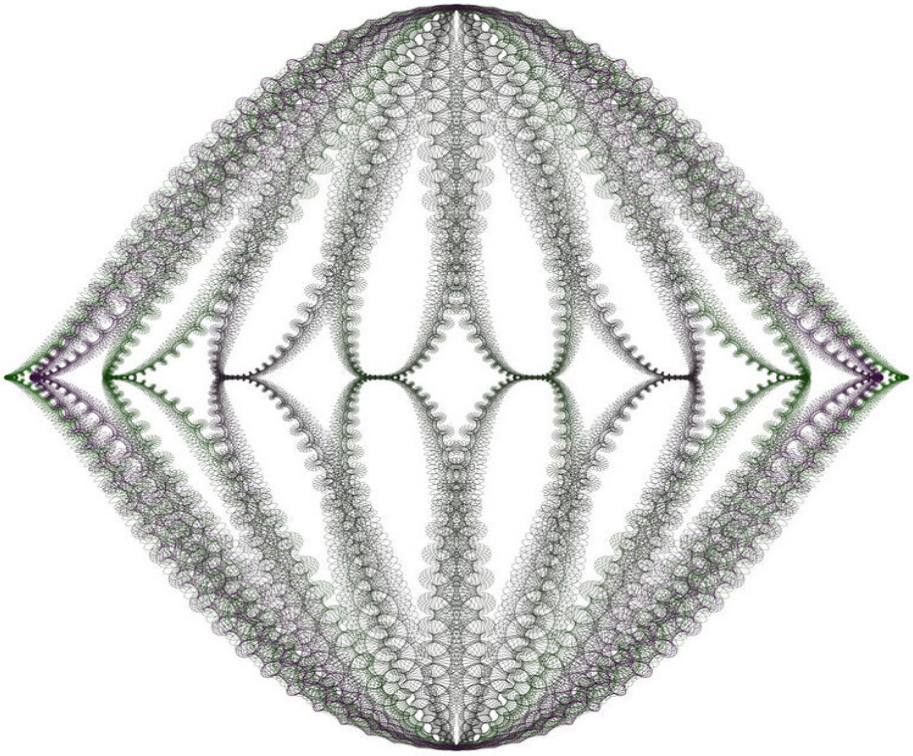
McMaster University

STATure



*STA**T***istical applications for *u*ndergraduate *r*esearch *e*xploration

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The field of statistics is the study of learning from data. Statistical learning causes you to utilize the best possible strategies to gather the information, utilize the right investigations, and adequately present the outcomes. Statistics is an urgent procedure behind how we make disclosures in science, settle on choices dependent on information, and make predictions. Statistics is an energizing field about the rush of discovery, learning, and challenging your assumptions.

LIFE SCI 3LL3 – Living Systems Laboratory Practicum provides students with the opportunity to explore various areas of study within Life Sciences in a small-group learning environment. This term, the theme focused on a lab-based statistics course that provided students the opportunity to explore databases through SPS software. Students were encouraged to gain knowledge in scientific research, learning several different statistical analysis methods. Within this course, they were challenged to develop research questions, run appropriate statistical test on their data, and compose a scientific manuscript.

This **STATure (STAT**istical applications for **u**ndergrad **r**esearch **e**xploration) publication is a compilation of the final assignments of students within the Winter 2022 course. Each report is a statistical story that reflects the knowledge gathered throughout the semester.

Thank you to my students for a wonderful semester of learning, sharing, and exploring statistical analysis using SPSS.

A special thank you to our Teaching Assistant's: Andrea Krishnapillai, Jane Jomy, Mahsa Gholiof, and Taylor Hittner.

Enjoy!

Ms. Noella Noronha, MSc eHealth (Course Instructor)

Cover Art – 12000 ellipses. Hamid Naderi Yeganeh (1900-) is an mathematical artist known for using formulas to create drawings of real life objects, illustrations and artwork.

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The Investigation of the Relationship of Alcohol and Cannabis Use Associated with Stress Levels Caused by the COVID-19 Pandemic in Immigrant Canadians

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LIFESCI 3LL3: Living Systems Laboratory Practicum

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Introduction

Since the start of the COVID-19 global pandemic, Canada, along with the rest of the world, has adopted rigorous public health measures such as public lockdowns, vaccination and mask mandates, school closures, and social distancing practices, to reduce the spread of COVID-19. Although these guidelines have been implemented to manage the illness and protect the population, they have undoubtedly disrupted the typical patterns of human, social, and economic activities (Varin et al., 2021).

As a result, there has been a recent increase in research on the effects of the global pandemic on individuals' mental well-being. For example, a study conducted among 3000 Canadian adults (18 years and older) discovered that 38.2% of respondents reported a decline in mental health since the beginning of the pandemic and 14.3% of respondents indicated that they were "not coping very well" or "not well at all" (Jenkins et al., 2021). It is evident that extreme public health measures have inadvertently had an impact on the mental well-being of Canada's population and that these mental health impacts are beginning to be recognized as a growing concern (Gadermann et al., 2020).

Due to the pandemic, many health behaviours such as changes in alcohol and cannabis use are seen among the population. A study conducted among 4383 participants in Canada discovered that 14% of participants increased alcohol consumption, and 5.5% of participants increased cannabis consumption following the onset of the pandemic (Zajacova et al., 2020). Another study reported that 15.7% of participants indicated an increase in their alcohol use and 5.4% indicated an increase in cannabis use, in a population of 12344 Canadians (Varin et al., 2021). It was also reported in this study that 21.9% of the sample, individuals aged 35-44 years old, and 21.0% of the sample, individuals aged 45-54 years old, had a higher increase in alcohol

consumption (Varin et al., 2021). These results show the impact of COVID-19 on various health changes for many individuals in Canada. It was also discovered that there was an association between mental health and alcohol and cannabis consumption among Canadian individuals. The results of a study outlined that 27.0% of the sample of 12344 participants, who had a significant change in their mental health since the beginning of the pandemic, had the highest proportion of increased alcohol use (Varin et al., 2021).

Although the spread of COVID-19 and subsequent public guidelines have affected all individuals, certain vulnerable populations have been disproportionately affected by the psychosocial consequences of the pandemic (Goodyear et al., 2021). For example, immigrants may face additional stress compared to non-immigrants due to language barriers, family dynamics, discrimination, employment problems, and other general stressors that are associated with assimilating into a new culture (Ru & Li, 2021). These stressors, alongside other socio-economic stressors due to COVID-19, may contribute to disproportionate health outcomes for these individuals. Despite the rapid emergence of research on the relationship between the COVID-19 pandemic, mental health, and substance use, significant knowledge gaps in the literature remain. Many previous studies have examined substance use in association with individuals' overall mental health which may include mood, personality, eating, anxiety disorders, and other changes to mental wellbeing. Thus, we set out to address the experiences of immigrant versus non-immigrant Canadians concerning alcohol and cannabis consumption, specifically associated with feelings of stress during the pandemic using a national Canadian perspective survey on substance use and stigma during the COVID-19 pandemic from January 25th, 2021 to January 31st, 2021.

The relationship between stress, alcohol, and cannabis use among Canadian immigrants, specifically in the context of the COVID-19 pandemic remains underexplored. Investigating the association of stress and substance use within this population context is necessary to assist public health guidance to develop an informed recovery plan from the long-term effects of the pandemic. Therefore, our proposed research question is as follows: Is there a change in alcohol and cannabis consumption related to changes in stress levels caused by the COVID-19 pandemic in immigrant Canadians aged 15-75 years old compared to non-immigrant Canadians aged 15-75 years old?

Methods

Study Design and Database

Our study draws on data collected from the 2021 Canadian Perspectives Survey Series 6 (CPSS-6): Substance Use and Stigma During the Pandemic, a cross-sectional survey conducted by Statistics Canada. The purpose of CPSS-6 was to collect information directly from Canadians regarding health behaviour changes during the COVID-19 pandemic to advise policymakers and enable them to respond to emerging needs. CPSS-6 data was gathered using an online survey throughout the collection period between January 25th and January 31st, 2021. Specifically, the survey frame was drawn by selecting a sample of participants from the Labour Force Survey (LFS) at random. The LFS uses a rotating sample design. Dwellings are selected at random and remain in the sample for six consecutive months. Each month, one-sixth of this sample is chosen to complete the survey. These six sub-samples comprise what are called rotation groups. Ultimately, four rotation groups who answered the LFS were chosen to be used in the CPSS survey panel (LFS rotation groups from April, May, June, and July of 2019). From the dwellings within these rotation groups, one person from each household (aged 15 years or older) was

randomly selected and invited to participate in the CPSS. Of the participants who agreed to complete the CPSS, only those who provided a valid email address formed the survey panel.

Study Participants

The CPSS-6 target population was Canadians aged 15 years and older among the ten provinces. The survey exclusion criteria consisted of institutionalized individuals, along with individuals who reside in the Canadian territories, on Indigenous reserves, or in extremely remote areas. In addition, any study participants with missing data for our variable of interest were also manually ruled out of this study. The final sample size for our study consisted of 696 participants for alcohol use (604 immigrants and 92 non-immigrants) and 251 participants for cannabis use (228 immigrants and 23 non-immigrants).

Study Outcomes

We have two primary outcomes being investigated in this study. The first is the change in cannabis consumption related to changes in stress levels since the start of the pandemic for immigrant and non-immigrant Canadians. Our second primary outcome is the change in alcohol consumption related to changes in stress levels since the start of the pandemic for immigrant and non-immigrant Canadians.

Additional Data Collection

In addition to the data collected concerning the variables of interest, supplementary demographic information was obtained to provide insight into the characteristics of the study population. Additional variables include sex (male or female), age of respondents (15-24; 25-34; 35-44; 45-54; 55-64; 65+), employment status (Employed and at work at least part of the reference week, Employed but absent work for reasons not related to COVID-19, Employed but

absent from work due to COVID-19, Not Employed), place of residence (rural or urban), and respondents' mental health now compared to before the pandemic (5-point Likert scale).

Statistical Analysis

First, using Statistical Packages for the Social Sciences (SPSS) version 28, a Chi-square test was conducted to identify the proportion of participants with an increased amount of stress or no change in the amount of stress in their life and their change in cannabis consumption since the start of the pandemic for non-immigrant and immigrant Canadian participants. The ME_15 variable was transformed to create a cut-off point to organize people into two categories: Not at all stressful and Stressful (which includes people who felt a little stressful, stressful, very stressful, and extremely stressful) and the new nominal variable was named 'Categorical stress level'. Next, using SPSS, a second Chi-square test was conducted again to identify the proportion of participants with an increased amount of stress or no change in the amount of stress in their life and their change in alcohol consumption since the start of the pandemic for non-immigrant and immigrant Canadian participants. The new transformed nominal variable 'Categorical stress level' was used. These results were dichotomized to reflect an increase in stress levels versus no change in stress levels since the start of the pandemic. Figures 1 and 2 were created using Microsoft Excel. Two figures were generated to represent the results of individuals who responded to the question "Increased use of cannabis, reasons: Stress." The results were broken down into two figures: Figure 1A: participants that felt more stressed since the start of the pandemic, and Figure 1B: participants that did not have a change in stress level. Another two figures were generated to represent the results of individuals who responded to the question "Increased use of alcohol, reasons: Stress." The results were broken down into two figures: Figure 2A: participants that felt more stressed since the start of the pandemic, and Figure

2B: participants that did not have a change in stress levels. Each figure contained participants that answered “Yes” or “No” to the question. Following this, using SPSS, a binary logistic regression was conducted to analyze if a change in participants' cannabis consumption was related to their change or no change in stress levels since the start of the pandemic and their immigration status. The predictor variables used were categorical stress level and immigration status. A second binary logistic regression, using SPSS, was conducted to analyze if a change in participants’ alcohol consumption was related to their change or no change in stress levels since the start of the pandemic and their immigration status. The predictor variables used were categorical stress levels and immigration status.

Results

In total, there were 252 participants included in our analysis of cannabis consumption and 696 participants in our analysis of alcohol consumption in relation to stress levels, immigration status, and the COVID-19 pandemic. Descriptive characteristics for the participants can be found in Table 1 and Table 2. The majority of participants were employed, lived in urban areas, felt more stressed, and had worse mental health conditions since the start of the pandemic. There were more non-immigrant Canadian participants than immigrant Canadian participants.

Table 1: Characteristics of immigrant and nonimmigrant respondents (N=3941) on alcohol use in a national Canadian perspective survey on substance use and stigma during the COVID-19 pandemic, collected from January 25th, 2021 to January 31st, 2021.

		Immigration Status		
		Born in Canada (n=604)	Landed Immigrant (n=92)	**P-Value**
Age of respondent	15 to 24 years old	135 (4.1)	23 (3.4)	0.682
	25 to 34 years old	408 (12.5)	72 (10.6)	
	35 to 44 years old	488 (15.0)	141 (20.7)	

	45 to 54 years old	520 (16.0)	134 (19.7)	
	55 to 64 years old	805 (24.7)	112 (16.4)	
	65 to 74 years old	688 (21.1)	131 (19.2)	
	75 years and older	216 (6.6)	68 (10)	
Sex of respondent	Male	281 (46.3)	45 (48.9)	0.550
	Female	323 (53.5)	47 (51.1)	
Employment Status	Employed and at work at least part of the reference week	400 (67.6)	55 (61.1)	0.478
	Employed but absent work for reasons not related to COVID-19	13 (2.2)	2 (2.2)	
	Employed but absent from work due to COVID-19	9 (1.5)	7 (7.8)	
	Not Employed	170 (28.7)	26 (28.9)	
Rural/Urban Indicator	Rural	127 (21.0)	9 (9.8)	<0.001
	Urban	477 (79.0)	83 (90.2)	
Mental health now compared to before pandemic	Much better now	8 (1.3)	2 (2.2)	0.259
	Somewhat better now	37 (6.1)	3 (3.3)	
	About the same	163 (27.0)	20 (21.7)	
	Somewhat worse now	303 (50.2)	50 (54.3)	
	Much worse now	93 (15.4)	17 (18.5)	
Amount of stress in your life, since the start of the pandemic	Not at all stressful	11(1.8)	2 (2.2)	0.755
	A little stressful	233 (38.6)	31 (33.7)	
	Stressful	195 (32.3)	32 (34.8)	
	Very stressful	110 (18.2)	18 (19.6)	
	Extremely stressful	55 (9.1)	9 (9.8)	
Average alcohol consumption change comparing to before the pandemic	Increased	604 (100.0)	92 (100.0)	N/A
	Decreased	0 (0.0)	0 (0.0)	
	Not Applicable	0 (0.0)	0 (0.0)	
	Stayed about the same	0 (0.0)	0 (0.0)	
Increased use of alcohol, reasons: Stress	Yes	350 (57.9)	52 (56.5)	0.632
	Not	254 (42.1)	40 (43.5)	

Data are presented as number (%)

Data Source: Canadian Perspectives Survey Series 6, collected from January 25th, 2021 to January 31st, 2021: Substance Use and Stigma During the Pandemic

Table 2: Characteristics of immigrant and nonimmigrant respondents (N=3941) on cannabis use in a national Canadian perspective survey on substance use and stigma during the COVID-19 pandemic, collected from January 25th, 2021 to January 31st, 2021.

		Immigration Status		
		Born in Canada (n=228)	Landed immigrant (n=23)	**P-Value**
Age of respondent	15 to 24 years old	21 (9.2)	5 (21.7)	0.895
	25 to 34 years old	60 (26.3)	6 (26.1)	
	35 to 44 years old	60 (26.3)	6 (26.1)	
	45 to 54 years old	27 (11.8)	1 (4.3)	
	55 to 64 years old	36 (15.8)	3 (13.0)	
	65 to 74 years old	20 (8.8)	2 (8.7)	
	75 years and older	4 (1.8)	0 (0.0)	
Sex of respondent	Male	108 (47.4)	17 (73.9)	<0.001
	Female	120 (52.6)	6 (26.1)	
Employment Status	Employed and at work at least part of the reference week	150 (68.2)	12 (57.1)	0.079
	Employed but absent work for reasons not related to COVID-19	6 (2.7)	0 (0.0)	
	Employed but absent from work due to COVID-19	6 (2.7)	1 (4.8)	
	Not Employed	58 (26.4)	8 (38.1)	
Rural/Urban Indicator	Rural	29 (12.7)	1 (4.3)	0.010
	Urban	199 (87.3)	22 (95.7)	
Mental health now compared to before pandemic	Much better now	3 (1.3)	1 (4.3)	0.071
	Somewhat better now	18 (7.9)	0 (0.0)	
	About the same	56 (24.7)	3 (13.0)	
	Somewhat worse now	109 (48.0)	15 (65.2)	
	Much worse now	41 (18.1)	4 (17.4)	

Amount of stress in your life, since the start of the pandemic	Not at all stressful	9 (3.9)	0 (0.0)	0.706
	A little stressful	66 (28.9)	7 (30.4)	
	Stressful	75 (32.9)	8 (34.8)	
	Very stressful	54 (23.7)	4 (17.4)	
	Extremely stressful	24 (10.5)	4 (17.4)	
On average, cannabis use change when comparing to before the pandemic	Increased	228 (100.0)	23 (100.0)	N/A
	Decreased	0 (0.00)	0 (0.00)	
	Not applicable	0 (0.00)	0 (0.00)	
	Stayed about the same	0 (0.00)	0 (0.00)	
Increased use of cannabis, reasons: Stress	Yes	148 (64.9)	16 (69.6)	0.319
	No	80 (35.1)	7 (30.4)	

Data are presented as number (%)

Data Source: Canadian Perspectives Survey Series 6, collected from January 25th, 2021 to January 31st, 2021: Substance Use and Stigma During the Pandemic

First, a Chi-squared test was conducted to determine the proportion of non-immigrant and immigrant Canadians who had an increased or unchanged amount of stress in their life and their change in cannabis consumption since the start of the pandemic. Figure 1 represents the participant's answers to the question ‘Increased use of cannabis, reasons: Stress’ for participants who had increased stress levels (Figure 1A) and participants who had no change in stress levels (Figure 1B) with different immigrant statuses from a Chi-squared test. The analysis found that 117 out of 162 (72.7%) non-immigrant Canadians and 13 out of 16 (81.3%) immigrant Canadians who felt more stressed since the start of the pandemic answered ‘Yes’ to the question. 45 out of 162 (27.8%) non-immigrant Canadians and 3 out of 16 (18.7%) immigrant Canadians who felt more stress since the pandemic answered ‘No’ to the question. 31 out of 66 (47.0%) non-immigrant Canadians, and 3 out of 7 (42.9%) immigrant Canadians who had no change in their stress levels since the start of the pandemic answered ‘Yes’ to the question. 35 out of 66

(53.0%) non-immigrant Canadians and 4 out of 7 (57.1%) immigrant Canadians who had no change in their stress levels since the start of the pandemic answered 'No' to the question. There was no significant difference in the proportion of individuals who had increased stress since the start of the pandemic between different immigrant groups as P>0.05. Also, there was no significant difference in the proportion of individuals who had increased cannabis consumption since the start of the pandemic between different immigrant groups as the continuity correlation was 0.828.

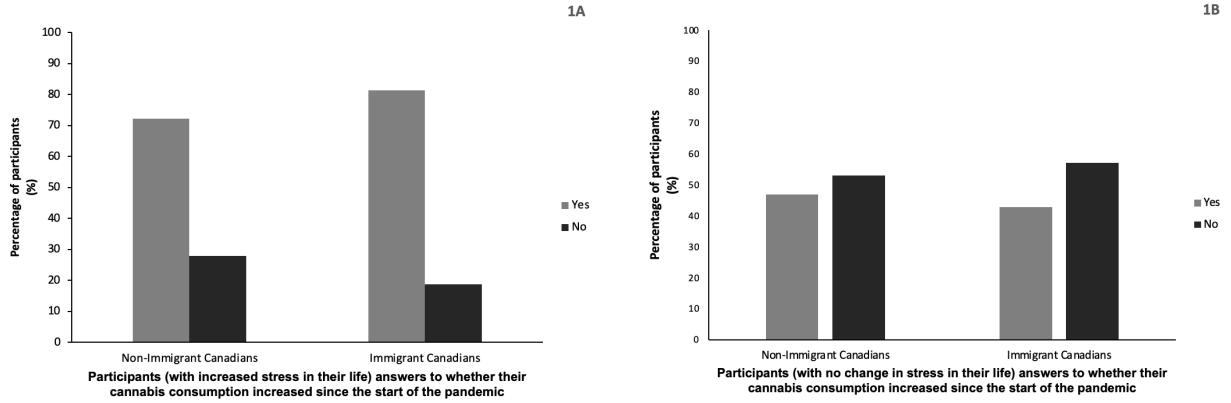

Figure 1: (A) Percentage of participants who had increased or no change in cannabis use with increased stress levels since the pandemic among non-immigrant and immigrant Canadians (n=251); (B) The percentage of participants who increased or no change in cannabis use with no change in stress levels since the pandemic among non-immigrant and immigrant Canadians (n=251).

A second Chi-square test was conducted to determine the proportion of non-immigrant and immigrant Canadians who had an increased or unchanged amount of stress in their life and their change in alcohol consumption since the start of the pandemic. Figure 2 represents the result of participants' answers to the question 'Increased use of alcohol, reasons: Stress' for participants who had increased stress levels (Figure 2A) and participants who had no change in

stress levels (Figure 2B) with different immigrant status from a Chi-squared test. The analysis found that 349 out of 593 (58.9%) non-immigrant Canadians and 52 out of 90 (57.8%) immigrant Canadians who felt more stressed since the start of the pandemic answered 'Yes' to the question. 244 out of 593 (41.1%) non-immigrant Canadians and 38 out of 90 (42.2%) immigrant Canadians who felt more stressed since the start of the pandemic answered 'No' to the question. 1 out of 11 (9.0%) non-immigrant Canadians and 0 out of 2 (0.0%) immigrant Canadians who felt no change in stress level since the start of the pandemic answered 'Yes' to the question. 10 out of 11 (91.0%) non-immigrant Canadians and 2 out of 2 (100%) immigrant Canadians who felt no change in stress level since the start of the pandemic answered 'No' to the question. There was no significant difference in the proportion of individuals who had increased stress levels since the start of the pandemic between different immigrant groups as $P>0.05$. Also, there was no significant difference in the proportion of individuals who had increased alcohol consumption since the start of the pandemic between different immigrant groups as the continuity correlation was 0.885.

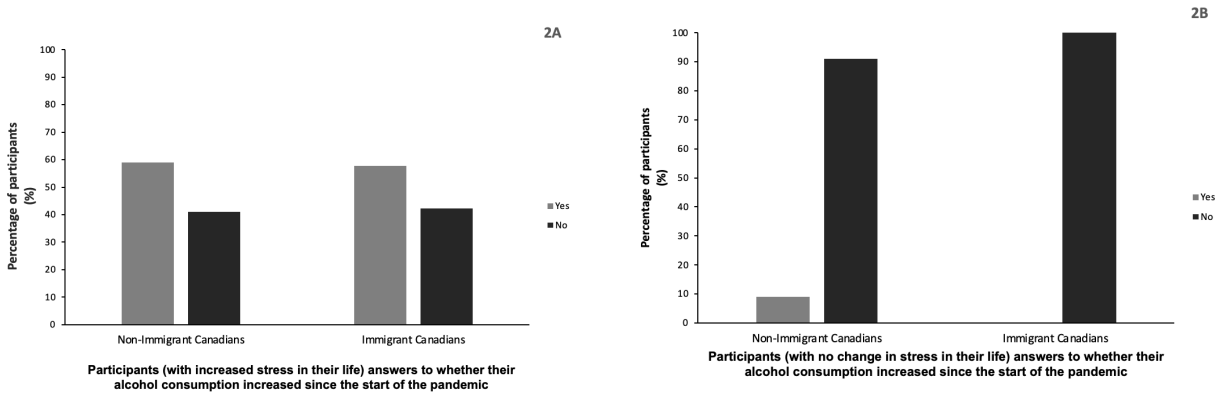

Figure 2: (A) Percentage of participants who had increased or no change in alcohol use with increased stress levels since the start of the pandemic among non-immigrant and immigrant Canadians (n=696); (B) Percentage of participants who increased or no change in alcohol use

with no change in stress levels since the start of the pandemic among non-immigrant and immigrant Canadians (n=696).

In table 3, a logistic regression analysis was conducted to determine if individuals whose cannabis consumption changed was related to their change in stress levels and immigrant status. According to the Omnibus Tests of Model Coefficients, the model containing all 2 predictors was statistically significant (Chi-squared=15.831, p<0.001), suggesting that the model was able to predict cases who increased versus did not increase cannabis consumption since the start of the pandemic. Only one predictor variable 'Categorical stress level' showed a significant contribution to the analysis model (sig <0.001) and was the variable that contributed to the model most (Wald test value = 15.418). The odds of increased use of cannabis related to stress are 3.115 times (95% C.I. 1.767-5.493) greater if individuals reported increased stress levels since the start of the pandemic. The other variable 'Immigrant status' presented no statistical significance, which indicated that there is no relationship between immigrant status and change in cannabis consumption.

Table 3: Logistic regression results examining the association between the change in cannabis consumption with participants' immigrant status and their change in stress level (n= 251).

Predictor variable	β	S.E	Wald	Exp(β)	P-value	95% CI for Exp(β)
Categorical stress level	1.136	0.289	15.418	3.115	***<0.001	1.767-5.493
Immigration status	-0.245	0.490	0.249	0.783	0.618	0.300-2.045

In table 4, a logistic regression analysis was conducted to determine if individuals whose alcohol consumption changed was related to their change in stress level and immigrant status. According to the Omnibus Tests of Model Coefficients, the model containing all two predictors was statistically significant (Chi-squared=15.036, p<0.001), suggesting that the model was able to predict cases who increased versus did not increase alcohol consumption since the start of the

pandemic. Only one predictor variable 'Categorical stress level' showed a significant contribution to the analysis model (sig = 0.007) and was the one that contributed to the model most (Wald test value = 7.383). The odds of increased use of alcohol due to stress would be 17.047 times (95% C.I. 2.204 - 131.854) greater if people had increased stress levels since the pandemic. 'Immigration status' presented no statistical significance, which showed that there would be no relationship between immigrant status and change in alcohol consumption.

Table 4: Logistic regression results examining the association between change in alcohol consumption with participants' immigrant status and their change in stress level (n=696).

Predictor variable	β	S.E	Wald	Exp(β)	P-value	95% CI for Exp(β)
Categorical stress level	2.836	1.044	7.383	17.047	**0.007	2.204-131.854
Immigration status	0.052	0.228	0.052	1.053	0.820	0.673-1.648

Discussion

Our study aimed to investigate the changes in alcohol and cannabis consumption, attributed to stress, in association with changes in stress levels in the context of the COVID-19 pandemic, in immigrant versus non-immigrant Canadians aged 15-75 years old. Findings from the first Chi-squared test revealed that immigrant Canadians had higher levels of stress-induced increased cannabis use compared to non-immigrants, but the difference was not statistically significant. Similarly, the second Chi-squared analysis also found no significant difference between the proportion of non-immigrant and immigrant Canadians who reported stress-induced increased alcohol consumption. Through logistic regression analysis of individuals' stress levels as a function of cannabis and alcohol consumption, it was found that 'categorical stress level', but not immigrant status, was a predictor of cannabis and alcohol use attributed to stress. Taken together, these results suggest that there is no significant difference between immigrant versus non-immigrant Canadians' increased alcohol and cannabis consumption attributed to stress. In

addition, there was an association between increased levels of stress during the pandemic and increased cannabis and alcohol consumption attributed to stress.

Looking at a study by Varin et al., (2021), results concluded that non-immigrant Canadians had a higher increase in cannabis use compared to pre-pandemic than immigrant Canadians. Results also showed that these individuals reported a worsening in their mental health since the start of the pandemic (Varin et al., 2021). These results contradict our findings as we found immigrant Canadians had higher cannabis use than non-immigrant Canadians suggesting a disparity with our results.

Furthermore, no significant difference between the number of non-immigrant and immigrant Canadians who reported stress-induced increased alcohol consumption was found. These findings are comparable to the literature, as a 2021 study found that immigrants, independent of their mental health status, drank less alcohol compared with non-immigrants (Ru & Li, 2021). However, similar to our study, these results were also not statistically significant (Ru & Li, 2021). The lack of significance both in the present data and the literature suggests that there is no distinguishable difference in stress-induced alcohol consumption patterns between immigrant statuses.

A relationship between individuals' stress levels and increased cannabis and alcohol use attributed to stress was also evident in the present study. Specifically, increased cannabis use was approximately three times greater for those who reported increased levels of stress, respectively. This finding aligns with previous research as a three-year prospective study sought to identify several predictors of the incidence of cannabis dependence (van der Pol et al., 2013). Researchers found that as negative life events increase, it puts cannabis users at an increased 43% risk to develop cannabis dependence (van der Pol et al., 2013). This, along with our results,

supports the notion that stressful events can be predictors of cannabis use. Implications of this finding concern public health officials as evidence shows that cannabis as a coping strategy for stress only provides temporary relief and may ultimately exacerbate the negative emotions that users are trying to manage, in addition to it predicting higher levels of depression (Glodosky & Cuttler, 2020).

In addition, the odds of increased alcohol consumption were found to be approximately 17 times greater for those who reported increased levels of stress since the start of the pandemic. Looking at a 2020 cross-sectional study, researchers reported that 60% of participants consumed more alcohol during the pandemic primarily due to increased stress, but also due to increased boredom, and alcohol availability (Grossman et al., 2020). This study also found that participants with COVID-19-related stress were more likely to consume more alcohol over the study duration than participants without COVID-19-related stress (Grossman et al., 2020). A previous study has linked alcohol intake to the modulation of stress pathways in the brain, such as the hypothalamic-pituitary-adrenal axis (Herman, 2012).

Importantly, a strength of our study is that it contains data from all ten provinces, where the majority of Canada's population resides, making it a nationally representative study. It is important to note that the lack of statistical significance in the results may be attributed to the various limitations of the study. Limitations of this study include shortcomings of the original data obtained from the CPSS-6 database. For example, the CPSS-6 did not survey institutionalized individuals, Indigenous reserve populations, and those residing in remote areas, all of which may include a portion of the population who use substances. In addition, because the CPSS-6 only surveyed Canadian populations online, potential sampling bias may have occurred due to the exclusion of offline residents. Notably, there is likely a complex relationship between

stress, and existing mental health conditions, along with other factors in accordance with increased alcohol and cannabis use during the pandemic (Varin et al., 2021). However, due to the nature of the categorical variables used in this study, analysis of covariance (ANCOVA) could not be performed. Thus, another limitation of this study was that it was uncontrolled for the possible effects of potential covariates, such as mental health or employment status, that may have had an impact on the dependent variables (alcohol and cannabis use). Additionally, the exclusion of all participants with missing data resulted in a relatively small sample size (N=696 and N=292), limiting the generalizability of our results. Lastly, self-reporting of survey answers may have led to bias in results due to the incidence of social desirability bias, an individual's lack of insight into their own situation, or loss of interest in the survey (Fadnes et al., 2009).

Our findings agree with existing theories and previous research on the relationship between substance use and stress. It appears that there is an increased alcohol and cannabis use during COVID-19. This is concerning because increased drug usage is related to short-term and long-term negative impacts on health, such as injuries from falls, liver diseases from alcohol usage, and cancer (Aday et al., 2020). Without proper intervention, the results of our data could suggest an increased substance misuse in the future. Our data could also be used as an anchor to explore new drug regulations and mental wellness strategies in the context of COVID-19 and what variables may influence drug use within cultural contexts. However, as immigration status was not predictive of a change in cannabis and alcohol use during the COVID-19 period, more research may be needed to reconcile the differences between our hypothesis and data. Future research should preferably use a larger number of participants in Canada as it is needed for a better understanding of the mechanisms behind the relationship between immigration status, stress, and substance use. Future research could investigate how recreational drug regulation or

mental wellness supports could change during stressful global periods to allow adequate resources to support healthcare and population health.

Overall, by the lack of significant between-group-differences among immigrants versus non-immigrants, these results suggest that the odds of stress-induced cannabis and alcohol consumption are not simply a matter of Canadian immigration status. Rather, complex factors related to stress, possibly mental health, and other covariates, likely also play a role in the outcome of cannabis and alcohol consumption attributed to stress.

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The Difference in Mental Health of Female Nurses Under 35 Years of Age as Compared to Female Nurses 55 Years and Older in Ontario During the COVID-19 Pandemic: An Observational Study

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Introduction

The world faced a new health crisis in December 2019 with an outbreak of SARS‑CoV‑2 (Covid-19) which causes acute respiratory syndrome (Singhal et al., 2020). After originating in Wuhan, China at first, the disease spread across the world quickly causing the World Health Organization to declare a pandemic in March 2020. Governments soon started to take precautions such as lockdowns, use of masks, isolation, and limiting indoor capacities. The transmission of the virus is through inhalation of the particles that spread from the infected person's mouth/nose with the basic reproduction number of 2.2 (on average, an infected individual causes 2 other individuals to get the virus) (WHO, 2022 & Fauci et al., 2020).

Individuals' previous health condition becomes an important factor when they combat the virus. In most cases, the virus has mild to moderate symptoms such as cough, fever, loss of smell, and/or taste which does not require hospitalization for recovery (WHO, 2021). However, the virus can cause life-threatening symptoms in individuals that were previously diagnosed with diabetes, respiratory, and autoimmune diseases such as difficulty breathing and chest pain while having an increased risk of being hospitalized for recovery (ibid). As of March 2022, there are 1.6 million total cases and 12,751 deaths in Ontario (Public Health Ontario, 2022).

