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Loneliness and cannabis use among older adults: findings from a Canada national survey during the COVID-19 pandemic

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Abstract

Background Cannabis use has been increasing among older adults in Canada, particularly during the COVID-19 pandemic. This study aims to examine the association between loneliness and cannabis use among older Canadians during the pandemic.

Methods Quantitative data analyses were performed based on 2,020 participants aged 55 years and older from the Canadian Perspectives Survey Series 6, 2021: Substance Use and Stigma During the Pandemic.

Results This study found that participants who used cannabis in the 30 days before the survey reported significantly higher loneliness scores than those who never used cannabis after adjusting social-demographic, social interaction, and pandemic-related factors. Participants who kept using cannabis during the pandemic also reported significantly higher loneliness scores than those who never used cannabis.

Conclusion The findings about the correlation between cannabis use and greater loneliness contribute to the discourse on potential health and wellbeing harms of cannabis use among older adults.

Keywords Loneliness, Cannabis use, Healthy aging

Background

During the COVID-19 pandemic that began in early 2020, the enormous increase of loneliness among older adults has become a public health concern in Canada and worldwide [1, 2]. Generally, older adults are at greater risk for loneliness than the younger population, due to factors such as aging-related limited mobility, shrinking social network size, and chronic illnesses, preventing them from maintaining active social interactions [3, 4]. During the pandemic, physical distancing, restricted access to public services, and the disproportionate impact of the COVID-19 on aging people, all adversely affected the daily lives of older adults in Canada. Many studies conducted during the pandemic have revealed the amplified sense of loneliness among older adults in Canada, and relevant risk factors of loneliness [1]. However, the relationship between loneliness and cannabis use among older adults has been explored less than other topics such as multimorbidity or gender, either in Canada or other countries where cannabis use is legal, such as some states in the United States (U.S.).

Cannabis use among older adults has become an important public health topic for two main reasons: the greatest increase in cannabis use has been observed among older adults, and older adults are more vulnerable to potential adverse health and wellbeing effects of using

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cannabis [5]. During the pandemic, older adults have experienced a considerable increase in cannabis consumption in Canada [6]. However, most studies of cannabis use and its effects have been conducted on certain groups within which older adults are not involved or not specified, such as young adults, individuals with post-traumatic stress disorder (PTSD) or other chronic health conditions, or the general population [7]. This limits the knowledge application and implications for the aging population. In addition, most investigations of cannabis use focus on its effects on physical and mental health, while social wellbeing outcomes such as loneliness are less commonly addressed [8]. Therefore, it is salient to examine the association between loneliness and cannabis use among older adults during the COVID-19 pandemic.

Loneliness among older adults

Loneliness is defined as individuals' distress or unpleasant feelings that their needs are not being met through social relationships, and/or a perceived disparity between the expected and existing quantity or quality of social relationships [3, 9]. Loneliness is distinguished from social isolation in that the latter is conceptualized with quantified social relationship/interaction, indicated by social participation, network size, and other factors [10]. Loneliness is a common experience among older adults, and at least 20 to 40% of older adults experience occasional to severe loneliness [11]. Raina et al. (2018) examined the Canadian Longitudinal Study on Aging (CLSA) and found that about 25% of older women and 20% of older men feel lonely at least some of the time [4]. Higher levels of loneliness are also reported among certain groups of older adults, such as those living in remote areas, older caregivers, and those with multimorbidity, to name a few [1]. Loneliness is an essential risk factor for healthy aging due to its concurrent and longitudinal link to accelerated physiological aging, increased morbidity and mortality, impaired cognitive capability, deleterious mental illness, worsened quality of life, among other effects [9, 12]. Thus, it is critical to examine risk factors for loneliness among older adults, and further intervene to mitigate those risk factors.

