faulkner, 2010; Blevins, Walker, Stephens, Banes, & Roffman, 2018; Dempsey, McAlaney, & Bewick, 2018; Kilmer et al., 2006; Neighbors, Geisner, & Lee, 2008; Page & Roland, 2004), our findings indicated that cannabis users meeting screening criteria for cannabis-related problems were more accurate with regard to descriptive norm estimates, compared to non-problematic users. That is, problematic users appear to correctly recognize that they use more cannabis than their closest friends, peers, and the average Albertan. This may be a novel finding, but may also be a result of several methodological choices. First, descriptive norms were only assessed in an analytic subsample of current cannabis users (i.e., 30% of respondents

participating in the broader population survey). From this broader perspective, all cannabis users in the present study, regardless of CUDIT status, objectively used more cannabis than fellow students. Future research should determine whether cannabis users, in general, overestimate perceived prevalence in social reference groups (compared to non-users in the reference population), by assessing descriptive norm perceptions among non-users and current cannabis users. Second, most studies of descriptive norm perceptions assess misperceptions by asking respondents to indicate their own frequency of use, and then the frequency of use within a social reference group – subsequently comparing the two estimates (e.g., Arbour-Nicitopoulos, Kwan, Lowe, Taman, & Faulkner, 2010; Blevins, Walker, Stephens, Baner, & Roffman, 2018; Dempsey, McAlaney, & Bewick, 2018; Kilmer et al., 2006; Neighbors, Geisner, & Lee, 2008; Page & Roland, 2004). Our study, however, asked participants to reflect on their own use and then judge whether social reference groups used more or less cannabis than they did. Our measure may have more indirectly assessed descriptive norm perceptions, resulting in contrary findings. It is recommended that future research compares direct and indirect measurements of descriptive norm perceptions among non-users, current cannabis users, and problematic cannabis users.

Our second objective was to compare current cannabis users who did and did not meet criteria for problematic cannabis use in relation to injunctive norm perceptions, and partial support for our second hypothesis was found across all three social reference groups. Our findings indicated pluralistic ignorance among closest friends and average Albertan judgements – cannabis users were privately more approving of the cannabis use of these social reference groups than perceived public approval of those groups. This finding is inconsistent with previous literature, which found more public approval, relative to private approval (e.g., Dempsey et al., 2016). This pattern changed when respondents considered fellow students. That is, judgments of fellow students displayed a pattern consistent with the literature, with greater perceived public approval than private approval toward cannabis use. Within the student reference group, only non-problematic cannabis users displayed pluralistic ignorance (a discrepancy between private and public approval), whereas problematic cannabis users displayed a shift of private approval to match

perceived public approval. Notably, this is the first study to evaluate a distal social reference groups (i.e., average Albertan) and to compare injunctive norm perceptions among objectively defined problematic cannabis users, which may explain the counterintuitive findings.

Our third objective was to determine if there is a difference in the way that problematic and non-problematic cannabis users perceive sociobehavioral criteria in defining whether or not someone has a problem with cannabis. Support was found for the prediction that problematic cannabis users have lower ‘thresholds’ for attributing problems than non-problematic users among several measures. In general, problematic users indicated that all items were less definitive of a cannabis use problem in comparison to non-problematic users. This is a novel and important finding because these discrepancies in personal ‘thresholds’ for attributing problems may perpetuate hazardous use. This finding implies that elements of problem recognition should be integrated into interventions designed to change norm perceptions. It may also be important to examine the reasons why problematic users have a lower threshold for problem attribution, as this idea has not been explored in the literature to date.

#### Implications, limitations, and future directions

To our knowledge, this is the first study to examine descriptive and injunctive norm perceptions among objectively defined problematic cannabis users. Despite the recent change in cannabis legal status in Canada, this is one of only two studies (to the author’s knowledge) to document descriptive norm misperceptions (e.g., Arbour-Nicitopoulos et al., 2010) and the only study to address injunctive norm misperceptions, among cannabis using students attending a Canadian University. Moreover, it is the only study to identify perceptions of sociobehavioural criteria in defining problematic cannabis use. Norm misperceptions and discrepancies in personal ‘thresholds’ for attributing problems may perpetuate hazardous use, and may therefore contribute to cannabis-related problems. Additionally, these findings (i.e., problematic cannabis users display altered norm perceptions in reference to non-problematic users), support the development of interventions that aim to correct norm misperceptions surrounding substance use behavior. These personalized assessment-feedback (PAF) interventions, allow users to compare their

personal beliefs to the actual frequency of use within a reference population. This corrects mistaken beliefs and motivates people to use substances more moderately and preliminary evidence suggests short term improvements in cannabis-related outcomes in college students following PAF interventions (Lee et al., 2013; Palfai et al., 2014). These interventions are promising but are still underdeveloped in relation to other substance use interventions (Tait et al., 2013). Future research should further develop PAF interventions for cannabis misuse and determine other factors beyond cannabis risk status in the attribution of cannabis use problems.

The present research is limited by its reliance on self-report data, which may be influenced by response biases. Although self-report data for cannabis use has been shown to be reliable and valid to some extent (Ramo, Liu, & Prochaska, 2012), future studies may benefit from including a confirmatory measure of cannabis use (i.e., biological markers). Next, the cross-sectional nature of this study is limiting and cohort studies should be completed to examine the change in norm perceptions among cannabis using University students. Finally, selection bias may contribute to lack of generalizability of this study, for example, if only the most highly functioning cannabis students completed the survey, this could lead to findings that are not representative of all cannabis using students.



**Supplementary Table 1**Descriptive norm perceptions for trichotomized frequency of cannabis use ( $N = 753$ ).

Social reference group target	Cannabis subgroup			$F$
	Low	Moderate	Heavy	
Closest friends	3.42 (1.06)	3.07 (1.18)	2.55 (1.09)	30.60***
Students	3.56 (0.85)	2.78 (0.93)	1.98 (0.84)	174.96***
Average Albertan	3.44 (0.95)	2.58 (0.90)	1.98 (0.93)	140.75 <sup>ϕ</sup> ***

*Notes:* Shown as mean (standard deviation) unless otherwise specified. SD), unless otherwise specified. Response scale was: “If you compare (*your closest same-sex friends/ same-sex students/the average Alberta man or woman (as appropriate)*) with yourself, do you think that they normally use more or less cannabis than you do? They use much less cannabis than I do (=1), they use less cannabis than I do (=2), they use about as much cannabis as I do (=3), they use more cannabis than I do (=4), they use much more cannabis than I do (=5).” \* $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .  $F$  value is reported from oneway ANOVAs with  $df = 2, 750$ . <sup>ϕ</sup> Results reported from the Welch test, with  $df = 2, 306$ .

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## Chapter 3: Study 2 – Interest in Online Supports and Brief-Self Help Interventions Among Young Adult Cannabis Users

### Introduction

It is estimated that 1.3% of the general Canadian population will experience problematic cannabis use (Fischer et al., 2016). Although problematic cannabis users may benefit from specialty addiction treatment, only a fraction of them will ever seek help or access addiction treatment (Jutras-Aswad et al., 2019). This treatment gap reflects a number of factors, including stigma, concerns about confidentiality, and lack of space and capacity in treatment programs (Breda & Heflinger, 2007; Gates et al., 2012; Hammarlund et al., 2018; Kertesz et al., 2006; Rapp et al., 2007; Sterling et al., 2010). Young adults and college students are especially unlikely to seek treatment for substance use (Caldeira et al., 2009; Kessler, 2001); this is problematic considering that young adults are most likely to use cannabis (Statistics Canada, 2017) and therefore most likely to experience cannabis-related problems and harms.