The COVID-19 vaccine was authorized in many countries including Canada by December, 2020. Immunization soon started across the provinces and by March 2022, 81.7% of Ontario's population received 2 doses of the vaccine (primary series) (Public Health Ontario, 2022). However, even though the vaccine efficacy decreases the mortality rates by 72%, statistics show that the cases and hospitalization rates in Ontario still remain relatively high due to different variants of the virus (Jablonska et al., 2021 & Statistics Canada, 2021).

During the pandemic, Ontario has taken measures such as work from home policies and online education system for schools and colleges to minimize the risk of spread. Approximately seven out of ten people worked from home in Ontario which altered routines and brought changes to individuals' lives (Statistics Canada, 2021). These disruptions affected individuals from economic, social, and psychological perspectives. Job loss (15%) and reduced work hours (32%) were identified as a cause of anxiety and stress levels (Lemiux et al., 2020 & Cullen et al., 2020). According to a survey, 41% of the population had increased anxiety and stress levels due to the pandemic while another study analyzed the main reasons of these increased stress levels and emotional distress during the pandemic as restrictions in individuals' freedom (lockdowns) and decreased human interaction (Cullen et al., 2020 & Health Essentials, 2020).

One of the most vulnerable groups to emotional distress and mental health decline was health care workers (HWCs) (Pfefferbaum et al., 2020). Issues such as high risk of exposure to the virus, infecting loved ones, longer work hours, and shortages of personal protective equipment put health care providers under mental pressure (ibid). Vizheh et al. (2020) assessed the psychological state of male and female HCWs by running a systematic review of 11 studies. The most explored conditions through self-reporting were anxiety, depression, and stress from disease risk. Overall, negative mental effects in HCWs were high along with sleep interruption and poor sleep quality. These were more common in nurses due to prolonged direct contact with patients as well as situations where hospitalizations increased. Social support had an opposite effect on factors, producing better sleep quality, reduced anxiety, and stress, therefore, these factors were associated with psychological pressures on HCWs, leading to resignation (ibid).

A prominent issue is the lack of research and evidence surrounding the impact of COVID-19 on the mental health of young female front-line nurses. Although nurses experience

mental distress more commonly than other HCWs, individual studies which distinguish this investigate nurses as a homogenous group. In a meta-analysis by Varghese and colleagues (2021), mental impacts of COVID-19 in a population of female nurses around the world 21-45 years of age was explored, however the focus of outcomes was over a large age range.

Over the last decade, the amount of employed nurses under 35 classified as being early in their career has increased by 7.5%, while a 3.2% decrease has been seen in nurses older than 55 (Canadian Nurses Association). The transition from a student or another career to a registered nurse presents issues including skill gaps, team collaboration, application of theory, and tending to patients with complex medical histories/comorbidities, etc (ALobaid et al., 2020). Despite current studies on the mental health of nurses during the pandemic, there is a largely unexplored age group in the context of the Canadian Health Care System when it pertains to mental and physical after effects, important factors in assessing the severity of and contributors to distress.

Given these gaps in literature, including early-career influencing factors in the context of the pandemic, young female nurses who make up a large and growing percentage of the workforce should be monitored to gauge preservation of mental health, regulation of stress, and quality of patient care (Vizheh et al., 2020).. Additionally, this may provide insight into existing and future interventions and support. The research question to address this gap is, 'Is there a difference in self-reported mental health levels during the COVID-19 pandemic in female nurses <35 years of age in Ontario compared to female nurses 55 years and older in Ontario?'. The secondary question pertaining to this is "what association is there between mental health levels and perceived life stress levels in female nurses <35 years of age in Ontario compared to female nurses 55 years and older in Ontario?"

Methods

Study Design and Database

The data used in this study was chosen from the Odesi database, under the Covid-19 section with a title of Impacts of COVID-19 on Health Care Workers: Infection Prevention and Control, 2020 [Canada]. The database was created by Statistics Canada with the initial purpose to gain an understanding of how COVID-19 impacts on the Canadian health care workers, focusing on specific measures in the workplace such as personal protective equipment (PPE) and infection prevention and control (IPC) (Statistics Canada, 2021). The participants were obtained through a non-probabilistic approach where a random selection of the population was not involved. Due to this, there was no calculation of a sample size or design and no adaptations occurred in relation to nonresponse bias from missing responses since this is deemed to be an inapplicable factor in a crowdsourced survey. Data from participants was collected using an online survey, which was directly advertised to the population of focus, healthcare workers such as nurses, doctors, dentists, dietitians, etc. The online survey was accessible in Statistics Canada's webpage and a link was sent to the emails of the stakeholders where participants completed the survey without the surveillance by the interviewers.

This study is an observational study, specifically a descriptive cross-sectional study as it investigates the prevalence (the rates of presence or absence) of one or many outcomes in the population of interest at one point of time (Wang et al., 2020). Including this, cross-sectional studies have various strengths including inexpensiveness, fast data collection, applicability, and the ability to be a baseline study for prospective studies. One weakness of this study design is the inability to make causal inferences/relationships or measure the incidence/development of new manifestations or responses due to questions being asked at a set point in time (Thelle et al.,

2015). Recall and reporting bias may potentially exist as without a biomarker, information is prone to being forgotten and correctly recalled, and over reported or under-reported by participants. Self-reporting can also result in reluctance to answer questions in light of preconceived notions and perceptions associated with cultural, lifestyle, socioeconomic, and demographic factors further exacerbated by stigma, for instance surrounding disclosure of mental health (Celentano et al., 2019).

Study Participants

Participants in the database were HCWs from different provinces across Canada. There are four components to the inclusion criteria. To reach the target population, only female participants whose career is in nursing were included. Among these participants, only respondents from Ontario were included. Lastly, female nurse participants in Ontario were divided into two categories according to their ages: <35 Yr group and ≥55 Yr group. In total, 705 and 276 participants were gathered in the <35 Yr group and ≥55 Yr group, respectively. Nurses will benefit from study findings as an opportunity to inform governing bodies and, as mentioned, it is a largely overlooked age group within the healthcare system.

Study Outcomes

The primary outcome of the study is if there is a significant difference between the perceived mental health of female nurses <35 and ≥55 years of age who are working in Ontario. To assess the perceived mental health, participants rated their perceived mental health on a scale of “Excellent, Very good, Good, Fair, and Poor”. The participants that were investigated had to fulfill all of the following categories: female, nurse, working in Ontario, and either aged below 35, or 55 years old and above. A cross sectional observational approach was used to compare the variables, as it is the best way to compare them at the same time with quicker results and higher

validity (Carlson and Morrison, 2009). The secondary outcome of the study is if there is an association between mental health levels and perceived life stress levels in female nurses <35 years of age in Ontario compared to female nurses ≥55 years in Ontario.

Additional Data Collection

In addition to the data collection, there are characteristics that are observed in the database. These include perceived immigration status, population group flag, and number of years worked in the current occupation. The additional characteristics are important factors for the understanding of any outside contributors of stress or negative mental health such as those relating to family traditions and ethnicity. This is important as race, ethnicity, and immigration status can have an effect on an individual's mental health (Satcher, 2001). This will aid in analyzing potential factors in the event of a relationship between age groups of Nurses and perceived mental health. The number of years worked in the occupation is also important additional information as an association can be determined if years worked would add to stress or change mental health levels.

Statistical Analysis

Tests of normality could not be performed as there were only categorical data and no continuous data. Using the categorical data (i.e. perceived mental health, perceived life stress, etc.), two statistical analyses were performed. A 2x2 Chi-squared test was conducted to look for significant differences in perceived mental health between the two age groups. A Spearman's rho test was also performed to measure the secondary outcome: the association between perceived mental health and perceived life stress. SPSS was used to perform all statistical tests. A p-value of <0.05 was used for statistical significance. The data in Table 1 summarizes the number of participants of both age groups for each category (perceived mental health, perceived life stress,

participant's immigration status, population group flag, number of years worked in current occupation) and their sub-categories. The percentage of participants were calculated and included. The p-values for each Chi-squared test were included as well.

Results

Table 1. Descriptive characteristics of study population [N = 981]. The study population consists of female nurses <35 years and ≥55 years of age working in Ontario. The values are presented as no. (%) of participants, unless otherwise stated. Chi-squared test was conducted to determine significance between the two groups of participants. Perceived mental health had significant Pearson Chi-Square values. *** represents statistical significance with a p-value of <0.001.

Variable	<35 Yr Group (N = 705)	≥55 Yr Group (N = 276)	p-value (Chi-square test)
Perceived mental health – no. (%)			
Excellent	25 (3.5)	28 (10.1)	
Very good	122 (17.3)	76 (27.5)	
Good	210 (29.8)	81 (29.3)	<0.001***
Fair	236 (33.5)	74 (26.8)	
Poor	112 (15.9)	17 (6.2)	
Perceived life stress – no. (%)			
Not at all stressful	1 (0.1)	0 (0.0)	
Not very stressful	22 (3.1)	14 (5.1)	
A bit stressful	220 (31.2)	85 (30.8)	0.250
Quite a bit stressful	349 (49.5)	122 (44.2)	
Extremely stressful	113 (16.0)	55 (19.9)	
Participant's immigration status – no. (%)			

Non-immigrant	624 (88.5)	242 (87.7)	
Immigrant or non-permanent resident	81 (11.5)	32 (11.6)	1.000
Not stated	0 (0.0)	2 (0.7)	
Population group flag – no. (%)			
Visible minority	121 (17.2)	8 (2.9)	
Not a visible minority	580 (82.3)	264 (95.7)	<0.001***
Not stated	4 (0.6)	4 (1.4)	
Number of years worked in current occupation – no. (%)			
Less than 10 years	497 (70.5)	21 (7.6)	
10 to 19 years	69 (9.8)	27 (9.8)	<0.001***
20 or more years	N/A	210 (76.1)	
Not stated	139 (19.7)	18 (6.5)	

Table 2. Spearman's *rho* test values. This table illustrates data regarding the significant difference between perceived mental health and perceived life stress and the significant difference between perceived mental health and number of years worked in current occupation. *** represents statistical significance with a p-value of <0.001.

Variable			Perceived life stress	Number of years worked in current occupation
Spearman's *rho*	Perceived mental health	Correlation coefficient	0.337	-0.184
		Sig. (2-tailed)	<0.001***	<0.001***

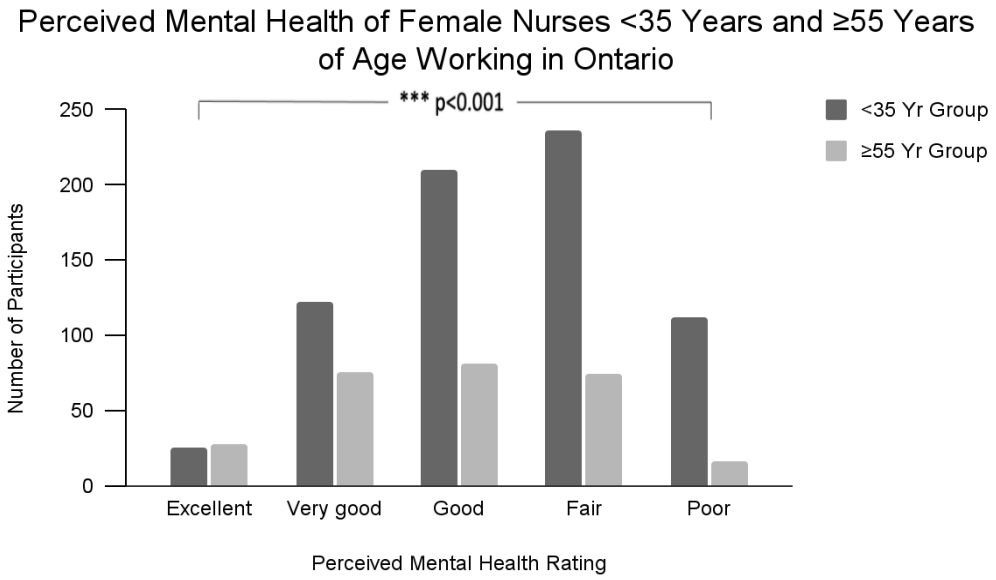

Figure 1. Perceived mental health of female nurses <35 years and ≥ 55 years of age working in Ontario. The figure displays the participants who rated their perceived mental health on a scale of Excellent, Very good, Good, Fair, and Poor. A p-value of <0.001 is shown to represent statistical significance between the two groups.

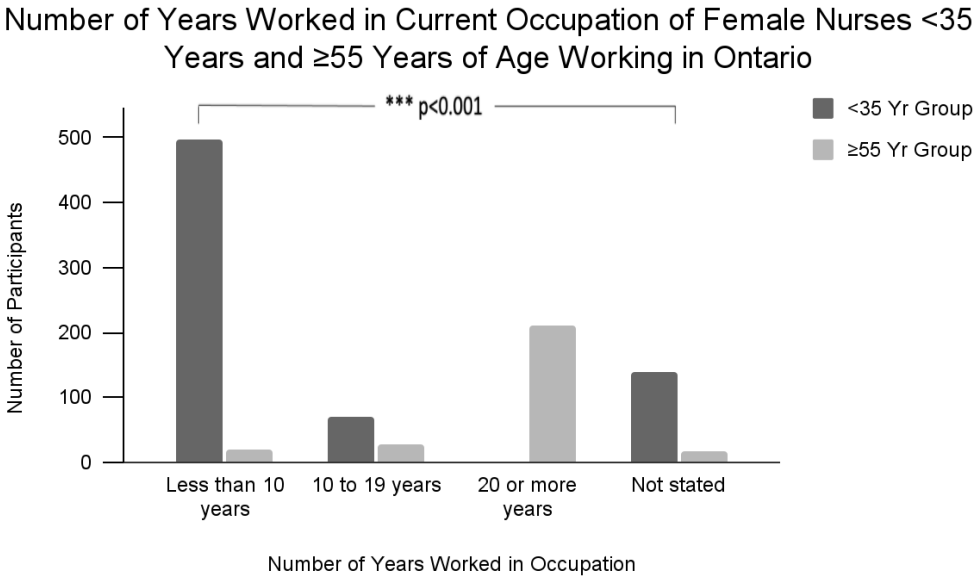

Figure 2. Number of years worked in current occupation of female nurses <35 years and ≥55 years of age working in Ontario. This graph illustrates the number of years worked as a female nurse in Ontario from the age group of <35 years and ≥55 years of age. A p-value of <0.001 is shown to represent statistical significance between the two groups.

Among the 18,139 individuals from the original ODESI database, 981 were extracted and included in Table 1. Table 1 shows the number of participants of each group for five categories which include perceived mental health, perceived life stress, participant's immigration status, their population group flag, and the number of years worked in current occupation. The table was split into two groups of female nurses <35 years and ≥55 years of age working in Ontario. The age groups of 35-44 years of age and 45-55 years of age, as well as the 'valid skip', 'don't know', and 'refusal' options were removed from the dataset.

Figure 1 specifically illustrates the perceived mental health of the female nurse participants from the age groups of <35 years and ≥55 years. It can be seen that there were almost the same number of participants from each age group who had rated their mental health as 'Excellent'. As the mental health rating went from 'Very good' to 'Fair', the number of participants from the age group of <35 years increased (17.3% to 29.8%). Lastly, there was a higher number of participants from the <35 years age group who rated their mental health as 'Poor' (15.9%) compared to the ≥55 years age group (6.2%). A Chi-squared test was conducted to measure the difference between two groups. The results showed a significance p-value of <0.001 with a Pearson Chi-square value of 43.345 and a degree of freedom of 4. Statistical analysis demonstrated a significance level of <0.001, proving that there is a significant difference in perceived mental health between the two groups. Female nurses <35 years were more likely to

have worse perceived mental health. The p-value of <0.001 is shown to represent statistical significance in perceived mental health between the two groups.

As seen in Figure 2, the age group of <35 years consisted of 497 (70.5%) participants who worked less than 10 years, 69 (9.8%) participants worked 10 to 19 years, and 0 participants had worked 20 or more years. 139 (9.7%) participants from the group did not state the number of years worked. The age group of <35 years of age had a significantly larger portion of participants who worked less than 10 years compared to the age group of ≥55 years. There were a higher number of participants in the age group of <35 years of age who had worked for 10 to 19 years. However, the age group of ≥55 years had a significantly larger number of participants who had worked for 20 or more years. From the age group of ≥55 years, 21 (7.6%) participants worked less than 10 years, 27 (9.8%) participants worked 10 to 19 years, and 210 (76.1%) participants worked 20 or more years. 18 (6.5%) participants from the group did not state the number of years worked.

A higher percentage of participants were observed who were not a visible minority in both age groups (Table 1). A Chi-squared analysis displayed a significance p-value of <0.001 with a Pearson Chi-square value of 34.942 and a degree of freedom of 1. This demonstrated that there is a significant difference in population group flag status between the two groups. A Chi-squared analysis resulted in a significance p-value of <0.001 with a Pearson Chi-square value of 640.084 and a degree of freedom of 2, indicating that there is a difference in number of years worked between the groups.

To find a correlation between perceived mental health and perceived life stress, a Spearman Rho's test was performed. The result shows a value of 0.337 with a p<0.001 (Table 2),

indicating a moderate positive correlation between the two variables. Perceived mental health and number of years worked in current occupation showed a Spearman's rho value of -0.184 with a $p<0.001$ (Table 2), indicating a weak negative correlation between the two variables.

Discussion

This study aimed to explore the differences in mental health levels of female nurses <35 years and ≥55 years of age in Ontario during the COVID-19 pandemic. Our findings show that female nurses in Ontario who were <35 experienced poor perceived mental health compared to those who were ≥55 years of age. The secondary outcome of the research investigated the association between mental health levels and perceived life stress of 2 target groups. Results show that there is moderate correlation between mental health and stress levels of the target groups.

The results from this study showed no statistically significant difference in perceived life stress and immigration status between the participants who were <35 years of age and those that were ≥55 years of age. This could be due to the fact that both groups have been exposed to the COVID-19 pandemic and working many stressful hours to provide care for patients while watching families grieve for their loved ones in the hospitals. Therefore, both participant groups would have experienced high stress levels during the pandemic. Immigration status may not have contributed to significant differences in mental health between the two groups due to the fact that it is a minor factor as compared to life stress of participants during COVID-19. Most of the participants were non-immigrants while a minority were immigrants or non-permanent residents.

Similar to this study, research conducted by Perry and colleagues (2015) found that 14% of nurse participants in Sydney, Australia disclosed they had a history of mental health issues with 13% reporting anxiety and/or depression diagnoses. Throughout the study, 65.1% of those

participants stated that they experienced at least one mental health symptom sometimes or often in the last 12 months. This study also used specifics in the research question (narrowing down the region and occupation) in order to allow the study to be generalized reasonably and add to the quality of the study.

In contrast to this study, there is a published finding called "Personal Age and Assessment of Work Stress in Polish Nurses" which focuses on a similar study design and participants, just in the different regions of Poland (Iskra-Golec, 2002). However, the results that are found are different to the current study in this paper. The difference is that this study included male participants and focused on the level of stressors in Polish nurses' lives, categorized in groups of age. This includes a table with numbers of hours worked in the profession, which is a variable included in their results. The results of this study indicates the importance of age as the younger nurses were being reported as less tired, stressed, and in a more positive mental health state than the nurses who were older (Iskra-Golec, 2002).

Other limitations with outside studies include being concentrated in one region of the world, as other cities and countries may have different stresses or results in general. As well, due to the information being collected from one region, the data would be based on voluntary participation, and therefore exposed to self-selection bias. Based on other studies, another limitation could be the fact that the study is self-reporting measures. As a whole, the study is limited in general as empirical studies can be used to investigate the complex relationships of stress levels in nurses over a period of time, or more specifically, comparing the stress levels before and during the pandemic.

Our study has some limitations that should be considered. Firstly, the research focused solely on female nurses working in Ontario. The inclusion of other groups of health care workers

including physicians, personal support workers, laboratory workers etc. would increase the sample size of the data, allowing for a more accurate depiction of how the COVID-19 pandemic has impacted the mental health of health care workers overall. The study also focused on the age groups of less than 35 years of age and 55 years of age or older, and excluded male participants, which may have led to biased results. The results can't be generalized to the overall population of health care workers. A separate limitation would be the statistical analysis methods used in this study. There were only categorical variables in our dataset, therefore only Chi-squared test and a Spearman's Rho test were performed. Normality test was not conducted as there were no continuous variables. Additionally, Pearson correlation analysis, biserial correlation analysis, or analysis of covariance (ANCOVA) were not performed, as all of these require continuous variables to be present.

Sample size was not established for this study as the study was crowdsourced and an estimate was not calculated against a benchmark. Being a cross-sectional study, incidence of the outcome of interest cannot be assessed as only responses in at one time were collected rather than at various points in time. The nature of the research question does not allow for outcomes associated with pre-pandemic variables, such as 'perceived' mental health before the pandemic. The types of data present for each variable are only categorical or ordinal data as participants were presented with various options for each question. The survey questions allowed only for self-reporting as a tool which introduces recall and reporting bias.

Our data adds to the field in that it provides insight as to which groups of health care workers and which age groups are more susceptible to worse mental health and higher stress levels. For example, this allows us to see that younger health care workers, specifically female nurses, who have worked for a fewer number of years find their mental health to be worse and

life stress to be greater. This knowledge can then be passed on to the public at large, to create an understanding of how much psychological distress and burnout health care workers have endured during the COVID-19 pandemic. It can be seen which groups of health care workers may need more support and thus provide those groups with the resources to seek help during the ongoing pandemic. As well, the study allows for those to see which health care worker occupation is in higher demand, in order to hire more people.

This study can further enlighten up the different mental health challenges faced by different age groups in the nursing field to shape the workplace organization better during the pandemic. Moreover, work distributions and innovations based on a smaller range of age groups and work field experiences may provide the minimal stress/anxiety levels to nurses, therefore, increase their field performance by maintaining healthy mental health levels. By having a future direction in order to improve mental health with female nurses in Ontario, it can be generalized or modified to help other healthcare workers. One possible direction for future research could be to investigate solutions to both professional and personal challenges that are faced by different age groups during the pandemic. Study suggests that social support is an effective way to help the HCWs combat challenges such as increased anxiety levels and poor sleep quality (Vizheh et al, 2020). With the future research focusing on smaller age range groups, the social support provided to each age group can target the challenges better by providing a more effective and a direct way to overcome the major problems they face depending on their experiences and other factors in the field. The information provided within this study can allow for health officials to create public health policies to ensure the mental health of the healthcare workers in our cities are being taken care of, or options for support to mitigate the stress of the occupation, especially in times like the COVID-19 pandemic.

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Exploring the Association Between Cannabis and Alcohol Co-use and Sleep Satisfaction Among Grade 7-12 Canadian Students: A Cross-Sectional Study

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I | Introduction

According to the World Health Organization in 2018, 5.6% of the global population are drug users, and among them, 31 million individuals are battling a substance addiction (Moonajilin et al., 2021). In a study by Moonajilin et al. (2021), they researched substance use behaviour among high school students in Bangladesh. The results from their study reported that 14.4% of the students were involved with drug use at some point in their lifetime, and 11.3% of them were currently using substances (Moonajilin et al., 2021). The high prevalence of drug use among youth is consistent with various other studies. A 2019 survey by the Substance Abuse and Mental Health Services Administration (SAMHSA) revealed that the two most common substances used by youth are alcohol and cannabis. According to the results, approximately 1 in 4 (24.5%) adolescents between the ages of 12-17 had used at least one illicit drug during their lifetime and more than half of this group consisted of marijuana users (SAMHSA, 2019). In the same survey, 80.3% of youth in this age group reported that they have tried alcohol in their lifetime, and among them, almost 30% of them were binge drinkers (SAMHSA, 2019).

Due to the high rate of occurrence and the elevated risk involved with these behaviours, substance abuse among adolescents can be qualified as a prominent public health issue (Moonajilin et al., 2021). Existing literature shows that adolescent substance use has various negative repercussions including poor development, economic consequences, and health problems, including changes associated with sleep cycles (Moonajilin et al., 2021).

Hser and colleagues (2017) investigated the relationship between cannabis and mental health. They analyzed the data of 302 individuals, comparing decreased and increased cannabis use to changes in sleep and other mental health factors (Hser et al., 2017). Hser et al. (2017) found a significant association between reduced cannabis usage and improved sleep quality.

Their study concluded that there was a relationship between reductions in cannabis use and improvements in anxiety, depression, and sleep quality (Hser et al., 2017).

The findings of the research done by Hser et al. (2017) are consistent with some other papers on the topic. Bolla and colleagues (2008) also looked at the association between sleep and cannabis use by recording polysomnographic (PSG) measures in marijuana users (Bolla et., 2008). The PSG studies were performed on 17 adults, (ages 18-30), with chronic marijuana use over two nights after ending the use of marijuana (Bolla et., 2008). Results concluded that marijuana users had shorter total sleep time, inferior sleep efficiency, and longer sleep latency than the controls on night 2 (Bolla et., 2008).

Regarding alcohol consumption and changes in sleep patterns, Geoghegan et al. conducted a study in 2012 exploring the effects of alcohol consumption on sleep quality. In their study, participants were asked to complete a sleep diary, a Profile of Mood States Questionnaire, and to describe their subjective perception of sleep quality and waking mood (Geoghegan et al., 2012). Objective sleep quality was recorded via actigraphy (Geoghegan et al., 2012). In the results, they found that compared to the control, individuals who consumed alcohol prior to bed had a lower total sleep time and decreased time in bed (Geoghegan et al., 2012). Self-reported data also showed that these individuals experienced increased wakefulness in the second half of the night and increased waking fatigue (Geoghegan et al., 2012). Due to the results, Geoghegan et al. (2012) concluded that it is highly likely that alcohol consumption has a negative effect on sleep quantity and quality.

With the understanding that there is a link between sleep and cannabis and alcohol, we explore the few primary studies that investigate cannabis and alcohol co-use with sleep. In a study by Goodhines et al. (2019), they reinforced the existing evidence that alcohol and cannabis

use are linked to sleep quality. Their study population included 217 college students who used either cannabis, alcohol, or both as a sleep aid within the last month (Goodhines et al., 2019). 58% of the group were cannabis and alcohol co-users (Goodhines et al., 2019). The results showed that while several of the sleep aid users reported a longer night sleep duration and shorter night wake time, they also experienced increased daytime fatigue the following day (Goodhines et al., 2019). Their study concluded that despite the sleep-related benefits, daytime fatigue remained a potential adverse outcome of cannabis sleep aid use (Goodhines et al., 2019). This is consistent with previous literature regarding cannabis or alcohol on sleep quality, where numerous papers concluded participants found that they woke up feeling more fatigued compared to participants who were not using any substance. However, the results from this study do not differentiate cannabis only users, alcohol only users, and alcohol and cannabis co-users. Thus, our understanding of the results from this study are incomplete.

Existing literature on the relationships between cannabis or alcohol use and sleep are extensive, but research covering the topic of cannabis and alcohol co-use in relation to sleep is still sparse. Current research about sleep and cannabis/alcohol co-use has not thoroughly explored our target outcome or population of interest. For instance, research done by Gunn et al. (2021) and Read et al. (2021) investigated cannabis and alcohol co-use but did not look at sleep cycles. Goodhines et al. (2019) researched sleep and cannabis-alcohol co-use, but in an adult population (18 and older) rather than our target population (12–18-year-old students). Thus, we state our knowledge gap: despite cannabis and alcohol being the two most common recreational substances among youth (ages 12-18), the co-use of the two substances is an area that has only been very shallowly explored. Our research question is: Is there a difference between the sleep patterns of Canadian adolescents (Grade 7-12 (ages 12-18)) who are exposed to both alcohol and

cannabis and Canadian adolescents in the same age group who have never been exposed to either substance?

2 | Methods

2.1 Study Design

The design used for our research was observational and cross-sectional. The database that was used was Odesi (Ontario Data Documentation, Extraction Service, and Infrastructure Initiative) and allowed us to have access to datasets in a web-based data extraction system. Additionally, it allowed us to download data into external statistical analysis packages, such as SPSS. The data in Odesi was collected from Statistics Canada datasets, polling companies, datafiles from Gallup Canada, Canadian National Election Surveys which are public-domain files, and specific files from the inter-University Consortium for Political and Social Research (ICPSR). The data was obtained under the tab 'Health' and 'CANADA' subsection. Under that tab we chose the 'Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS)' dataset. The data on student tobacco, alcohol and drug use was conducted for Health Canada by the Propel Centre for Population Health Impact at the University of Waterloo. The CSTADS was obtained from data collected from October 2018 to June 2019. Students in grades 7 to 12 across 10 Canadian provinces had their information regarding tobacco use, alcohol, drug use, bullying and sleep collected. All the variables that were not mentioned in the data code book and were not related to the research question were removed from our dataset to run statistical tests more efficiently.

2.2 Participant Selection Criteria

Middle school and high school students between the ages of 12-18 who reside within the 10 provinces in Canada were selected for our study. Students who had either 1) exposure to both

marijuana and alcohol or 2) exposure to neither marijuana nor alcohol were included. Only individuals who provided a valid response to all our studied variables were included. Students who were exposed to only marijuana or only alcohol were excluded from our study. Anyone that was not within the age range of 12-18 years old were also excluded. All students who responded to any of the variables as "not stated" were excluded. 62,850 students ranging from grades 7 to 12 have completed the survey. After accounting for all inclusion and exclusion criteria, the number of participants was narrowed down to 37,568 students.

2.3 Study Outcome

This study's primary outcome in our study is sleep quality. Specifically, we are looking at the sleep conditions of adolescents aged 12-18 years, related to the co-use of alcohol and marijuana compared to no substance use at all. Since alcohol and marijuana influence an individual's physical and mental state, there is evidence to suggest that these substances combined also influence the distinctive characteristics of sleep. Sleep plays a key role in adolescent brain function and behaviour, especially in relation to supporting learning, memory, attention, cognition, and emotion processing (Tarokh et al., 2016). To have positive experiences in life related to school, work, family life, etc., a well-functioning brain is important to maintain. As a result, the way we care for our sleep and brain during our adolescent years matters. While sleep is the primary outcome assessed in this study related to adolescent alcohol and marijuana co-use, there are additional outcomes that should be assessed too. Listed below are the questions from the survey that were used to collect data for the independent variable and outcomes:

Independent Variable: Have you tried both alcohol and cannabis?

(Groups: Never exposed to neither cannabis nor alcohol; Exposed to both cannabis and alcohol)

Primary outcome:

In the last 2 weeks, how often have you felt satisfied with your sleep?

Additional sleep variable outcomes (Secondary Outcomes):

In the last 2 weeks, how often have you felt tired/dragged out/sleepy during the day?

In the last 2 weeks, how often have you arrived late to class because you overslept?

In the last 2 weeks, how often have you had an extremely hard time falling asleep?

In the last 2 weeks, how often have you gone to bed because you couldn't stay awake?

In the last 2 weeks, how often have you struggled to stay awake while reading, studying, or doing homework?

2.4 Additional Data Collection

The additional variables used in our data collection were descriptive data that include the participants' sex at birth, their grade in school, and the province they reside in. These variables help give a more detailed description of how different subcategories within the entire study are affected by the independent variables. To better understand the gender division in our study, we identified the number of male and female participants in each group, as well as their respective proportions. We also identified how many individuals were in each grade, from grade 7 to 12. Finally, the location of our participants in Canada was better understood by collecting the population data for each province.

2.5 Statistical Analysis

The software that was used was Statistical Package for the Social Sciences (SPSS) statistics. SPSS statistics is a leading software program made by IBM and allows you to import, visualize and analyze data. SPSS was chosen due to it being the most popular and widely used package in both academic and business areas. The p-value that was used to determine significance was 0.05 (significant if $p < 0.05$). A normality test was not used since no continuous data was included during the study. Instead, cross-tabulation tests were run to compare variables. The descriptive

data was organized in **Table 1**. Data comparing the outcomes between groups is summarized in **Table 2**. The Chi-squared test was used to assess the significance of our results. Tables and graphs were created according to the SPSS analyses to summarize the data.

3 | Results

Table 1. Baseline Characteristics of the Surveyed Canadian Students (n = 37 568).

Descriptive Variable	Never exposed to neither cannabis nor alcohol n = 25342 (67.45%)	Have been exposed to both cannabis and alcohol n = 12226 (32.54%)	p-value
Sex at birth (n (%))			
Male	12 495 (49.30%)	6235 (51.00%)	0.002**
Female	12 847 (50.70%)	5991 (49.00%)	
Grade in school (n (%))			
Grade 7	8480 (33.46%)	364 (2.98%)	0.000**
Grade 8	6569 (25.92%)	930 (7.61%)	
Grade 9	4684 (18.48%)	1872 (15.31%)	
Grade 10	2950 (11.64%)	2924 (23.92%)	
Grade 11	1777 (7.01%)	3521 (28.80%)	
Grade 12	882 (3.48%)	2615 (21.39%)	
Province (n (%))			
Newfoundland and Labrador	2234 (8.82%)	1219 (9.97%)	<0.001**
Prince Edward Island	2302 (9.08%)	786 (6.43%)	
Nova Scotia	2819 (11.12%)	1411 (11.54%)	
New Brunswick	1381 (5.45%)	862 (7.05%)	
Québec	4930 (19.45%)	2953 (24.15%)	
Ontario	3201 (12.63%)	792 (6.48%)	
Manitoba	1590 (6.27%)	657 (5.37%)	
Saskatchewan	1382 (5.45%)	706 (5.77%)	
Alberta	2573 (10.15%)	1255 (10.27%)	
British Columbia	2930 (11.56%)	1585 (12.96%)	

Table 1 is based on data from the Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS), 2018 - 2019. Students ranging from 12-18 years old answered questions on descriptive characteristics (n = 37 568). Individuals who did not state answers for all questions were excluded from this table, decreasing our study population from 62 850 to 37 568. The data is expressed by the units of n (= number of individuals) and percentages (%) of the total surveyed population. Significance at the 0.05 level is denoted by *. Significance at the 0.01 level is denoted by **.