During the pandemic, fear of infection and public practices to prevent infection (e.g., physical distance) all intensified the feeling of loneliness among older adults [2]. For instance, a survey conducted in May 2020 in Canada revealed that over 43% of older adults felt lonely at least some of the time [13]. A higher prevalence (51%) of loneliness in early 2020 was also reported in a study of older adults in the United Kingdom [14]. In addition, the prevalence of loneliness among older adults increased significantly over time during the pandemic, according to a systematic review of 33 articles [15]. Both before and during the pandemic, loneliness is detrimental to the health and wellbeing of older adults. For instance, Wister and colleagues (2022) reported that among older Canadians, the pre-pandemic loneliness and the increase of loneliness from pre-pandemic to peri-pandemic is significantly predictive of the development of depressive symptoms [16]. Other researchers also observed a positive impact of loneliness on different health issues, such as insomnia [17] and drinking problems [18], during the pandemic among older adults.

Cannabis use and wellbeing among older adults

Since the legalization of cannabis use in Canada in 2018, more and more older Canadians have been using it. According to The Commonwealth Fund's International Health Policy surveys 2020 edition, about 18% of Canadians aged 50 to 64 years, and 8% of those aged 65 years and older have used cannabis in the 12 months prior to the survey [19]. In addition, older adults have been observed as the fastest growing cannabis user group in Canada and other countries such as the U.S [20, 21]. Researchers attribute the increase in cannabis use among older adults to legalization of cannabis use, more liberal and tolerant attitudes toward cannabis use among baby boomers, as well as increasing availability and medically related use for older adults [8]. After the declaration of the COVID-19 pandemic, cannabis use among older adults increased significantly compared to pre-pandemic statistics, though less comparably to younger generations [21, 22]. As noted by Statistics Canada (2022), 20% of previous cannabis users aged 50 to 64 years, and 22% of those aged 65 and older, increased their cannabis use during the pandemic, with a 34% increase among previous users in general [6].

The relationship between cannabis use and wellbeing of older adults is multifold. First, evidence supports beneficial effects of cannabis in alleviating chronic pain, relieving stress, anxiety, and depressive symptoms [23–25]. For instance, during the pandemic, cancer survivors used cannabis to manage their anxiety and sleep problems [26], and older cannabis users took it to elevate mood or calm anxiety [27]. However, other evidence has indicated that the benefits of cannabis use tend to be short-term, emphasizing the need to examine the long-term harms of cannabis use. An increasing body of literature has pointed out that cannabis use is associated with multimorbidity, unhealthy behaviors such as excessive alcohol use, greater vulnerability to falls and injuries, and more Emergency Department visits among older adults [23, 28]. Recent studies conducted during the pandemic also support the negative effects discourse, particularly for long-term users. For instance, in a study of individuals with PTSD, Murkar et al. (2022) found that increased cannabis use was associated with more depressive symptoms during the pandemic [7]. Cannabis users also tend

to experience more COVID-19-related hospitalization and higher COVID-19 mortality [29]. For example, the association between cannabis use and Chronic obstructive pulmonary disease or other respiratory diseases has been well established [30, 31], which further increases the health risk for older adults who were infected with the COVID-19. Therefore, the use of cannabis leads to greater health risks for older adults, both before and during the pandemic. The existing of paradoxical evidence regarding the benefits and harms of cannabis use calls for more research in this area.

Loneliness and cannabis use

Loneliness has been examined less in studies of cannabis use than other health and wellbeing indicators. The association between loneliness and cannabis use has been confirmed in previous studies. First of all, although a potential bi-directional relationship exists between cannabis use and health/wellbeing factors, including loneliness, the majority of studies focus on identifying common indications for cannabis use [25]. In line with this stream of thoughts, cannabis use is viewed as a coping strategy to deal with loneliness. During the pandemic, loneliness is among the top reasons for increases in cannabis use among Canadians; others include stress, boredom, relaxation, and numbing of tension, anger, or sadness, etc [6, 32]. A study of young adult cannabis users in the U.S. during the pandemic reported that loneliness is the most common factor in cannabis users increasing their consumption [33]. Due to their close relationship with loneliness, social isolation or living alone also contributed to cannabis use during the pandemic [34]. However, the causal association between feeling lonelier than usual and increased cannabis use was not supported in a U.S.-based study featuring four waves of panel data collected between 2020 and 2021 [35], or another study based on American veterans during the pandemic [36]. Therefore, paradoxical results exist regarding whether people used cannabis to cope with loneliness before and during the pandemic.