An emerging approach that addresses these barriers is the provision of online self-help and brief intervention resources. Online interventions are desirable because they are easily accessible, affordable (Sahlem et al., 2018) and because users of those resources do not have to present to health services in person, which may minimize stigma associated with help-seeking. Exposure to self-help resources and tools has been shown to successfully reduce frequency and quantity of cannabis use, reduce symptoms of abuse and dependence, and can assist in promoting abstinence (Bonn-Miller et al., 2011; Rooke et al., 2013; Schaub et al., 2015). However, these interventions are still underdeveloped.

While online access to self-help resources may, in theory, improve the uptake of interventions to reduce cannabis related harm, it is not clear whether cannabis users are interested in accessing these types of materials. Moreover, although evidence from people who drink alcohol indicates that those meeting objective screening criteria for alcohol problems are more likely than non-problematic drinkers to be interested in accessing supports (including brief self-help materials; Cunningham, 2005; Cunningham et al., 1999; Wild et al., 2004), this finding has not been replicated for cannabis to our knowledge.

An important predictor of cannabis-related problems are motives for use. Prominent theories propose that the reasons people have for using substances have distinct antecedents and consequences and that these motives represent the ‘final common pathway’ to substance use and related problems (Cooper, 1994; Cooper et al., 1995). For example, using cannabis to cope with negative affect predicts cannabis-related problems over and above the impact of other motives (i.e., social, enhancement, conformity, and expansion motives; Benschop et al., 2015; Bonn-Miller, Zvolensky, & Bernstein, 2007; Simons, Correia, Carey, & Borsari, 1998; van der Pol et al., 2013). These results are consistent with research on other substances showing that help-seeking is more likely among problematic alcohol users who strongly endorse using alcohol for coping purposes, compared to other motives (Hammarberg, Öster, & Nehlin, 2017). Although these results suggest that coping motives may be associated with increased interest in accessing cannabis-related supports and resources, this issue has not yet been examined in the literature to our knowledge.

Beyond motives for using cannabis, a number of protective behavioral strategies can be used to reduce users’ risk of developing cannabis-related problems. These protective behavioral strategies fall into 3 broad categories (a) harm reduction (e.g., using cannabis only among trusted peers), (b) manner of cannabis use (e.g., avoid methods of using cannabis that promote more intoxication than desired) and (c) limiting cannabis use (e.g., limiting use to weekends). It is well-documented that individuals endorsing high levels of protective behavior experience fewer cannabis related negative consequences than cannabis users who do not engage in these tactics (Bravo et al., 2017; Pedersen, Huang, Dvorak, Prince, & Hummer, 2017; Pedersen et al., 2016). By implication, cannabis users who spontaneously engage in protective behavioral strategies may have little reason to access online supports and resources, and may subsequently express less interest in self-help. However, this idea has not yet been explored in the literature.

The present study addressed all of these knowledge gaps in a study of young adult cannabis users to determine if interest in accessing relevant online self-help resources is associated with objective risk status for cannabis problems (Objective 1). We predicted that problematic cannabis use will be positively



associated with interest in accessing brief online self-help materials (Hypothesis 1). Our second objective is to determine whether coping motives for using cannabis also contributes to the prediction of interest in accessing online self-help resources. We predicted that coping motives (but not other motives) will be positively associated with interest in self-help after accounting for age, sex, and objective risk status for cannabis-related problems. Our third objective is to determine whether cannabis-related protective behaviours and strategies incrementally add to the prediction of interest in self-help. We predicted that protective behaviors will be inversely associated with interest in self-help after accounting for the impact of age, sex, objective risk status for cannabis problems, and motives for using cannabis. The interaction between protective behaviors and objective risk status was also be examined to test our fourth hypothesis, i.e., engaging in protective behaviours will moderate the association between problematic cannabis use and interest in accessing online self-help resources. These hypotheses were tested twice: first for interest only in online cannabis supports, and second for interest in online supports in general.

## Methods

### Participants and procedures

A secondary analysis of cross-sectional data collected from a large sample of University students was completed. The study protocol invited University of Alberta (UA) students to complete an online survey in exchange for \$5.00 credit on their student services card. The UA Office of the Registrar randomly selected 12,000 students to receive the invitation to participate through email and 3,562 students completed the survey, which was conducted from April – May, 2018, prior to legalization of cannabis across Canada. The study protocol received approval from the UA Health Research Ethics Board.

All of the study hypotheses focused on current users of cannabis. Of 3,562 survey respondents, 1,073 (30%) were current cannabis users, i.e., reported using cannabis one or more times in the 6 months preceding the survey; these respondents formed the analytic subsample for our analyses. Of this subsample, 424 survey respondents were removed from the dataset because they were missing a value on one or more of the study variables (sex, age, cannabis use, motives, protective behaviors, or interest in support items),

resulting in a final sample of 649<sup>2</sup>. Among current (past 6-month) cannabis users, 373 (58%) were women and the mean (SD) age of the sample was 22.52 (4.40).

## Measures

**Predictor variables.** Objective risk status (problematic cannabis use) was assessed using the Cannabis Use Disorders Identification Test revised (CUDIT-R; Adamson et al., 2010), motives according to the Marijuana Motives Measure (MMM; Simons et al., 1998), protective cannabis use behavior from the Protective Marijuana Behavioral Strategies scale (PMBS; Pedersen et al., 2016). Demographics (age and gender) for the analytic sample were also extracted from the dataset.

**Cannabis use and cannabis problems.** Current cannabis use was assessed using the CUDIT-R's initial screening question (i.e., *Have you used any cannabis over the past six months?*). For respondents who endorsed past 6-month cannabis use, the 8-item CUDIT-R was administered to determine the objective risk status of cannabis use. The CUDIT-R was developed based on DSM-IV diagnostic criteria for abuse, dependence and psychological features with each item scored on a 5 point Likert scale with 0 (never), 1 (monthly or less), 2 (2-4 times a month), 3 (2-3 times a week), 4 (4 or more times a week), and a maximum score of 32 (Adamson et al., 2010). Using DSM-5 criteria, cut-offs are used to establish whether the pattern of cannabis use is non-problematic (scores of 0 to 8) or problematic (scores of 9 or greater which suggest mild, moderate or severe cannabis use disorders; Marshall, 2012). About three-quarters of the analytic sample 481 (75%) were identified as non-problematic cannabis users.

**Motives for use.** The 25-item MMM was used to establish cannabis use motives. Each item was rated on a 5-point Likert scale ranging from 1 (almost never/never) to 5 (almost always/always) to reveal five motive subscales (coping, conformity, social, enhancement, and expansion). Internal consistency

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<sup>2</sup> The percentage of respondents scoring positive on the CUDIT-R was equivalent when those with a valid sex value were compared to (a) respondents reporting 'other' sex, and (b) non-responders to the sex question [ $\chi^2(1, N = 1035) = 0.30, p > .05$ ]. Non-respondents and 'other' sex were removed from the analytic sample in order to enhance interpretability of our findings.

estimates (Cronbach's  $\alpha$ ) were excellent for coping ( $\alpha = .90$ ), conformity ( $\alpha = .89$ ), social ( $\alpha = .89$ ), enhancement ( $\alpha = .87$ ) motives, and expansion motives ( $\alpha = .91$ ).

Protective behaviors. The 17-item Protective Marijuana Behavioral Strategies scale (PMBS) assessed protective cannabis use behavior (Pedersen et al., 2016). The PMBS consists of 17-items scored on a 6-point Likert scale ranging from 1 (never) to (6) always, with a minimum score of 17 and a maximum score of 102 with higher scores indicating more protective cannabis use behavior (Pedersen et al., 2016). Cronbach's  $\alpha$  was excellent for the full scale ( $\alpha = 0.86$ ).

Sociodemographics. Respondents specified their gender (male, female) and their age (birth month and year).