All results summarized in both **Table 1** and **Table 2** were significant. Descriptive variables comparing between groups can be seen in **Table 1**. There were more females in the "Never

exposed" group compared to the "Exposed" group, as seen in the table. Vice versa, there were more males in the "Exposed" group than the "Never exposed" group. 7th to 9th graders had more respondents who have never been exposed to either substance and made up 77.86% of those who answered: "never tried alcohol or cannabis". On the other hand, grades 10 to 12 had more respondents who have tried both alcohol and cannabis at least once in their lives compared to those who did not. Almost 3 in every 4 (74.11%) of the individuals who have tried alcohol and cannabis before were students in grades 10 to 12. There was uneven distribution from provinces as we saw that some provinces had more respondents than others. Quebec (n = 7883) had the most total respondents. Almost ¼ of the respondents who have tried both alcohol and cannabis before were from Quebec. Contrarily, New Brunswick (n = 2243), Manitoba (n = 2247) and Saskatchewan (n = 2088) had the fewest total respondents in comparison to other provinces.

Table 2. Sleep Quality Ratings among Canadian Students Who Have Been Exposed to Both Cannabis and Alcohol Compared to Those Who Have Not.

Sleep Variable	**Never exposed to neither cannabis nor alcohol n = 25342 (67.45%)**	**Have been exposed to both cannabis and alcohol n = 12226 (32.54%)**	**p-value**
In the last two weeks, how often have you felt satisfied with your sleep? (n (%))			
Every day/night	5811 (22.93%)	1410 (11.53%)	0.000**
Several times	11783 (46.50%)	4514 (36.92%)	
Twice	3364 (13.27%)	2524 (20.64%)	
Once	1830 (7.22%)	1696 (13.87%)	
Never	2554 (10.08%)	2082 (17.03%)	
In the last two weeks, how often have you felt tired/dragged out/sleepy during the day? (n (%))			
Every day/night	2595 (10.24%)	2690 (22.00%)	0.000**
Several times	7941 (31.34%)	5252 (42.96%)	
Twice	4530 (17.88%)	1853 (15.16%)	
Once	4444 (17.54%)	1226 (10.03%)	
Never	5832 (23.01%)	1205 (9.86%)	

In the last two weeks, how often have you gone to bed because you couldn't stay awake? (n (%))			
Every day/night	1056 (4.16%)	1121 (9.16%)	0.000**
Several times	5187 (20.46%)	3895 (31.85%)	
Twice	3691 (14.56%)	2356 (19.27%)	
Once	4448 (17.55%)	1955 (15.99%)	
Never	10960 (43.24%)	2899 (23.71%)	
In the last two weeks, how often have you struggled to stay awake while reading, studying, or doing homework? (n (%))			
Every day/night	1053 (4.15%)	1307 (10.69%)	0.000**
Several times	4024 (15.87%)	3428 (28.03%)	
Twice	2794 (12.34%)	1727 (14.12%)	
Once	3641 (11.02%)	1575 (12.88%)	
Never	13830 (54.57%)	4189 (34.26%)	
In the last 2 weeks, how often have you arrived late to class because you overslept? (n (%))			
Every day/night	242 (0.95%)	540 (4.41%)	0.000**
Several times	932 (3.67%)	1567 (12.81%)	
Twice	982 (3.87%)	1068 (8.73%)	
Once	2089 (8.24%)	1854 (15.16%)	
Never	21097 (83.24%)	7233 (59.16%)	
In the last 2 weeks, how often have you had an extremely hard time falling asleep? (n (%))			
Every day/night	2388 (9.42%)	2271 (18.57%)	0.000**
Several times	5206 (20.54%)	3542 (28.97%)	
Twice	3979 (15.70%)	2108 (17.24%)	
Once	5087 (20.07%)	1780 (14.55%)	
Never	8682 (34.25%)	2525 (20.65%)	

Table 2 results were collected from the Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS), 2018 - 2019. 37 568 students answered questions related to their relationship with cannabis and alcohol co-use and sleep. Individuals who did not state answers for all questions were excluded. The data is expressed by the units of n (= number of individuals) and percentages (%) of the surveyed population. Significance at the 0.05 level is denoted by *. Significance at the 0.01 level is denoted by **.

Table 2 compares the sleep outcome variables between students who have used cannabis and alcohol with students who have not. Our primary outcome was sleep satisfaction. When analyzing sleep satisfaction between groups, proportions of participants who responded that in the last two weeks, they were satisfied with their sleep "every day/night" or "several times" were consistently higher in the group that had never tried alcohol and cannabis (69.43%), compared to the group who had (48.45). 17.03% of the individuals who have used cannabis and alcohol responded to the same question with "never," while only 10.08% of the group that have never been exposed to these substances had given that response. The Chi-squared value for this variable was 1729.097 with a p-value of 0.000. The respective numbers of respondents who responded with "Every day/night," "several times," "twice," "once," and "never" regarding sleep satisfaction is summarized in **Figure 1** below.

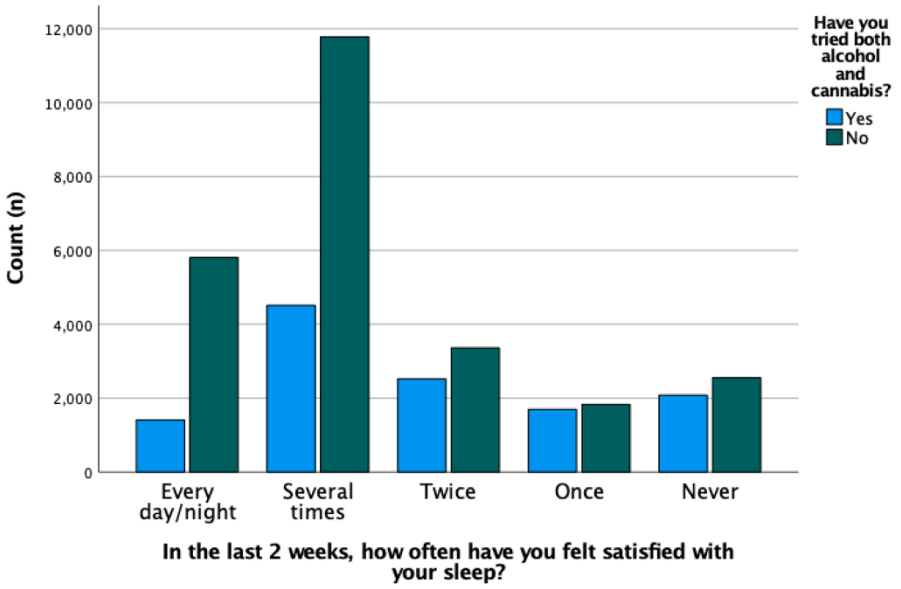

Figure 1. Bar graph summarizing the results of the students' responses (by the units of n (= number of individuals) regarding sleep satisfaction (primary outcome). Results were collected from the Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS), 2018 - 2019. Students ranging from 12-18 years old answered questions related to their relationship with cannabis and alcohol co-use and sleep (n = 37 568). The raw data can be found in Table 1.

Regarding waking or daytime fatigue, 64.96% of individuals who co-used both alcohol and marijuana reported feeling tired/dragged out/sleepy during the day “every day” or “several times” in the last two weeks. This can be compared with 58.43% of non-users who had only reported feeling this way 0-2 times in the last two weeks. In addition, 41.01% of individuals who co-used both substances stated that they had to go to bed because they were unable to stay awake every day or several times, compared to the non-users who reported 60.79% of individuals who only felt this way once or not at all in the last two weeks. Furthermore, when considering how often one struggled to stay awake while reading, studying, or doing homework, 54.57% of individuals who did not use either of the substances never had any trouble while doing their work, whereas 65.72% of individuals who did co-use struggled to stay awake when doing their work at least once in the past two weeks. When examining who had been late to class because they had overslept in the last two weeks, 41.11% of participants who co-used both substances had overslept at least once, compared to the 83.24% of participants who did not use either substance, who had never arrived late to school after oversleeping. Finally, when asking this population how often they had an extremely tough time falling asleep over the last two weeks, 47.54% of co-users had trouble falling asleep either several times or every day/night compared to the 54.32% of individuals who did not co-use alcohol or marijuana and responded with “once” or “never” having an extremely hard time falling asleep.

4 | Discussion

Upon analysis of the data from the CSTADS (2018–2019), investigating the sleep patterns among Canadian adolescents (Grade 7-12 (ages 12-18)) who are co-using cannabis and alcohol and those who are using neither substance, we found a repeating pattern of higher sleep disturbances in the group of adolescents that co-used alcohol and cannabis. Consequently, there

is evidence to suggest that by avoiding co-using alcohol and cannabis completely, the adolescent population exhibit healthier sleeping habits.

Upon assessing the baseline characteristics of the surveyed Canadian students in Table 1, it was evident that there was significance amongst overall gender differences. However, we found only a 1.4% difference between sexes for never exposed students, and a 2% sex difference for those that have been exposed to these substances. The percentage differences are exceedingly small. It is fair to say that gender holds some influence on the likelihood of the co-use of alcohol and cannabis. Thompson et al. (2021) also investigated the simultaneous co-use of marijuana and alcohol. Their study was not able to identify any sex differences in the co-use (Thompson et al., 2021). This finding, along with our own results, may suggest that both females and males may share similar patterns of substance co-use and that sex plays a minor role.

In terms of grade levels, it is seen that as the grade level increases, the likelihood of alcohol and cannabis co-use in Canadian students also increases. Up until grade 10, there are more individuals who have never been exposed to cannabis or alcohol. In grades 11 and 12 there is a shift in the results. By grade 11, there is a higher rate of being exposed to both cannabis and alcohol, as seen in Table 1. This is consistent with existing literature. According to O'Malley et al. (2006), adolescents may become more inclined to try substances such as alcohol and cannabis due to numerous factors (individual factors, family, peers, schools, communities, regulations). It could be due to the increasing responsibilities or stressors that accumulate as one ages; substance use may seem like an effective way to relieve the mental burden that older students are facing.

Table 2 shows the sleep quality ratings among Canadian students who have been exposed to both cannabis and alcohol compared to those who have not. Looking at previous research, a longitudinal study conducted on adolescents and young adults, by Hasler et al. (2017), linked

evening-ness (preference for later sleep) to increased alcohol and drug use. The results showed that greater evening-ness was correlated with greater at-risk alcohol use and past-year use of marijuana. This is consistent with our findings, where the group that has been exposed to both cannabis and alcohol also reported having a harder time falling asleep than those who were never exposed. Our results were also consistent with the study by Goodhines et al. (2019), which found a relationship between alcohol and cannabis and daytime fatigue. This is evident when looking at the following results from Table 2: the number of individuals who struggled with staying awake while reading, studying, or doing homework more than 2 times in the last two weeks was higher in the group who have been exposed to both cannabis and alcohol compared to those who did not. The responses to the question, "in the last 2 weeks, how often have you arrived late to class because you overslept?" have a higher percentage of people who responded once or more in the group that has been exposed to both cannabis and alcohol. These results suggest that there is a difference between the sleep patterns of Canadian adolescents who are co-using both cannabis and alcohol and adolescents who are not exposed to either cannabis or alcohol. A study conducted by Ogeil et al. (2019) also showed that there was an association between alcohol and cannabis use and sleep quality in adolescents. Early drug use correlated with poor sleep quality at the age of 18 years (Ogeil et al., 2019). By comparing our results to those of other researchers, it is evident that there is a correlation between sleep quality and cannabis and alcohol consumption. Therefore, it is important to consider the impact of adolescent drug use on sleep quality.

Based on Figure 1, which shows the responses to the question, "in the last 2 weeks, how often have you felt satisfied with your sleep?", it is evident that people who are not exposed to both alcohol and cannabis are shown to be more satisfied with their sleep with a significantly higher count than those who are exposed to both alcohol and cannabis. However, it is also

important to note that external health factors can play a role in sleep ratings, which was not accounted for in our study. For example, some students may be experiencing insomnia or other sleeping disorders that this study did not consider. A study by Harvey et al. (2008), showed that the insomnia group had more requirements for judging their sleep quality than the normal sleepers. There is a knowledge gap in the literature regarding sleep quality and insomnia because many studies focus on examining the sleep quality in normal sleepers. These results may be a factor to consider for future studies as they can influence people's responses.

The limitations of our research are that it is not a longitudinal study, and it is difficult to detect developments or changes in the target population. Our results cannot be generalized to the global population, as we only surveyed students from grades 7 to 12, selected from 10 provinces completed Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS). Also, students may be subject to self-report biases like purposely giving an untruthful, socially acceptable answer or being unable to objectively assess themselves, both of which can affect the accuracy of our results. Some respondents may feel uncomfortable giving truthful responses due to the fear of being judged and their answers may be influenced by “social desirability.” Furthermore, this study is prone to recall bias. Since it is a survey reflecting on their cannabis/alcohol consumption and sleep behaviours in the last 2 weeks, they may not fully remember the details which can result in guessed responses.

Further research on this topic should be done by using a longitudinal study to allow researchers to detect changes or developments in the cannabis/alcohol consumption to sleep quality of the target population. Other ethnicities, age groups, and condition groups (e.g., insomnia patients) should also be explored to expand our understanding and generalizability of findings on this topic. Also, for future survey research, to prevent missing data and encourage full participation, a reward-based system can be implemented. For example, giving an entry to a contest or a gift card can motivate participants to give more thorough, direct and honest answers.

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Appendix

Data Code Book

SPSS name	What is the variable? (Similar to Label in SPSS)	Coding instructions	Measurement scale	How will the variable be used?	Variable type
PROVINCE	Province ID Number	10 = Newfoundland and Labrador 11 = Prince Edward Island 12 = Nova Scotia 13 = New Brunswick 24 = Québec 35 = Ontario 46 = Manitoba 47 = Saskatchewan 48 = Alberta 58 = British Columbia	Nominal	This will help describe our population and show us the distribution of population throughout Canada.	Descriptive
GRADE	Grade that the student is in (What grade are you in?)	7 = Grade 7 8 = Grade 8 9 = Grade 9 10 = Grade 10 11 = Grade 11 12 = Grade 12	Nominal	This will help describe our population and let us divide our population into their specific age groups for analysis.	Descriptive
GENDER	Gender at birth (What was your gender at birth?)	1 = Female 2 = Male	Nominal	This will allow us to separate the two genders for comparison if	Descriptive

				needed for analysis.	
ALC_CAN	Have you tried both alcohol and cannabis?	1 = Yes 2 = No	Nominal	This will allow us to decipher between individuals who co-use alcohol and cannabis versus those who do not.	Independent
SLP_SATISFIED	In the last 2 weeks, how often have you felt satisfied with your sleep?	1 = every day/night 2 = several times 3 = twice 4 = once 5 = never 99 = not stated	Nominal	This variable will be useful because it tells us if the individual felt as if they had a satisfying sleep experience during a short span (2 weeks).	Dependent
OVERSLEPT	In the last 2 weeks, how often have you arrived late to class because you overslept?	1 = every day/night 2 = several times 3 = twice 4 = once 5 = never 99 = not stated	Nominal	This variable will be useful because it tells us if the individual had overslept/could not wake up at their intended time during a short span (2 weeks).	Dependent
TIRED	In the last 2 weeks, how often have you felt tired/dragged out/sleepy	1 = every day/night 2 = several times 3 = twice 4 = once	Nominal	This variable will be used to tell us how often these individuals felt tired	Dependent

	during the day?	5 = never 99 = not stated		throughout the day, within a short period of time (2 weeks)	
TRBL_SLP	In the last 2 weeks, how often have you had an extremely hard time falling asleep?	1 = every day/night 2 = several times 3 = twice 4 = once 5 = never 99 = not stated	Nominal	This variable will be used to tell us how difficult it was to fall asleep during a short period of time (2 weeks).	Dependent
CNT_STAY_AWAKE	In the last 2 weeks, how often have you gone to bed because you couldn't stay awake?	1 = every day/night 2 = several times 3 = twice 4 = once 5 = never 99 = not stated	Nominal	This variable will be used to tell us how difficult it was to stay awake every day for a short period of time (2 weeks).	Dependent
STRUGGLE_HW	In the last 2 weeks, how often have you struggled to stay awake while reading, studying, or doing homework?	1 = every day/night 2 = several times 3 = twice 4 = once 5 = never 99 = not stated	Nominal	This variable will be used to tell us how difficult it was to wake up every day during a short period of time (2 weeks).	Dependent

*** Within the data that was used in Table 1., all the extra variables where people did not respond (I.e., “Not Stated”) were removed. ***

The association between concern about maintaining social ties during COVID-19 pandemic and mental health, within the youth and elderly populations in Ontario: An observational cross-sectional study

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Introduction

Mental health is an undervalued topic of interest in today's world, despite its interconnectedness to other health issues. In fact, mental health has been found to be linked to a wide range of chronic diseases, such as cardiovascular disease and diabetes, as well as communicable diseases, such as HIV and tuberculosis (Prince et al., 2007). Poor mental health can also evolve into neuropsychiatric disorders, which account for 1.2 million deaths every year (Prince et al., 2007). This goes to show the severity of the mental health crisis at hand and why it is worth analyzing during the current COVID-19 pandemic.

There are several components of mental health, which is why its decline can lead to multifarious problems within an individual. Anxiety is one of these critical components of mental health and is subject to change depending on the situation a person experiences (Headey et al., 1993). A person experiencing anxiety tends to worry and develop a fear of everyday situations. Such feelings can intensify with time and lead to symptoms beyond control. Research indicates that the mental health and physical health of an individual are linked (Cloitre et al., 2019). It is also indicated that anxious experiences can lead to immense distress and places a person at risk of long-term damage emotionally, physically, and mentally (Awick et al., 2017).

There are numerous anxiety disorders that differ depending on the severity and duration of symptoms. Anxiety symptoms include experiencing fatigue, inability to relax, irritability, nervousness, elevated heart rate, rapid sweating, lack of control over feelings, and difficulty sleeping (Tiller, 2013). These symptoms can lead to several health repercussions and, in some cases, chronic physical conditions (Prince et al., 2007). Anxiousness and poor mental health can increase the risk of developing heart diseases, diabetes, thyroid complications, respiratory problems, and tremors (Prince et al., 2007).

Mental health has exacerbated many mental health problems. Aside from the direct consequences of COVID-19, the pandemic has generated an atmosphere in which numerous mental health determinants have been impacted. Social restrictions, lockdowns, school and business closures, loss of livelihood, reductions in economic activity, and shifting government priorities in the fight against COVID-19 outbreaks all have the potential to impact Canadian mental health. Due to governmental restrictions, people stay deprived of social activities and suffer from modified interpersonal relationships (Gloster et al., 2020). Research shows that this social life cut-off has developed a sense of loneliness within people, leading to negative emotional and behavioural changes (Orgilés et al., 2020).

Canada, among many other countries in the world, experienced an increase in the prevalence of anxiety during the COVID-19 pandemic (Généreux et al., 2021). Prior to the pandemic, approximately 5% of Canadians self-reported high to extremely high levels of anxiety (Dozois et al., 2021). However, since the pandemic began, this percentage of high anxiety levels in Canadians has quadrupled to about 20% (Dozois et al., 2021). Also, 39% of the 72% of Canadians who self-reported low anxiety levels prior to the pandemic experienced higher levels of anxiety during the pandemic (Dozois et al., 2021). Anxiety has evidently taken a toll on Canadians' mental health. Multiple societal and age groups are also at a higher risk, including young children and their parents, who are worried about their increased sedentary time (McCormack et al., 2020).

Although some existing research has looked into how mentally taxing the pandemic was, the concern of maintaining social ties during the pandemic has not been readily explored in conjunction with mental health problems, such as anxiety. For example, evidence shows that reduced social interactions during the pandemic led to mental health problems (Gloster et al.,

2020), but the specific concern people had regarding their social ties was not well studied in this context. There is also a lack of research looking at perceived life stress, which is the precursor of many mental health problems (Toussaint et al., 2016). Life stress has a significant impact on the mental well-being of an individual and can manifest itself physically as well in the form of hypertension and insomnia (Toussaint et al., 2016). It is crucial to take into consideration perceived life stress along with generalized anxiety severity when dealing with mental health. These specific variables are not well studied within the Ontario youth and elderly population, especially during the COVID-19 pandemic. With the Canadian lockdowns isolating the elderly in nursing homes or seniors' homes (Clarke, 2021), it is valuable to analyze if and how mental health problems changed for the elderly and compare the data to the youth population of Ontario.

As such, our team decided to focus on this topic and answer the following research question: Does the concern about maintaining social ties during the COVID-19 pandemic have an association with mental health (generalized anxiety severity score, perceived life stress) in Ontario's elderly population (65 years or older) when compared to Ontario's youth population (15 to 24 years old)? In order to do this, we utilized a dataset based on a crowdsource questionnaire conducted by Statistics Canada called "Impacts of COVID-19 on Canadians- Mental Health, 2020" (Statistics Canada, 2020).

Methods

Study Design and Database

Our observational cross-sectional analysis draws data from the Canadian Perspective Survey Series (CPSS): Impacts of COVID-19, available for public use and administered by Statistics Canada (2020). This cross-sectional survey series aims to collect information about the health and socioeconomic impacts of COVID-19 on Canadians and study their reaction to the

pandemic (Statistics Canada, 2020). Our database includes data from the second iteration of the survey series that focuses on the effects of the pandemic on mental health specifically, collected via a voluntary online survey administered between April 24th and May 11th, 2020, through the Crowdsourcing application (Statistics Canada, 2020). The above-mentioned survey series had a sampling frame of respondents 15 years and older living in one of the ten provinces or three territories in Canada during the collection period. Statistics Canada (2020) utilized a non-probabilistic sampling procedure without employing a sample design. The survey was available in English and French, and it took respondents approximately five minutes to answer the questions (Statistics Canada, 2020). We refer to the corresponding database generated through the Odesi portal, including 45,989 responses four months into the pandemic.

Study Participants

As per the inclusion criteria, data was included for the variables 'concern about maintaining social ties during the COVID-19 pandemic,' 'GASS,' and 'PLS,' as these were the variables studied. For these three variables, data with missing values were removed as per the exclusion criteria to improve the accuracy of the measures of central tendency. Also, our study focused on Ontario specifically, so data from other provinces were removed from the dataset. On top of that, this study compared the findings between elderly and youth participants. Elderly participants were defined as those within the age group of 65 years or older, which included a sample size of 2413 individuals. Likewise, youth were defined within the age group of 15 to 24 years old, which included a sample size of 1104 individuals. The data for all other age groups were removed.

Study Outcomes

Relating to the concern about maintaining social ties (independent variable), the primary outcomes that were of interest in our research study include GASS and PLS (dependent variables). GASS and PLS are our measures of mental health since both anxiety and life stress have significant impacts on mental health (Tiller, 2013; Toussaint et al., 2016).

GASS, otherwise known as GAD-7, is a seven-question standardized questionnaire developed to measure a participant's anxiety levels. GASS has proved to be a valid and reliable tool (Spitzer et al., 2006). This questionnaire asks participants whether they have experienced the following problems over the past two weeks: (1) feeling nervous, anxious or on edge, (2) not being able to stop or control worrying, (3) worrying too much about different things, (4) trouble relaxing, (5) being so restless that it is hard to sit still, (6) becoming easily annoyed or irritable, and (7) feeling afraid as if something awful might happen. Participants chose 1 of 4 options for each prompt: Not at all (=0), Several days (=1), More than half of the days over the last two weeks (=2), Nearly every day (=3). A numeric value for each response was summed to provide a GASS for each subject, with a higher score representing more severe anxiety levels.

PLS was determined by the participant's ranking of how stressful they perceived their life to be over the last two weeks. Rankings were on a scale of 1 to 5, with 1 being "Not at all stressful" and 5 being "Extremely stressful." This method was favoured instead of using the 'Perceived Stress Scale' (Cohen et al., 1994) in order to avoid overlap of question prompts from the GAD-7 questionnaire. According to Statistics Canada (2020), all survey questions follow standard practices.

Additional Data Collection

The additional variables that were used in our research study include Sex, Residence Type, Community Population Size, Immigration Status, Socioeconomic status indicators, and Concern about Maintaining Social Ties, which were used to describe the study population in *Table 1*.

The participant's sex was determined by the two categories: (1) male and (2) female. The variable 'Residence Type' is split into three categories: (1) urban, (2) rural and (3) not stated. The variable 'Community Population Size' is divided among 5 categories: (1) living in a non-census metropolitan area, (2) living in a community of 10,000 - 99,999, (3) living in a community of 100,000 - 499,999, (4) living in a community of 500,000 - 1,499,999 and (5) living in a community of 1,500,000 +. The variable 'Immigration Status' is categorized as: (1) non-immigrants, (2) immigrants and (3) not stated. The variable 'Socioeconomic status' indicators are split into: (1) Visible Minority and (2) Indigenous Identity. Concern about maintaining social ties was determined by participants' rankings regarding their concern about maintaining social ties. Rankings were placed on a scale of 1 to 4, with 1 being "Not at all" and 4 being "Extremely."

Statistical Analysis

For *Table 1*, the variables being directly studied were included, along with the respective descriptive statistics. This included GASS, PLS, and concern about maintaining social ties. Some additional variables were included to describe the study population, including sex, residence type, community population size, immigration status, and socioeconomic status indicators (visible minority, indigenous identity).

In order to conduct statistical tests on the data, the software SPSS was utilized. Amongst the variables studied, only GASS was a continuous variable. The Shapiro-Wilk normality test was conducted on this variable for the prepared youth and elderly datasets. The normality test found

that GASS was not normally distributed. The subsequent statistical tests were therefore chosen accordingly. First, the relationship between concern about maintaining social ties and GASS amongst the youth and elderly age groups was assessed using the Mann-Whitney U test. Next, the relationship between concern about maintaining social ties and PLS amongst the two age groups was assessed using the Spearman's Rho correlation test. For the significance value of these tests, a benchmark of ≤0.05 was used for statistical significance.

Results

Missing data

The core dataset had 45,989 entries, but 11,421 were blank, so they were removed. After removing all participants whose residence was outside of Ontario (n=12,432), the dataset had 22,136 participants (64%). Amongst these, a number of participants had missing values for the variables, concern about maintaining social ties (n=64), GASS (n=461), and PLS (n=44). It was deemed appropriate to remove these missing variables to increase the accuracy of descriptive statistics, considering that the number of participants with missing values was very small compared to the sample size of 22,136 people.

Table 1. Participant characteristics of Ontarians who reported a GASS during the COVID-19 pandemic

Characteristics	**Youth: 15-24 years (n=1104)**	**Elderly: 65+ years (n=2413)**
Sex [Frequency (%)]		
Male	298 (27.0)	734 (30.4)
Female	806 (73.0)	1679 (69.6)
Residence type [Frequency (%)]		

Urban	1035 (93.8)	2006 (83.1)
Rural	62 (5.6)	396 (16.4)
Not stated	7 (0.6)	11 (0.5)
Community Population Size [Frequency (%)]		
Non-Census Metropolitan Area	62 (5.6)	396 (16.4)
10,000 - 99,999	52 (4.7)	254 (10.5)
100,000 - 499,999	195 (17.7)	432 (17.9)
500,000 - 1,499,999	396 (35.9)	834 (34.6)
1,500,000 +	392 (35.5)	486 (20.1)
Immigration Status [Frequency (%)]		
Non-Immigrant	933 (84.5)	1961 (81.3)
Immigrant	170 (15.4)	443 (18.4)
Not stated	1 (0.1)	9 (0.4)
Socio-economic status indicators [Frequency (%)]		
Visible Minority	345 (31.4)	78 (3.3)
Indigenous Identity	31 (2.8)	29 (1.2)
Concern about Maintaining Social Ties [Mode (%)]	Somewhat (39.6)	Somewhat (45.7)
Mental Health		
GASS [Median (IQR)]	9 (9)	3 (5)
PLS [Mode (%)]	A bit stressful (43.8)	A bit stressful (36.8)

To start off, the relationship between concern about maintaining social ties during the COVID-19 pandemic and GASS was assessed qualitatively. This was done by plotting both variables on a clustered box plot in SPSS for the youth and elderly populations, as can be seen in

Figure 1. The graph shows that as the concern about maintaining social ties increases, so does the GASS. It can also be seen that the youth population has a higher GASS among all the categories.

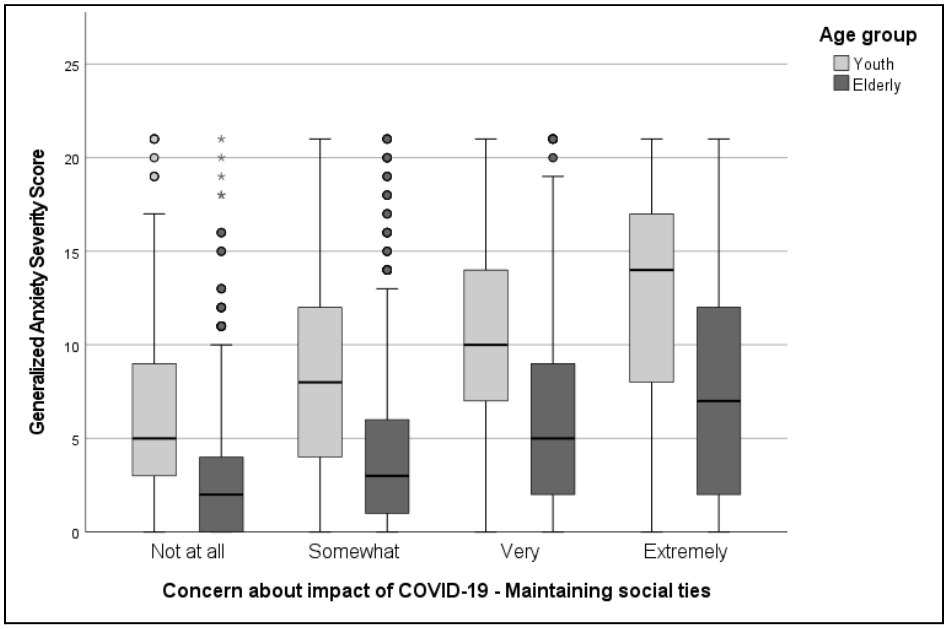

Figure 1. Concern about the impact of maintaining social ties during the COVID-19 pandemic vs. GASS amongst the youth and elderly population in Ontario. The dots and asterisks represent outliers. Data was acquired from the "Crowdsourcing: Impacts of COVID-19 on Canadians' Mental Health Public Use Microdata File" dataset (Statistics Canada, 2020).

To confirm this relationship quantitatively, a Mann-Whitney U test was conducted on the same variables, whose results are in *Table 2*. As can be seen, the median values for GASS increase as the concern about maintaining social ties increases. It can also be seen that median values were significantly higher for the youth population across all 'concern about maintaining social ties' categories when compared to the elderly group.

Table 2. Descriptive statistics and Mann-Whitney U test results for the relationship between concern about maintaining social ties during the COVID-19 pandemic and GASS amongst the youth and elderly population.

		Youth		Elderly		
		Number of respondents	Median (IQR) GASS	Number of respondents	Median (IQR) GASS	Mann-Whitney U test
Concern about maintaining social ties during COVID-19 pandemic	Not at all	200	5 (6)	680	2 (4)	Z = -11.181 P = <0.0005*
	Somewhat	437	8 (8)	1102	3 (5)	Z = -17.101 P = <0.0005*
	Very	295	10 (7)	484	5 (7)	Z = -10.854 P = <0.0005*
	Extremely	172	14 (9)	147	7 (10)	Z = -7.012 P = <0.001*

*statistically significant difference between youth and elderly populations with a p-value ≤ 0.05.

As in GASS, a similar relationship was found between concern about maintaining social ties and PLS. The relative percent of the youth and elderly populations were analyzed in order to remove the influence of sample size differences. As seen in *Figure 2*, a larger proportion of youth respond as being 'extremely stressed' and 'extremely concerned' when compared to the elderly population in the same categories. Conversely, larger proportions of the elderly population respond with the least extreme concerns and life stress when compared to the proportion of youth.

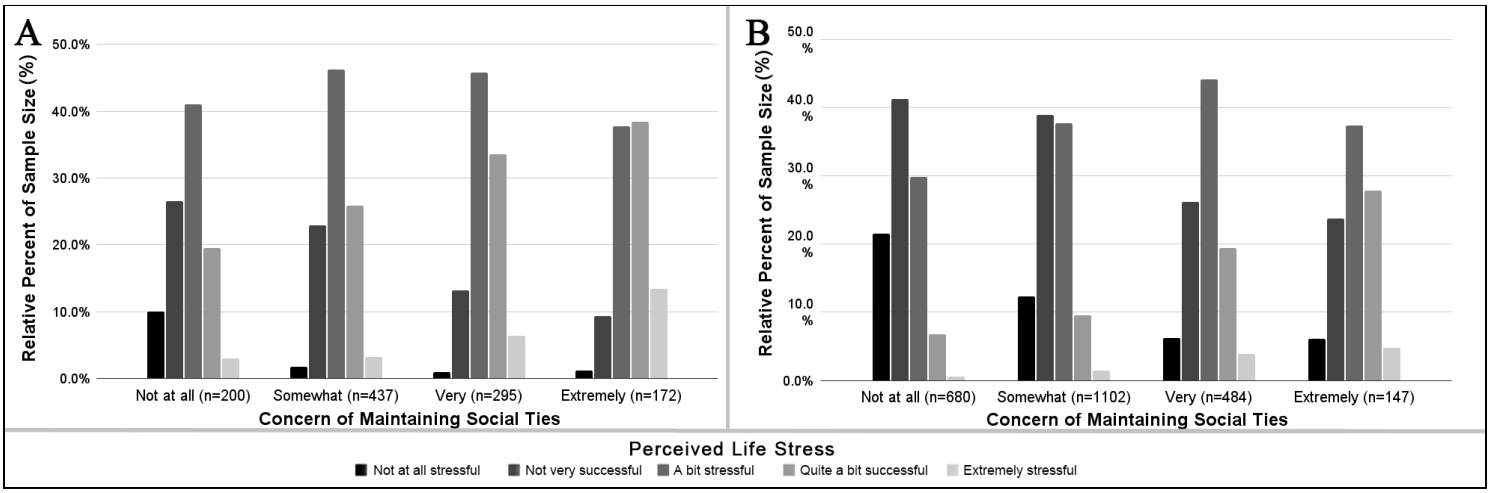

Figure 2. The relationship between concern of maintaining social ties during the COVID-19 pandemic and PLS in **(A)** the youth and **(B)** the elderly Ontario populations. Data was acquired from the "Crowdsourcing: Impacts of COVID-19 on Canadians' Mental Health Public Use Microdata File" dataset (Statistics Canada, 2020). The figure graphs were generated using Google sheets.