In addition, another body of evidence supports the argument of cannabis use leading to greater loneliness. There are several explanations; first, substance users, including cannabis users, may experience considerable loneliness due to the stigma related to substance use [37]. For instance, among individuals with substance use disorder, the stigma of drug addiction is a key predictor of loneliness [38]. Frank et al. (2013) also noticed that some regular cannabis users choose not to use cannabis in front of family members or before social events, since they are aware of the potential misunderstanding and the distinction between cannabis users and non-users [39]. Although this does not mean they would refrain from social interaction, their use of cannabis does prevent them from engaging in many opportunities in social interactions. Also, cannabis users, particularly regular users or users with cannabis use disorder, tend to experience emotional dysregulation, and the feeling of loneliness may be sustained longer than usual [40]. According to Cadigan et al. (2023), those young adults with higher loneliness trajectories during the pandemic were more likely to use cannabis in the month before the survey, compared to those with lower loneliness trajectories [40]. In addition, loneliness might be the essential mechanism regarding how cannabis use increases the risk of mental illness, such as depressive disorders, or suicide risk [41]. Therefore, a better understanding of the impact of cannabis use on loneliness can also facilitate better understand the negative health effects of cannabis use.

In sum, cannabis use is understudied among older adults, particularly the impact of cannabis use on loneliness. Thus, the purpose of this study is to examine the association between cannabis use and loneliness among older adults in Canada during the pandemic.

Methods

This study was conducted based on the Canadian Perspectives Survey Series (CPSS) 6, 2021: Substance Use and Stigma During the Pandemic [42]. The CPSS is a series of surveys starting from early 2020, intended to collect information about the knowledge and behaviors of Canadian population in all ten provinces. Series 6 collects information related to alcohol and drug use, lifestyle, and social life, as well as the impact of COVID-19 among Canadians aged 15 and older. A total of 3,941 participants finished the CPSS 6 in January 2021, representing about 54.4% of the CPSS participant panel. For the purpose of this study, a sample of 2,020 participants aged 55 years and older were selected to form the unit of data analysis.

Dependent variable The dependent variable in this study is adapted from the 3-item UCLA loneliness scale [43]. In this scale, participants are asked to indicate their feelings about: (1) lack of companionship, (2) being left out, and (3) isolated from others. The original version of scale uses a 3-point Likert scale (Hardly ever, Some of the time, Often), and has been proved to be reliable and valid in capturing loneliness for older adults in Canada and other countries [44, 45]. The CPSS 6 uses a 5-point Likert scale (1 = never, 5 = always) with the same three items, and the high value of Cronbach's Alpha (0.826) in the studied sample indicates a high level of internal consistency. The loneliness score (ranging from 5 to 15) was summed up from those three items, and a higher score indicates greater loneliness.

Independent variables There are two independent variables in this study, including the use of cannabis and the change of cannabis use. First, participants were asked: in the past 30 days, how often did you use cannabis? Participants were invited to choose the following seven options: never used cannabis, not during the past 30 days, 1 day in the past 30 days, 2–3 days in the past 30 days, or daily. The answers were further grouped into three categories: Never used cannabis, Not during the past 30 years, and Used in the past 30 days. Second, those participants who used cannabis were further invited to compare their usage of cannabis to their usage before the COVID-19 pandemic: increased, decreased, or stayed about the same. In order to include the group of participants who never used cannabis, the measurement of this variable was further categorized as Never used, Increased, Decreased/stayed about the same (due to the low number of participants indicating decreased use of cannabis), as well as Not stated due to a high percentage of missing value (about 7%).

Controlling variables A group of social-demographic factors and social aspects of life were included in the data analysis to adjust to potential confounding issues [1]. Age was measured according to age groups: 55 to 64 years old, 65 to 74 years old, and 75 years and older. Sex was measured according to sex at birth, with Male and Female categories. Marital status was originally measured with five categories and further grouped into Married/ partnered and Single (not married, separated, and widowed). Highest education attainment was measured at four levels: Less than high school, High school, Some post-secondary education, and University diploma or degree. Employment status was binary, measured as Working and Not working. The living area was grouped, based on population density area, into Rural and Urban. Country of birth (Canada and Other countries) was also included in the data analysis. In addition, three factors regarding social interaction closely related to loneliness were adjusted in the data analysis: household size, number of close relatives and friends, and social participation. Household size was measured as One person, Two person, and Three persons or more. Number of close relatives and friends ranged from None, One to two, Three to five, Six to nine, and Ten or more. The social participation was indicated according to whether (yes or no) participants were members of any group or association.