Outcome variables. Interest in online self-help resources for substance use was assessed using seven investigator-developed questions. Respondents were asked, "*If a website were available to you for free to provide the following information, how interested would you be in...*": (a) general information about substance use and mental health in Alberta and Canada (b) information about cannabis use (c) information about substance use and mental health in your own age group (d) a screening tool to find out more about your own cannabis use (e) general information about interventions and help for substance use and mental health problems (f) access to interactive, on-line tools to help you manage substance use problems and (g) information about locally available, specific treatment resources for substance use and mental health problems and supports related to substances. Each item was scored on a 5 point scale ranging from 1 (not at all interested), 2 (somewhat interested), 3 (do not care one way or another), 4 (Very interested), 5 (Would definitely want to access). Responses to each item were recoded into an index assessing level of interest in accessing online supports. For each item, not interested (= 0) was assigned for responses of 1 (not at all interested), 2 (somewhat interested), or 3 (do not care one way or another); interested (= 1) was assigned for responses of 4 (Very interested) or 5 (Would definitely want to access).

## Analyses

Proportions of respondents expressing interest in accessing online supports were calculated for the entire sample and for those who did and did not meet objective criteria for cannabis problems. Using methods outlined by Kim and Rabjohn (1980), correlations between recoded items informed the creation of two continuous outcome variables to represent interest in accessing online cannabis self-help materials and general interest in accessing self-help materials. We calculated the phi-coefficient ( $\phi$ ) for the two cannabis specific questions (i.e., *information about cannabis use*, *screening tool to find out more about your own cannabis use*). Results indicated that these 2 items were highly correlated ( $\phi=0.59$ ,  $p < 0.001$ ); dichotomous scores for these two items were combined into one continuous variable (ranging from 0 to 2), with higher scores representing more interest in accessing cannabis-specific online self-help resources. Next, to inform creation of a variable to represent interest in accessing general online self-help resources, intercorrelations between the five non-cannabis items were examined. All items were highly correlated ( $\phi s > 0.50$ ; *Table 1*); those items were combined into one continuous variable (ranging from 0 to 5), with greater scores representing more interest in general self-help.

*Hypotheses 1, 2, 3, and 4* were evaluated for each outcome variable using setwise hierarchical multiple linear regression (Cohen, Cohen, West, & Aiken, 2003) in SPSS (version 25). This analytical approach was chosen because the predictor variables could be appropriately categorized into sets (Cohen et al., 2003), and this method facilitates identifying their unique predictive contributions on outcomes by examining changes in  $R^2$  observed after sequentially entering each set of predictor variables; Cohen et al., 2003).

Linear regression was first used to adjust results for age and sex (Cohen et al., 2003; Step 1). Next, interest in self help scores were regressed on objective risk status (CUDIT +/- scores; Step 2), cannabis motives subscale scores (Step 3), protective behavioural strategies (Step 4), and the interaction between objective risk status and protective behavioural strategies (Step 5). *Hypotheses 1, 2, 3, and 4* were examined from the output in Steps 2 through 5, respectively. For each step, issues with multicollinearity were

identified as occurring when Variance Inflation Factors (VIF) were greater than 10 (Cohen et al., 2003). A summary of the hierarchical regression models for interest in cannabis self help and general interest in self-help are shown in *Tables 3 and 4, respectively*. All significance tests were two-sided and set at an alpha level of 0.05.

**Table 1**  
Phi-coefficients between each self-help item for subsample of cannabis using UA students ( $N = 649$ ).

	General information	Cannabis information	Age specific information	Cannabis screening	Interventions and help	Interactive online tools	Local resources
General information	-	0.78	0.76	0.54	0.67	0.56	0.62
Cannabis information	-	-	0.73	0.59	0.65	0.55	0.60
Age specific information	-	-	-	0.60	0.68	0.56	0.63
Cannabis screening	-	-	-	-	0.56	0.53	0.54
Interventions and help	-	-	-	-	-	0.74	0.78
Interactive online tools	-	-	-	-	-	-	0.78
Local resources	-	-	-	-	-	-	-

Notes: All phi-coefficients are significant ( $p < .001$ ).

## Results

### Overall interest in accessing online resources

Overall interest in accessing online resources was assessed by examining those who endorsed interest in accessing one or more of the seven online resources. More than half of the respondents (59%,  $n = 384$ ) expressed interest in accessing one or more of the seven online supports. Cannabis users meeting DSM criteria for hazardous/harmful (problematic) use, showed more interest in accessing, online self-help resources. That is, problematic users were significantly more likely than respondents not meeting criteria for cannabis-related problems to express interest in accessing online cannabis information,  $\chi^2(1, N = 649) = 3.99, p = .046$ , cannabis screening,  $\chi^2(1, N = 649) = 13.67, p < .001$ , interactive online tools,  $\chi^2(1, N = 649) = 11.90, p < .001$ , local resources  $\chi^2(1, N = 649) = 4.39, p = .036$ , and overall interest,  $\chi^2(1, N = 649)$

= 4.35,  $p = .037$ , compared to non-problematic users (Table 2). There were no significant differences between problematic and non-problematic users in the items corresponding to general information, age specific information, and brief interventions and help, however, problematic cannabis users expressed greater interest in each of these items.

**Table 2**

Proportions of cannabis-using UA students ( $N = 649$ ) expressing interest in accessing online self-help resources.

Resource	% Interested (n)				$\chi^2$
	CUDIT- ( $n = 484$ )		CUDIT+ ( $n = 165$ )		
	%	$n$	%	$n$	
General information	37.8	(183)	45.5	(75)	3.00
Cannabis information	38.4	(186)	47.3	(78)	3.99*
Age specific information	41.9	(203)	49.1	(81)	2.56
Cannabis screening	36.4	(176)	52.7	(87)	13.67***
Brief interventions and help	33.7	(163)	40.6	(67)	2.58
Interactive online tools	25.8	(125)	40.0	(66)	11.90***
Local resources/supports	32.2	(156)	41.2	(68)	4.39*
Interest in one or more of the above	56.8	(275)	66.1	(109)	4.35*

Note: \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

Interest in cannabis-specific online resources

Simple linear regression revealed that a model containing age and sex did not significantly predict interest in cannabis self-help,  $F(2/646) = 2.66$ ,  $p > .05$ ; however these predictors were retained as a set so that hypotheses were tested after adjusting for the impact of these demographics. In order to examine the first hypothesis, objective risk status (CUDIT +/- scores) was added to the model containing age, and sex; this step, significantly improved predictability of interest in cannabis self-help,  $\Delta R^2 = .017$ ,  $\Delta F(1/645) = 11.23$ ,  $p < .001$ . Objective risk status was positively associated with interest in cannabis self-help,  $\beta = 0.13$ ,  $t(645) = 3.35$ ,  $p < .001$ , after adjusting for age and sex. To test the second hypothesis, the set of five motive subscales (coping, conformity, social, enhancement, and expansion) were added to the model containing

age, sex, and objective risk status; adding these variables significantly improved predictability of interest in cannabis self-help,  $\Delta R^2 = .048$ ,  $\Delta F(5/640) = 6.56$ ,  $p < .001$ . Coping, enhancement and expansion motives were positively associated with this outcome,  $\beta_s = 0.11$  &  $0.10$  &  $0.11$ , respectively,  $t_s(640) = 2.48$  &  $2.20$  &  $2.45$ , respectively,  $p_s < .028$ . To examine the third hypothesis, protective behaviors were added to the model containing age, sex, objective risk status, and motives. Adding this variable significantly improved predictability of interest in cannabis self-help,  $\Delta R^2 = .012$ ,  $\Delta F(1/639) = 8.09$ ,  $p = .005$ . Protective behaviors were positively associated with interest in accessing online cannabis self-help resources,  $\beta = 0.12$ ,  $t(639) = 2.84$ ,  $p = .005$ , accounting for age, sex, objective risk status, and motives. Next, to test the fourth hypothesis, an interaction term between objective risk status and protective behaviors was added to the model containing age, sex, objective risk status, motives, and protective behaviors. Adding this interaction term did not significantly improve the predictability of interest in cannabis self-help,  $\Delta R^2 = .0020$ ,  $\Delta F(1,638) = 1.20$ ,  $p > .05$ . Collectively, the variables entered sequentially in these analyses accounted for 9% of the total variance in interest in cannabis self-help.