A Spearman's Rho test was conducted, as seen in *Table 3*, to validate the effectiveness of comparing the concern of maintaining social ties with PLS between the two populations. Two statistically significant correlation coefficients, which are relatively similar, mean that it is fair to compare youth and elderly populations in *Figure 2*.

Table 3. Correlation of the results obtained from concern about maintaining social ties and PLS in youth and elderly populations in Ontario. Values represent Spearman's Rho regression values.

	Perceived Life Stress (ρ)	
	Youth	Elderly
Perceived Life Stress	1.000	1.000
Concern about maintaining social ties during COVID-19 pandemic	0.257*	0.265*

*$p<0.001$ indicates that the difference between the outlined variables is statistically significant

Discussion

The overwhelming disruption brought about by the COVID-19 pandemic has sparked research worldwide. However, most research has centred around the spread of the virus and the resulting fatality rate. The disturbance to the population's daily lives and mental health has received less attention. This aspect is important to analyze as mental health impacts are severely detrimental to one's health and can lead to long-term consequences (Prince et al., 2007).

Our research focuses on finding the association between concern about maintaining social ties and the mental health of Canadians. We focus on two age groups: youth (15-24 years old) and

elderly (65 years or older), and analyze the differences between the effect of this concern on their mental health. Unpacking how this distress affects different age groups and the extent to which the effect persists is essential for assessing interventions to mitigate long-term effects.

Findings from our research indicate that the GASS is significantly higher for individuals aged 15-24 years old, and they are affected more than elderly people. Our findings also suggest that more individuals from the youth age bracket report having an extremely stressful life compared to older individuals. Overall, youth mental health is impacted more negatively than the elderly population of Canada due to an increase in the concern about maintaining social ties during the COVID-19 pandemic.

Our findings align with previous research regarding mental health and the COVID-19 pandemic. Research done by Jenkins and colleagues (2021) on a similar database pertaining to survey data collected two weeks after our survey was conducted finds significant mental health impacts that are distributed unequally across the Canadian population. They further highlight that disruption in having a social life results in poor mental health, depending on the characteristics of the Canadian population (Jenkins et al., 2021). Our findings support these observations as we find a significant difference amongst age groups, with younger Ontarians feeling more stressed and anxious than older adults when discussing concerns about maintaining social ties.

Further research by Bulloch et al. (2021) yields findings that are supported by our research. Researchers used survey data from Statistics Canada conducted in the month prior to our chosen database. They found that younger Canadians aged 15-24 years old were more likely to suffer from poor mental health due to the pandemic (Bulloch et al., 2021). Upon testing all the age groups in the database, they found that as the age increased, the number of people experiencing poor mental health also declined (Bulloch et al., 2021). Further, they also report elevated GAD-7

scores for 15-24-year-old Canadians, which also decrease with age (Bulloch et al., 2021). Our findings complement this research as they add to existing evidence showing higher median GASS for the youth population in comparison to senior citizens. We also find that younger Ontarians are more likely to experience poor mental health.

Another research study conducted by Findlay and colleagues (2020) shows that younger Canadians across all provinces were more likely to report worse mental health in response to the COVID-19 pandemic. Results from their research also provide significant evidence about individuals having poor mental health and also being concerned about maintaining social ties at the same time (Findlay et al., 2020). They show that many factors elevate the anxiety and stress of an individual, including concern about social ties (Findlay et al., 2020). Our findings support the work of Findlay et al. (2020), as we show a significant association between concern and anxiety and stress levels. Our findings provide numerical evidence regarding the increase in GASS scores for both age groups as the concern increases from 'Not at all' to 'Extremely.' Furthermore, we add to their findings by showcasing younger individuals having worse mental health (depicted by GASS and PLS) than elderly citizens of Ontario.

Unlike previous research in the field, our research focuses on the province of Ontario and compares two extreme age groups; 15-24 years old and 65 years or older. Furthermore, we use two mental health indicators (GASS and PLS) to explore the changes across our selected age groups while considering their concern about maintaining social ties. Our research findings support work done by other researchers and add further to reduce the knowledge gap regarding the difference in the effect of the pandemic on the mental health of different age groups. Although conducted on the dataset one month prior to our research, Bulloch et al. (2021) did not take into consideration the concern about maintaining social ties. Our selected time period represents a few

months into the stages of quarantine and other protocols such as social distancing, which were active at the time. Thus, our dataset is reflective of well-formed opinions about such protocols.

Individuals in the 15-24 year age bracket represent the student population, which is affected more heavily by stressful life events (Wombe, 2003). These individuals face additional stressors such as time management, assignment deadlines, sleep deprivation, and relationship uncertainty (Wombe, 2003). Research by Monterio et al. (2014) indicates that younger individuals have lower coping capabilities and find it challenging to manage their social life along with their academic and personal life. Our findings align with this research, which is why we believe that 15-24 years olds struggle with balancing their life and the novel pandemic inflicted a greater burden on them with virtual studies. These additional responsibilities might exceed their coping capabilities, which might be the reason why they report having poor mental health when compared to older individuals that are settled and do not have to experience academic pressure.

Limitations and next steps

There are several limitations to this study. The first is a cross-sectional design which limits the effectiveness to draw conclusions due to both the outcome and the exposure being evaluated simultaneously. Another limitation of our study is our exclusion of missing data from the analysis, which could sway the findings if the information was critical. The reduced sample size lowers the statistical power of the study, reducing its applicability. Furthermore, another limitation of this study is the vagueness of the categorical variable ‘concern about maintaining social ties’. This variable had the options ‘Not at all,’ ‘Somewhat,’ ‘Very,’ and ‘Extremely.’ If someone’s concern level did not fit within these defined categories, their selection would not accurately depict their concern level. This subsequently reduces the accuracy of the study’s findings in regards to

relationships found between ‘concern about maintaining social ties during the COVID-19 pandemic’ and GASS/PLS.

Also, the findings of this study draw information from survey data, which can decrease the reliability of our study. This is because self-reported survey data has the potential to cause social desirability bias, over-reporting bias, and recollection problems. On top of that, the survey data utilized within this study pertained to a short collection period, from April 24th to May 11th, 2020. Due to this short time frame, the ability to make concrete conclusions and generalize the results to other populations is limited.

As for the next steps, future studies should incorporate a longer study duration in order to gain a more thorough analysis of the impacts of the COVID-19 pandemic on mental health. On top of that, the survey options should be increased for categorical variables, or a scalar means of measurement should be utilized. Also, future studies should broaden their study scope in order to study more provinces in Canada to gain a more comprehensive insight into the impact of the COVID-19 pandemic on the mental health of Canadians as a whole. This would also increase the sample size of the study population, which would increase the statistical power of the results. Furthermore, it would be informative to analyze additional variables such as socioeconomic status, which could potentially have an impact on the mental health of the Canadian population. Doing so would allow researchers to better understand the Canadian population in terms of their mental health and expand their knowledge to other countries as well.

Ultimately, one cannot be healthy without good mental health, so it should always be prioritized despite circumstantial differences.

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The Association of PPE Supply Restrictions in Canadian Female Nurses (Less Than 35 Years of Age) working since March 2020 and Perceived Mental Health during the COVID-19 Pandemic

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Introduction

In March 2020, the novel coronavirus SARS-CoV-2 (COVID-19) was declared a global pandemic affecting millions of people and quarantining the rest of the world (WHO, 2020b). This unprecedented situation has left health care workers (HCWs) on the frontline to keep up with the demands of patient care, requiring HCWs to work longer hours under stressful conditions. Nurses represent the largest proportion of HCWs in Canada and the group among the greatest risk of exposure to the virus (Gómez-Ochoa et al., 2021). The fear of exposure, isolation from family and friends, inadequate medical and personal protective equipment (PPE), lack of effective vaccines, and the loss of patients and colleagues contributes negatively to the self-reported mental health symptoms in nurses during the ongoing pandemic (Wu et al., 2020).

Mental Health in Healthcare Workers

According to the Canadian Nurses Association (2019), about 91% of regulated nurses were female, with the average age of nurses being between 35 to 50. It has been speculated that younger nurses are more likely to experience mental health illness compared to older adults because of a lack of experience both professionally and psychologically (Arnetz et al., 2020).

Nurses caring for patients with COVID-19 are at great risk for psychological distress (Wu et al., 2020). These psychological effects described as anxiety, depression, distress, and fear can compromise mental health and result in poorer functioning. A 2020 study demonstrates critical care nurses showing a high degree of psychological distress when providing direct care to COVID-19 patients during the initial phases of the pandemic (Crowe et al., 2021). Similarly, Havaei et al. (2021) observed a 10 to 15% increase of anxiety and depression among nurses in British Columbia, prior to, and during early and mid-phases of the pandemic. These emerging

studies suggest an increased prevalence of mental health problems since the start of the pandemic, however the results are limited to a small study population.

Personal Protective Equipment (PPE)

A major contributing factor to the psychological and mental burden faced by nurses is the shortage of PPE (WHO, 2020a). Throughout the pandemic, the government and health facilities have been struggling to secure PPE supplies such as masks, gloves, and gowns to HCWs amidst an ongoing shortage of critical supplies. This has led to many restrictions being placed on access to PPE. A study by Martin-Delgado et al. (2020) reported 13% of healthcare professionals had to supply their own PPE, obtained through personal means. In order to safely reuse PPE, many studies have shown that decontamination methods, such as oven decontamination or hydrogen peroxide vapor, are necessary to maintain the protective characteristics of certain PPE (Côrtes et al., 2021; Schwartz et al., 2020). Additionally, the extended use of PPE can lead to difficulty breathing and excessive sweating which can lead to adverse skin reactions, which was found to affect the work performance of about 70% of HCWs (Uthayakumar et al., 2021).

The lack of accessible PPE has presented more risk to the safety of HCWs, resulting in an unprecedented increased risk of poor mental health. Lai et al. (2020) conducted a cross-sectional study of 1257 HCWs treating COVID-19 patients in China and found that female nurses were more likely to experience anxiety, depression, and psychological distress due to working in high-risk situations. Another study by Arnetz et al. (2020) administered a questionnaire to 695 nurses in Michigan and found that nurses that lack access to adequate PPE are more likely to report symptoms of depression, anxiety, or post-traumatic stress disorder. Mediavilla et al. (2021) surveyed 2370 HCWs in Spain on the relation of access to protective equipment to mental health outcomes and found that 27% screened positive for depression and 74% for psychological

distress. However, the effect of restricted access to PPE on the mental health of Canadian nurses has not been investigated.

Study Rationale

Although many studies have identified mental health illness associated with the rapid spread of the COVID-19 pandemic, limited studies explore HCWs' access to adequate PPE and mental health outcomes. To address this knowledge gap, our study will primarily address whether there is a difference between the perceived mental health of Canadian female nurses under 35 years of age who experienced at least one restriction on the supply of PPE, compared to Canadian female nurses under 35 years of age who experienced no restrictions on supply of PPE. The secondary outcomes will investigate the following restrictions: nurses supplying their own PPE, nurses re-using their own PPE without decontamination, and nurses using PPE for an extended amount of time beyond the normal use on perceived mental health. Understanding this relationship will help to address the knowledge gaps and determine which population of HCWs have been disproportionately affected by the COVID-19 pandemic. This study aims to promote the mental well-being of nurses and provide insight on enforcing better healthcare policies and practices that are urgently required to alleviate the suboptimal work conditions of nurses who are at a greater risk for psychological distress during the COVID-19 pandemic.

Methods

Study Design and Database

The study design was cross-sectional, observing all variables at one point in time. Our study uses data from the "Impacts of COVID-19 on Health Care Workers: Infection Prevention and Control, 2020 [Canada]" database provided by Statistic Canada, retrieved from the Ontario Data Documentation, Extraction Service and Infrastructure (ODESI). The database was designed

to provide insight into the attitudes towards the accessibility of healthcare resources and protection of healthcare personnel. A crowdsourcing initiative was used to collect data which is a participatory method of collecting information through an online questionnaire starting November 24th, 2020 to December 13th, 2020. The questionnaire was openly advertised to recruit participants and made accessible through attachment links on the Statistics Canada website and social media posts or emailed directly to interested parties.

Study Participants

The original database included participants from both sexes, all ages, and different healthcare occupations across Canada. However, from the 18,139 HCWs that participated in the online questionnaire, the population of 1,670 included in the final database was targeted towards the specific demographic used to address our research question. A target population of female nurses less than 35 years of age were chosen as nurses were found to be at greater risk for psychological distress, and females were found to be disproportionately impacted by the pandemic. Those who were working before March 2020 were excluded, as our target population involves nurses working since the beginning of the pandemic. This study included participants recruited for the purpose of comparing the perceived mental health of female nurses with at least one restriction to PPE access to those with no restrictions to PPE access.

Study Outcomes

The primary findings of this study assessed the association between the condition or restriction on the supply of PPE and the perceived mental health of Canadian nurses under the age of 35 years working since March 2020. Nurses' response to the question: *"At any time in March 2020, were there any of the following conditions or restrictions on the supply of PPE at your primary job location? No conditions or restrictions on the supply of PPE"* was used to

create the derived variable: condition or restriction on supply of PPE - since March. Participants who answered "yes" to the question were categorized in the "no restriction" case in the derived variable, while participants who answered "no" were categorized in the "at least one restriction" case. Those who answered with "valid skip", "don't know", "refusal", and "not stated" remained the same in the derived variable. The secondary findings of this study investigated the association between specific restrictions or conditions on the supply of PPE: extended use, supplying own PPE, and re-use own PPE without decontamination on the perceived mental health of Canadian nurses under the age of 35 years working since March 2020. Participants were asked: *"At any time in March 2020, were there any of the following conditions or restrictions on the supply of PPE at your primary job location? Extended use of PPE beyond the normal use, needed to supply your own PPE, required to re-use PPE previously worn by you without decontamination."* Participants' responses were categorized as "yes", "no", "valid skip", "don't know", "refusal", and "not stated" for each condition or restriction. Participants responded to the following question to report their perceived mental health status: *"In general, how would you describe your mental health?".* The answers were categorized as "excellent", "very good", "good", "fair", "poor", "valid skip", "don't know", "refusal", and "not stated". Missing responses labeled "valid skip", "don't know", "refusal" and "not stated" in any of the aforementioned questions were deleted from the dataset and not included in the analysis. Perceived mental health responses were transformed from five responses to three. Answers labeled "very good" were combined with "excellent" while "fair" was combined with "good".

After examining the database, it was evident that more nurses reported having at least one restriction on the supply of PPE. Frontline nurses are at a greater risk of negative mental health outcomes directly due to the COVID- 19 pandemic, with the access of PPE being a major

challenge during the pandemic (Shaukat et al., 2020). As a result, the condition or restriction types were further investigated to determine whether there existed an association between supply on PPE and perceived mental health. Protecting the well-being of nurses is imperative to efficiently fighting outbreaks. Investigating both the primary and secondary study outcomes provide insight on the psychological distress faced by nurses to promote better mental health.

Additional Data Collection

Additional variables in our database were included to define the population of interest. This includes work status, job setting type, type of contact, formal training on PPE, and types of restrictions on supply of PPE which are categorical, nominal variables. The categorical, ordinal variable indicating the number of years worked as a nurse was also included.

Statistical Analysis

Differences between groups for both the primary and secondary outcomes were assessed using chi-square ($\chi 2$) tests since our database consisted entirely of categorical variables. Normality tests were not performed as there were no continuous variables in the dataset. The perceived mental health status were classified into three categories representing ordinal categorical variables. A chi-square test for a 2x5 contingency table was transformed into a 2x3 table as it was not possible to determine which proportions were similar or different, with one chi-squared significance value for the entire table. The perceived mental health status was transformed from five to three categories: very good and excellent status were grouped into a category labeled “excellent”, fair and good status were categorized as “good”, and poor status remained in a category labeled “poor”. The characteristics of the study population are highlighted in Table 1. This table includes the frequency and percentage of female nurses under 35 years of age (n=1670) who experienced one of the following five mental health statuses: “poor”, “fair”,

"good", "very good", and "excellent", and the impact of restrictions on access to PPE during the COVID-19 pandemic. The analysis was conducted using SPSS Statistics and figures were created using GraphPad Prism version 6. A p-value of <0.05 was used to measure the significance between groups, indicating a 5% probability that the null hypothesis (i.e. nurses' perceived mental health were not affected by the restriction of PPE) is true.

Results

Among the 18,139 HCWs included in the selected database, a total of 1670 female nurses were included in the analysis based on the aforementioned criteria. There was no missing data for any of the participants included. As seen in Table 1, there were a total of 1534 females in the "nurses that experienced at least one restriction to PPE" group and 136 females in the "nurses who experienced no restriction to PPE" group. There was a large difference in distribution between the different perceived mental health status groups, both within the same restriction to PPE group and between the two restrictions to PPE groups.

Referring to Table 1, 245 (16.0%) of female nurses who experienced at least one restriction on supply of PPE were found to have poor mental health, while 987 (64.3%) reported good mental health, and 302 (19.7%) reported excellent mental health. On the other hand, the female nurses who experienced no restrictions on supply of PPE were less likely to report poor mental health, as 58 (42.7%) of them had excellent mental health, 69 (50.8%) experienced good mental health, and only 9 (6.6%) reported poor mental health.

Table 1. Demographics of Canadian Female Nurses Assessing Impacts of Restrictions on Supply of PPE since March 2020 on Perceived Mental Health during the COVID-19 Pandemic (n=1670)

Variable	**Nurses who experienced at least one restriction to PPE (n=1534)**	**Nurses who experienced no restriction to PPE (n=136)**

Sex (% female)	91.9	8.1
Age (<35 years of age)	1534 (91.9)	136 (8.1)
Work Status		
Full-time	1147 (74.8)	96 (70.6)
Part-time	372 (24.3)	39 (28.7)
Not stated	15 (1.0)	1 (0.7)
Number of Years Worked as a Nurse		
Less than 10 years	1085 (70.7)	93 (68.4)
10- 19 years	137 (8.9)	13 (9.6)
20 or more years	0 (0.0)	0 (0.0)
Not stated	312 (20.3)	30 (22.1)
Job Setting Type		
Acute care	1261 (82.2)	90 (66.2)
Long-term care	132 (8.6)	25 (18.4)
Outpatient and ambulatory care	83 (5.4)	15 (11.0)
Community/home care	31 (2.0)	2 (1.5)
Congregate living	2 (0.1)	0 (0.0)
Other	18 (1.2)	2 (1.5)
Not Stated	7 (0.5)	2 (1.5)
Type of Contact		
Contact with suspected or confirmed cases of COVID-19	1197 (78.0)	93 (68.4)
Contact only with those not suspected of COVID-19 cases	314 (20.5)	39 (28.7)
No contact with others	8 (0.5)	3 (2.2)
Not Stated	15 (1.0)	1 (0.7)
Received Formal Training on PPE		
Yes	1337 (87.2)	120 (88.2)
No	192 (12.5)	14 (10.3)
Not stated	5 (0.3)	2 (1.5)
Type of Restriction on PPE:		
Need Permission		
Yes	1278 (83.3)	0 (0.0)
No	256 (16.7)	136 (100.0)
Supply own PPE		
Yes	272 (17.7)	0 (0.0)
No	1262 (82.3)	136 (100.0)
Extended use		
Yes	1177 (76.7)	0 (0.0)
No	357 (23.3)	136 (100.0)
Re-use own PPE without decontamination		

Yes	852 (55.5)	0 (0.0)
No	682 (44.5)	136 (100.0)
Use expired PPE		
Yes	294 (19.2)	0 (0.0)
No	1240 (80.8)	136 (100.0)
Use wrong type of PPE		
Yes	381 (24.8)	0 (0.0)
No	1153 (75.2)	136 (100.0)
Perceived mental health		
Excellent	**302 (19.7)**	**58 (42.7)**
Excellent	55 (3.6)	14 (10.3)
Very good	247 (16.1)	44 (32.4)
Good	**987 (64.3)**	**69 (50.8)**
Good	467 (30.4)	44 (32.4)
Fair	520 (33.9)	25 (18.4)
Poor	**245 (16.0)**	**9 (6.6)**
Poor	245 (16.0)	9 (6.6)

Data values are presented as the number (%) of participants.

Figure 1 examines our primary research analysis for perceived mental health status between participants who experienced at least one restriction on the supply of PPE (n=1534) since March 2020 and participants who experienced no restrictions (n=136). The Pearson Chi-square significance value was 4.351, with a p-value of 0.114. Since this value was greater than 0.05, there was no significant difference in the proportions of female nurses between groups on perceived mental health with individuals having at least one or no restrictions on supply of PPE.

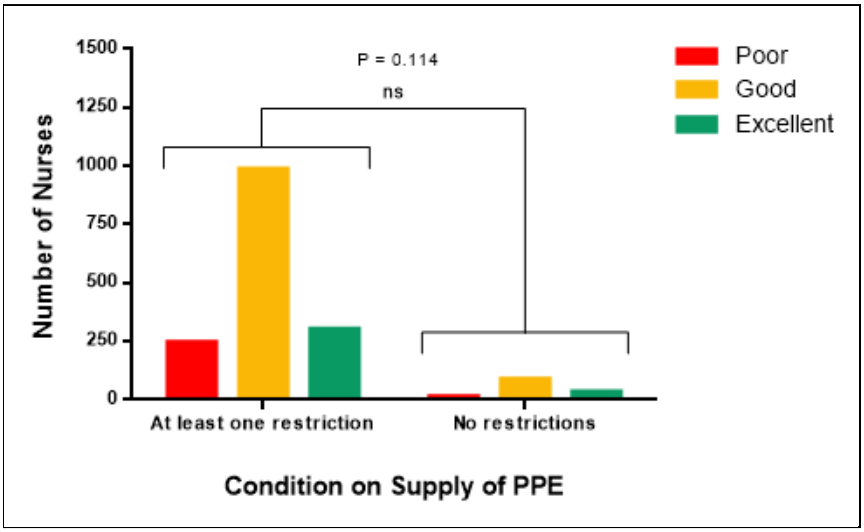

Figure 1: Perceived mental health status in female Canadian nurses under 35 years of age who experienced at least one restriction or no restriction on supply of PPE since March 2020. X^2=4.351, df=2, p=0.114. Note: *p=0.05. N=1670.

Figure 2 explores the perceived mental health status of female nurses for those who experienced at least one restriction on the supply of PPE since March 2020, focusing on three specific restriction groups. Chi-squared analyses were conducted to determine the between-group differences in individuals who experienced a restriction and those that did not experience a restriction. There were significant differences in proportions between female nurses restricted to supplying their own PPE and those that do not need to supply their own PPE with regards to perceived mental health (p=0.009). Similarly, there was a difference in proportions between groups in the restriction of reusing their own PPE without decontamination, as a p-value with <0.001 is less than 0.05 and is deemed significant. In contrast, there was no difference in the proportions of perceived mental health status between female nurses restricted to using PPE for an extended period of time and those that do not need to use PPE for an extended period of time (p=0.298).

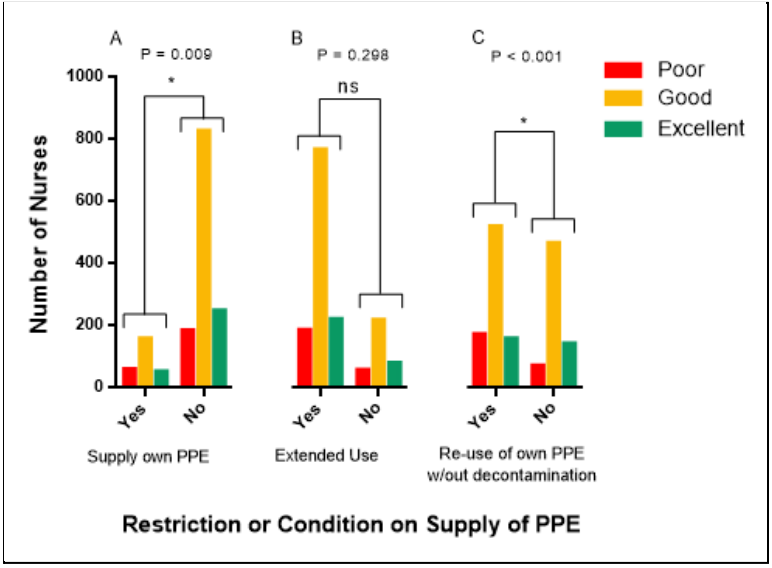

Figure 2: Perceived mental health status in female Canadian nurses under 35 years of age based on at least one specific restriction on the supply of PPE including (A) supply own PPE, X^2=9.458, df=2, p=0.009; (B) extended use, X^2=2.423, df=2, p=0.298; and (C) re-use of own PPE without decontamination, X^2=26.820, df=2, p<0.001. Note: *p<0.05. N=1534.

Discussion

This study investigates the association of PPE supply restrictions in Canadian nurses under the age of 35 years working since March 2020 on perceived mental health during the COVID-19 pandemic. The results in the primary analysis show no significant difference (p=0.114) in the proportion of female nurses aged less than 35 years between those that experienced at least one restriction compared to those that experienced no restrictions on the supply of PPE on perceived mental health. Contrasting to previous studies, which found that US nurses lacking adequate access to PPE had higher reports of mental health symptoms such as depression, anxiety, and post- traumatic stress disorder (Arnetz et al., 2020). One possible explanation for this finding is that there are other factors that may more strongly influence the perceived mental health of nurses instead of experiencing at least one restriction on the supply of PPE or no restriction on the supply of PPE. Poor social support, burnout, and self- efficacy were all associated with more negative mental health outcomes in nurses (Spoorthy et al., 2020).

The results in the secondary analysis show that there was a significant difference between the proportion of nurses between two restriction groups: nurses that had to supply their own PPE compared to those that did not, and nurses that had to re- use their own PPE without decontamination compared to those that did not on perceived mental health (p=0.009 and p<0.001, respectively). There was no significant difference (p=0.298) in the proportions of

nurses between those that were restricted to using PPE for an extended period of time compared to those that did not need to use PPE for an extended period of time.

Consistent with the present literature, the significant results seen in nurses that have to supply their own PPE and the impact on their mental health was expected. The findings may be due to the financial burdens nurses face with purchasing their own PPE. The shortage of PPE has caused nurses to procure their own PPE through the open market incurring a high cost to nurses and increasing financial stress (Moradi et al., 2021). Lower socioeconomic status is associated with lower mental health outcomes among HCWs which may have a compounding effect in nurses supplying and purchasing their own PPE (Agberotimi et al., 2020). Additionally, a prominent theme was the desire for an increase in pay or other benefits for HCWs during the pandemic with an inequity in workload and compensation for nurses.

The non-significant results seen in nurses restricted to extended use of PPE beyond the normal use was not expected in comparison to previously existing literature. Extended use of PPE is commonly associated with dermatologic problems, specifically skin lesions, nasal bridge scarring, acne, dry skin, and rashes (Barnawi et al., 2021). A study found that nurses' mental health outcomes were positively correlated with dermatological complications (Hu et al., 2020). The worse the dermatological problems, the higher the reported burnout and depression levels (Hu et al., 2020). This non-significant result may be due to suggestions made by personnel in hospitals to enforce mandatory breaks, ensuring that female nurses have adequate hydration, and that the working environment is maintained at an optimal temperature and is well ventilated.

Finally, compared to previous studies, the significant results seen in nurses that were restricted to re- using their own PPE without decontamination was expected. A study by Kea et al. (2020) found that the re-use of PPE increased negative mental health outcomes in HCWs. The

most commonly re-used PPE amongst HCWs was N95 masks which are designed to be single-use and can become contaminated with extended use (Kea et al., 2020). The shortage of PPE has forced nurses to go against occupational safety measures and reuse masks without decontamination. As a result, the reuse of PPE designed to be disposable has increased fears and anxieties in HCWs with exposing family members (Kea et al., 2020; Lake et al., 2021). Thus, the association between the re-use of PPE without decontamination and perceived mental health may be intensified by these fears and anxieties.

Strengths & Limitations

A strength of our study is the novelty of examining the association between specific restrictions on the supply of PPE on perceived mental health in nurses. During the first few months of the pandemic, there were many unknowns about the novel infectious disease. Nurses were on the frontlines, caring for sick patients while putting themselves at high risk for exposure. Our novel research hopes to emphasize the need for supporting nurses who have been working tirelessly throughout the pandemic.

However, it is important to note that several limitations may have impacted our results. The data collected by Statistics Canada was through a crowdsourcing questionnaire, where participants received an electronic questionnaire via a link and chose to participate based on interest. The crowdsourcing method of obtaining data is a non-probabilistic approach and does not involve the random selection of participants, limiting its generalizability to a larger population of HCWs. Another limitation of our study is the subjective nature of the questions and the nominal answer categories. The categories; Excellent, Very good, Good, Fair, and Poor, as indicators of mental health are subject to an individual's interpretation. Additionally, participants who answered yes to at least one restriction on the supply of PPE do not all

experience the same number of restrictions. Some restrictions may have a stronger or weaker association with perceived mental health and those associations cannot be concluded. Furthermore, nurses who have been experiencing a lower mental health status before March 2020 could have responded to the questions of the lack of access to PPE differently, creating an opposite causal direction. The subjective nature of the questionnaire limits its reliability and validity of the study.

Implications & Future Directions

Despite these limitations, our study gives rise to important and practical implications. Protecting the mental well-being of nurses who have been working throughout the COVID-19 pandemic is an important part of public health measures. Both the federal and provincial government should take the necessary precautions to ensure that an adequate amount of PPE is stocked at all times so that nurses have access to proper equipment. This will help contain the spread of COVID-19 and allow nurses to feel safe at their workplace.

Although our findings were not significant, our study still raises important questions to be explored in the future. Our data was collected almost 8 months after the initial lockdown in Canada, therefore, an updated questionnaire on the mental-being and the access of PPE should be conducted to better understand the long-term effects of the pandemic on the mental health of nurses. Further replication on the correlation between the access to PPE and the effect on the mental well-being of nurses should be studied as there are many conflicting reports. After over two years of the pandemic, the psychological and physical pressure may start to wear on health care professionals. Overall, our study points to the need to monitor the long-term mental strain of the pandemic, identifying high risk factors, such as inadequate access to PPE, can help mitigate mental disorders and provide a safe workplace.

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Analyzing food insecurity and generalized anxiety severity among male and female Canadian adults aged 25-34 during the COVID-19 pandemic: An observational cross-sectional study

Assignment 2

LIFESCI 3LL3

Group 6

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Introduction

Food insecurity is defined as limited or uncertain access to sufficient and healthy food (Wolfson et al., 2021). Based on these criteria many Canadians can, unfortunately, classify themselves as having some level of food insecurity. The current pandemic has put additional stress on this issue. The COVID-19 pandemic started in early 2020 due to a virus, SARS-CoV-2. This disease is known to cause severe acute respiratory syndrome and can be fatal. In Canada, the pandemic caused massive lockdowns that lasted for extended periods of time, with the implementation of physical distancing measures and the prohibition of social gatherings (Abba-Aji et al., 2020). Since the start of the COVID-19 pandemic, there have been many reports of a significant exacerbation of this food insecurity issue due to various factors such as financial difficulties, or inaccessibility to community resources (i.e., food banks and other support services etc.) (Wolfson et al., 2021). Research has also shown that food insecure individuals are also more likely to report higher levels of psychological distress and worse mental health outcomes as compared to those who are food secure (Wolfson et al., 2021). There is a supposed bidirectional relationship between the two that various researchers have begun to analyze.

In May 2020, early in the pandemic, 14.6% of Canadians were estimated to live in food insecure households, with 9.3% of Canadians having to access free food or meals from food banks or the community (Statistics Canada, 2020a). This was a large increase from 2018 where only 8.8% of Canadian household experienced food insecurity (Statistics Canada, 2020b). In addition to food insecurity caused by unemployment in Canada, there are also food insecure individuals who rely on the Canada's social assistance programs for living expenses. According to Statistics Canada in 2012, 70% of households that relied on social assistance as a source of income were food insecure, with the food bank providing food to half of these individuals (Tarasuk et al., 2014).

With the additional stress and progression of the recent COVID-19 pandemic, there are evidently more households today that are and will continue to be food insecure. Therefore, beyond past research, the current pandemic can worsen the mental health symptoms of individuals that experience food insecurity.

In understanding the food insecurity issue, gender differences also often come into question. Research has shown that gender does indeed play a role in the demographic breakdown of those affected by food insecurities, with females and female-led households being more affected (Dasgupta & Robinson, 2022). This subject was also analyzed by Elgar et al. (2021) who concluded that symptoms of depression are more common in females that experience food insecurity than males. There is, however, a gap in knowledge since this study does not look at the difference between the sexes and its correlation with anxiety.