Furthermore, three substance-use-related variables were also added, including attitudes to substance use, drink situation, and opioids use situation. The attitude toward substance use was a summary of scores from four questions: People who have a problem with alcohol or drugs should be embarrassed or uncomfortable to tell friends or family that they have a problem; Society should be friendlier toward people with an alcohol or drug problem; People who have an alcohol or drug problem should find it embarrassing or uncomfortable to seek help or treatment; and, I have sympathy for people who misuse alcohol or drugs (the second and fourth questions were reverse coded). As noted above, the attitudes toward substance use scores were determined from a sum of all four questions (Cronbach's Alpha = 0.640), and a higher score means more positive attitudes toward substance use. The situation of drinking any alcoholic beverage was measured at three levels, including Never drank alcohol, Drink in the past 30 days, and Not in the past 30 days. Participants also reported their utilization of drugs containing opioids (prescribed or not) situation, which was measured at three levels (Never used opioid products, Used in the past 30 days, and Not in the past 30 days).

Data analytic procedure The SPSS version 28 was used to perform the data analysis. Descriptive analysis was first conducted to provide information about the selected participants, illustrated in Table 1. Group comparison among participants based on their cannabis use frequency with regard to their social demographic background, social interaction factors, and attitudes towards substance use, drink and opioids use was further conducted and listed in Table 2. Finally, linear regression analyses were conducted to examine the associations between loneliness and the use of cannabis and changes in cannabis use. As shown in Table 3, Model 1 includes all the controlling variables and the use of cannabis, while Model 2 includes all the controlling variables and the change in cannabis use. As required by Statistics Canada, weight variable was applied all data analyses (sampling weight and standardized weight).

Results

The characteristics of selected participants are illustrated in Table 1. Most of the participants were aged 55 to 64 years old (44%), female (52%), married or partnered (70%), highly educated with post-secondary degrees (60%), retired (67%), living in urban areas (83%), and born in Canada (79%). The majority of participants were living with another person in the same household (61%). Most of participants have 1 to 5 close relatives and friends (70%). The proportion of whether participants are members of certain groups or associations or not are close to 50%. Also, participants reported an average score of 13.39 ($SD = 1.95$) for their attitudes toward substance use, out of 20. Most participants (69%) drank alcoholic beverage in the 30 days prior to the survey, while most participants (77%) never used any drug containing opioids. The loneliness score based on the UCLA 3-item scale is 7.83 (SD = 2.72) among all participants.

In addition, about 80% of participants have never used cannabis. Among the 20% of participants who have

Table 1 Characteristics of participants ($N = 2,020$)

Variables	Mean (SD)/ percentage
Age	
55 to 64 years old	43.87
65 to 74 years old	40.39
75 years and older	15.74
Sex	
Male	47.82
Female	52.18
Marital status	
Married/ partnered	70.23
Not married	29.77
Education attainment	
Less than high school	11.66
High school	28.46
Some post-secondary education	33.11
University diploma or degree	26.77
Employment	
Working	33.21
Not working	66.79
Living area	
Rural	17.36
Urban	82.64
Country of birth	
Canada	78.66
Other countries	21.34
Household size	
1 person	20.88
2 persons	60.78
3 persons and more	18.34
Number of close relatives and friends	
None	3.39
1 to 2	34.20
3 to 5	35.40
6 to 9	17.67
10 or more	9.33
Participation in groups and associations	
No	49.46
Yes	50.54
Attitudes toward substance use	13.39 (*1.95*)
Drink any alcoholic beverage	
Drink in the past 30 days	69.28
Not in the past 30 days	15.30
Never drank alcohol	15.41
Prescribed or not, used drugs containing opioids	
Used in the past 30 days	6.63
Not in the past 30 days	16.28
Never used opioid products	77.09
Frequency of cannabis use	
Never used	80.34
Not used in the past 30 days	10.14
Used in the past 30 days	9.53
Cannabis use change when comparing to before the pandemic	
Never used	80.28
Increased	2.83