**Table 3**

Relationship between risk status, cannabis motives, protective behaviors, and interest in cannabis-specific online resources among cannabis-using UA students (N = 649).

Predictor	$\Delta R^2$	$R^2$	$\Delta F$	$\beta$
Step 1: Demographics	.0082	.0082	2.66	
Age				-0.08*
Sex				0.039
Step 2: Risk status (CUDIT)	.017	.025	11.23***	0.13***
Step 3: Cannabis motives	.048	.073	6.56***	
Coping				0.11**
Conformity				0.006
Social				-0.021
Enhancement				0.10*
Expansion				0.11**
Step 4: Protective behaviors	.012	.083	8.09**	0.12**
Step 5: Risk status X protective behaviours	.0020	.086	1.20	0.20

Note: \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

Interest in general online supports.

Simple linear regression indicated that age and sex did not significantly predict interest in general supports,  $F(2/646) = 1.60, p > .05$ , but these predictors are retained as a set so the following hypotheses could adjust for the impact of these (non-significant) demographics. In order to examine the first hypothesis, objective risk status (CUDIT +/- scores) was added to the model containing age, and sex, and significantly improved predictability of interest in general supports,  $\Delta R^2 = .010, \Delta F(1/645) = 6.75, p = .01$ . Objective risk status was positively associated with interest in general self-help,  $\beta = 0.10, t(645) = 2.60, p = .01$ , after accounting for age and sex. To test the second hypothesis, the set of five motive subscales (coping, conformity, social, enhancement, and expansion) were added to the model containing age, sex, and objective risk status. This significantly improved predictability of interest in general self-help,  $\Delta R^2 = .036, \Delta F(5/640) = 4.80, p < .001$ . Contrary to prediction, coping motives did not contribute to predicting interest in accessing general self-help resources ( $p > .05$ ), and only expansion motives were positively associated with interest in general self-help,  $\beta = 0.11, t(640) = 2.43, p = .02$ , after accounting for age, sex, objective risk status, and other motives. To examine the third hypothesis, protective behaviors were added to the model containing age, sex, objective risk status, and motives, and significantly improved predictability of general interest in self-help,  $\Delta R^2 = .011, \Delta F(1/639) = 7.51, p = .01$ . Contrary to prediction, protective behaviors were positively associated with interest in accessing general self-help,  $\beta = 0.12, t(639) = 2.74, p = .01$ , accounting for age, sex, objective risk status, and motives. Next, to test the fourth hypothesis, an interaction term between objective risk status and protective behaviors was added to the model containing age, sex, objective risk status, motives, and protective behaviors, which did not significantly improve the predictability of general interest in self-help,  $\Delta R^2 = .00020, \Delta F(1/638) = 0.16, p > .05$ ). Collectively, the variables entered sequentially in these analyses accounted for 6% of the total variance in interest in general interest in self-help.



**Table 4**

Relationship between risk status, cannabis motives, protective behaviors, and interest in general online resources among cannabis-using UA students (N = 649).

Predictor	$\Delta R^2$	$R^2$	$\Delta F$	$\beta$
Step 1: Demographics	.0050	.0050	1.60	
Age				-0.018
Sex				0.067
Step 2: Risk status (CUDIT)	.010	.015	6.75**	0.10**
Step 3: Cannabis motives	.036	.051	4.80***	
Coping				0.080
Conformity				0.044
Social				-0.017
Enhancement				0.075
Expansion				0.107*
Step 4: Protective behaviors	.011	.062	7.51**	0.12**
Step 5: Risk status X protective behaviours	.0002	.062	0.16	0.074

Note: \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

## Discussion

The present study examined demographics, risk status, motives, and protective behaviors as predictors of interest in accessing online support resources in a sample of cannabis-using students attending a Canadian University. We found that most of these young adults were interested in accessing these supports (59% of the analytic subsample). Although young adults and college students are unlikely to seek treatment for substance use problems (Caldeira et al., 2009; Kessler, 2001), this study indicates that most cannabis-using University students are interested in accessing free online self help resources and supports. This suggests that online interventions may be a feasible intervention strategy for cannabis-using University students.

Results indicated that interest was also positively associated with objective risk status for cannabis problems. Bivariate analyses indicated that cannabis users meeting CUDIT/DSM criteria for hazardous and harmful use were more likely than non-problematic users to be interested in accessing general addiction and mental health information, cannabis information, age specific information, cannabis screening, brief interventions and help, interactive online tools, and local resources. Regression analyses indicated that the

positive relationship between problematic cannabis use and interest in online resources held after adjusting for age and sex of respondents. These results conceptually replicate other research showing that drinkers meeting screening criteria for alcohol problems are more interested in accessing supports than non-problematic drinkers (e.g., Cunningham, 2005; Cunningham et al., 1999; Wild et al., 2004). Similar to those studies, and as hypothesized, cannabis users meeting screening criteria for problematic use expressed more interest in accessing brief online self-help materials (cannabis and general) than non-problematic users. This is an important finding as it suggests that young, problematic cannabis users would engage in online interventions designed to reduce problematic cannabis use.

Our second objective was to determine if coping motives for using cannabis would improve predictability of interest in accessing online self-help resources. Consistent with previous literature showing that coping motives predict cannabis-related problems (Benschop et al., 2015; Bonn-Miller, Zvolensky, & Bernstein, 2007; Simons, Correia, Carey, & Borsari, 1998; van der Pol et al., 2013), and are most often endorsed by alcohol users enrolled in treatment (Hammarberg et al., 2017), we observed that using cannabis to cope with negative affect was positively related to interest in accessing cannabis-specific online resources. Two other motives for using cannabis - enhancement and expansion – also predicted interest in accessing cannabis-specific online supports. Only expansion motives for using cannabis predicted interest in general online supports. Both enhancement and expansion motives are associated with higher frequency of cannabis use, past 30-day use, using greater quantities, and self-reported cannabis problems (Bonn-Miller, Zvolensky, & Bernstein, 2007; Bravo et al., 2017; Foster et al., 2015; Norberg et al., 2014), so it is possible that students endorsing these motives may engage in more problematic cannabis use and therefore display more interest in supports. Contrary to the prediction (and the alcohol research), as a set, motives (coping, enhancement and expansion) accounted for more unique variance in each outcome (cannabis and general), than objective risk status. Therefore, the reasons why people use cannabis seem to be the most predictive of these outcomes. However, the literature is underdeveloped for cannabis use motives, and to

our knowledge, this is the only study that has explored cannabis use motives in the prediction of interest in self-help resources. As such, future research is needed to confirm these findings.