Past research has concluded only limited information about food insecurity, mental health, and gender disparities collectively, and more exploration is needed. The correlation between these variables will be addressed in this paper to provide more information to address this knowledge gap. Although the study done by Gao et al. (2020) did discuss the mental health of Canadians with food insecurity during the pandemic, it does not compare the difference between female and males. The study conducted by Tarasuk et al. (2018) examined the relationship between household food insecurity and the utilization of health services for mental health reasons. But while this study did examine the impact of food insecurity on severity of mental health problems, this was reported as the secondary outcome. Another study found that females were more affected by food insecurity than their male counterparts (Dasgupta & Robinson, 2022). This research paper, however, never investigated how food insecurity could disproportionately affect the mental health of these females compared to the males. This is something that we wish to focus on within this paper by seeing how

food insecurity is correlated to females self-reported level of generalized anxiety. It is also important to note that the majority of studies focus on overall mental health rather than specifically generalized anxiety. In addition, there are very few studies that have looked at the age group of 25-34 specifically in terms of food insecurity, anxiety, and the pandemic. A study done by Fang et al. (2021) did aim to explore how food insecurity was associated with mental health during the COVID-19 pandemic, however this study looked at three age groups: 18-39 years, 40-59 years, and 60+ years, and did not focus on how each age group could be at risk for or impacted by food insecurity. It should also be noted that many of these studies are largely based in the United States of America, and we would like to explore these relationships in a Canadian population. While quite a few recent studies have looked at the increase in reports of food insecurity during the pandemic or looked at the gender differences in the issue, we hope to reflect on the issue in a more combined and inclusive manner, which is why we decided to focus on individuals that are between the ages of 25 and 34. As such we hope this paper allows us to touch on the triad relationship between food insecurity, gender, and generalized anxiety during the pandemic. Specifically, exploring if self-reported food insecurity during the pandemic is correlated with self-reported generalized anxiety severity in Canadian men aged 25 – 34 years as compared to Canadian women of the same age group?

Methods

Study Design and Database

The Canadian Perspective Survey Series (CPSS) was a set of 20 observational and cross-sectional online surveys conducted to examine the behaviours of Canadians. The CPPS was created with the goal of collecting demographic and behavioural data at a national level, and the information collected would be used in creating policies. One of the surveys conducted was the

"Canadian Perspective Survey Series 2, 2020: Monitoring the Effects of COVID-19" (CPSS2 – COVID 19), which collected information on how the COVID-19 pandemic impacted the food security, mental health, and employment status of Canadians in 2020. A selected sample of Canadians were contacted with a letter describing the CPSS. Interested individuals could register online. All registered participants were sent a link to the CPSS2 – COVID 19 survey which they could fill out. The surveying period began on May 4th, 2020 and concluded on May 10th, 2020. Data collected from respondents was compiled into a database for public use.

Study Participants

For this study, we included male and female participants who voluntarily completed the survey from the Canadian Perspective Survey Series 2, 2020: Monitoring the Effects of COVID-19. The study included participants that were between the ages of 25 and 34, who answered questions regarding their demographic, lifestyle, and mental health during the COVID-19 pandemic. We focused on a population of somewhat middle-aged individuals, as many studies investigate younger or older populations, with almost no studies catered towards adults. The demographic of this study included individuals of all education levels, employment status and household size. To condense the dataset further, we excluded participants who did not answer all the questions of the survey that were relevant to our study.

Study Outcomes

As mentioned above for all the outcomes, the data was collected using self-administered surveys. In terms of the primary outcome the question that was specifically asked was: "What is the Severity of your Generalized Anxiety symptoms"? With the options being categorized in our dataset in an ordinal manner from 0=no symptoms, 1=minimal symptoms, 2=mild symptoms, 3=moderate symptoms, and 4=severe symptoms. By using this simple classification, we allowed

participants to qualify their symptoms in a more qualitative manner that really focused on the severity. We decided to use the quite accurate and reliable Generalized Anxiety Disorder scale (GAD-7) to help us with this. While scales can be burdensome for participants due to their length and extensiveness, the GAD-7 was ideal for our purposes (Spitzer et al., 2006). The questions we asked from the GAD-7 were easy to understand and allowed for easy classification into our above categories. This scale is also quite reputable in the literature and has been around for a long time (Spitzer et al.,2006). Therefore, providing our research team the assurance that the question asked would provide valid results on anxiety statuses for the sample.

For our second outcome, the question we asked the participants was: "How would you label your current mental health status"? The responses for this question were also put into our dataset ordinally from worse to increasingly better mental health reports, with 0=poor, 1=fair, 2=good, 3=very good, and 4=excellent. Mental health is very subjective, and we wanted to give the participants the room to self-assess and appropriately label themselves. This would allow them to consider their general overall well-being. We used a single-item measure of self-rated mental health (SRMH) for this question. SRMHs are being used extensively in health research and population health surveys, and according to review studies have been found to be quite effective at assessing mental health (Ahmad et al.,2014). The purpose of having this second outcome was to scope our sample for their mental health status to provide additional support to our findings. Understanding overall mental health statuses was essential to reliability—as anxiety is of course a mental health disorder.

Our third outcome of interest for this study was asked as: "How often in the last two weeks would you say you felt nervous, anxious, or on edge?". The responses to this question were classified nominally in our data set with 0=not at all, 1=several days, 2=more than half the

days, and 3=nearly every day. This allowed our participants to report these feelings more quantitatively, so that we could get a clear estimate of duration. By getting a response for a degree of feelings (i.e., nervous, anxious, or on edge) we were able to get a more comprehensive answer, than if we had just asked if the participants had felt anxious. As the literature has shown, oftentimes individuals have a challenging time classifying anxiety, and so this method of providing synonym-like options in the question gave people a benchmark for their feelings (Evans et al.,2005). While we could not diagnose any of these individuals with an anxiety disorder from this question (nor did we need to), we used the data from this outcome to get an idea of how people were feeling during the COVID-19 pandemic and get a sense of any anxiety-like feelings in our population. Thus, providing another layer of reliability to our findings.

Additional Data Collection

In addition to our primary variables, we included other variables within our code book and Table I to provide demographic information about our population. Variables related to either anxiety or food insecurity were included. We were specifically investigating the difference between males and females within the age range 25-34 year, thus, both sex and age are included in our primary data collection. We included the employment status, household size, and level of education. These are important factors that may have a large effect on food insecurity. Finally, since our study is focused on the COVID-19 pandemic, we included a variable addressing how the pandemic has impacted the participants ability to meet their financial obligations or essential needs during this time.

Statistical Analysis

All the statistical analyses completed for this research paper was done with the SPSS software. Table I contains the relevant demographic data to the individuals that we are focusing

on in our study. Since all the variables in the table are categorical data, the frequency and precents were calculated. With the descriptive statistics we were able to determine the percentage of different responses for each variable split by biological sex.

For this study, we did two statistical analyses, the Spearman's Rho correlation test and a Chi-square analysis. To test the relationship between our variables, we used a correlation test. The Spearman's Rho correlation test was used because only ordinal variables were used in this study. For the Spearman's Rho Analysis, correlations with a r^2 value of 0.1 or higher are considered significant. We also completed a Chi-square test to see if the difference observed in our categorical variables are due to a relationship between them. For this test, the p value used for significance is 0.05.

Results

The Canadian Perspective Survey Series 2, 2020 – Monitoring the Effects of COVID-19 survey included the responses of 4600 participants that were the ages of 15 or older. For this study, we used 601 (13%) of these participants to analyze and determine the association between food security and severity of generalized anxiety levels of male and female participants that were between 25 and 34 years of age. We accounted for missing data by excluding participants who were out of this age group and those who did not identify as male or female. In addition, we excluded participants who did not complete the entirety of the survey, particularly those who disregarded the survey questions that were relevant to answer the research question. These included questions about an individual's food security level, severity of generalized anxiety, perceived mental health, feelings of nervousness and on edge, as well as other demographic information.

In conducting the various analyses for our three outcomes we present the following resultants. In terms of food insecurity differences based on gender, more women are reported to be food insecure when compared to their male counterparts. While about the same number of men and women are food secure at 81.3% and 82.5% respectively, 1.7% of women are severely food insecure, and 4.1% of men are. For the categories of marginally and moderately food insecure, similar gender differences can be noted to the one discussed for severely food insecure individuals, with men being less insecure than women. This data can be found in the information presented in Table I and is also presented visually in Figure 1a. On the same note of gender, our Table I shows the differences between men and women in terms of their severity of generalized anxiety reports. According to the data, 18.3% of men report having no symptoms while 10.7% of women report having no symptom, and 35.4% of men versus 29.9% of women have minimal symptoms. As we move onto mild and moderate symptoms, the percentage of women with these types of symptoms increases. And for severe symptoms, 8.7% of women report severe anxiety symptoms while 4.5% of men report the same. This can be examined further visually in Figure 1b and 1c, which show the anxiety symptom distributions for the two sexes as they relate to food insecurity status. These graphs and all other bar graphs mentioned were developed with 95% Confidence intervals included.

Table I. Baseline variables of men and women recorded in CPSS - Canadian Perspective Survey Series 2: Monitoring the Effects of COVID-19 (N = 601).

Variable	Men *N (%)*	Women *N (%)*
Food Insecurity		
Food secure	200 (81.3)	293 (82.5)
Marginally food insecure	24 (9.8)	25 (7.0)
Moderately food insecure	12 (4.9)	31 (8.7)
Severely food insecure	10 (4.1)	6 (1.7)
Employment Status		
Employed and at work at least part of the reference week	184 (74.7)	230 (64.8)

Employed but absent from work for reasons not related to COVID-19	5 (2.0)	26 (7.3)
Employed but absent from work due to COVID-19	21 (8.5)	34 (9.6)
Not employed	36 (14.6)	65 (18.3)
Education Level		
Less than high school diploma or its equivalent	7 (2.8)	12 (3.4)
High school diploma or high school equivalency certificate	34 (13.8)	44 (12.4)
Trade certificate or diploma	28 (11.4)	12 (3.4)
College/CEGEP/other non-university certificate or diploma	56 (22.8)	79 (22.3)
University certificate or diploma below the bachelor's level	6 (2.4)	6 (1.7)
Bachelor's degree	76 (30.9)	130 (36.6)
University certificate, diploma, degree above the BA level	39 (15.9)	72 (20.3)
Household Size		
1	84 (34.1)	107 (30.1)
2	137 (55.7)	215 (60.6)
3	19 (7.7)	20 (5.6)
4	4 (1.6)	7 (2.0)
5 and more	2 (0.8)	6 (1.7)
COVID-19 Impact Ability to Meet Financial Obligations or Essential Needs		
Major impact	26 (10.6)	23 (6.5)
Moderate impact	39 (15.8)	44 (12.4)
Minor impact	54 (22.0)	73 (20.6)
No impact	105 (42.7)	178 (50.1)
Too soon to tell	22 (8.9)	37 (10.4)
Perceived Mental Health		
Poor	10 (4.1)	25 (7.0)
Fair	51 (20.7)	88 (24.8)
Good	75 (30.5)	142 (40.0)
Very good	69 (28.0)	66 (18.6)
Excellent	41 (16.7)	34 (9.6)
Feeling Nervous, On Edge or Anxious – Frequency in the last 2 weeks		
Not at all	90 (36.6)	75 (21.1)
Several days	112 (45.5)	183 (51.5)
More than half the days	28 (11.4)	56 (15.8)
Nearly every day	16 (6.5)	41 (11.5)
Severity of Generalized Anxiety		
No symptoms	45 (18.3)	38 (10.7)
Minimal symptoms	87 (35.4)	106 (29.9)
Mild symptoms	80 (32.5)	124 (34.9)

Moderate symptoms	23 (9.3)	56 (15.8)
Severe symptoms	11 (4.5)	31 (8.7)

Data is presented as number (%) of participants unless otherwise stated.

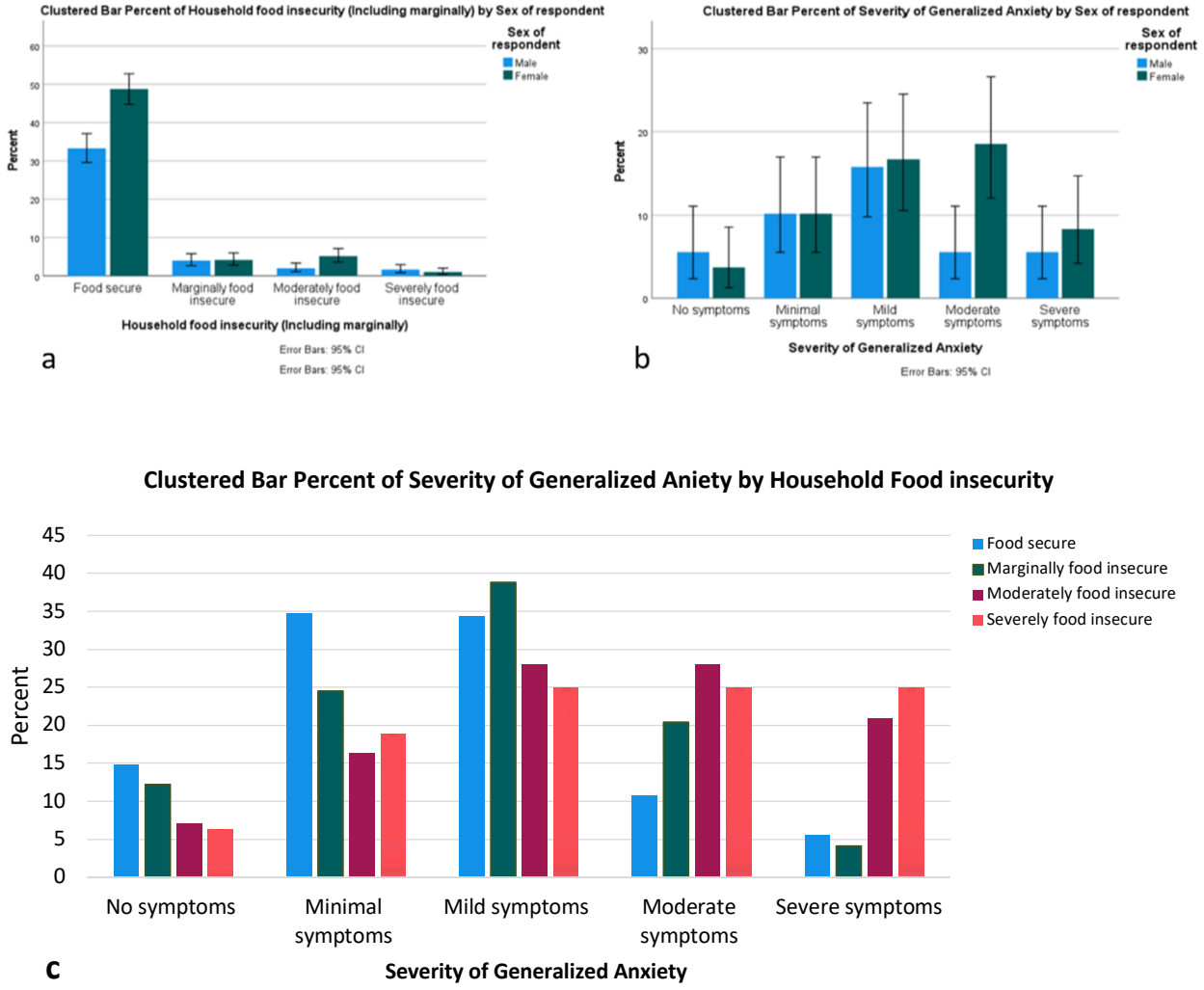

Figure 1. (a) This graph represents the percentage of the population within each level of food security (N = 601). **(b)** This figure represents the distribution of both sexes based on there leave of self reported anxiety symptoms. Only individuals with some level of food insecurity were included (N = 108). **(c)** Represented in this graph is the percent of each household food insecurity group spread over the severity of generalized anxiety (N =601).

Furthermore, as seen in the conducted Chi Square test (Table II) that was done to look at the association between generalized anxiety severity and food security, there is no relationship between the two variables for males. This is indicated by a P value of 0.142. However, for

females there is a significant relationship between the two aforementioned variables denoted by a P value less than 0.001.

Table II. This table displays the results from the Chi-Square test. Shown here are the significance values for the relationship between the independent variable of household food insecurity and the dependent variable of severity of generalized anxiety for males (n=246) and females (n=355) aged 24-35 years (N=601). For this test, the degree of freedom was 12 and it had a critical value of 21.026.

Sex of Respondent	**Chi-Square value (df =12)**	**P - value**
Male	17.209	0.142
Female	36.556	<0.001

In terms of the Spearman rho correlations (Table III) that were done the results show a small positive correlation between increasing household food insecurity and severity of generalized anxiety, with a correlation coefficient of 0.200. The r^2 value is 0.04. A correlation coefficient of –0.081 was found for household food insecurity and perceived mental health, indicating a small negative correlation, and it had a r^2 value of 0.006561. Household food insecurity and the frequency of feeling nervous, anxious, and on edge had a correlation coefficient of 0.108 indicating a small positive correlation, and r^2 value of 0.011664.

Table III. This table displays the results of the Spearman's Rho correlation test. Shown here are the correlations between the independent variable, household food insecurity, and the dependent variables (N =601).

	Household Food Insecurity
Severity of Generalized Anxiety	0.200
Perceived mental health	-0.081
Feeling nervous, anxious or on edge – Freq last 2 weeks	0.108

Discussion

With regards to the statistical analyses that were completed, the findings suggest that females tend to be more food insecure and have more symptoms of generalized anxiety than males. Females are more marginally and moderately food insecure compared to males, even if

there are more females than males that report to be food secure. Additionally, females reported more moderate and severe symptoms of generalized anxiety than males.

The Chi Square analysis indicates that the relationship between food insecurity and symptoms of generalized anxiety are insignificant for males and significant for females, as the values of 0.142 and <0.001 are respectively more and less than the P-value of 0.05.

The Spearman Rho's Correlation test indicate that there is a small positive correlation between food insecurity levels and severity of generalized anxiety, and food insecurity levels and feelings of nervous, anxious or on edge in the last two weeks. Therefore, as food insecurity levels increase, there is an increase in reported generalized severity anxiety symptoms and feelings of nervous, anxiety and on edge. Furthermore, there is a small negative correlation between food insecurity levels and perceived mental health, which indicates that as there is an increase in food insecurity levels, perceived mental health worsens. Although there were small correlations present in this analysis, these results can be deemed insignificant, according to Spearman's statistical measures, as the r^2 correlation coefficient was less than 0.1.

Overall, though the information we present in this study is quite relevant in that many other researchers have shown interest in similar topics. One study of note used the same data set our team did and looked at the relationship between mental health and food insecurity during the COVID-19 pandemic (Gilmour & Polsky, 2020). This is quite similar to our research question, yet we approached different knowledge gaps. While our study looked particularly at the differences in food insecurity status between genders in the age group of 25-34 as they related to Generalized Anxiety symptoms, this study looked to identify the relationship between general mental wellbeing in the entire sample (McLean et al., 2011). Like our study, they found that those most likely to be food insecure were young men. However, our results differ in that our

data notes that women who are food insecure report a higher prevalence of anxiety and have poorer mental health, not men. We believe that the fact that anxiety is more prevalent among women combined with the fact that the entire sample/a wider age range was used in this case, as the reasons for these differences. But again, our correlation results were insignificant, which can also explain these differences. Another study done by Fang et al. (2021) surveyed 2714 low-income Americans in 2020, and conducted an odds ratio analysis, finding a positive association between food insecurity and anxiety scores. Our study also found a small positive association between increasing food insecurity and higher generalized anxiety severity scores; however, it was insignificant.

Another study to note was one done in Bangladesh during the COVID-19 pandemic looking at similar topics. Using the Perceived Stress Scale (PSS), this study found that women in Bangladesh were more likely to report an increase of stress, followed by worsening mental health as their food security status declined. This is on par with our research, and highlights a cross-cultural component to our findings, that could be worth exploring further (Hasnain & Islam, 2021). Furthermore, one other study looked at anxiety and psychological symptoms in male and female adults aged 60 and above living in Mexico during the COVID-19 pandemic (González-González et al., 2020). Data was collected using a demographic questionnaire asking for information such as sex, age, education, occupation, and medical issues (González-González et al., 2020). Results showed that the women who had greater concerns regarding the COVID-19 pandemic had a higher prevalence of depression and anxiety (González-González et al., 2020). The findings of this study and our study share similarities, as both found that women presented with higher anxiety than men during the pandemic, however our study does focus on a population in a different country and age group.

Since this is a survey-based study there are some limitations to the findings. The variables that we constructed our hypothesis around, food insecurity and generalized anxiety severity, were both self-reported response-based questions. This can create a problem as it allows some participants to report false claims or result in some participants not having a full understanding of what the question is asking. For example, an individual may not know what food insecurity is defined as, and falsely report being food insecure when they are not. Another limitation involves the chi-square analysis, as we used two variables that had more than two categories. This can pose a problem, as it is difficult to identify which specific categories are significant based on the one test.

As future directions and next steps, it would be best to modify the survey to account for the biases involving food security and severity of generalized anxiety levels. Researchers can create a set of guidelines that outlines what entails being not, mildly, moderately, marginally, and severely food insecure and anxious, based on information provided by professionals who have studied this topic. This would help study participants get a sense of how they are feeling, resulting in clear, more accurate survey answers. In addition, there could be more studies that are done regarding this topic to determine which categories are most associated with each other and to identify main trends using other statistical analyses. This study can also be completed again using different surveys and datasets to determine if household food insecurity does have a significant correlation with generalized anxiety severity, perceived mental health statuses and frequency of feeling nervous. Repeating this study will provide more information, determining if there are any significant correlations among variables and understanding on how food insecurity can impact mental health.

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The Weak Correlation Between Bullying and Vaping Behaviour Among Grade 7 Males in Canada: An Observational Cross-sectional Study

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Introduction

Substance use in adolescents has increased dramatically in recent years and continues to increase as a result of various social factors and the evolution of illicit drugs (Kulak & Griswold, 2019). There is little research surrounding vaping in middle schools as the highest prevalence of vaping in Canada is between ages 15-24 which excludes grade 7 students (Government of Canada, 2021). Fischer et al. (2019) suggest that social influences, such as bullying may play a role in the initiation of drug use, especially in school settings. Though bullying is present in both genders, research indicates a higher number of aggressive incidents, violence, and insults involving boys than girls, resulting in more male victims (Silva et al., 2013). There is a well-established correlation between bullying, victimization, and a higher risk of substance use in literature. Victims of bullying are at a higher risk of lifetime alcohol consumption and weekly cigarette smoking than individuals who have not been bullied (Hansen et al., 2021). Nicotine is a highly addictive substance that has many negative side effects. Children are more susceptible to these side effects as it can alter their brain development (*Talking with Your Teen about Vaping*, 2020). Notably, a drastic increase in e-cigarette use has resulted in increased advertising directed towards adolescents. Adolescence is a key transition in human development, where juveniles tend to seek a sense of self-identification by reward- and sensation-seeking behaviors (Steinberg et al., 2008; Harden and Tucker-Drob, 2011). Hence, females generally mature psychologically faster than males during the adolescent stage, and the prolonged developing process conveys the significant emotional swiftness caused by the increased impulsive reward-seeking behaviors in males (Tyborowska et al., 2016). This in turn supports the idea that males have an overall higher dependence on substance use than females (Cotto et al., 2010), in which males are less likely to

consider the negative consequences of action due to neurological and socio-cultural differences by gender (Fausto-Sterling, 2012).

Not only the divergent maturation rate but there is also a considerable possibility that peer relationships can act as a primary stressor on adolescent negative behavior. According to Allen and Loeb (2015), adolescents achieve social and mental well-being by building strong peer relationships with their peers; more specifically, they are often rewarded by peer norms in early adolescence (Allen et al., 2006; Chango et al., 2015). Yet, there is often a dilemma within it which leads to a rise in negative acts and substance use: juveniles might fail to create a flexible tension between their desire and the need to build bonds with peers (Allen and Loeb, 2015). Therefore, peer interactions play a prominent role in adolescents' ability to facilitate peer tensions.

Though substance use has been highly observed in high school populations, there is a lack of research on social influences surrounding substance use in early adolescence (11-13 years) (Fisher et al., 2019). Research finds that vaping is much more common in high school with a 1:5 ratio than 1:20 in middle schools (Wang, 2020). Most research such as the study done by Kulak & Griswold (2019) analyzed vaping over 30 days in high school students but fails to acknowledge middle school. A recent study by Klinck et al. (2020) made observations between victimization and substance use by gender. However, e-cigarette use was not considered in the study and they only focused specifically on appearance-related teasing which highlights the need for a more all-encompassing approach to this topic. Additionally, a lack of studies on vaping over time makes it difficult to determine the severity of long-term side effects (Fiani et al., 2020). However, vaping can cause chronic obstructive pulmonary disease (COPD), asthma, lung cancer, and acute lung injury (American Lung Association, 2020). The increase in hospitalizations due

to vaping and lung issues over the last several years proves the need for further research (Fiani et al., 2020).

Moreover, there is a limited amount of research correlating the effects of bullying and vaping in young children (Hansen et al., 2021). One cross-sectional study aimed to identify the association between bullying and the use of e-cigarettes, however, they could not conclude a causal relationship between the two (Hansen et al., 2021). A longitudinal study would be needed to further investigate the temporal sequence between these two components (Hansen et al., 2021). Another concern that the literature fails to identify is the psychological impact bullying has on elementary school children which may contribute to the peer pressure associated with vaping. Many students identified wanting to vape to fit in and be seen as popular and cool (Park et al., 2019). However, the literature does not identify how strong the correlation between bullying and vaping is in regard to peer pressure from others or if it is a causational relationship. In order to fill these knowledge gaps, the question remains: primarily, over a span of 30 days, is there a difference between vaping frequency in grade 7 males who report getting bullied compared to grade 7 males who do not report getting bullied across all ten Canadian provinces? Additionally, among the portion of grade 7 Canadian males who report vaping, does the presence or absence of nicotine when vaping correlate with bullying in comparison to those who do not get bullied?

Methods

Study Design and Participants

An observational cross-sectional study was performed based on data obtained from the 2018-2019 Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS; formerly the Youth

Smoking Survey), conducted by the Propel Center for Population Health Impact in partnership with Health Canada at the University of Waterloo. A paper questionnaire on student tobacco use, alcohol consumption, drug use, bullying, and sleep-related behaviors was delivered to 116 school boards in all 10 Canadian provinces. A total of 442 schools (private, public, and Catholic) participated in the survey, in which approximately 84% of students participated with passive permission and 16% of them participated with active permission (excluding New Brunswick). The survey, available in English and French, collected information on bullying and substance use from a sample of 62,850 students enrolled in grades 7 to 12 (secondary I to V in Quebec) from October 2018 to June 2019. Notably, students from Yukon, Northwest Territories, and Nunavut; students from special schools (i.e. schools for visually impaired, schools for hearing-impaired, daycares, special needs, First Nation reserve schools, virtual schools, schools located on military bases, international schools); and schools with fewer than 20 students enrolled in a grade were excluded from the target population. Students were informed to complete the survey over a 30 to 40 minute period under teachers' supervision. Data obtained was machine-scanned using Optical Mark Recognition (OMR) technology. This cross-sectional study focused specifically on grade 7 males. After eliminating all cases of students in grades 8-12 and grade 7 students who responded "female" or "not stated", the remaining population sample was 6,237 grade 7 males.

Study Outcomes

To evaluate our study outcomes, we analyzed four ordinal variables from the data set. The independent variable was the students' history of being bullied. This was assessed with the question "In the last 30 days, how often have you been bullied by other students". The response options were "I have not been bullied in the last 30 days, less than once a week, about once a week, 2 or 3 times a week, daily or almost daily, and not stated." For the primary outcome, the

question, “On how many of the last 30 days did you use an e-cigarette (vape, vape pen, tank & mod, e-juice)?” was used to determine the frequency of vaping in the last 30 days. The response options were “Daily or almost daily; less than daily, but at least once a week; less than weekly, but at least once a month; less than monthly; not at all; I do not know; and not stated.”

The secondary outcomes were similar, but were assessed using separate/different variables. The question, “In the last 30 days, did you use e-cigarettes (vape, vape pen, tank & mod) with nicotine?” was used to assess the presence of nicotine when vaping in the last 30 days. The question, “In the last 30 days, did you use e-cigarettes (vape, vape pen, tank & mod) without nicotine?” was used to assess the absence of nicotine when vaping in the last 30 days. The response options to these two questions were “Daily or almost daily; less than daily, but at least once a week; less than weekly, but at least once in the last 30 days; tried, but not in the last 30 days; never tried; and not stated.”

Statistical Analysis

To understand the correlation between variables, descriptive statistical analyses were performed using IBM SPSS 28.0 based on the original data set. First, the missing data from each variable was excluded. This was done by eliminating all cases with responses of “not stated” or “I do not know” to any of the four questions analyzed. A total of 1082 cases were eliminated, resulting in a valid sample size of 5152 individuals. The ordinal variables were then transformed into dichotomous variables where responses that indicated any bullying, vaping, vaping with nicotine, or vaping without nicotine for the respective variables within the last 30 days were labeled as “yes” and all other responses were labeled as “no”. These filtered responses were then used to calculate the measure of central tendency as the frequency (%) of responses and perform 2 x 2 chi-square tests to determine if each vaping variable was independent from bullying. The

frequencies of individuals who have or have not been bullied in each province and in urban or rural regions were reported as well. The data set was entirely categorical, therefore, a normality test was not calculated for this study. After confirming that each variable was independent, the correlations and significance between bullying and vaping, bullying and vaping specifically with nicotine, and bullying and vaping specifically without nicotine were calculated using Spearman's Rho Correlation.

Results

Table 1 describes the survey response frequencies from the selected survey questions for the study population of 5,152 grade 7 males. It was found that 22.7% of the respondents reported getting bullied while 77.3% of the respondents did not report getting bullied. Among those who reported getting bullied, 29.5% had used an e-cigarette in the last 30 days. Meanwhile, 70.5% of individuals who did not report getting bullied had used an e-cigarette in the last 30 days, as illustrated in Figure 1.

Table 1

Description of the Study Population

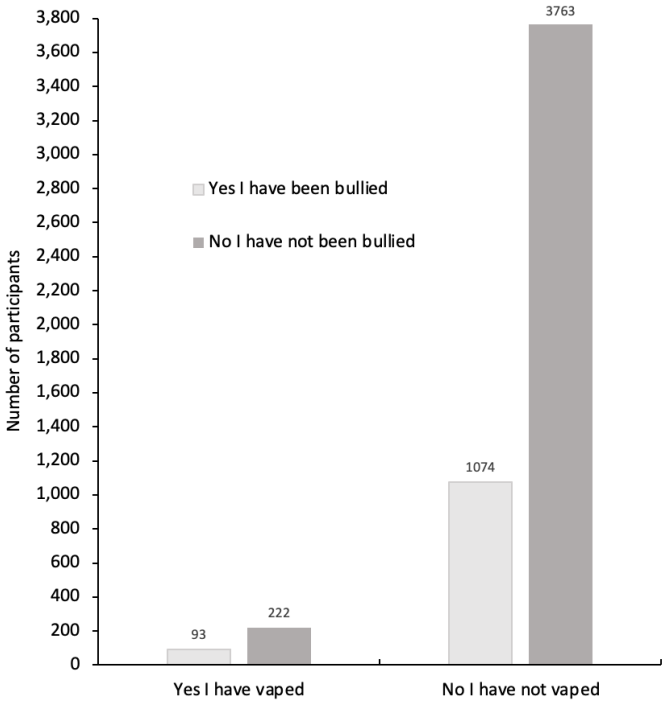
Variable	**Options**	**Measure of central tendency to be reported**	
		Grade 7 males who report getting bullied (n = 1167, 22.7%)	**Grade 7 males who do not report getting bullied (n = 3985, 77.3%)**
Province ID Number	Newfoundland and Labrador	101 (23.3%)	332 (76.7%)
	Prince Edward Island	115 (28.7%)	286 (71.3%)
	Nova Scotia	132 (26.0%)	376 (74.0%)
	New Brunswick	43 (19.5%)	178 (80.5%)

	Québec	193 (15.0%)	1091 (85.0%)
	Ontario	154 (23.0%)	516 (77.0%)
	Manitoba	78 (25.7%)	226 (74.3%)
	Saskatchewan	90 (26.6%)	248 (73.4%)
	Alberta	124 (27.6%)	325 (72.4%)
	British Columbia	137 (25.2%)	407 (74.8%)
Is the respondent's school in an urban or rural region?	Urban	895 (22%)	3179 (78%)
	Rural	272 (25.2%)	806 (74.8%)
Did you use an e-cigarette in the last 30 days?	Yes	93 (29.5%)	222 (70.5%)
	No	1074 (22.2%)	3763 (77.8%)
Did you use e-cigarettes (vape, vape pen, tank & mod) with Nicotine in the last 30 days?	Yes	47 (30.5%)	107 (69.5%)
	No	1120 (22.4%)	3878 (77.6%)
In the last 30 days, did you use e-cigarettes (vape, vape pen, tank & mod) without nicotine?	Yes	63 (33.2%)	127 (66.8%)
	No	1104 (22.2%)	3858 (77.8%)

Note. Data are presented as frequency (%) of participants. $N = 5,152$.

Figure 1

The Number of Canadian Grade Seven Males that Were or Were Not Bullied and How it Was Associated With or Without Vaping Over a Span of 30 Days



Note. N=5,152.

Table 2 displays the results of the 2 x 2 chi-square tests between each dependent variable and the independent variable, bullying. The results showed that all of these variables were significantly independent of one another ($p > 0.05$). The correlation coefficients of Spearman's Rho for all variables that were not found to be independent from bullying are reported in Table 3.