Table 1 (continued)

Variables	Mean (SD)/ percentage
Decreased / Stay about the same	9.71
Not stated	7.18
Loneliness scale	7.83 (2.72)

Notes: *SD*=standard deviation.

used cannabis, half of them did not use cannabis within 30 days before the survey, and another half had used in those 30 days. Furthermore, 3% of participants increased their cannabis use during the pandemic compared to before the pandemic, about 10% of them reported either decreased or a similar amount of cannabis use, while roughly 7% of them chose to not answer the question.

As illustrated in Table 2, participants who used cannabis in the past 30 days also reported significantly higher loneliness scores than those who never used cannabis (8.41 vs. 7.75). In addition, higher proportions of participants who used cannabis in the past 30 days reported drinking alcoholic beverage (79% vs. 72% or 68%) and using drugs containing opioids (13% vs. 5% or 6%) than those who did not use cannabis in the past 30 days or never used cannabis. Participants with different frequency of cannabis uses were also different in most other co-variates, including age, sex, marital status, education level, employment status, country of birth, household size, or number of close relatives and friends (see Table 2 for detailed information).

The results of the regression analyses listed in Table 3 show the relationship between loneliness and use of cannabis and the change in use after adjusting all the controlling variables. As indicated in Model 1, participants who used cannabis in the 30 days before the survey reported a higher loneliness score, compared to those who had never used cannabis (beta=0.06, $p<.05$). In addition, participants who increased their cannabis use (beta=0.06, $p<.05$), or kept using cannabis (beta=0.05, $p<.05$) during the pandemic also reported a higher level of loneliness than those who had never used cannabis.

The relationships between the loneliness score and social-demographic factors, and the social interaction aspects of life, are basically consistent in Model 1 and Model 2. Female participants showed a higher loneliness score than their male counterparts. Participants with a high school education reported higher loneliness scores than those without. Household size is significantly related to loneliness, and participants with a household size of three or more persons scored lower for loneliness than those with smaller household sizes. Also, participants with close relatives and friends at any level all reported lower loneliness scores than those without any close network. Positive attitude towards substance use was significantly associated with lower levels of loneliness. Also, participants who have used drugs containing opioids in the past 30 days, or other times before, both reported higher loneliness scores than those who never used opioids-related products.

Discussion

This project is one of the first studies to examine the association between loneliness and cannabis use among older adults during the pandemic using a population-based national dataset in Canada. Based on the data collected in early 2021 during the pandemic and a sample of 2,020 Canadians aged 55 years and older, this study found that: (1) participants who used cannabis in the 30 days before the survey reported significantly higher loneliness scores than those who never used cannabis; and (2) participants who increased their cannabis use during the pandemic also reported significantly higher loneliness scores than those who never used cannabis.

The significant association between past-month cannabis use, increased cannabis use, and greater loneliness among older Canadians resonates with previous studies that regular cannabis users tend to experience sustained and heightened levels of loneliness [40]. There are several explanations. First, research during the pandemic with different groups of people have found that increased cannabis use is associated with functional impairment in daily activity among adolescents [29], worsening of depressive symptoms among people with PTSD [7], and more alcohol consumption among general cannabis users [46], which are all positively related to loneliness. Also, older adults who use cannabis may experience dizziness and impaired short-term memory, which also prevents them from experiencing meaningful social interactions with others [25]. Thus, regular or increased cannabis use posits greater risk for older cannabis users to feel lonely.