Our third objective was to investigate the influence of cannabis-related protective behaviours on the prediction of interest in self-help. Since it is well-documented that higher levels of cannabis-related protective behaviors are associated with fewer cannabis consequences (Bravo et al., 2017; Pedersen, Huang, Dvorak, Prince, & Hummer, 2017; Pedersen et al., 2016), we hypothesized that cannabis users engaging in protective behavioral strategies would have little reason to access online supports. However, contrary to this prediction, we found that protective behaviors were positively associated with interest in self-help. We also found that there was no interaction between problematic cannabis use and protective behaviors. One possible explanation for these findings is that students engaging in protective behaviors may be more conscientious than students who do not adopt protective strategies. Conscientiousness is a personality trait positively associated with healthy behaviors (Bogg & Roberts, 2004), impulse control (Pervin & John, 1999), and reduced risk of substance use disorders (Kotov, Gamez, Schmidt, & Watson, 2010; Ruiz, Pincus, & Schinka, 2008). Protective alcohol use behaviors have also been shown to mediate the relationship between conscientiousness and alcohol use and related problems (Martens et al., 2009). That is, those higher in conscientiousness, use more protective behaviors, which are associated with less alcohol use and related problems. Therefore, conscientious cannabis users may be more likely to spontaneously adopt cannabis-related protective behaviors, and may also be more motivated to access brief online self-help tools. However, this idea in relation to cannabis users, has not been explored in the literature to date.

Overall, the variables predicted only 6 to 9% of the variance in accessing online self-help materials, which suggests that other factors, not measured in this study, are important in predicting these outcomes. In this context, perceived need for treatment and problem identification may also be relevant to predict interest in self-help. For example, it is well-documented that perceived need for change and problem recognition influenced treatment readiness and treatment seeking among substance users (Glass, Grant, Yoon, & Bucholz, 2015; Gulliver, Griffiths, & Christensen, 2010; Rapp et al., 2007). Therefore, cannabis users who

do not perceive a need for treatment or recognize that they are using cannabis problematically may be unlikely to express interest in self-help. Although the subsample included in this study were current cannabis users, we did not ask students if they wanted to change their cannabis use or if they felt that their cannabis use was problematic. In addition, social environments may also facilitate or reduce the likelihood of help-seeking behavior. For example, having supportive family members or peers (Gulliver et al., 2010; McCrady, 2004) or knowing someone close who has sought treatment (Disabato, Short, Lameira, Bagley, & Wong, 2018; Glass et al., 2015) may encourage help seeking. Alternatively, being surrounded by peers or family members who engage in substance misuse may decrease the chance of help-seeking (Kertesz et al., 2006; Lynch, Long, & Moorhead, 2018). We did not ask students about their social environment on this survey iteration, but this may be an important factor to explore in future studies.

#### Limitations and future directions

The current study has several limitations. Namely, the reliance on self-report data is prone to respondent bias. However, the online and confidential nature of the survey may have, in part, mitigated the occurrence of respondent bias. Next, the cross-sectional nature of the study does not allow for casual conclusions to be made, and more rigorous cohort studies could be completed in the future.

Despite these issues, this is the first study to our knowledge that has examined problematic cannabis use, motives for cannabis use, and cannabis-related protective behavioral strategies as predictors of interest in accessing brief, online, self-help resources. Overall these findings suggest that many cannabis users – and especially those who meet screening criteria for hazardous and harmful use – are interested in online self-help resources, and that certain factors such as motives and protective behavioral strategies may influence interest. As this area of research is underdeveloped, future research should aim to further explore motives for cannabis use as predictors of interest in self-help and treatment seeking behavior. Protective cannabis behaviors and their correlates seem to be an important area to understand in relation to help-seeking, and more research is recommended in this area. Other factors (e.g., personality traits, social network, and environmental factors) should be further explored as they may aid in the prediction of interest in self-help

materials. Finally, more specific qualitative explorations should be completed to identify ways to increase engagement in these resources. In the context of intervention development, the results from this study provide the first step in the development of future randomized control trials and population-level intervention strategies. That is, the findings identify the proportion of cannabis users interested in accessing online self-help materials, which is required to determine the sample size necessary to sufficiently power future trials. Second, it provides concrete evidence that this is a feasible intervention strategy to reach the target population (i.e., cannabis using Canadian University students).

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## Chapter 4: General Discussion

Prior to Cannabis legalization in October 2018, about 15% of Canadians over the age of 15 reported using cannabis (Statistics Canada, 2018b). It is unclear if cannabis consumption will change following legalization, but it is possible that cannabis use will increase. Although using cannabis does not guarantee the experience of any adverse physical or mental health effects, frequent heavy users are more likely to experience cannabis-related problems. In fact, it is estimated that 1.3% of the general Canadian population, or approximately 380,000 Canadians experience cannabis use disorders (DSM-IV abuse or dependence) each year (Fischer et al., 2016). Beyond problems experienced at the individual level, cannabis misuse places a financial strain on Canadian society as a whole, with over \$2.8 billion dollars in annual costs to health care, lost productivity, criminal justice costs, and other costs directly and indirectly related to cannabis misuse (Canadian Substance Use Costs and Harms Scientific Working Group, 2018). Ongoing surveillance is essential to identify changing trends in cannabis use and related problems in Canada.

There are three major psychological approaches used to understand the causes of cannabis use and cannabis-related problems - norm perceptions, personality traits, and motives for use. While each of these approaches are widely accepted to explain and understand alcohol use problems, there are relatively few studies within each of these domains focusing on cannabis use. Although each psychological approach addresses unique determinants of cannabis use, norm perceptions are perhaps the most modifiable intervention target for addressing public health priorities at the population level. Unlike selective personality trait interventions (Hecimovic, Barrett, Darredeau, & Stewart, 2014; Johnson, Mullin, Marshall, Bonn-Miller, & Zvolensky, 2010; Malmberg & Overbeek, 2010) provided to particularly 'at risk' subpopulations based on trait liabilities, interventions that target norm misperceptions do not depend on screening criteria and are available to anyone who displays interest. It is very important to develop interventions that are easily accessible and available because only a fraction of cannabis users who experience problems with this substance will ever seek help or access specialty treatment (Jutras-Aswad et al., 2019). However, research on norm misperceptions in relation to problematic cannabis use is still

underdeveloped. Thus, Study 1 of this thesis compared a variety of norm perceptions between cannabis users who did and did not meet screening criteria for hazardous and harmful use. It is also essential to develop realistic intervention strategies to reduce cannabis use based on interest level within groups of cannabis users. For example, it is of little use to develop interventions that are not appealing to cannabis users since they will not be utilized. Therefore, as Public Health professionals it is our responsibility to minimize treatment gaps by developing widely accessible interventions and to promote interventions that are appealing to cannabis users as part of our strategy to reduce cannabis use in Canadian society. Thus, Study 2 of this thesis described interest of young adult cannabis users in accessing free online self-help resources and tools, and identified several predictors of interest in these resources.

Perceptions and beliefs about behavior in social reference groups are powerful influences of individual behavior (Berkowitz, 2004; Perkins, 2002) and existing research suggests that mistaken norm perceptions may perpetuate cannabis use (e.g., Arbour-Nicitopoulos, Kwan, Lowe, Taman, & Faulkner, 2010; Blevins et al., 2018; Dempsey, McAlaney, & Bewick, 2018; LaBrie, Hummer, & Lac, 2011). Study 1 examined the relationship between cannabis risk status and norm perceptions among current cannabis using UA students. Our first objective was to examine descriptive norm perceptions among current cannabis users who did and did not meet criteria for problematic cannabis use. Contrary to existing research that suggests cannabis using young adults overestimate the frequency of cannabis use among peers and friends (Arbour-Nicitopoulos et al., 2010; Blevins et al., 2018; Dempsey et al., 2018; Kilmer et al., 2006; Neighbors et al., 2008; Page & Roland, 2004), our findings indicated that cannabis users meeting screening criteria for cannabis-related problems were more accurate with regard to descriptive norm estimates, compared to non-problematic users. That is, results from Study 1 indicated that problematic users accurately recognized that they used more cannabis than their closest friends, peers, and the average Albertan. This may be a novel finding, but it alternatively could be a result of two methodological issues: (a) only assessing descriptive norms among current cannabis users and (b) indirectly measuring descriptive norm perceptions. First, descriptive norms were only assessed among current cannabis users (i.e., 30% of respondents participating