Table 2

2 x 2 Chi-Square Tests for Independence

Bullying With Dependent Variable	Pearson Chi-Square
Vaping	0.03*

Vaping with nicotine	0.018*
Vaping without nicotine	< 0.001*

Note. Variables with significance values > 0.05 are not independent

*. Asymptotic significance (2-tailed)

Table 3

Correlation Between Presence of Bullying and All Other Measures

	Bullying History	Vaping History	Vaping with Nicotine	Vaping without Nicotine
Bullying History	1			
Vaping History	0.042**	1		
Vaping with Nicotine	0.033*	0.692**	1	
Vaping without Nicotine	0.049**	0.742**	0.665**	1

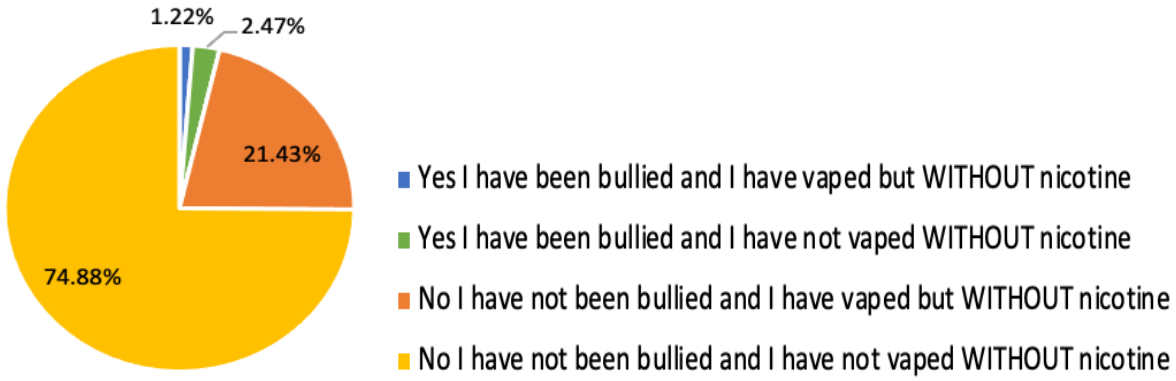
**. Correlation is significant at the 0.01 level (2-tailed)

*. Correlation is significant at the 0.05 level (2-tailed)

Figure 2 demonstrated that the majority of the participants (74.88%) reported not being bullied and had not vaped without nicotine. Among those who reported having used an e-cigarette, 75.27% of respondents reported not getting bullied and used e-cigarettes with nicotine (see Figure 3).

Figure 2

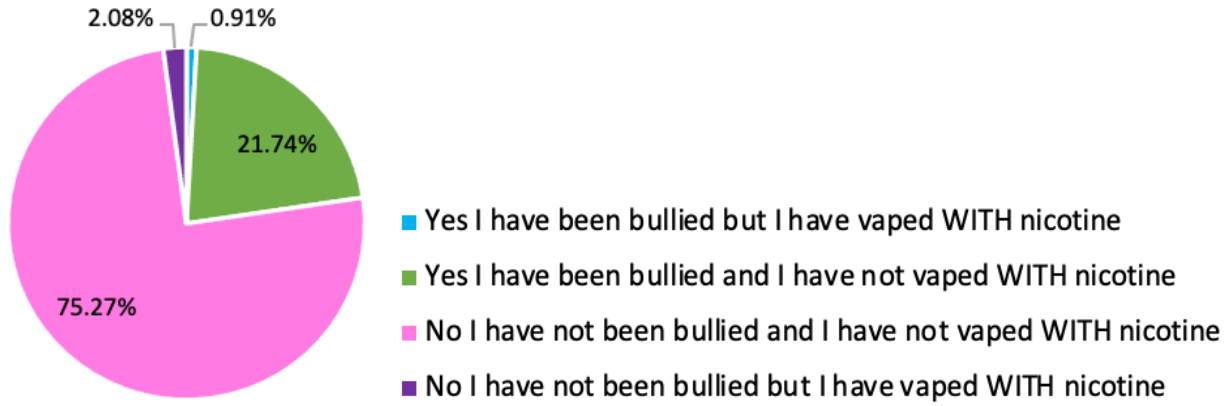
The Percentage of Canadian Grade Seven Males that Either Have or Have Not Been Bullied and Have or Have Not Vaped Without Nicotine Over a Span of 30 Days



Note. N=5,152.

Figure 3

The Percentage of Canadian Grade Seven Males That Either Have or Have Not Been Bullied and Have or Have not Vaped With Nicotine Over a Span of 30 Days



Note. N=5,152.

Discussion

The purpose of this study was to examine the relationship between bullying and vaping of grade 7 males in all ten Canadian provinces. An additional goal was to identify whether the presence or absence of nicotine when vaping has been linked to bullying. Understanding these outcomes is crucial to developing intervention approaches for those involved in bullying, vaping, and e-cigarette use.

E-cigarette use has increased dramatically among youths around the globe (Gaiha & Halpern-Felsher, 2020). Evidence shows that bullying victims have a higher likelihood of suffering from negative internal states (Espelage et al., 2014; Naveed et al., 2019). Therefore, it is possible that adolescents may choose to cope with the anxiety that arises from peer pressure and the need to fit in by using illegal substances (Carlyle and Steinman, 2007; Continente et al., 2010; Romaní and Gutiérrez, 2010). Based on the current literature surrounding the relationship between social influences and substance use, it was expected that students victimized by bullying would vape more frequently compared to those who have not been bullied.

Adolescents who are addicted to nicotine have a greater risk of becoming lifelong tobacco consumers. Considering the well-established consequences of long-term nicotine use, including implications on brain development, dependence on vaping is a potential health problem for this demographic (Ferkol et al., 2018). However, the obtained results from this study were not consistent with the current literature, despite the large sample size.

Our findings show that respondents who did not experience bullying reported a higher level of vaping compared to those who did experience bullying. Although the correlation of each variable is significant in both outcomes, the observed difference is not consistent with the data reported from the previous 2016-2017 Canadian Student Tobacco, Alcohol and Drugs Survey, as

well as the findings of a US student survey of youths indicated that bullying victims were more likely to use e-cigarette products compared to those who were not bullied (Azagba et al., 2020; Doxbeck, 2020). Findings from these two studies concluded that students who are exposed to negative experiences have a heightened risk of substance use.

Although we did not find significantly strong associations between substance use and bullying, there is literature that stands with our result. Liang et al. (2007) suggested that victims of bullying vaped less than those who were not involved in bullying. Another study identified a similar result, in which the researchers conveyed the negative relationship between adolescent victims of bullying and substance use (Houbre et al., 2006). These converse findings might be possible because students that experienced bullying are socially less interactive with their peers and thus lack access to substances (Nansel et al., 2001; Alikasifoglu et al., 2007).

Limitations

Regarding the inconsistency between the observed results and prior studies, there are several limitations in this study to consider when collecting and interpreting the data. Data were collected only from students who attended public and private schools in all ten provinces. Other potential confounding factors that might contribute to substance use among grade 7 males were not considered in the analysis, such as academic pressure or psychiatric problems. This reduces the generalizability of the results for grade 7 youths across the country, specifically for those not attending school. Current e-cigarette use was estimated based on fully responded surveys while missing and invalid data were excluded. This may have led to underestimated results. Data was also self-reported and might be subject to recall and response bias, as there was not a guideline that defines the extent of actions that should be considered bullying.

Future Directions

This study is a crucial step in examining the gender differences in the association between negative social behavior and substance use. The results indicate that there was a weak, but significant association with substance use after experiencing bullying. This result underscores the importance of reducing youths' health risk behaviours including finding alternative ways to cope with stress. Programs that are designed to educate youths on the social and emotional skills of managing their stress and peer pressures may be essential for preventing individuals from turning to substance use as a way to release stress (Conley, 2015). Proceeding onward, it is also important to consider that e-cigarette control policies and strategies are necessary to prevent youths from obtaining or using all e-cigarette products. In Canada, it is illegal to sell or provide vaping products to individuals under the age of 18, while some provinces have increased the legal age from 19 to 21 (Health Canada, 2020). Yet, the Canadian Tobacco and Nicotine Survey conducted by Health Canada conveyed that youths could still obtain vaping products from retail and surrounding social resources (Health Canada, 2019). This study's findings align with Health Canada's notion, considering the large number of grade 7 males from the study population who had access to e-cigarette products. This in turn suggests that the policy should be more strongly enforced to further prevent youths from accessing e-cigarette products.

Although the current study did not reveal any close associations between bullying, vaping and using e-cigarette products, it does not rule out the possibility that bullying plays a role in the rise of substance use. More research is needed to understand the mechanisms and timing in which being bullied and substance use come to be associated. There may be other factors (e.g. parental influences, desire for peer approval) that play a role in adolescent substance use,

therefore, future research on contextual factors is needed to differentiate bullying from other motivations behind substance use..

Different types of bullying could have also contributed to e-cigarette addiction among youths. Some studies summarize the effects of different types of bullying and their associations with substance use (Tharp-Taylor et al., 2009; Vieno et al., 2011). The present study did not differentiate the types of bullying that the sample population experienced. More research is needed to investigate the association of different types of bullying with e-cigarette use.

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Understanding the association between physical activity and type 2 diabetes prevalence under different sleeping habits in the Canadian elderly population

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Introduction

Type 2 diabetes (T2D) affects the body's ability to regulate and metabolize glucose. It is a chronic condition that typically results in high levels of blood glucose, which can lead to disorders of the circulatory, nervous, and immune systems (Forouhi & Wareham, 2010).

There is a high incidence of T2D in the elderly, due to variables that commonly affect individuals over the age of 65, such as frailty, comorbidities, and disability (Jain & Paranjape, 2013). Immunologic factors that are related to chronic, low-grade inflammation can affect both the aging process and diabetes progression (Perkisas & Vandewoude, 2015). People with diabetes tend to biologically age at an accelerated rate, therefore increasing their risk of frailty (Perkisas & Vandewoude, 2015). Simultaneously, low muscle mass and poor glycemic control linked with frailty leads to increased insulin resistance, therefore increasing risk of T2D development (Perkisas & Vandewoude, 2015). In older individuals, T2D is associated with an increased risk of complications such as microvascular and macrovascular disease (Bradley & Hsueh, 2016). T2D can exacerbate age-related comorbidities including cognitive impairment, sarcopenia and urinary incontinence (Bradley & Hsueh, 2016). This may be attributed to an overall state of chronic inflammation and dysregulated immunometabolism (Bradley & Hsueh, 2016).

In the general population, it was consistently demonstrated that regular physical activity could substantially reduce the risk of T2D development (Teixeira-Lemos et al., 2011). Specifically, moderate- to vigorous-intensity physical activity was found to have the greatest protective ability against T2D development (Teixeira-Lemos et al., 2011). While light intensity physical activity was also promising, the data was less consistent (Teixeira-Lemos et al., 2011). The benefits of physical activity include increased glycemic control and decreased

cardiovascular risk, as well as antioxidant and anti-inflammatory properties that reduce the risk of T2D (Teixeira-Lemos et al., 2011). Studies suggest that the beneficial effects of physical activity in preventing T2D are greatest in those who are at higher risk of developing the disease (Teixeira-Lemos et al., 2011).

One risk factor that is often overlooked is quality and quantity of sleep. A study conducted in 2010 found that sleep can "consistently and significantly" predict the risk of T2D development (Cappuccio et al., 2010). The time in which humans spend sleeping is crucial for the body to rebalance and regulate hormones. Disruptions to sleep can affect glucose metabolism and insulin sensitivity (Cappuccio et al., 2010). Short sleep duration has shown to increase the hormone leptin, which is key in regulating appetite, while also increasing levels of ghrelin, which is associated with increased hunger (Cappuccio et al., 2010). Chronic sleep deprivation can therefore represent a risk factor for weight gain, decreased insulin sensitivity, and T2D.

Regular exercise has also been shown to produce beneficial effects on sleep time and sleep quality (Kredlow et al., 2015). A longitudinal study revealed that sleep quality indirectly predicted physical activity levels over time. This dual-natured relationship suggests physical activity as a preventative strategy for poor sleep habits, ultimately preventing the risk of long-term illness.

In elderly populations, factors that contribute to sleep deprivation include increased sedentary time, chronic stress, poor mental health, and underlying health conditions (Govt. of Canada, 2019). According to the Government of Canada health guidelines, adults aged 65+ are recommended to get 7-9 hours of sleep per night. Therefore, individuals with less than 7 hours of sleep per night are considered to be sleep deprived.

The World Health Organization (WHO) has laid out physical activity guidelines to promote a positive quality of life while reducing risk of health problems such as obesity and diabetes. In regards to adults aged 65 and above, the WHO specifies guidelines related to the amount of time performing physical activity of varying intensity per week required to be considered physically active. In addition, they advise this age group to limit sedentary time, replacing it with light intensity activity, as well to incorporate multicomponent physical activity that emphasizes functional balance and strength training on 3 or more days a week, in order to enhance functional capacity and to prevent falls (WHO, 2022).

We aim to address the current gap in knowledge around the association between sleep habits and physical activity levels with the prevalence of T2D in the elderly (65+ years old) Canadian population. This analysis will explore the prevalence of T2D in elderly people with varying levels of physical activity that either get adequate sleep or are sleep deprived. We will aim to understand if physical activity levels (based on WHO guidelines) are associated with T2D prevalence in Canadians over the age of 65 who get adequate sleep (7-9 hours) compared to Canadians of the same age who are sleep deprived (<7 hours).

Methods

Study Design and Database

This is a cross-sectional observational study that analyzes the difference in T2D prevalence in adequate sleeping and sleep deprived populations with varying physical activity levels. All relevant variables were self-reported. Data was collected using survey answers from the 2017-2018 Canadian Community Health Survey (CCHS). The CCHS collects information at the national and provincial levels from Canadian citizens on their health status, health care use, as well as other health determinants. The purpose of this database is for its use in health

surveillance and research of the population. Multiple government agencies use this information to implement or evaluate existing health programs to improve the health of all Canadians. The data was collected voluntarily throughout the whole country by using a computer assisted telephone interview software, as well as computer assisted interviewing.

Study Participants

This dataset contained information collected from 12,742 individuals from the CCHS. Specific inclusion criteria was used while selecting participants. Only Canadians over the age of 65 were included since there is a high incidence of T2D in this age group and increased risk of T2D-associated complications. Participants were included if they reported having at most 9 hours of sleep per night. This is because we investigated participants who are getting adequate sleep (7-9 hours) and those who are sleep deprived (<7 hours), based on guidelines set by the Canadian government. Furthermore, participants were allowed to not state their answer, skip, or refuse to answer questions. When considering these options and any missing data in the dataset, Canadians in the specified age group that did not indicate their physical activity levels according to the WHO guidelines, diabetes status and amount of sleep obtained per night were excluded from the study. Answers to questions regarding physical activity levels, daily sleep and diabetes status were required since our research question investigated these three variables.

Study Outcomes

T2D prevalence in sleep deprived and adequate sleeping populations with varying physical activity levels was the primary outcome. T2D prevalence is a dichotomous categorical variable and was self-reported. Sleep habits and physical activity levels were required to analyze the impact of sleeping habits on the association between physical activity and T2D prevalence in Canadians aged 65 or above. When assessing sleep habits, the survey asked, “How long do you

usually spend sleeping each night?". The available answers were provided using categories, ranging from 3 hours until 12 hours or more, and were separated in one-hour increments (e.g. "4 hours to less than 5 hours"). The participants were then further separated into those with sleep deprivation (<7 hours) and those with adequate sleep (7-9 hours).

Physical activity levels and intensity used in this study were based on the guidelines created by the WHO. Moderate-intensity physical activity involves movement that will stimulate heart rate and moderate levels of energy expenditure such as walking or casually bicycling. Vigorous-intensity physical activity involves larger stimulation of heart rate, and more energy used such as running or bicycling uphill. In the CCHS, participants were asked, "How much time did you spend doing either moderate and/or vigorous physical activity per week ?". Volume of weekly activity done in the past 7 days was measured by the amount of time spent performing moderate and/or vigorous physical activity. The time spent performing vigorous-intensity physical activity was doubled to accommodate for the energy expenditure difference when performing moderate-intensity physical activity. For example, 75 minutes of vigorous physical activity is roughly the same as 150 minutes of moderate-physical activity. With Canadians aged 65+ in mind, the WHO created different levels of physical activity. Level 1: >150 minutes of moderate-intensity aerobic physical activity, or >75 minutes of vigorous-intensity physical activity and muscle-strengthening activities (weights or resistance training) twice a week. Level 2: 150 minutes of moderate-intensity aerobic physical activity, or 75 minutes of vigorous-intensity physical activity. Level 3: <150 minutes of moderate-intensity aerobic physical activity, or <75-minutes of vigorous-intensity physical activity. Level 4: physical activity done at a less than moderate intensity or no activity in the last week.

T2D prevalence data was collected through two survey questions. Firstly, the survey asked if they had diabetes, and if they answered “no”, then no further questions on that topic were asked. If the participant answered “yes”, then it would lead to the next question, “What is your diabetes type?”. Possible survey responses included: “Type 1 Diabetes”, “Type 2 Diabetes”, “Gestational Diabetes” or “Prefer not to answer”. For the purposes of this study, participants that answered “Type 1 Diabetes”, “Gestational Diabetes” and “Prefer not to answer” were classified as not having T2D. This is because T2D prevalence is primarily dictated by a person’s lifestyle–including sleeping habits and physical activity levels, which are the variables observed in this study.

Additional Data Collection

Additional data included in Table 1 from the database are sex, age, personal income, BMI, and drinking and smoking habits. While they were not used in the analyses, they served to describe the population. These variables may have an impact on our dependent variable–T2D–that is out of the scope of this study. This could be a further point of research in the future that may require additional investigation and research in order to fully fill the knowledge gap.

Statistical Analysis

Data in table 1 was summarized by the frequency and percent of individuals who fell into categories based on sex, socioeconomic status, lifestyle, weight, and diabetes status. Individuals were classified into two groups based on their daily sleeping habits (sleep deprived and adequate sleep). Individuals with less than 7 hours of sleep per night were classified as sleep deprived, while individuals with 7-9 hours of sleep per night were classified as having adequate sleep. IBM SPSS was used to perform the statistical analyses. To achieve the main objective of the study, binary logistic regression was performed on physical activity levels (according to the

WHO guidelines) to assess their impact on the likelihood that subjects would fall into the "has Type 2 Diabetes" category, which is the predicted outcome variable. Two logistic regression analyses were performed, one in the sleep deprived population (<7 hours) and the other in the adequate sleeping population (7-9 hours). This was done to establish for which sleeping habit, physical activity had a greater impact on the likelihood of T2D prevalence. Moreover, a p-value of less than 0.05 was used as a marker of statistical significance for the binary logistic regression.

Results

Table 1. Population characteristics (n= 12,742)

	Individuals over the age 65 with Sleep Deprivation (<7 hours) (n= 5455)	Individuals over the age 65 with Adequate Sleep (7-9 hours) (n= 7287)
Sex (n= 12,742)		
Male	2388 (43.8 %)	3328 (45.7 %)
Female	3067 (56.2 %)	3959 (54.3 %)
Age (n= 12,742)		
65 - 69	1910 (35 %)	2661 (36.5 %)
70 - 74	1456 (26.7 %)	2005 (27.5 %)
75 - 79	986 (18.1 %)	1287 (17.7 %)
≥ 80	1103 (20.2 %)	1334 (18.3 %)
Self-Reported Personal Income (n=12,742)		
No Income	11 (0.2 %)	5 (0.1%)
< 20,000 $	1423 (26.1 %)	1740 (23.9 %)
20,000 - 39,999 $	2155 (39.5 %)	2804 (38.5 %)
40,000 - 59,999 $	972 (17.8 %)	1453 (19.9 %)
60,000 - 79,999 $	419 (7.7 %)	642 (8.8 %)

≥ 80,000 $	473 (8.7 %)	643 (8.8 %)
Self-Reported Diabetes Status (n= 12,742)		
Type 1	6 (0.1 %)	9 (0.1 %)
Type 2	878 (16.1 %)	1091 (15 %)
Gestational Diabetes	4 (0.1 %)	1 (0.0 %)
No Diabetes	4567 (83.7 %)	6186 (84.9 %)
Body Mass Index (BMI) (n= 12,742)		
Underweight (<18.50)	113 (2.1 %)	140 (1.9 %)
Normal weight (18.50-24.99)	2058 (37.7 %)	2873 (39.4 %)
Overweight (25-29.99)	2065 (37.9 %)	2831 (38.9 %)
Obese (class I,II,III) (>30)	1219 (22.3 %)	1443 (19.8 %)
Physical Activity Levels Based on WHO Guidelines[1] (n=12,742)		
Level 1	1481 (27.1 %)	2188 (30 %)
Level 2	769 (14.1 %)	1097 (15.1 %)
Level 3	1215 (22.3 %)	1590 (21.8 %)
Level 4	1990 (36.5 %)	2412 (33.1 %)
Self-Reported Drinking Habits in Last 12 Months (n= 12,742)		
Regular Drinker	2958 (54.2 %)	4381 (60.1 %)
Occasional Drinker	992 (18.2 %)	1161 (16.0 %)
Does not Drink	1483 (27.2 %)	1708 (23.4 %)
Not Stated	22 (0.4 %)	37 (0.5 %)
Self-Reported Smoking Habits in Last 12 Months (n= 12,742)		
Daily Smoker	495 (9.1 %)	591 (8.1 %)
Occasional Smoker	116 (2.1 %)	160 (2.2 %)

Does not Smoke	4844 (88.8 %)	6534 (89.7%)
Not Stated	0 (0.0 %)	2 (0.0 %)

Data is presented as frequency (%) unless otherwise stated.

1. Level 1: >150 minutes of moderate-intensity aerobic physical activity, or >75 minutes of vigorous-intensity physical activity and moderate to high intensity muscle-strengthening activity (weights or resistance) twice a week. Level 2: 150 minutes of moderate-intensity aerobic physical activity, or 75 minutes of vigorous-intensity physical activity. Level 3: <150 minutes of moderate-intensity aerobic physical activity, or <75-minutes of vigorous-intensity physical activity. Level 4: physical activity done at a less than moderate intensity or no activity in the last week.

Data for this table was taken from the 2017-2018 Canadian Community Health Survey database. The total number of participants in this study is 12,742 and they are all above the age of 65. Data is grouped into two different columns–those in the sample that are sleep deprived (<7 hours of sleep per night) and those that get adequate sleep (7-9 hours of sleep per night).

Table 2. Logistic Regression Output (Block 1: Variables in the equation). Dark blue represents the adequate sleep population and light blue represents the sleep deprived population. * indicates significance (p<0.05), and ** indicates greater significance (p<0.001).

	B		Wald		Sig.		df		Exp(B)	
PA 1			73.607	29.530	<0.001**	<0.001**	3	3		
PA 2	-.674	-.503	63.190	26.970	<0.001**	<0.001**	1	1	.510	.605
PA 3	-.530	-.353	26.001	8.994	<0.001**	.003*	1	1	.589	.703
PA 4	-.410	-.187	21.642	3.791	<0.001**	.052	1	1	.663	.829

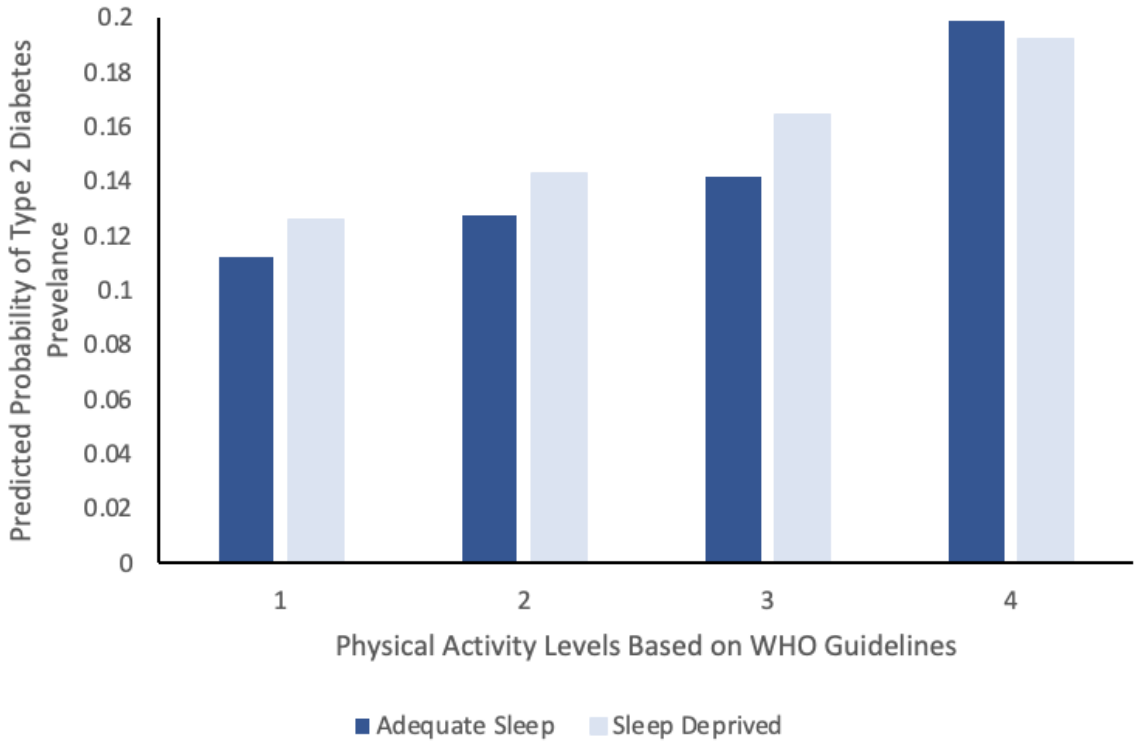

Figure 1. Predicted probability of T2D prevalence based on physical activity levels in sleep deprived and adequate sleeping populations.

A logistic regression was carried out to assess the impact of physical activity levels on T2D status in those who had adequate sleep, and those who were sleep deprived. According to the Omnibus Tests of Model Coefficients, both models (adequate sleep and sleep deprived) containing the predictor variable (physical activity) were statistically significant in being able to predict cases of who had versus who did not have T2D (Chi-squared= 73.487, $p<0.001$** for adequate; Chi-squared=30.135, $p<0.001$** for sleep deprived, respectively). The model correctly classified 85% of cases in the adequate sleep population, while it correctly classified 83.9% of cases in the sleep deprived population. All predictor variables were significant except for physical activity level 4 in sleep deprived populations ($p=0.052$). The Wald scores for the adequate sleep population were much higher than the inadequate sleep population across the

board. Additionally, physical activity level 1 had the highest Wald score in both sleep deprived and adequate sleeping populations.

Discussion

Main Findings

In Canadians aged 65 or above, having adequate daily sleep improves the effectiveness of physical activity levels as a predictor for T2D prevalence in comparison to sleep deprived populations. This was denoted by the higher Wald scores across all physical activity levels in the adequate sleep population compared to the sleep deprived population (Table 2). Another important finding was a negative relationship between physical activity and T2D prevalence. Participants with higher levels of physical activity (level 1 being the highest) had lower probability of T2D prevalence (Figure 1). These results were observed in both the sleep deprived and adequate sleeping populations. Additionally, sleeping adequately lowered T2D prevalence further when combined with higher physical activity levels compared to the sleep deprived population (Figure 1). Adequate sleep lowered the probability of levels 1, 2, and 3; however, there was an unexpected finding in which the probability of T2D prevalence in level 4 was higher for the adequate sleep population compared to the sleep deprived population. This could have been due to the fact that physical activity level 4 in sleep deprived populations was not a significant contributor to predicting T2D prevalence, since it had a p-value of 0.052. Confounding factors may have also contributed to this unexpected result such as self reported responses, lifestyle, sex, BMI and socioeconomic status (Shrestha et al., 2012). Furthermore, in table 2, the Wald scores for the adequate sleep population were much higher than the inadequate sleep population across the board. This showed that the physical activity levels for the adequate

sleep population were more important contributors in predicting T2D prevalence compared to the sleep deprived population.

Comparison of Results to Other Studies

When comparing the negative relationship between physical activity and T2D prevalence found in our research to other studies, a similarity was observed in another study where increases in physical activity decreases the risk of T2D development based on self reported data from participants (Wannamethee et al., 2000). Furthermore, another study's findings state that physical activity was negatively related to cardiovascular diseases such as coronary heart disease–those diagnosed with T2D have a higher cardiovascular morbidity and mortality compared to non-diabetic populations (Gu et al., 1999). However, this study was not able to precisely differentiate between the different types of diabetes and did not account for patients with undiagnosed diabetes (Gu et al., 1999). Additionally, physical activity was found to be an accessible and cost-effective strategy to treat and prevent T2D (Di Loreto et al., 2005). Our study highlights the influence of sleep on the effectiveness of physical activity in reducing T2D prevalence.

Limitations

In our study, one of the most important limitations was the self-reporting methods used to obtain the data. This is because all of the variables in our study are self-reported. Self-reporting can lead to misleading results due to inaccurate answers from participants. This can be caused by the social desirability bias, which is a tendency by the participants to make their answers look more socially desirable rather than what is reflective of their true answers, especially for sensitive topics such as weight (Grimm, 2010). Our study contains socially sensitive topics includings obesity, diabetes, lifestyle habits, and physical activity levels, which could influence

participants to give answers that are socially desirable rather than accurate. Due to the data being collected via self reporting, another possible limitation could be miscommunication regarding the physical activity intensity. The survey did not provide supplemental information regarding physical activity intensity. Therefore, participants had to use their own judgment on determining the level of intensity (moderate or vigorous) used during their physical activity. Since physical activity intensity is very subjective and can also depend on an individual's level of fitness, this could also lead to inaccurate categorization of participants.

Another limitation that was prevalent throughout our study was the external impacts of the social determinants of health such as access to health care, race/ethnicity, and education levels. In regards to access to health care, it was found that roughly 40% of those with undetected diabetes were uninsured (Zhang et al., 2008). Uninsured adults are less likely to receive treatment for conditions such as diabetes due to lack of access to healthcare professionals. Also, T2D diagnosis requires patients to get examined by a healthcare professional, which could have led to unreported T2D. For social barriers pertaining to race/ethnicity, studies provide strong evidence that race/ethnicity impacts the glycemic index and blood pressure of patients with diabetes significantly (Walker et al., 2016). Additionally, factors such as poverty and race/ethnicity are correlated with diabetes risk factors, obesity and physical inactivity (Shrestha et al., 2012). Lastly, education levels have been found to be inversely related to the prevalence of T2D. Those with less than a high school diploma were 1.6 times more likely to have diabetes than those with a bachelor’s degree (Borrel et al., 2006). Since these social determinants of health have an impact on T2D development and progression, it is possible that they may have influenced the results. In future studies, these confounding variables should be accounted for between the different populations.

Future Directions

Future directions and research could include further studies on the impacts of the social determinants of health on T2D. The previously mentioned examples of education levels, race/ethnicity, and access to healthcare do not include other determinants such as income, housing and/or living environment, food insecurity, smoking or drinking habits, and many more. Future studies could include their relationships with T2D to determine other factors that are correlated with increased risk in vulnerable populations.

Secondly, future studies avoiding data that relies on self reporting could reduce factors such as the social desirability bias that can skew the quality of available data and subsequent findings. Avoiding methods such as questionnaires that rely on self reporting could limit biases.

The conclusions found in this study regarding the effects of sleep on physical activity's effectiveness in reducing T2D prevalence can be useful in its treatment and management. Further research needs to be conducted with the exclusion or consideration of external factors such as the social desirability bias to achieve unbiased results. With increased knowledge regarding physical activity as a preventive measure for T2D development, we can improve the effectiveness of this strategy with the goal of reducing T2D prevalence.

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Employment Status Alters Eating Habits among Male Adults Aged 25-34 from Single Identity First Nations and Single Identity Métis Identity: An Observational Cross-Sectional Study

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Introduction

Canada's Aboriginal population comprises approximately 1.6 million people and includes three constitutionally recognized communities; First Nations, Métis, and Inuit (Statistics Canada, 2022b). These populations are considered minorities in Canada as they experience racial inequality when obtaining employment, food security, and mental health resources.

Aboriginals have historically lacked educational opportunities, leading to lower employment success, making it challenging to secure nutritious food (Anderson, 2019). Postsecondary requirements were completed by 55% of Métis compared to 45% of First Nations, which may explain the gap in unemployment between Métis and First Nations people (Statistics Canada, 2015; Statistics Canada, 2022a). Over a five-year period, the employment rate increased by eight percent for Métis but only three percent for First Nations (Ciceri & Scott, 2006). The difference between the rate of increase is unknown and requires further exploration.

Food security refers to the access one has to a sufficient quantity of affordable and nutritious food (Deaton et al., 2020). According to Bhawra et al. (2017), 9% of First Nations and Métis populations reported low food security and 7% reported severe food insecurity. Isolated communities in Canada have high rates of food insecurity due to the inflated pricing of necessities (Deaton et al., 2020). A gender correlation determined that Aboriginal men are less likely to report food insecurity than women (Deaton et al., 2020). Batal et al. (2021) reported that almost half of First Nations households were food insecure and that food insecurity restricts Aboriginals from attaining a healthy diet.

A healthy diet consists of nutritious foods that improve and maintain health. The Canadian Food Guide recommends a minimum serving of five vegetables and fruits per day (Black & Billette, 2013). A study by Langlois et al. (2013) examined the dietary habits of

Aboriginal children and found that about 90% of First Nations and Métis children consumed fruit at least once a day, and over 80% consumed vegetables at least once a day. The study reported that only 49% of First Nations children consume fruits multiple times throughout the day, and only 35% consume vegetables several times a day (Langlois et al., 2013). In lower-income households, Bhawra et al. (2017) found a high risk of obesity in First Nations children and an even higher risk in Métis children. These studies show an evident disparity between fruit and vegetable intake between the Aboriginal communities, which may lead to further health implications.