Second, stigma related to cannabis use does exists among older adults [47, 48], although no significant difference of attitudes toward substance use between cannabis users and non-users was identified in this study. Older cannabis users choose not to disclose their cannabis use situation to family, friends, or colleagues in order to avoid judgement and disappointment [24]. As a result, many older adults tend to use cannabis at home alone or with their spouse/partner and to stay at home afterwards, which increase their risk of being lonely. They may feel embarrassed to let others know that they need to increase their cannabis use or that they have developed cannabis dependence to handle pandemic-related

Table 2 Group comparison of participants based on cannabis use ($N = 2,020$)

Variables	Never used ($n = 1601$) (a)	Not in the past 30 days ($n = 206$) (b)	Used in the past 30 days ($n = 211$) (c)	χ^2(df)/t test
Age				111.35 (4) ***
55 to 64 years old	38.48	68.05	63.96	
65 to 74 years old	43.70	30.31	23.30	
75 years and older	17.81	1.64	12.74	
Sex				37.53 (2) ***
Male	44.58	64.85	57.17	
Female	55.42	35.15	42.83	
Marital status				37.35 (2) ***
Married/ partnered	72.91	66.42	52.07	
Not married	27.09	33.58	47.93	
Education attainment				16.30 *
Less than high school	12.57	10.58	5.22	
High school	29.40	24.30	24.56	
Some post-secondary education	32.10	36.12	38.65	
University diploma or degree	25.93	29.00	31.57	
Employment				37.26 (2) ***
Working	30.04	47.81	44.15	
Not working	69.96	52.19	55.85	
Living area				3.27 (2)
Rural	17.63	19.33	13.07	
Urban	82.37	80.67	86.93	
Country of birth				16.30 (2) ***
Canada	76.98	88.74	81.91	
Other countries	23.02	11.26	18.09	
Household size				20.59 (4) ***
1 person	19.39	21.77	32.11	
2 persons	62.24	61.86	47.63	
3 persons and more	18.38	16.37	20.26	
Number of close relatives and friends				27.06 (8) ***
None	2.99	7.30	2.68	
1 to 2	33.46	33.42	41.59	
3 to 5	36.16	29.57	34.85	
6 to 9	17.80	23.14	10.73	
10 or more	9.59	6.57	10.14	
Participation in groups and associations				4.36 (2)
No	50.50	47.93	42.62	
Yes	49.50	52.07	57.38	
Attitudes toward substance use	13.39 (1.98)	13.43 (1.74)	13.39 (1.92)	0.04
Drink any alcoholic beverage				38.46 (4) ***
Drink in the past 30 days	67.67	72.33	79.36	
Not in the past 30 days	14.77	22.70	12.07	
Never drank alcohol	17.56	4.97	8.56	
Prescribed or not, used drugs containing opioids				113.84 (4) ***
Used in the past 30 days	6.15	4.79	12.73	
Not in the past 30 days	12.43	37.04	26.80	
Never used opioid products	81.42	58.18	60.47	
Loneliness score	7.75 (2.76)	7.85 (2.69)	8.41 (2.77)	5.01 **; c > a

Notes: *$p < .05$. **$p < .01$. ***$p < .001$.

Table 3 Linear regression of loneliness for selected participants ($N = 2,020$)

Variables	Model 1	Model 2
	Beta	Beta
Frequency of cannabis use (Never used)		--
Not used in the past 30 days	0.01	
Used in the past 30 days	0.06 *	
Cannabis use change (Never used)	--	
Increased		0.06 *
Decreased / Stay about the same		0.05 *
Not stated		-0.02
Age (55 to 64 years old)		
65 to 74 years old	-0.05	-0.05
75 years and older	-0.04	-0.04
Gender (Male)		
Female	0.12 ***	0.12 ***
Marital status (Married/ partnered)		
Not married	0.05	0.06
Education attainment (Less than high school)		
High school	0.019 ***	0.19 ***
Some post-secondary education	0.02	0.03
University diploma or degree	0.03	0.04
Employment (Working)		
Not working	0.04	0.04
Living area (Rural)		
Urban	0.06 *	0.06 *
Country of birth (Canada)		
Other countries	-0.02	-0.02
Household size (1 person)		
2 persons	-0.01	-0.01
3 persons and more	-0.05 *	-0.04 *
Number of close relatives and friends (None)		
1 to 2	-0.22 ***	-0.22 ***
3 to 5	-0.30 ***	-0.29 ***
6 to 9	-0.29 ***	-0.28 ***
10 or more	-0.23 ***	-0.23 ***
Participation in groups and associations (No)		
Yes	0.05	0.05
Attitudes toward substance use	-0.08 ***	-0.09 ***
Drink any alcoholic beverage (Never drank alcohol)		
Drink in the past 30 days	0.04	0.04
Not in the past 30 days	0.02	0.02
Prescribed or not, **used drugs containing opioids** (Never used opioid products)		
Used in the past 30 days	0.04 *	0.04 **
Not in the past 30 days	0.05 *	0.05 **