in the broader population survey). From this perspective, all participants in the analytic subsample used in that study, regardless of CUDIT status, objectively used more cannabis than their fellow students. In the future, descriptive norm perceptions should be assessed among non-users and current cannabis users to determine whether cannabis users, in general, overestimate perceived prevalence in social reference groups (compared to non-users in the reference population), as results from other studies indicate (e.g., Arbour-Nicitopoulos et al., 2010; Dempsey et al., 2016). The second methodological choice that may have influenced the findings was using an indirect measurement of descriptive norm perceptions. Studies of descriptive norm perceptions tend to use direct measurements, which compare a respondents' self-reported frequency of cannabis use, to the actual frequency of use within a social reference group (e.g., Arbour-Nicitopoulos, Kwan, Lowe, Taman, & Faulkner, 2010; Blevins, Walker, Stephens, Banes, & Roffman, 2018; Dempsey, McAlaney, & Bewick, 2018; Kilmer et al., 2006; Neighbors, Geisner, & Lee, 2008; Page & Roland, 2004). However, we used an indirect measurement that asked respondents to reflect on their own use and then judge whether social reference groups use more or less cannabis than they do. Future research should compare direct and indirect measurements of descriptive norm perceptions among non-users, current cannabis users, and problematic users to evaluate possible differences associated with each measurement approach.

Our second objective was to compare current cannabis users who did and did not meet criteria for problematic cannabis use in relation to injunctive norm perceptions, and partial support for our second hypothesis was found across all three social reference groups. Pluralistic ignorance (a discrepancy between private and public approval) was observed among all three reference groups (closest friends, students, and average Albertan). Our findings indicated that cannabis users were privately more approving of the cannabis use among closest friends and average Albertan judgements, relative to perceived public approval. This finding is inconsistent with previous literature that suggests more public approval, relative to private approval (e.g., Dempsey et al., 2016). This inconsistency might be explained by cannabis use becoming more normalized within Canada (Duff et al., 2012). This point may be especially relevant when this study is

placed in its context – it was conducted within the year leading up to cannabis legalization in Canada. Therefore, shifts toward cannabis approval and changes in norm perceptions should be expected. Within the student reference group, a pattern consistent with the literature was observed, with greater perceived public approval than private approval toward cannabis use. When thinking about fellow students, only non-problematic cannabis users displayed pluralistic ignorance, whereas problematic cannabis users displayed a shift of private approval to match perceived public approval. This is the first study (to the author’s knowledge) to examine norm perceptions of the average Albertan, and more research should be completed on the ways that cannabis users view these more distal social reference groups.

Our third objective was to determine if there was a difference in the way that problematic and non-problematic cannabis users perceive sociobehavioral criteria defining whether or not someone has a problem with cannabis. Consistent with previous findings indicating that heavy alcohol users rate certain criteria (e.g., drinking alone, frequency of intoxication) as being less definitive of problem drinking, compared to lighter drinkers (Danko et al., 1988; Wild, 2002), problematic cannabis users had higher ‘thresholds’ for attributing problems than non-problematic users among several sociobehavioral measures. Specifically problematic users were less likely report that using cannabis alone, a family history of cannabis problems, type of cannabis used, and number of times stoned/week, are important in defining whether a person has cannabis problems compared to non-problematic users. These discrepancies for attributing problematic use, may contribute to cannabis misuse. Since this is the first study to outline that there are discrepancies in personal ‘thresholds’ for attributing cannabis problems, studies should try to replicate this finding in the future. If problematic users do indeed have a higher threshold for problem attribution, future studies should seek to explain the reasons why.

To our knowledge, Study 1 is the first study to examine descriptive and injunctive norm perceptions of cannabis use in social reference groups among cannabis users who do and do not meet screening criteria for problematic cannabis use. Additionally, it is the second study to document descriptive norm misperceptions for cannabis use among students attending a Canadian University (i.e., Arbour-Nicitopoulos

et al., 2010), and the first study to examine injunctive norm misperceptions of cannabis use within a Canadian sample. Finally, it is the first study to evaluate perceptions of sociobehavioral criteria in relation to cannabis use problems. In sum, this is an important study because norm misperceptions and discrepancies in personal ‘thresholds’ for attributing problems may perpetuate hazardous use, and may therefore contribute to cannabis-related problems.

Identifying contributors of cannabis related problems is only one part of a broader strategy to reduce problematic cannabis use within Canada. That is, in addition to identifying correlates of cannabis-related problems, effective intervention strategies for reducing problematic cannabis use must be developed. This is important because only a fraction of cannabis users who experience problems with this substance ever seek help or access specialty treatment. Despite young adults being most likely to use cannabis (Statistics Canada, 2017), this population is especially unlikely to seek treatment for substance use (Caldeira et al., 2009; Kessler, 2001). Exposure to self-help resources and tools has been shown to successfully reduce frequency and quantity of cannabis use, reduce symptoms of abuse and dependence, and can assist in promoting abstinence (Bonn-Miller et al., 2011; Rooke et al., 2013; Schaub et al., 2015), but these interventions are still underdeveloped. It is also not clear if cannabis users are interested in accessing these types of online, self-help resources. As such, Study 2 examined demographics, risk status, motives, and protective behaviors as predictors of interest in accessing online self-help resources in a sample of cannabis-using students attending a Canadian University.

We found that the majority of young adult cannabis users (59%) were interested in accessing one or more of seven online supports (i.e., general information, cannabis information, age specific information, cannabis screening, brief interventions and help, interactive online tools or local resources/supports). Our first objective was to establish whether interest in accessing relevant online self-help resources was associated with objective risk status for cannabis problems. Consistent with literature suggesting that objectively defined problematic alcohol users are more likely to be interested in accessing alcohol-related supports than non-problematic alcohol users (including brief self-help materials; Cunningham, 2005;



Cunningham et al., 1999; Wild et al., 2004), our results indicated that cannabis users meeting screening criteria for problematic use expressed more interest in accessing brief online self-help materials (cannabis and general) than non-problematic users. Overall, this finding suggests that young, problematic cannabis users would engage in online interventions designed to reduce problematic cannabis use.

Our second objective was to determine if coping motives for using cannabis would improve predictability of interest in accessing online self-help resources. Consistent with previous research suggesting that coping motives predict cannabis-related problems (e.g., Benschop et al., 2015; Bonn-Miller, Zvolensky, & Bernstein, 2007; Simons, Correia, Carey, & Borsari, 1998; van der Pol et al., 2013) and are most often endorsed by alcohol users enrolled in treatment (Hammarberg et al., 2017), we found a positive relationship between coping motives and interest in accessing cannabis-related supports. Enhancement and expansion motives also predicted interest in cannabis-related supports and only expansion motives predicted interest in general supports. Both enhancement and expansion motives are associated with higher frequency of cannabis use, past 30-day use, using greater quantities, and self-reported cannabis problems (Bonn-Miller, Zvolensky, & Bernstein, 2007; Bravo et al., 2017; Foster et al., 2015; Norberg et al., 2014), so it is possible that students endorsing these motives may engage in more problematic cannabis use and therefore display more interest in supports. Further, the reasons why people use cannabis were more predictive of interest in self-help (general and cannabis) than objective risk status but further research is needed to confirm these findings.