Despite the implementation of a universal healthcare system, Canada continues to fall short when providing accessible mental health resources to different Aboriginal groups. The inaccessibility arises from poor quality of care, inability to obtain services, and socioeconomic disparities (Goodman et al., 2017). Compared to non-Aboriginals in Canada, Aboriginal communities have higher mental health concerns, with rates varying dramatically between different communities (Nelson & Wilson, 2017). Given that existing research often groups Aboriginal communities as one, there is less emphasis on the varying rates of individual communities leading to less awareness of each communities struggles, and less individualized resources.

A lack of research in Aboriginal communities creates a knowledge gap such that food security and nutritional intake studies focus on youth and female dietary intake while placing less attention on adult male populations. According to Anderson (2019), most Aboriginal males begin working from the ages of 25 to 34, and thus research surrounding unemployed men of this age group is scarce. Aboriginal identities are often grouped as one while conducting research, leading to general results for individual groups. Waldram (2013) found that generalizing

Aboriginal communities damages one's sense of identity and inflicts historical trauma and possibly mental health concerns. Due to Métis' European descent, they were only recently recognized as an Aboriginal group in Canada, making it essential to explore this group (Bhawra et al., 2015). With current research focusing heavily on First Nations females and overlooking Métis and Inuit populations, this study analyzes First Nations and Métis male populations.

The primary research question of this study is "Is there an association between employment status (employed and unemployed) and eating habits (poor means consumed fruits and vegetables less than two times a day and good means consumed two or more times a day) in males aged 25 to 34 who identify as Single Identity First Nations compared to Single Identity Métis males in the same age group?" The primary outcome is eating habits. Given that most Aboriginal mental health research looks at anxiety in females with little focus on males, the secondary research question in this study is "Is there an association between employment status (employed and unemployed) and the presence of chronic anxiety in males aged 25 to 34 who identify as Single Identity First Nations compared to Single Identity Métis males in the same age group?" The primary outcome is the presence of anxiety. The purpose of this study is to analyze factors within Aboriginal communities that are interconnected but under-researched.

Methods

Study Design and Database

Statistics Canada administered the 2017 Aboriginal Peoples Survey (APS) from January 16, 2017 to August 15, 2017, and it includes information from the 2016 Census of Population (Statistics Canada, 2018b). APS is an observational, cross-sectional survey that analyzed individuals in Canada who identified as First Nations, Métis, or Inuit and excluded First Nations in Yukon and Northwest Territories (Ali-Hassan et al., 2020). Interviews were held in-person, by

phone, or a blend of both (Statistics Canada, 2018b). The survey focused on topics such as health, income, education, food habits, transportation, and employment. This survey aimed to obtain information about Aboriginal people in Canada to guide policy and programming activities targeted at enhancing their welfare (Statistics Canada, 2018b).

Study Participants

The final database included 998 participants. The inclusion criteria consisted of individuals aged 25 to 34 years, identified as male, Single Identity First Nations or Métis, and are employed or unemployed. Participants were excluded from the final database if they did not fall into these categories. Missing data was deleted based on individuals who answered "not stated" for the dependent variable, "Fruit and vegetable consumption - Frequency."

Study Outcomes

In this study, the primary outcome was eating habits, and the variable "Fruit and vegetable consumption - Frequency" was used to assess this. Participants were asked, "On average how often do you eat fruits and vegetables? Fruits include fresh, frozen, or canned fruits but do not include fruit juice. Vegetables include fresh, frozen, or canned vegetables" (Statistics Canada, 2018a). The answer choices that were analyzed included "two or more times a day," "once a day," "a few times a week," "about once a week or less," or "never/hardly ever" (Statistics Canada, 2018a). To define good eating habits and poor eating habits, "two or more times a day" represented good eating habits, while all other options represented poor eating habits. Given that Canada's Food Guide recommends five servings of fruits and vegetables per day, the category "two or more times a day" was the closest to this amount and, as such, was classified as good eating habits (Black & Billette, 2013). Consuming this food group has

important implications for public health, as fruits and vegetables are high in nutrients and reduce the risk of chronic diseases, like cancer and cardiovascular diseases (Slavin & Lloyd, 2012).

The primary outcome for the secondary question was the presence of chronic anxiety, which was measured based on the question, “Do you have an anxiety disorder such as a phobia, obsessive-compulsive disorder, or a panic disorder?” In the database, this was the only question specific to the presence of anxiety disorders. The answer choices analyzed were “yes” and “no,” and individuals who answered “don’t know” were recoded into the “no” category (Statistics Canada, 2018a). Investigating anxiety can provide an incentive for incorporating mental health resources within workplaces and for individuals that are seeking work (Rajgopal, 2010).

Additional Data Collection

Food security and post-secondary education were anticipated to be confounding variables for the primary question. The variable “Food security status - Canadian Method" was based on six questions (FS_Q05 through FS_Q30), and responses were “food secure,” “moderate food insecurity,” and “severe food insecurity” (Statistics Canada, 2018a). Morales & Berkowitz (2016) found a link between food insecurity and unhealthy dietary practices in non-Aboriginals, so this variable was used to determine whether the same applies to Aboriginal males. The second variable that was analyzed was “Post-secondary - Education taken - University certif./diploma/degree,” and the answer choices considered were “yes,” and “no,” while “valid skip,” “don’t know,” and “not stated” were recoded as “no” (Statistics Canada, 2018a). Rippin et al. (2020) found that higher education status in lower-income areas has shown increased nutritional intake and healthy eating in non-Aboriginal families. Analyzing post-secondary education helped determine whether such a correlation exists between post-secondary education and healthy eating in Aboriginal males.

Statistical Analysis

Statistical analyses were run using version 28 of the SPSS Statistics software and through the manipulation of the original dataset found on ODESI. Table 1 included variables related to the independent and dependent variable(s) and was summarized based on two groups. All variables used in the analysis were categorical variables, so a limited number of tests could be conducted, and a normality test was not required. The data were filtered for Age (25-34 years old), Sex (male), and Identity (Single Identity First Nations or Métis). A 2x2 Chi-square test assessed fruit and vegetable consumption differences between employed and unemployed men, for First Nations and Métis. A Spearman Rho's correlation evaluated whether food security status and post-secondary education fulfilled the rules for a binary logistic regression with the cut-off value of at least 0.10. The binary logistic regression assessed whether the predictor variables were significantly related to fruit and vegetable consumption. The p-value of 0.05 helped determine significance. Previous literature shows that Aboriginal communities lack education and tend to be food insecure, but the implications for eating habits are under-researched, hence the rationale for choosing these variables (Anderson, 2019). For the secondary question, a 2x2 Chi-square test assessed the presence of chronic anxiety between employed and unemployed males, for First Nations and Métis.

Results

The dataset started with 20849 participants. Based on the inclusion and exclusion criteria, 1000 participants remained, of which 550 were First Nations and 450 were Métis. Missing data was removed based on participants who answered "not stated" for the dependent variable, fruit and vegetable consumption, which entailed four respondents; two First Nations and two Métis. The study consisted of 996 male participants aged 25 to 34 years old.

Table 1 (n = 996) consisted of 548 First Nations and 448 Métis, all of which are male, aged 25 to 34, and reside in Canada. Of the Single Identity First Nations respondents, 381 responded "employed," and 167 responded "unemployed" when asked about their employment status. Of the Single Identity Métis respondents, 367 responded "employed," and 81 answered "unemployed." Table 1 shows the descriptive characteristics of the study population.

Table 1. Characteristics of males aged 25 to 34 who identify as Single Identity First Nations compared to males aged 25 to 34 who identify as Single Identity Métis (n = 996).

Variable	Single Identity First Nations (n = 548) No. (%)	Single Identity Métis (n = 448) No. (%)
Employment		
Employment status in reference week		
Employed	381 (69.5)	367 (81.9)
Unemployed	167 (30.5)	81 (18.1)
Eating Habits		
Fruit and vegetable consumption - Frequency		
Two or more times a day	214 (39.1)	200 (44.6)
Once a day	193 (35.2)	161 (35.9)
A few times a week	109 (19.9)	75 (16.7)
About once a week or less, or never/hardly never	32 (5.8)	12 (2.7)
Food Security		
Food security status - Canadian Method		
Food secure	353 (64.4)	323 (72.1)
Moderate food insecurity	140 (25.5)	87 (19.4)
Severe food insecurity	54 (9.9)	37 (8.3)
Not stated	1 (0.2)	1 (0.2)
Education		
Postsecondary - Education taken - University certif./diploma/degree		

Yes	103 (18.8)	112 (25.0)
No	226 (41.2)	204 (45.5)
Valid skip	216 (39.4)	129 (28.8)
Don't know	1 (0.2)	1 (0.2)
Not stated	2 (0.4)	2 (0.4)
Mental Health		
Chronic Conditions - Anxiety Disorder		
Yes	71 (13.0)	60 (13.4)
No	474 (86.5)	387 (86.4)
Don't know	3 (0.5)	1 (0.2)

Values are listed as the number (%) of participants. Missing data was removed from the data set.

Figure 1 displayed the number of First Nations participants [n = 548] and the number of Métis participants [n = 448] who had good or poor eating habits based on their employment status.

Figure 1. Results from a 2x2 chi-square assessing eating habits based on employment status. A - Chi-square results for First Nations participants (n = 548). **B** - Chi-square results for Métis participants (n = 448). Statistical significance is denoted by asterisks.

Based on Figure 1A, 166 (44%) employed First Nations participants reported good eating habits, while 215 (59%) reported poor eating habits. 48 (29%) unemployed First Nations participants reported good eating habits, while 119 (71%) reported poor eating habits. The

p-value for the 2x2 Chi-square was 0.001. Based on Figure 1B, 176 (48%) of employed Métis respondents reported good eating, while 191 (52%) reported poor eating habits. Of the unemployed Métis participants, 24 (30%) reported good eating habits, and 57 (70%) reported poor eating habits. The p-value for the 2x2 Chi-square was 0.004.

Figure 2 displayed the number of First Nations participants [n = 548] and the number of Métis participants [n = 448] who reported presence or absence of anxiety based on their employment status.

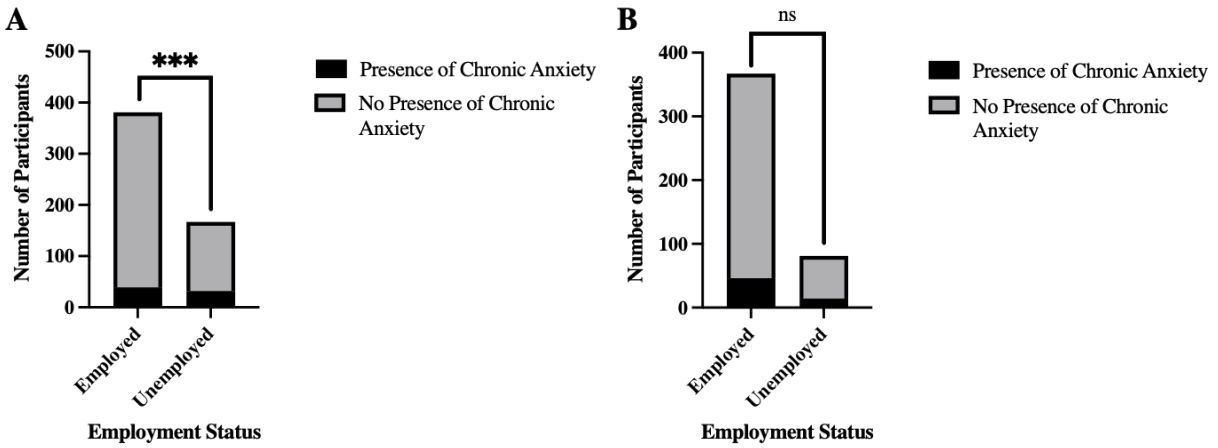

Figure 2. Results from a 2x2 chi-square assessing presence of chronic anxiety based on employment status. A - Chi-square results for First Nations participants (n = 548). **B** - Chi-square results for Métis participants (n = 448). Statistical significance is denoted by asterisks.

Based on the database, three First Nations answered "not stated," and one Métis answered "not stated;" all were recoded as "no." Based on Figure 2A, 39 (10%) employed First Nations participants reported presence of chronic anxiety, while 342 (90%) reported no presence of chronic anxiety. 32 (19%) unemployed First Nations reported presence of chronic anxiety, while 135 (81%) reported no presence. The p-value for the 2x2 chi-square was 0.006. Based on Figure 2B, 46 (13%) employed Métis participants reported presence of chronic anxiety, while

321 (87%) reported no presence of chronic anxiety. 14 (17%) unemployed Métis participants reported the presence of chronic anxiety, while 67 (83%) reported no presence of chronic anxiety. The p-value for the 2x2 chi-square was 0.339.

Spearman's Rho Correlation

For First Nations, the Spearman's Rho analysis for post-secondary education yielded $r = -0.109$, $p = 0.049$, and $r = -0.179$, $p < 0.001$ for food security status. Using a cut-off value of 0.1, both variables were related to the dependent variable. For Métis, the analysis for post-secondary education yielded $r = -0.146$, $p = 0.010$, and $r = -0.172$, $p < 0.001$ for food security status. Using a cut-off value of 0.1, both variables were related to the dependent variable.

Binary Logistic Regression

Table 2 and 3 shows the binary logistic regression output for the two predictor variables. B represents the regression coefficient which shows the relationship between poor eating habits and the predictor variables. Wald shows the importance of the predictor variable's contribution. The significance value shows whether the predictor values significantly contribute to the dependent variable, at alpha level $p > 0.05$.

Table 2. Binary logistic regression output examining the association between poor eating habits with post-secondary education and food security status for First Nations (n = 548).

							95% C.I. for EXP(B)	
Predictor Variable	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**	**Lower**	**Upper**
Post-Secondary Education	.441	.245	3.252	1	0.071	1.554	.962	2.510
Food Security Status	.961	.266	13.054	1	<.001	2.613	1.552	4.400
Constant	-.296	.211	1.975	1	.160	.743		

According to the Omnibus Tests of Model Coefficients, the chi-square value was 17.811, and only one predictor variable was significant, which was food security status ($p < 0.001$). The model correctly classified 61.1% of cases. The odds of having poor eating habits were 2.613 (95% CI 1.552 - 4.400) times higher for participants with food insecurity.

Table 3. Binary logistic regression output examining the association between poor eating habits with post-secondary education and food security status for Métis (n = 548).

Predictor Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B) Lower	Upper
Post-Secondary Education	.584	.240	5.898	1	0.015	1.793	1.119	2.871
Food Security Status	.701	.274	6.526	1	.011	2.016	1.177	3.451
Constant	-.367	.201	3.337	1	.068	.693		

According to the Omnibus Tests of Model Coefficients, the chi-square value was 13.470. Both predictor variables were significant, with $p = 0.015$ for post-secondary education and $p = 0.011$ for food security status. The model correctly classified 58.9% of cases. The odds of having poor eating habits were 1.793 (95% CI 1.119 - 2.871) times higher for participants without post-secondary education and 2.016 (95% CI 1.177 - 3.451) times higher for participants with food insecurity.

Discussion

This study investigated whether employment status impacted eating habits of First Nations and Métis males. The main findings suggest a significant difference in eating habits based on employment status for both First Nations and Métis. For First Nations, there was a significant difference in the presence of anxiety between individuals who are employed and unemployed.

The significant difference in eating habits based on employment status for First Nations and Métis can be attributed to the idea that low income may result in poor eating habits. According to Anderson (2019), employed individuals were more likely to be food secure than their unemployed counterparts, which may explain why food security is a significant predictor of eating habits. Domingo et al. (2020) found similar results, such that Aboriginal families who rely on social assistance rather than employment income were at a higher risk of food insecurity, poorer eating habits, and obesity (Domingo et al., 2020). Both groups have high proportions of lower-income households, led by single mothers dependent on convenience stores and highly processed foods while neglecting milk, meat alternatives, and fruits and vegetables (Richmond et al., 2020). Studies have shown that regardless of Aboriginal identity, employment status has implications associated with food security and thus eating habits.

There is a significant difference in anxiety based on employment status for First Nations but not for Métis which may be due to the higher unemployment rates in First Nations. A study conducted by Hu et al. (2019) found that First Nation individuals present with significant gaps in their income and employment outcomes, which could have induced long-term financial anxiety. Although minimal research was conducted on Métis' health, the insignificant difference between employment status and anxiety for Métis contradicts previous studies. According to Hahmann et al. (2019), unemployed Métis were at risk for poor mental health, including anxiety and depression, but the results of this study showed that the majority of unemployed Métis men did not have anxiety. Other confounding variables in the database, such as family income, mental health consultations, and leisure activities (hunting, fishing, crafts, and making clothing) could reduce/inhibit feelings of anxiety.

There is a significant difference in eating habits among Métis based on their post-secondary education. Finger et al. (2013) supports this, as adults with a higher level of education reported higher consumption of energy-dense food more frequently than adults with a lower level of education. Similarly, Slater & Mudryj (2016) found that Aboriginal Canadians were more likely to report poor eating habits than their highly educated counterparts. This supports the significant findings of Métis' eating habits and post-secondary education while contradicting the insignificant difference in eating habits for First Nations based on post-secondary education. Arriagada (2021) found that education is less accessible for First Nations compared to Métis, with a 10% difference in post-secondary education between men in both communities. The insignificant finding may be due to confounding variables in the database, such as skills level. Statistics Canada (2015) shows that education is not the only factor linked to labor market success. Other skills such as computer and numeracy skills play a vital role in the success of employment for First Nations men, which may impact the level of food security and eating habits for this population (Statistics Canada, 2015).

The findings emphasize the importance of researching individual Aboriginal identities rather than generalizing results for all Aboriginals. Generally, research focuses on children and women's eating habits and food insecurity in single-parent households. The findings of this study shed light on the importance of researching male eating habits and how a social determinant like employment may affect them.

A limitation of this study is that participants may fall susceptible to social desirability bias when discussing fruit and vegetable consumption, as they may feel inferior sharing poor eating habits. Another limitation of the study is that it excludes Aboriginal populations residing in Yukon and Northwest Territories, which may skew the results as their income, food

availability, and employment may differ. According to Deaton et al. (2020), communities in Northern Canada experience elevated rates of food insecurity due to inflation, making this population important to explore. The study is limited as there was only one variable regarding eating habits (fruits and vegetables), and a balanced diet consists of various food groups. The study neglected the examination of healthy eating in the Inuit community, so the conclusions cannot be applied to them. Another limitation is that the difference between part-time and full-time employment may affect eating habits, but this was not analyzed within the study, so the results cannot be generalized to both types of employment.

Future studies should investigate Aboriginal eating habits based on all food groups of the Canadian Food Guide. Public health should implement nutrition and healthy eating habits into high-school and post-secondary curricula so that adults are continuously informed about the risks of unhealthy eating. The addition of breakfast programs in elementary, secondary, and post-secondary institutions can increase healthy eating. It is crucial for youth to be surrounded by healthy food as they are impressionable and learn habits based on their environment, and as such, will continue implementing these habits into adulthood (Birch et al., 2007). Future research should focus on the long-term effects that breakfast clubs have on children and whether they should be implemented in workplaces. Public health should account for increased anxiety in First Nations by allocating more funds towards mental health resources for First Nations employed and unemployed to help reduce the risk and severity of chronic anxiety. Researchers should determine whether specific mental illnesses correlate more significantly to employment status. The implications of this research aim to enhance the welfare of individual Aboriginal communities in Canada.

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Cannabis Consumption Trends and the Implications on Canadian Youth Mental Health, During the Covid-19 Pandemic: A Large Cohort Prospective Study

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Introduction

The definition of overall health and well-being is different for everyone since every person has their own needs and opinion about what elements of health are most important to them. In most cases, a person should explore their own inner strength and weaknesses, to encourage healthy emotional management in terms of stress and negativity (Deiner, 2000). It is commonly agreed upon that the elements that are most responsible for a person's overall well-being include physical, mental and social health (World Health Organization, 2014). In short, a person must be physically active, mentally stable and have secure social relationships to have good overall health and well-being. It has been published and investigated by many that humans are social beings (Mühl, 2018), and an argument could be made that social health and by effect, mental health, are the most important aspects to regulating human health and well-being. For those who cannot receive gratifying amounts of either, they may turn to other substances to receive that dopamine hit such as alcohol, opiates, and most recently, cannabis. *Cannabis sativa* L. is a psychoactive plant that has been widely used throughout human history as far back as Ancient Egypt times (Russo, 2007). It is a substance that has seen an increase in usage. However much of the early research on cannabis and its effects suffer from poorly designed studies that limit the validity of such results (Iversen, 2003). Cannabinoids are the compounds in cannabis that work within the body and create the psychoactive effects of the plant.

There are many types of cannabinoids that come in different forms. They all have varying effects based on the strain of plant they come from, resulting in a lot of research needing to be done to understand all their effects clearly. Cannabinoid-Sensitive Receptors are found throughout the entirety of the Central Nervous System (CNS) and interact with many different neurotransmitters (Murkar et al., 2021). Although the specific interactions between different

cannabinoids and the brain are still not fully understood, researchers have proven that cannabinoids do in fact interact directly with the systems in the brain that control fear and anxiety (Murkar et al., 2021). They have also been able to prove that they directly interact with the enzymes that modulate dopamine release (Peters et al., 2020).

The two main strains of Cannabis are Sativa and Indica. Sativa strains of cannabis are thought to be more stimulating and conversely, Indica strains are known for releasing stress and allowing relaxation, acting as more of a depressant (Peters et al., 2020). Research has been conducted on these strains and the results align with these descriptions, however, whether or not these effects are significant enough to be classified into these separate strands is something that is still being studied (Peters et al., 2020). People will smoke different strains recreationally depending on what effects they are looking to feel and what environments they are in. With the 2019 to current SARS-CoV-2 pandemic occurring, there have been many stay-at-home mandates being put into place and people's daily lifestyles have been forced to drastically change. There have been hypothesis that this has resulted in people becoming more stressed out for varying reasons depending on their situation. With people being forced to adjust their daily habits, one could assume that they are more likely to look to external substances such as cannabis to help themselves cope. The pandemic has resulted in a change of environment for many, and our analysis aims to see if there is a connection between cannabis use and how environmental cues can affect mental health.

It is known that environmental cues and specificity have a significant effect on how the body processes, and even craves drugs (Siegel, 1999). Extended habitual drug use can result in steadily increasing drug tolerance and a conditioned response to the substances before they are even introduced to the system (Siegel, 1983). Consuming drugs in an environment that is not

associated with this conditioned response can result in overdoses due to the body failing to come to homeostasis (Siegel, 1983). However, the knowledge gap in existing research is it is unknown how much environmental cues affects homeostasis of the body under frequent cannabis consumption. With the COVID-19 pandemic significantly changing individuals' consumption environments and patterns, it is unknown what negative effects this can have on the body. We will primarily assess the affects of such changes on individuals through analysis of their changing mental health status. With respect to humans being social creatures, we will be focusing on social behaviours as it is a large contributor to overall human health and well-being.

The social/mental health variables related to social behaviours we will be using to determine if there is a behavioral link between differential cannabis consumption environments and negative health are: changes in cannabis use, the ability to maintain close relationships, self reported mental health, and usage related to stress. Albeit these variables are not direct measurements of mental health, they are a good reflection of behaviours that can worsen or increase in times of stress or anxiety. Therefore, our goal is to explore if the social distancing-protocols in Canada during the COVID-19 pandemic significantly affect the mental health of people aged 15-24 who consume recreational cannabis, compared to their mental health status before the implementation of social distancing measures?

Methods

This research paper uses data from the 2021 Canadian perspectives survey series 6, constructed by Statistical Canada (Including only Ontario; excluding Prairies provinces, Atlantic Oceanic provinces and Territories). Canadian perspectives survey series (CPSS) is a national-wide small and short questionnaire survey designed to investigate socioeconomic and health status of all Canadian citizens from 10 provinces (Excluding Northwest Territories, Yukon and Nunavut). The major goal of CPSS is to directly collect Canadian citizen's data in improving public policy, emergency needs and federal regulations (Study documentation, 2022). Participation in the national survey panel and questionnaires is voluntary and randomized, targeting 31, 000 selected individuals from LFS households (Labour Force Survey). The Labour Force Survey uses a rotating panel to select raw samples for six consecutive months (Study documentation, 2022). The 2021 Canadian perspective survey databases were collected through large cohort studies (N= 3941) which involve a series of questionnaires that rate respondent information, socioeconomic status, substance use and mental health issues on a scale of 1 to 5, where 1 indicates good or smaller status and 5 indicates worse or larger status. For example, rating mental health status on a scale of 1 indicates good mental health status, and rating on a scale of 5 indicates bad mental health status. All of the data were qualitative and discrete data. Summary of processed information demonstrates that most dataset were in valide percentage of 99.8% and missing data amounts for 5 - 30% of total data collection.

This research paper asks the significance of COVID-19 isolation strategies on mental health and the consumption of cannabis for individuals aged 15 to 24 years old. It is a cross-sectional and observational data-based study. This research paper intended to investigate social distancing protocols in Canada via social isolation (Including lockdown strategies such as

limiting occupancy level, closing programs, limiting social gathering and socialization events; Excluding public health measures such as mask policy, promotional strategies and informative propagandas). This research study will perform chi-squared analysis on 2 main categories of study participant (Including both gender aged 15 to 24 years old; Excluding both gender not aged 15 to 24 years old, full-time members of Canadian Armed Forces, Aboriginal reserves and settlement, institutionalized population, remote residents), compared against different cannabis usage (currently using or not currently using) and good mental health maintenance (rating mental health status 1 to 3, not using cannabis due to social isolation, not using cannabis due to stress, not using cannabis due to loneliness; excluding socioeconomic status, respondent educational level, or standard of living). Primary outcomes involve highly significant analysis in chi-squared analysis in 1 x 5 variable columns and rows (with above variables). Secondary outcome is scoring significant value in logistic regression analysis. To validate research data, it is important to include reproducibility and accuracy. These outcomes have to be reproduced and replicated for future researchers - thus it will have a simple method of new variables construction and chi-squared testing. Listed variables will have to be transformed into different categories (range 1 to 3, assigned value of 1; and range 4 to 5, assigned value of 2), then compared against age of respondent (aged 15 to 24; or not aged 15 to 24), to determine correlation between mental health status and respondent status. Additional data collection include respondent socio-economic status, marity and other variables (Employment, Household size, Educational level and other variables). Additional data collection will assist in determining the general databook summary for participant's socioeconomic status and its relation to mental health and substance use during pandemic.

Statistical analysis of this research study is conducted via chi-squared tests, error bar analysis with 95% confidence intervals and other statistical test. Since most of the dataset consisted of correlational datas, statistical tests such as linear regression, ANOVA, MANOVA and independent T-test will not be used. Instead, correlational study of the chi-squared test and Pearson's R-value will be used. Additionally, standard error bars within the 97% confidence interval will be used for this research study. Age of respondent (15 to 24) will be compared against cannabis use during COVID-19. It is determined that the study outcome will produce categorical variables and significant R-value. Kruskal-Wallis test will not be used due to the need for continuous independent variables, along with Wilcoxon Rank-Sum test which also require continuous variables.

Results

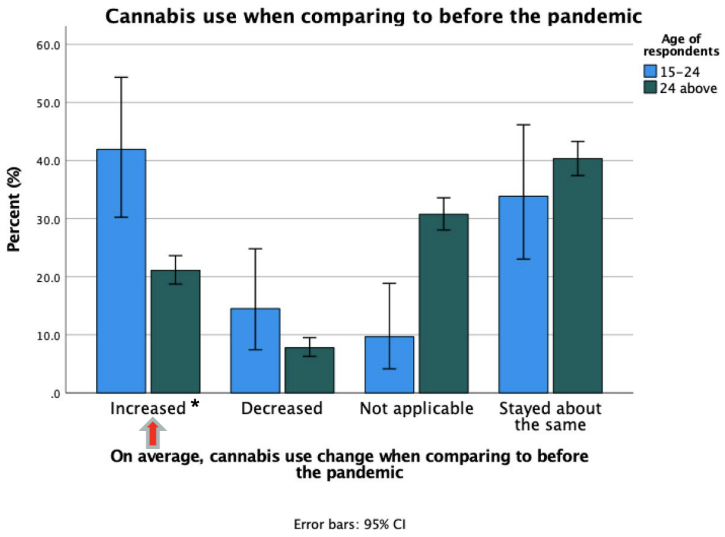

Figure 1: Percent of cannabis use change compared to before the pandemic. N = 3471. Age of respondent (15 to 24 years old and 24 above) compared against cannabis use. Standard error bars with 95% confidence interval. *Represent a highly statistical significant relationship between the two groups with p-value of < 0.001.

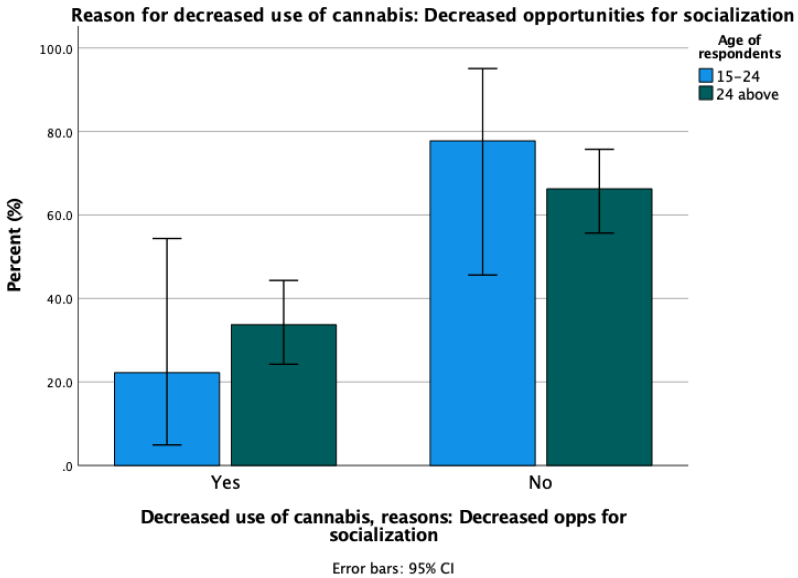

Figure 2: Percent of decreased use of cannabis, reasons: decreased Opps for socialization by the age of respondents. N= 3471. Standard error bars with 95% confidence intervals, p-value = 0.745 (p-value > 0.05). The relationship is not significantly different between the two groups.

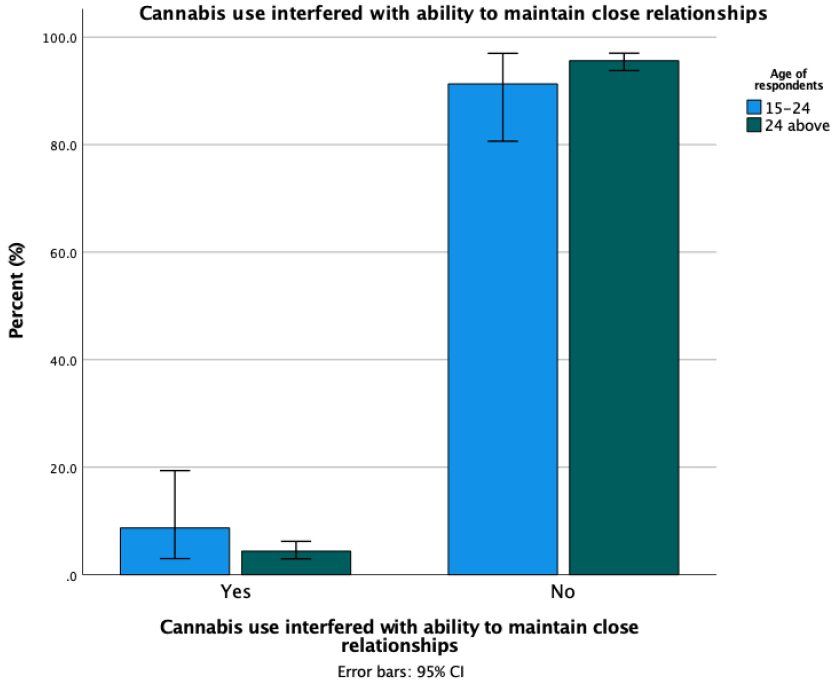

Figure 3: Percent of cannabis sue interfering close relationship by age of respondents (15 to 24 years old and 24 above), N = 3491. Error bars with 95% confidence intervals, p-value = 0.329 (p-value > 0.05). The relationship is not significantly different between the two groups.

(a)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	115.973[a]	6	<.001
Likelihood Ratio	118.830	6	<.001
Linear-by-Linear Association	107.600	1	<.001
N of Valid Cases	3935		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 68.98.

(b)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.467[a]	6	.052
Likelihood Ratio	12.402	6	.054
Linear-by-Linear Association	2.606	1	.106
N of Valid Cases	1128		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.80.

Figure 5(a): Mental health (reporting or not reporting) against age of respondent (aged 15 to 24 years old and 24 above).

Figure 5(b): Consuming cannabis due to stress (stress or no stress) against age of respondent (aged 15 to 24 years old and 24 above). N= 3935, 1128 respectively. Emission of missing datas.

**** we have no continuous variables ****

Table I: (Table illustrating categorical data only. Measure of central tendency expressed in mode. Descriptive characteristics of study population. [N= 3941]. Measurement scale listed).

Variable	**Measure of central tendency in mode**	**Frequency**	**Valid percent**
Cannabis use (%)	2	598	90.2%
Cannabis with close relationship (%)	2	632	95.3%
Age (yr)	5	917	23.3%
Sex (%)	2	2133	54.1%
Education (%)	6	997	25.3%
Employment (%)	1	2148	55.9%
Cannabis use in 30 days (days)	2	1615	59.8%
Reason (%)	1	455	67.6%
Socialization (%)	2	62	67.4%

Table II: (Table illustrating categorical data only. Valid percent compared against total percentage. Descriptive characteristics of study population. [N= 3941]. Emission of missing datas (Excluding not sure, not certain, do not answer).