Note: The reference group in the analysis is listed in the (ref.). *$p < .05$. **$p < .01$. ***$p < .001$.

situations [38]. Thus, increased cannabis use adds a more complex layer to the already difficult situation during the pandemic for older adults.

Also, older adults are more likely to use cannabis for medical reasons to control pain, or to improve sleep and mood, than younger generations in Canada [21]. Similar situations have been reported in the U.S., where over 60% of medical cannabis users are aged 50 years and older [49]. Therefore, it is possible that older adults who are regular cannabis users already manage multiple health conditions (such as chronic pain), making it harder for them to maintain social relationships and social interactions. Among our participants, significantly higher proportions of older adults who used cannabis in the past 30 days were living in a household with two or fewer persons, and having five or fewer close friends and relatives reflect the reality of smaller network size among regular cannabis users. A significant association between a

smaller network size and greater loneliness among older adults is supported in this study and other existing ones [3, 4].

In addition to the identified positive association between cannabis use and loneliness, several other findings in this study also highlight the greater incidence of loneliness among certain groups of older Canadians. The significant correlations between greater loneliness and smaller household and network sizes further emphasize the importance of social interaction, both at home and outside of home, particularly during the pandemic. Older adults tend to experience shrinking network sizes due to their own gradual loss of physical functions and mobility, as well as the passing of friends and relatives of similar ages [9, 10]. During the pandemic, the importance of family and friends to maintain daily communication and support was amplified, considering restricted access to public services and community events. Our study found no disparity between participants who are members of groups and associations or not. However, this does not mean participation in groups or associations is not important, but it reflects a pandemic-related situation. During the pandemic, those informal and formal groups or organizations stopped many activities, or shifted those activities onto digital platforms, which many older adults find hard to engage in or enjoy. Therefore, it is understandable that membership in organizations during the pandemic is not an enabling factor to resist loneliness.

In addition, positive attitude towards substance use is significantly related to lower loneliness among the studied sample. In the context of cannabis use, participants with higher levels of positive attitudes toward cannabis use may find it more comfortable to share their cannabis use situation to family or friends. Also, a positive attitude toward cannabis use may indicate that participants have better knowledge of both positive and negative effects of cannabis use and will use cannabis accordingly. The significant associations between social-demographic factors, such as age, gender, and employment, and loneliness are also consistent with existing studies [1] and highlight the need to support at-risk groups among older adults, such as female older adults.

Limitations

There are several limitations and issues worth clarifying. First of all, this study is based on cross-sectional survey data, which do not support the establishment of causality between loneliness and cannabis use. As indicated in the existing literature, cannabis use and loneliness have a bi-directional relationship [37]. In this study, setting cannabis use as the independent variable and loneliness as the dependent variable is based on the gap identified from existing literature. The identified significant association between cannabis use and loneliness in this study contributes to the increasing body of literature regarding the negative impact of cannabis use among older adults. However, more longitudinal studies are needed to further explore the potential bi-directional relationship (cannabis use as a coping strategy and/or cannabis use leads to loneliness) between cannabis use and loneliness. Second, the magnitude of statistical associations between cannabis use in the past 30 days and loneliness, and between increased cannabis use in the pandemic and loneliness are relatively modest after adjusting all covariates in this study. Considering that this study adjusted the essential loneliness contributors (e.g., social interaction factors, different types of substance use) in the data analysis, those modest statistical associations further highlight the close relationship between cannabis use and loneliness among older adults.