Our third objective was to investigate the influence of cannabis-related protective behaviours on the prediction of interest in self-help. Contrary to our prediction that cannabis users engaging in protective behavioral strategies would have little reason to access online supports (since spontaneous engagement in protective behavioral strategies are associated with less cannabis-related problems; e.g., Bravo et al., 2017; Pedersen, Huang, Dvorak, Prince, & Hummer, 2017; Pedersen et al., 2016), we found a positive relationship between protective behavioral strategies and interest in self-help resources. It is possible that students engaging in protective behaviors may be more conscientious than students who do not

spontaneously adopt protective strategies. Conscientiousness is a personality trait positively associated with healthy behaviors (Bogg & Roberts, 2004), and reduced risk of substance use disorders (Kotov et al., 2010; Ruiz et al., 2008). Moreover, those higher in conscientiousness are shown to use more protective behaviors, and experience less alcohol-related problems (Martens et al., 2009). Thus, conscientious cannabis users may be more likely to spontaneously adopt cannabis-related protective behaviors, and may also be more motivated to access brief online self-help tools.

Overall, there was a relatively small amount of variance explained by objective risk status, motives, and protective behavioral strategies in predicting interest in cannabis and general self-help. This suggests that other factors at the individual and social level may be important to consider. At the individual level, perceived need for change and problem recognition are shown to influence treatment readiness and treatment seeking among substance users (Glass et al., 2015; Gulliver et al., 2010; Rapp et al., 2007). Therefore, cannabis users who do not perceive a need for treatment or recognize that they are using cannabis problematically may be unlikely to express interest in self-help. Social environments may also facilitate or reduce the likelihood of help-seeking behavior. For example, while having supportive family members or peers (Gulliver et al., 2010; McCrady, 2004) may encourage help seeking, being surrounded by peers or family members who engage in substance misuse may decrease the chance of help-seeking (Kertesz et al., 2006; Lynch et al., 2018). These individual and social factors may be important to consider in future research exploring predictors of interest in self-help.

To our knowledge, Study 2, is the first study to establish that young adults who use cannabis are interested in accessing online self-help resources. It is also the first study to suggest that interest in self-help resources is greater among those meeting criteria for problematic cannabis use, those using this substance for expansion and enhancement reasons, and among those who already engage in protective behaviors. However, it is clear that other factors at the individual and social level still need to be explored as possible predictors of self-help.

Integrating the findings from Study 1 and Study 2 may advance the field of cannabis intervention research. First, while Study 1 explored the influence of normative perceptions as possible causes of cannabis problems, Study 2 went beyond exploring possible causes of cannabis problems, and aimed to establish whether cannabis users were interested in using online, self-help resources. The results from Study 1 suggested that problematic cannabis users hold different norm perceptions than non-problematic users. This is important because it implies that norm misperceptions may be a viable target for interventions that aim to reduce cannabis use. However, there may be little point in investing time and money to develop interventions to correct norm perceptions, if problematic users are not interested in these types of interventions. Fortunately, Study 2 established that cannabis using UA students are interested in engaging in online self-help interventions and that objective risk status, certain motives (coping, enhancement and expansion), and engaging in protective behavioral strategies are positively associated with interest in self-help. Taken together, these findings indicate that norm perceptions may be a valid target for interventions especially when designed as an online, self-help intervention, and that problematic users with coping, enhancement or expansion motives, engaging in protective strategies might be most willing to avail themselves of those self-help resources.

Interventions that aim to correct norm misperceptions (called personalized assessment-feedback interventions; PAFI), allow users to compare their personal beliefs about substance use to the actual frequency of use within a reference population. This corrects mistaken beliefs and motivates people to use substances more moderately and preliminary evidence suggests short term improvements in cannabis-related outcomes in college students following PAFI (Lee et al., 2013; Palfai et al., 2014). These interventions are promising but are still underdeveloped for cannabis use, in relation to other substance use interventions (Tait et al., 2013). Results from Study 1 of this thesis suggest that PAFI should aim to incorporate all three elements of norm perception considered in this study (i.e., descriptive, injunctive and sociobehavioral criteria in defining problems). For example, correcting misperceived descriptive and injunctive norms and integrating elements of problem recognition into interventions designed to change

norm perceptions. Findings from Study 1, also suggest that more research is needed to determine other factors beyond cannabis risk status in the attribution of cannabis use problems. From Study 2, it is clear that PAFI interventions will be most beneficial if they are easily accessible (i.e., online) and target problematic users, who use certain motives (coping, enhancement or expansion), and engage in protective behavioral strategies. However, more work still needs to be done to examine other factors (e.g., personality traits, social network, and environmental factors), that may contribute to the prediction of interest in self-help materials. Similarly, in the context of intervention development, the results from Study 2 provide the first step in the development of future randomized control trials and population-level intervention strategies. That is, the findings identify the proportion of cannabis users interested in accessing online self-help materials, which is required to determine the sample size necessary to sufficiently power future trials. Second, it provides concrete evidence that this is a feasible intervention strategy to reach the target population (i.e., cannabis using Canadian University students). Third, it suggest that factors including problematic use, motives, protective behavioral strategies and other unknown factors (e.g., personality traits), should be further evaluated and integrated into intervention efforts (e.g., target people using for certain motives).

There are several strengths of the simple, stratified random sampling approach utilized for both Study 1 and 2. First, it allowed for a large sample to be randomly selected. This increased the opportunity for normally distributed data which was essential for the data analyses techniques used in this study. Another strength was that the students' privacy was maintained as the Office of the Registrar initially reached out to students, and the researchers only had access to the students' email and preferred name (chosen by the students), following the consent process. Finally, a stratified simple sample strategy ensured that there was representation of different types of students (e.g., undergraduates, graduate students, and distance students), which increased the generalizability of the findings.

Despite several strengths, there are some limitations to this sampling approach. First, even though a random sample of UA students was drawn from the Office of the Registrar, there was still a relatively high

risk of selection bias. That is, the students who chose to complete the survey may be different in some systematic way than those who chose not to complete the survey, which may have influenced the results. For example, perhaps only the most highly functioning cannabis users decided to complete the survey. This could influence the results of Study 1 and 2. In Study 1, the norm perceptions of highly functioning cannabis using university students, may differ from the norm perceptions of less highly functioning cannabis users who did not complete the survey. In Study 2, perhaps there was a relationship found between expansion and interest in support because the cannabis users within this study were using cannabis for ‘healthier’ reasons (e.g., expansion motives are linked to creative thinking), rather than more pathological reasons (e.g., to cope with negative affect). Directly related to this idea, the findings of this cross-sectional study may not be representative of all cannabis using students at UA. Therefore, there may be issues with the generalizability of this study to all cannabis using UA students, and the generalizability of the results of this study to other cannabis using Canadian University students.

There are several strengths and weaknesses to the cross-sectional study design used in each of these studies. A limiting factor of a cross-sectional design is that researchers are unable to make statements regarding causal relationships. However, these cross-sectional designs are relatively affordable, allow the examination of multiple variables, and establish correlational relationships. These relationships may lead to the development of further hypotheses that can subsequently be tested under more rigorously controlled designs (i.e., randomized control trials) that can be used to draw causal conclusions. As in any survey that relies on self-report data, a limitation is that there is a chance of respondent bias. For example, some students may have minimized their amount of substance use, to make their level of use seem more socially desirable. Although self-report data for cannabis use has been shown to be reliable and valid to some extent (Ramo et al., 2012), future studies may benefit from including a confirmatory measure of cannabis use (i.e., biological markers). However, the online and confidential nature of the survey may have, in part, mitigated the occurrence of respondent bias.

## Chapter 5: Conclusion and public health significance

In conclusion, some cannabis users will experience cannabis-related harms, signifying the importance of developing effective intervention strategies. Online secondary prevention intervention strategies negate the reasons most often associated with treatment avoidance (i.e., concerns with stigma, confidentiality, and lack capacity in treatment programs), as they are anonymous, accessible from the privacy of ones own home, and have unlimited capacity. Norm perceptions about others' cannabis use are a viable target, and can be integrated into online intervention strategies that aim to change population-level cannabis use. Moreover, cannabis using University students are interested in participating in online interventions, making these a feasible strategy to reach this target population. Taken together, easily accessible, online, interventions that aim to correct norm misperceptions are an effective public health strategy to reduce problematic cannabis use among Canadian university students.