Third, in this study cannabis use is not separated into medical use and recreational use, since it is impossible to separate medical and recreational purposes based on the questions from CPSS 6. Considering that the majority (80%) of Canadian medical cannabis users also use it recreationally [50], examining cannabis users as a single group is acceptable. Other studies have already examined the differences between medical and recreational cannabis users [51]. Also, the way of consuming cannabis was not collected in CPSS 6, thus it is hard to separate the inhaling (smoking or vaping) and ingesting (eating or drinking) ways of consumption. Future study can further investigate whether and how different ways of consuming cannabis affect loneliness among older adults.

Finally, this study includes participants aged 55 years and older, rather than 65 years older, for two reasons. First, many cannabis users aged 65 years and older start to use cannabis at a younger age [8], and considerable studies of cannabis use among older adults also include participants in their 50s in order to understand the trend of cannabis use in the middle-age life stage (e.g., 5, 8). Thus, including participants aged 55 to 64 years old makes the findings of this study more comparable to those of others. The second reason is related to sample size. The CPSS 6 comprises over 3,000 participants aged 15 years and older, with about 160 participants aged 65 years and older reported cannabis use. In order to avoid any statistical issues due to small sample size, this study also includes participants aged 55 to 64 years old, resulting in over 400 participants with cannabis use experience. In addition, the CPSS 6 did not collect any long-term health conditions from participants. Considering the fact that older adults tend to use cannabis for medical purposes (e.g., alleviating chronic pain), this study is unable to explore the potential moderating or meditating effect of such situations on the relationship between cannabis use and loneliness.

Implications

This study supports the relationship between cannabis use and loneliness among older Canadians during the COVID-19 pandemic. The findings provide evidence for the discourse on the negative impact of cannabis use, which further emphasizes the salience of social services and programs in promoting awareness of various negative effects of cannabis use among older adults. Considering that older adults are more likely to experience harms from cannabis use due to their age-related health changes, older adults should take additional precautions when using cannabis for either medical or recreational purposes. However, previous studies found that older cannabis users tend to have lower cannabis risk perceptions than non-users [5]. A lack of formal education about cannabis use in both Canada and the U.S. has been reported in previous studies [52, 53], and advice from informal resources tends to be misleading [21]. Although the COVID-19 pandemic has ended, older adults are still susceptible to other adverse situations, including family caregiving, social isolation, natural disasters, or health decline. Older adults might start or keep using cannabis to deal with challenges related to such situations without appropriate guidance. Thus, providing structured social education programs to give older adults a better understanding of cannabis use and relevant health/wellbeing effects is essential.

In addition, more research of cannabis use among older adults in Canada is needed. Since the legalization of cannabis use in 2018, research on the subject lags behind the increase of cannabis use among older Canadians. The fact that more than half of first-time cannabis users are older adults in some studies [54] further highlights the increasing need to study cannabis use among older adults. However, the current literature is mainly based on younger adults or on the general population, and the evidence cannot be directly applied to older adults, who have different health and wellbeing profiles than younger adults. Longitudinal analyses with multiple waves of data are preferred to establish the causal relationship between cannabis use and different health and wellbeing outcomes, such as loneliness and other physical or mental health indicators.

Conclusions

This study identifies the significant association between greater loneliness and cannabis use during the pandemic, including recent cannabis use in the past 30 days and increased cannabis use compared to pre-pandemic. The findings add to the expanding body of literature of the negative health and wellbeing effects of cannabis use among older adults. Although the data were collected during the pandemic, the findings are also applicable to other adverse situations experienced by older adults. Canada is one of the few countries in which cannabis use is legal nationally, and more research based on older Canadians can provide implications not just to support aging Canadians, but also to other countries in which older adults also use cannabis.

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Author contributions
LL- Main writer of manuscript; QD - Secondary author made substantial contributions to the conception, design, data analysis, the interpretation of the results, and editing of the manuscript. All authors have read and approved the final version of the manuscript and have agreed to be accountable for all parts.

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Data availability
The data is publicly available from the Statistics Canada website: https://www150.statcan.gc.ca/n1/pub/45-25-0012/452500122021001-eng.htm.

Declarations

Ethics approval and consent to participate
N/A.

Consent for publication
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The authors declare no competing interests.

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