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Appendix A – Selected Items from the 2018 Campus Experiences with Cannabis Survey

**The Cannabis Use Disorder Identification Test - Revised (CUDIT-R)**

**Have you used any cannabis over the past six months? YES / NO**

**If YES**, please answer the following questions about your cannabis use. Circle the response that is most correct for you in relation to your cannabis use *over the past six months*

1.	How often do you use cannabis?	Never 0	Monthly or less 1	2-4 times a month 2	2-3 times a week 3	4 or more times a week 4
2.	How many hours were you “stoned” on a typical day when you had been using cannabis?	Less than 1 0	1 or 2 1	3 or 4 2	5 or 6 3	7 or more 4
3.	How often during the past 6 months did you find that you were not able to stop using cannabis once you had started?	Never 0	Less than monthly 1	Monthly 2	Weekly 3	almost daily 4
4.	How often during the past 6 months did you fail to do what was normally expected from you because of using cannabis?	Never 0	Less than monthly 1	Monthly 2	Weekly 3	Daily or almost daily 4
5.	How often in the past 6 months have you devoted a great deal of your time to getting, using, or recovering from cannabis?	Never 0	Less than monthly 1	Monthly 2	Weekly 3	almost daily 4
6.	How often in the past 6 months have you had a problem with your memory or concentration after using cannabis?	Never 0	Less than monthly 1	Monthly 2	Weekly 3	Daily or almost daily 4
7.	How often do you use cannabis in situations that could be physically hazardous, such as driving, operating machinery, or caring for children:	Never 0	Less than monthly 1	Monthly 2	Weekly 3	Daily or almost daily 4

8. Have you ever thought about cutting down, or stopping your use of cannabis?

Never

Yes, but not in the past 6  
Months

Yes, during the past  
6 months

0

2

4

**Protective Behavioral Strategies for Marijuana Scale  
PBMS (PBMS-17)**

*Please indicate the degree to which you engage in the following behaviors when using marijuana/cannabis.*

1 = never, 2 = rarely, 3 = occasionally, 4 = sometimes, 5 = usually, 6 = always

1	Use marijuana only among trusted peers
2	Avoid use while spending time with family
3	Avoid using marijuana before work or school
4	Avoid using marijuana to cope with emotions such as sadness or depression
5	Limit use to weekends
6	Only purchase marijuana from a trusted source
7	Avoid using marijuana habitually (that is, every day or multiple times a week)
8	Use a little and then wait to see how you feel before using more
9	Avoid mixing marijuana with other drugs
10	Avoid using marijuana in public places
11	Take periodic breaks if it feels like you are using marijuana too frequently
12	Buy less marijuana at a time so you smoke less
13	Have a set amount of “times” you take a hit (e.g., passing on a shared joint if you have already hit that limit)
14	Avoid methods of using marijuana that can make you more intoxicated than you would like (e.g., using large bong, volcano, ‘edibles,’ etc.)
15	Only use one time during a day/night
16	Limit the amount of marijuana you smoke in one sitting
17	Avoid using marijuana before engaging in physical activity (i.e., exercise, hiking)

## Marijuana Motives Measure

*Listed below are 25 reasons people might be inclined to use marijuana. Using the five-point scale below, decide how frequently your own marijuana use is motivated by each of the reasons listed. YOU USE MARIJUANA...*

1. because it helps me enjoy a party	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
2. to be sociable	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
3. because it makes a social gathering more fun	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
4. because it improves parties and celebrations	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
5. to celebrate special occasion with friends	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
6. to forget my worries	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
7. because it helps when me when I feel depressed or nervous	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
8. to cheer me up when I am in in a bad mood	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
9. because I feel more self-confident and sure of myself	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
10. to forget about my problems	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always

11. because I like the feeling	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
12. because it's exciting	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
13. to get high	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
14. because it gives me a pleasant feeling	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
15. because it's fun	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
16. because my friends pressure me to use marijuana	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
17. so that others won't kid me about using marijuana	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
18. to fit in with the group I like	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
19. to be liked	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
20. so I won't feel left out	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
21. to know myself better	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always

22. because it helps me be more creative and original	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
23. to understand things differently	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
24. to expand my awareness	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
25. to be more open to experience	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always



## Sociocultural Cannabis Norms

1. If you compare your closest same-sex friends with yourself, do you think that they normally use more or less cannabis than you do?

1	2	3	4	5
They use much less cannabis than I do	They use less cannabis than I do	They use about as much cannabis as I do	They use more cannabis than I do	They use much more cannabis than I do

2. If you compare same-sex students with yourself, do you think that they normally use more or less cannabis than you do?

1	2	3	4	5
They use much less cannabis than I do	They use less cannabis than I do	They use about as much cannabis as I do	They use more cannabis than I do	They use much more cannabis than I do

3. If you compare the average Alberta man or woman (as appropriate) with yourself, do you think that they normally use more or less cannabis than you do?

1	2	3	4	5
They use much less cannabis than I do	They use less cannabis than I do	They use cannabis about the same as I do	They use more cannabis than I do	They use much more cannabis than I do

4. How much do you approve or disapprove of your closest same-sex friends' cannabis habits?

1	2	3	4	5	6	7
I completely disapprove			Neutral			I completely approve

5. How much do you think your closest same-sex friends approve of their own cannabis habits?

1	2	3	4	5	6	7
They completely disapprove			Neutral			They completely approve

6. How much do you approve of your fellow students' cannabis habits?

1	2	3	4	5	6	7
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I completely  
completely  
disapprove

Neutral

I  
approve

7. How much do you think your fellow students approve of their own cannabis habits?

1	2	3	4	5	6	7
They completely disapprove			Neutral			They completely approve

8. How much do you approve of the average Alberta man or woman's (as appropriate) cannabis habits?

1	2	3	4	5	6	7
I completely disapprove			Neutral			I completely approve

9. How much do you think the average Alberta man or woman approves of their own drinking habits?

1	2	3	4	5	6	7
They completely disapprove			Neutral			They completely approve

*Some people who use cannabis become problem users and damage their own lives and the lives of others around them through cannabis use. For the next 7 items, rate each one based on how important it is in defining whether or not a person might have a problem with cannabis. Use the following scale to make your ratings:*

1	2	3	4	5	6	7
Not at all important					Extremely important	
in defining whether					in defining whether	
a person has a cannabis					a person has cannabis	
problem					problem	

10. How important is using cannabis while alone?
11. How important is growing up in a family where cannabis was abused?
12. How important is the total amount of cannabis that a person uses on any given occasion?
13. How important are negative effects on a person's job, for example, showing up late, missing work?
14. How important is the type of cannabis a person consumes, for example, marijuana versus hash?
15. How important is covering up one's cannabis habits, for example, lying, sneaking cannabis, and so on?
16. How important is the number of times a person gets stoned on cannabis in a given week?

### **Interest in Supports**

*Please indicate the degree to which you would be interested in having access the following resources and supports related to substances.*

**1 = not at all interested, 2 = somewhat interested, 3 = do not care one way or another  
4 = very interested, 5 = would definitely want to access**

1. If a website were available to you for free to provide the following information, how interested would you be in:
  - a) General information about substance use and mental health in Alberta and Canada?
  - b) Information about cannabis use?
  - c) Information about substance use and mental health in your own age group?
  - d) Screening tool to find out more about your own cannabis use?

- e) General information about interventions and help for substance use and mental health problems?
- f) Access to interactive, on-line tools to help you manage substance use problems?
- g) Information about locally available, specific treatment resources for substance use and mental health problems?

### **Sociodemographics**

What is your gender? Male/Female/Other

What is your birth month and year? mm-yyyy