Variables	Number of respondent (Including only 15 to 24 years old)	Valid Percent	Number of respondent (Including only 15 to 24 years old)	Valid Percent
Mental Health (Good or Bad)* Age respondent (15 to 24)	3935	99.8%	3941	100%
Cannabis Consumption (continuing even when having trouble and no continuing)* Age respondent (15 to 24)	663	16.8%	3941	100%
Cannabis Use (no or yes) *Age respondent (15 to 24)	251	6.4%	3941	100%
Cannabis Use (due to or not due to loneliness) *Age respondent (15 to 24)	251	6.4%	3941	100%
Cannabis Use (due or not due to stress) *Age respondent (15 to 24)	1128	28.6%	3941	100%

Discussion

An analysis was conducted on the correlation between different variables relating to mental health and the usage of cannabis by individuals aged 15-24 living in Canada before and after the implementation of social distancing measures. The variables studied were: changes in cannabis use before/after the pandemic started, frequency of cannabis use, if cannabis use interfered with the ability to maintain close relationships, and if decreased socialization opportunities reduced their cannabis intake. Although none of these variables are a direct measure of mental health, they all are scientifically proven to be a reflection of one's mental health, allowing us to draw conclusions from the data.

When looking at the data that was measured solely during the pandemic (effects of cannabis use on socialization/relationships), we found that there were not any major changes. Over 90% of individuals stated that they did not face any difficulties maintaining their close relationships due to their marijuana use during the pandemic. A little under 80% of individuals stated that the decreased opportunities for meeting with people due to social distancing measures did not particularly affect their marijuana intake. Both of these results emphasized the fact that the restrictions put into place due to the pandemic didn't directly affect the mental health of those who regularly consume marijuana.

Statistical analysis constructed based on ages of respondents (aged 15 to 24; against not aged 15 to 24) demonstrated that most variables have pearson's R-value of more than 5%. As stated in the methodology section, testing for significance was based on chi-squared analysis. Case processing summary (Comparing mental health, continuing cannabis even when having issues, cannabis use, loneliness as reason for cannabis use and stress as reason for cannabis use; against different age gaps (Between 15 to 24 years old) demonstrates that most participants are

within 99.8%, 16.8%, 6.4%, 6.4 % and 28.6% respectively. Pearson's chi-squared analysis between mental health (Good mental health range 1 to 3; Bad mental health range 4 to 5) and respondent shows Pearson's chi-squared value of 12.467 and significant value of 0.052, this indicates no correlation between mental health and age of respondent. Judging from the above results, most chi-squared analysis has no correlation between age of respondents (Including 15 to 24 years old; Against 15 to 24 years old), against four other variables (Continuing cannabis even when interfering social interaction, cannabis use, cannabis due to loneliness, cannabis due to stress; All measured based on range 1 to 3 for good and range 4 to 5 for bad). The result is consistent for reproductive strategies using simple different variables methods.

There were several limitations we faced while conducting our research using this study. To start, a majority of the data included in the study was collected using self-report methods. A flaw of using self-report methods is that any data collected may be somewhat biased as participants may feel inclined to be perceived a certain way. This can result in data being somewhat unrepresentative of the actual reality in the population. Another limitation we faced was the lack of provincial differences accounted for in the database itself. Social distancing measures and other pandemic regulations do vary between the Canadian provinces and territories, making it difficult to see what level of restrictions were placed upon each participant. Alongside this, the rules and regulations regarding Marijuana consumption do differ across provinces as well, once again making it difficult to properly compare some pieces of data. One of the more noticeable limiting factors was that all of the data from the database was categorical, meaning we were unable to run a normality test, also making it more difficult to graph.

When pairing these results alongside changes in cannabis use before/after the start of the pandemic, we are able to have a deeper understanding of how lockdown strategies (Including in

the methodology section) can affect youth individuals between the ages of 15 to 24 years old. According to systematic review of adolescent mental health during COVID-19 (Jones, Mitra & Bhuyian, 2021), adolescents generally experienced higher rates of depression, anxiety, stress and other mental health issues due to the pandemic. Numerous other research articles (Jones, Mitra & Bhuyian, 2021) also reported increased incidence of alcohol and cannabis during pandemic. However, following PRISMA guidelines of 16 quantitative studies with 40, 076 participants, it seems that communal support regarding social coping, quarantine, parent-child relationship seems to positively impact youth's mental health during crisis (Jones, Mitra & Bhuyian, 2021). Another web-based survey (Vanderbruggen et al, 2020), reported higher incidence of alcohol, cigarettes and substance abuse than before the COVID-19 pandemic, with statistical p-value more than 5%. Higher incidence of substance use during the lockdown were traditionally associated with youth, children and non-healthcare workers (Vanderbruggen et al, 2020). The fact that the result differs can prove a different perspective toward youth consumption of cannabis during COVID-19 times.

Conclusion

In conclusion, there is no significant difference between individuals aged 15 to 24 years old, against different social isolation strategies and mental health conditions. Future directions of the study include continuous data collection (outlining quantitative analysis based on the amount of drug used), targeting different age groups, investigating gender difference, incorporating better technological standards and other options. Implications of the study involve the importance of social programs in promoting adolescent's mental, physical and emotional health during the pandemic. It also suggested that correlational relationship between adolescence and cannabis may not be apparent at first investigation, and social stigma may be present. It is possible that some young adults may report their substance abuse differently because of fear of social rejection and prejudice against substance abuse. For the next steps of the study, it is important to collaborate results with other research organizations including designing specific survey choices, incorporating advanced statistical tests, plotting computer algorithms and programming with other software. Suggestions for no correlation between individuals aged 15 to 24 years old and mental health status, may implicate other socioeconomic, cultural and political dimensions of the research study.

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Factors Including Vaccine Safety are Important Predictors in Regards to Child Immunization Uptake in the First Nations Population: A Cross-Sectional Study

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INTRODUCTION

Childhood immunizations are an important component in controlling vaccine-preventable diseases (Tarrant & Gregory, 2003). According to UNICEF, childhood immunization uptake accounted for 84% of the global young population (Scheifele et al., 2014). Compared to countries with similar high rates of socioeconomic development, such as the United States or Australia, this rate is low (Scheifele et al., 2014). Lack of immunization coverage could be attributed to the growing reluctance of parents to immunize their children as a result of the spread of misinformation or lack of education on the subject (Scheifele et al., 2014). Other countries with similar status to Canada have tackled this challenge through the use of school entry requirements and linking child benefit payments to immunization (Scheifele et al., 2014). To overcome parental vaccine hesitancy for children, countries must educate the public, providing reliable and understandable information for those who lack a higher education level than secondary school.

Vaccine hesitancy is an emerging challenge in the First Nations population (Mosby & Swidrovich., 2021). The manifestations of vaccine hesitancy can range from; outright refusal of all vaccines, late vaccine administration, or acceptance of only specific vaccines (Limaye et al., 2021). A study conducted by Browne and Fisk (2001) analyzed healthcare experiences of First Nations women within Northwestern Canada and found that their experiences were impacted by racialization and unequal treatment. An additional study looking at two communities in the Sioux Lookout established that low vaccination numbers in the community's children were attributed to blocks in knowledge on vaccinations and opportunities for mothers to vaccinate their children (Tarrant & Gregory., 2001) Although parents may be vaccine-hesitant, research has shown that they still turn to and are heavily influenced by recommendations given to them by their child's pediatrician (Limaye et al., 2021). However, the child's healthcare workers have noted that they

feel inadequately prepared to answer questions from vaccine-hesitant parents citing a lack of knowledge on effective communications strategies (Limaye et al., 2021). Further research on childhood vaccinations in First Nation communities is required to determine the scope of this challenge.

More research must be conducted on the quality of information about vaccine safety and efficacy and the role this information plays in a First Nations mother's decision to vaccinate their child(ren). Henderson et al. (2018) identified that First Nations communities primarily rely on oral communication to transmit information. With regards to HPV vaccination education, elders in the community felt that this information compromised their culture by taking away their chance to teach their children about safe-sex practices; however, elders were not opposed to learning, but wanted to relay the information themselves to honour their heritage (Henderson et. al, 2018). Oral transmission of information arises in a study by Tarrant and Gregory (2003) where First Nations mothers stated that stories about negative side-effects of immunization explained why anti-vaccine attitudes were still prevalent in their communities. Thus, an investigation of the relationship between information gathered through word-of-mouth and its influence on a mother's choice to vaccinate her children would be valuable. This same study by Tarrant and Gregory (2003) discovered key themes for the reasoning behind First Nation mothers deciding to not vaccinate in Northwestern Ontario; vaccine skepticism may be attributed to health illiteracy. Scientific information on health must be accessible to those of all educational backgrounds, especially when examining First Nations communities. Although fevers are typically a consequence of the vaccine activating the immune system, many mothers were concerned and less likely to continue vaccination (Tarrant & Gregory 2003). Furthermore, the decline of communicable diseases due to factors such as herd immunity has caused First Nations

mothers to be concerned about the direct side effects of the vaccine over the prevention of the disease (Tarrant & Gregory 2003). Therefore, investigating the relationship between the education levels and an individual's understanding of vaccines is important to consider.

The aim of this manuscript is to investigate the relationship between access to vaccine uptake and level of trust in the healthcare system regarding childhood vaccinations. We hope to answer if there is a difference of trust in the safety and perception of efficacy of vaccines of First Nations mothers who have vaccinated their child(ren) within the first six years of their life compared to First Nations mothers who have chosen to not vaccinate their child(ren)? This will be done by measuring primary outcomes, specifically, the amount of confidence towards health care professionals' opinions on vaccines; secondary outcomes including perception of safety regarding vaccines and importance of childhood vaccinations; tertiary outcomes included concerns about the potential side effects of vaccinations.

METHODS

Design and Database

Researchers from Health Canada's First Nations and Inuit Health Branch employed a cross-sectional, observational study beginning on November 9th, 2010 to January 30th, 2011. The intent was to enhance the health of First Nations and Inuit populations in Canada via vaccine administration by measuring barriers and reasons of hesitancy. Data collection was done through surveys via phone interviews with participants. Survey questions included demographic data, past responses to immunization/relationship, access to vaccine information and trust towards immunizations. The process of interviews was at a mean time of 17 minutes per individual and the information gathered was able to help gain an understanding on the First Nations and Inuit attitudes and understanding towards immunizations. When conducting research, the database was not referenced in other studies limiting explorations for additional knowledge on the subject.

Study Participants

Initially, there were 659 respondents, which was reduced to 365 respondents. All respondents are First Nations mothers with children. To shrink our database, all respondents had to fit a specific criteria, first being that all respondents must be First Nations; 644 individuals fit this criteria. Next, all individuals who were not mothers were excluded, which included respondents who were pregnant; 366 respondents fit this criteria. Participants that did not answer whether their child had ever received vaccination were excluded, leaving 365 valid cases. All remaining cases were included regardless of whether they were missing data in certain categories.

Study Outcomes

The primary outcomes were First Nations mother's confidence in healthcare. Amount of confidence was measured in five categories; a lot of confidence, some confidence, little confidence, no confidence at all and lastly not applicable. Secondary outcomes included the mother's perception of vaccine importance and safety, measured by asking how important and safe childhood vaccinations are. Both questions were answered using a Likert scale ranging from very important to not at all important and very safe to not at all safe. The tertiary outcomes in the research analysis were concerns about potential side effects of vaccines, where respondents were asked how strongly they agreed that they were concerned about side effects of vaccines, on a Likert scale ranging from strongly agree to strongly disagree.

All study outcomes were selected because lower vaccination uptake in First Nations child populations may be attributed to these outcomes and therefore they aid in answering the research question. In terms of the validity and reproducibility, this research is likely representative of the

First Nations population as multiple studies confirm a lower uptake attributed to perceptions and concerns of vaccinations (Tarrant & Gregory, 2003).

Additional Data Collection

Additional variables included age of the child and participants, education level of the participant, total household income, and other personal questions such as reasons for not wanting to vaccinate their children, and how confident participants are in healthcare professionals. These variables were investigated and noted because it is important to take into account confounding variables that may ultimately skew results of the study. They were also useful to understand and analyze the main outcome of the study, and explain several of the dependent variables. For instance, age of the child and participants or education level may influence the decision to vaccinate. It may be that women who do not have access to education or simply do not possess a high education status, may choose not to vaccinate due to their lack of knowledge on the topic. The total household income may contribute to other factors, which could be used to make other inferences about mothers' decisions. Asking about mother's attitudes towards vaccination creates a better understanding in terms of their decision. Using a scoring system to rank how confident these mothers are in healthcare professionals gives a greater insight to their reasoning.

Statistical Analysis

The data were grouped into two categories: mothers who vaccinate their children, and mothers who do not. A Chi-square test was conducted as all data were categorical and n-values were greater than 5, which allowed for between-group differences to be compared based on the proportions of responses relating to information about vaccines. Spearman's Rank Order Correlation test was used to investigate the possibility of a relationship between risk factors of vaccine hesitancy. A test for normality was not conducted due to the type of data. A p-value of

0.05 was set as the value for significance to reject or accept the null hypothesis. Finally, a test for regression was included, allowing for the existence, strength, and direction of relationships between vaccination choice and predictor variables such as confidence in healthcare professionals, awareness of vaccine side-effects, and perceptions of vaccine safety and importance to be determined. Missing data was put into the 'unknown' category as seen in Table 1. The Statistical Package for Social Sciences (SPSS) was used to conduct all tests.

RESULTS

Characteristics	Mothers with vaccinated children (n=348)	Mothers with unvaccinated children (n=17)
Population Descriptives		
Age of child		
0 - 24 months	127 (36.5)	14 (82.4)
2 - 6 years	221 (63.50)	3 (17.6)
Age of mother		
< 25 years	72 (20.7)	10 (58.8)
25 - 34 years	173 (49.7)	4 (23.5)
35 - 44 years	92 (26.4)	2 (11.8)
45 - 54 years	9 (2.6)	1 (5.9)
55 - 64 years	2 (0.6)	0 (0)
Level of education		
High school or less	147 (42.2)	11 (64.7)
Some post secondary	102 (29.3)	2 (11.8)
College/vocational/ trade school	48 (13.8)	2 (11.8)
University degree	47 (13.5)	0 (0)
Unknown	4 (1.1)	2 (11.8)
Total Household Income		
Under $20,000	98 (28.2)	2 (11.8)
$20,000 to $40,000	80 (23.0)	3 (17.6)

$40,000 to $60, 000	61 (17.5)	2 (11.8)
$60,000 and up	53 (15.2)	2 (11.8)
Unknown	56 (16.1)	8 (47.1)
Vaccine-Related Information		
How safe are vaccinations for children?		
Very safe	208 (59.8)	8 (47.1)
Somewhat safe	123 (35.3)	5 (29.4)
Not very safe	5 (1.4)	1 (5.9)
Not at all safe	2 (0.6)	1 (5.9)
Depends	2 (0.6)	0 (0)
Unknown	8 (2.3)	2 (11.8)
Where would you go for more information?		
Doctor	32 (9.2)	3 (17.6)
Community Nurse	39 (11.2)	1 (5.9)
Other health care professional	12 (3.4)	4 (23.5)
Local health centre/nursing station	170 (48.9)	5 (29.4)
Family/friends	1 (0.3)	0 (0)
Internet	61 (17.5)	2 (11.8)
Other (television, books, etc)	28 (8.0)	1 (5.9)
Unknown	5 (1.4)	1 (5.9)
Where on the internet would you go for more information?		
Google	53 (15.2)	0 (0)
Other search engine	2 (0.6)	0 (0)
Health Canada Website	32 (9.2)	0 (0)
Government department websites	5 (1.4)	0 (0)
Aboriginal association/group website	2 (0.6)	0 (0)
Other	10 (2.9)	0 (0)
Unknown	244 (70.1)	17 (100)

Who do you most trust for information about vaccinations?		
Family/friends	13 (3.7)	1 (5.9)
Doctor	149 (42.8)	10 (58.8)
Nurse	96 (27.6)	4 (23.5)
Community health clinic	37 (10.6)	0 (0)
Other (Pharmacist, etc.)	24 (6.9)	1 (5.9)
Unknown	29 (8.3)	1 (5.9)

Table 1: Descriptive characteristics of First Nations mother population participants [N=365]. The data expressed is stated through the number of individuals (N), with the frequency value (%) being represented as a proportion, noted beside the group sample size. The total number of participants include 365 First Nations mothers. First Nations women who were pregnant were omitted from the table. Any entries with missing data values were included in the unknown category of the dataset.

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	0.072	1	0.788		
Continuity Correction	0.000	1	0.989		
Likelihood Ratio	0.072	1	0.789		
Fisher's Exact Test				0.802	0.487
Linear-by-Linear Association	0.072	1	0.788		
N of Valid Cases	365				

Table 2: Chi-Square Test. The Chi Squared test was computed for a 2 x 2 table using the binned variables of if the child has been vaccinated before and confidence in health care professionals. The minimum expected count for the cells is 6.47 from which 0 cells have passed the count of 5.

The 2 x 2 Chi squared test configured through the variables of confidence in health care professionals and if the child has received vaccinations before indicates no strong significant difference as the asymptotic significance is 0.78. The Chi-squared value formulated is 0.072.

			How important are childhood vaccines?	Concerned about potential side effects from vaccination	Confidence in Healthcare	How safe are vaccines for kids?
Spearman's Rho	How important are childhood vaccines?	Correlation coefficient	1.000	-0.089	0.149*	0.286*
		Sig. (2-tailed)	-	0.088	0.004	<0.001
		N	364	364	364	364
	Concerned about potential side effects from vaccination	Correlation coefficient	-0.089	1.000	-0.056	-0.157*
		Sig. (2-tailed)	0.088	-	0.284	0.003
		N	364	365	365	365
	Confidence in Healthcare	Correlation coefficient	.149*	-0.056	1.000	0.157*
		Sig. (2-tailed)	0.004	0.284	-	0.003
		N	364	365	365	365
	How safe are vaccines for kids?	Correlation coefficient	0.286*	-0.157*	0.157*	1.000
		Sig. (2-tailed)	<0.001	0.003	0.003	-
		N	364	365	365	365

Table 3: Spearman rho correlation analysis between the binned ordinal variables. Beliefs in the importance of childhood vaccines, level of concern with vaccine side effects, confidence in the healthcare system, and safety of vaccines.

For the survey question 'How important are childhood vaccines?', a small, positive association was observed between the importance of childhood vaccines and confidence in healthcare ($r = 0.149$; $p = 0.004$) and the safety of vaccines for kids. ($r = 0.286$; $p < 0.001$). For the survey question 'Concerned about potential side effects from vaccination', a small, negative correlation was seen with its relationship to the safety of vaccines for kids ($r = -0.157$; $p = 0.003$). A significant positive association was seen between the variables 'Confidence in healthcare' and 'How safe are vaccines for kids?' ($r = 0.157.$; $p = 0.003$).

			Predicted		
			Confidence in Health Care		Percentage Correct
Step 0	Variables	How important are childhood vaccinations?	1	2	
		How safe are vaccines for kids?	270	0	100
		Concerned about potential side effects from vaccination	94	0	0
	Overall Statistics				74.2

Table 4: Classification Table for Block 0. Values indicate the results of the analysis without predictor variables. The percentage correct value is 74.2.

		Chi-square	df	Sig.
Step 1	Step	13.268	3	0.004
	Block	13.268	3	0.004
	Model	13.268	3	0.004

Table 5: Omnibus Tests of Model Coefficients. The goodness-of-fit test indicates a Chi-square value of 13.268 and p-value of 0.004 when the 3 predictor variables are included in the model.

		B	S.E.	Wald	Sig.	Exp(B)	Lower 95% C.I. for Exp(B)	Upper 95% C.I. for Exp(B)
Step 1	How important are childhood vaccinations?	-.612	.313	3.816	.051	.542	.294	1.002
	How safe are vaccinations for children?	.578	.257	5.048	.025	1.783	1.077	2.953
	Concerned about potential side effects from vaccination	-.154	.286	.290	.590	.857	.490	1.501
	Constant	-1.184	.650	3.324	.068	.306		

Table 6: Variables in the Equation. Variable values in the equation for the 3 predictor variables included in the model are noted.

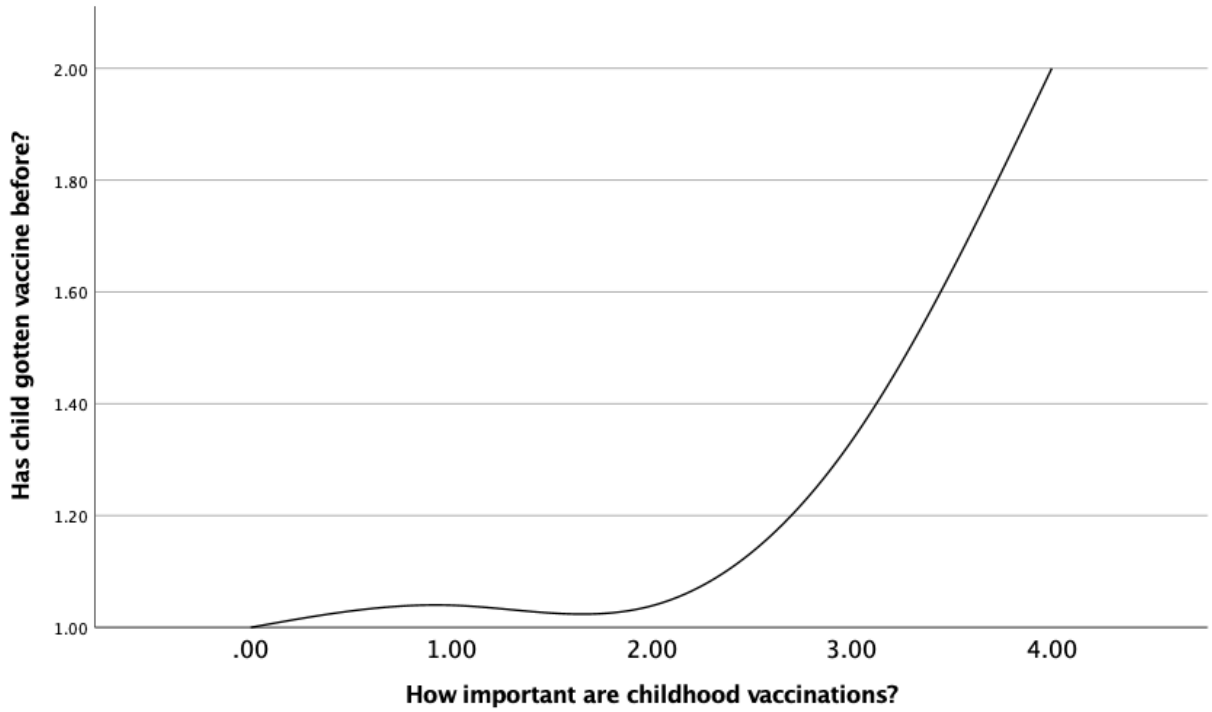

Figure 1: Logistic regression model in determining relationship between vaccine uptake and perception of importance of vaccination during childhood. Model was generated using SPSS regression variable plots, plotting childhood vaccine uptake in the First Nations population and maternal perception of the importance of childhood vaccination.

According to the Omnibus Tests of Model Coefficients in Table 5, the full model was statistically significant (Chi-squared = 13.268, p = 0.004), suggesting that the model was able to predict cases which First Nations mothers had or had not vaccinated their child(ren). The model correctly classified 74.2% of cases. As seen in Table 6, one predictor variable, perception of safety of vaccines, produced a significant contribution to the model and was the most important predictor of reporting vaccination status, as supported by the Wald value of 5.048. The chances of a First Nations mother having a higher perception of safety was 1.8 (95% C.I. 1.1-3.0) times higher than for mothers who chose not to vaccinate. As seen in Figure 1, perception of importance and whether a child had received a vaccine demonstrates a positive correlation.

DISCUSSION

The purpose of this study was to understand and analyze the relationship between perceptions on vaccines and health care of First Nations mothers, and its influence on the

decision to vaccinate their child(ren). The goal was to address whether there was a difference in trust of the effectiveness and safety of vaccines in First Nations mothers who had vaccinated their child(ren) in the first six years of their life compared to First Nations mothers who had not. The findings of this study determined the perception of vaccine safety to be the most influential predictor of the mother's decision to vaccinate her child(ren), followed by their beliefs in the importance of vaccination. Worries about vaccine side effects were found to have a very low contribution to a mother's choice to vaccinate her child. Furthermore, a mother's choice to vaccinate her child was not influenced by her confidence in health care workers.

The Chi Squared test, seen in Table 2, determined that there is no relationship between a mother's decision to vaccinate her child, and her confidence in health care professionals. This may be explained by a study done by White & Thomson (1995), where mothers with a poorer education status were less likely to understand how vaccines work, but were more likely to vaccinate their children. Therefore, it can be inferred that these First Nations mothers may vaccinate their children for other reasons besides their trust and confidence in health care workers.

The constructed logistic regression model was able to predict child vaccination status 74.2% of the time, as shown in Table 4. The figure showing logistic regression determined that the mother's belief on the importance of vaccination highly influences their choice to vaccinate their children. In fact, the stronger their opinion that vaccines are important, the more likely they were to vaccinate their children. However, a stronger variable influencing vaccine willingness was identified to be the perception of vaccine safety, with a Wald test value of 5.048. Mothers who viewed vaccines as safe were more likely to vaccinate their children, and those who believed vaccines to be unsafe were less likely to vaccinate their children. Prior studies support

this outcome, as they have indicated that reports of illnesses caused by vaccines have caused significant decreases in vaccination rates (Gangarosa et al. 1998). Media reporting of illnesses caused by vaccines could possibly lead to negative feelings towards vaccine safety, especially when considering that successes in vaccination are rarely reported in the media. The logistic regression model identified concerns about vaccine side effects as an insignificant contributor to a mother's decision to vaccinate her child(ren). However, a study by Tarrant and Gregory (2001) contradicts this, as it highlighted worries about vaccine side-effects as a major factor causing decreased immunization uptake rates in the First Nations population.

The findings from the Spearman Rho analysis, displayed in Table 3, show a low statistical significance between a First Nations mother's confidence in health care and their concerns about vaccine side effects. A study by Tarrant and Gregory (2001) found similar results and attributed a lack of knowledge on the topic of vaccination to low confidence in the healthcare system. It was noted that some First Nations mothers believed vaccines would provide the child with immunity against all childhood diseases, thus when the child eventually became sick, their confidence in healthcare was compromised (Tarrant and Gregory, 2001). Furthermore, other mothers did not fully comprehend the level of prevention or protection each vaccine provided. This is evident in a study by White & Thomson (1995), where mothers felt betrayed when their vaccinated child contracted the disease they were immunized against; this feeling likely contributes to low confidence levels in healthcare and the importance of childhood vaccination. The urgency of effectively educating First Nations mothers about the importance of vaccination is further demonstrated by the higher occurrence rate of vaccine-preventable diseases in First Nations communities (Tarrant and Gregory, 2003). Results from numerous studies

suggest that teaching First Nations mothers about the vaccine protection alleviates their mistrust in vaccines, and thereby increases vaccine uptake levels in this population.

Several limitations exist within this study. To begin, the low sample size for the unvaccinated group impacts the power of the study, as a larger sample size would allow for more variances between groups to be analyzed with a higher degree of certainty. In addition, the study focuses on First Nations mothers in Canada; however specific regions have smaller sample sizes. Alberta only had 55 participants, while the Maritime provinces had a combined 67 participants. As different regions in Canada can be vastly different, it is also likely that attitudes towards vaccination may vary greatly as well. A more detailed look into each province with a comparison at the end may have been more beneficial, or equivalent proportions based on population size may provide a better perspective on a First Nations mother's attitudes towards vaccination across Canada. The observational nature of this study is also a limitation, as survey-style research can result in misinterpretation and missing data due to participants abstaining from answering specific questions. The questionnaire relies heavily on the belief that participants will be truthful; an assumption which is not always the case and may lead to inaccurate or false data. Research regarding the exact rates of child vaccination as well as the reasons deterring mothers from vaccinating their children in First Nations communities is extremely limited; therefore, future steps into this research may include a cohort study examining the significance of the risk factors for reduced immunization rates such as concerns about side effects and the safety of vaccines. This would allow for the interplay between risk factors causing vaccine hesitancy and the choice for a mother to vaccinate her child(ren) to be studied further, as data can be collected after exposure to different risk factors through oral communication and/or the media.

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Assignment 2

Final Manuscript

Assessing the Relationship Between Marijuana Usage and the Sleep Quality of Canadian High-School Students

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Introduction

As marijuana has recently become legalized, it is important to investigate its connection to youth culture, particularly in high school-aged students. This period can bring about turbulent emotions as it precedes the transition to adulthood. In combination with the pressure to perform in classes, high school students may turn to Marijuana to cope with their situation. It is widely believed that Marijuana could improve sleep quality and increase feelings of relaxation, however, this effect is often contradicted in lab settings. If this supposed benefit is more understood, the drug use habits of high school-aged students can be further explained. As a result, adequate support can be given to address the issues in this population without them having to self-medicate with marijuana. The long-term effects of which are not fully known. This paper will investigate the association between the sleep quality (defined by sleep satisfaction and sleep duration) of Canadian high school students, grades 9-12, who have used only marijuana compared to students of this same cohort that have not used marijuana or any other drug that could affect sleep quality.

The Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS) runs annually and seeks to provide data on the habits of Canadian students from grades 7-12. Information regarding tobacco, alcohol and drug use were assessed as well as information on bullying and sleep. This data can further examine the interactions between substance use and sleep quality for this demographic. It is known that psychoactive drugs such as Marijuana can impact an individual's sleep quality. Moreover, marijuana use in high school students is an area that requires further research to understand the associated risks. Using the data gathered from this survey, it is possible to research the relationship between marijuana usage and the sleep quality of Canadian high school students. The study population will be limited to students in the range of grades 9 to

12. The exposure that will be measured is Marijuana usage. Sleep satisfaction and sleep duration will be analyzed. Comparisons will be made between the sleep quality of students who have used Marijuana and students who have not consumed Marijuana or any other drugs that could impact sleep. This study will observe the effect of Marijuana on sleep quality and potentially detect an inducement for marijuana usage in high school-aged students.

Sleep quality can be crucial for high school students. A paper by Yan et al. (2018) concluded a negative correlation between academic stress and sleep quality in adolescents. This paper further observed a negative association between depression, burnout, and sleep quality. These results indicate the importance of sleep as it can mediate academic stress and prevent feelings of burnout and depression. A component of Marijuana, cannabidiol (CBD), may have beneficial results in treating insomnia (Babson, Sottile & Morabito, 2017). However, research of the overall instrumental value of Marijuana is still in its infancy as research indicates, the other component in Marijuana, Delta-9 tetrahydrocannabinol (THC) could impair sleep quality long-term (Babson, Sottile & Morabito, 2017). Moreover, a study surrounding Marijuana use patterns in young adults elucidated that Insomnia Severity Index scores were significantly lower for non-daily users and controls in comparison to daily users (Conroy et al., 2016). That being said, as the effects are uncertain, Marijuana could still be used to self-medicate for insomnia and for particular demographics such as high school students; this could have lasting cognitive impacts. A review found that adolescent marijuana users demonstrated poorer performance on tests of attention, verbal learning and memory, sequencing, and psychomotor speed compared to non-using adolescents after approximately one month of abstinence (Medina et al., 2007). In addition, long-term implications of Marijuana use in adolescents can adversely affect the cognitive development of attentional and inhibitory control (Paige & Colder, 2020). These detractors

warrant further research into what factors motivate students to use Marijuana. A study across four decades reported that social and recreational reasons for usage have been on the decline. Whereas coping with negative affect reasons has nearly doubled over this time period (Patrick et al., 2019).

Despite cannabis having been legalized in Canada only recently, a reasonably large amount of research has already been conducted regarding its impact on sleep quality. e. A study by Ogeil et al. (2019) determined that the use of cannabis earlier in life (12-14 years old) is associated with poorer sleep quality among 18-year-old adolescents. While this study demonstrates a correlation between cannabis use and poor sleep quality at a later age, it does not investigate the quality of sleep students receive at an earlier point in the study. This leaves open questions regarding the causal relationship between cannabis and sleep quality, specifically the short-term application of marijuana use and sleep quality. Another study investigated the reduction of cannabis use among adults and subsequent changes in sleep quality (Hser et al., 2017). Findings suggested that a reduction in cannabis use resulted in an improvement in sleep quality in comparison to continued cannabis use. These findings are further supported by a study that found poor sleep quality is associated with the use of non-medical Marijuana (Ogeil et al., 2015). These studies suggest a strong association between marijuana use and poor sleep quality. However, few studies of this manner have been conducted with a sample size more extensive than a few hundred. In addition, these studies have not investigated key variables that could influence sleep quality, such as the time an individual goes to sleep and the time an individual wakes up (Moderie et al., 2020). There is a knowledge gap in the relation between the sleep quality of students from grades 9-12 and their usage of marijuana due to low testing populations

and the concern of facilitating marijuana use in youths. The CSTADS data addresses the ethical concern of investigating marijuana usage in youths.

The proposed research question to address the knowledge gap is the following: is there an association between the sleep quality (defined by sleep satisfaction and sleep duration) of Canadian high school students, grades 9-12, who have used only marijuana compared to students of this same cohort that have not used marijuana or any other drug that could affect sleep quality? The independent variable of this study is marijuana usage within the last 30 days. The dependent variable is sleep quality including self-reported sleep satisfaction and hours of sleep. Accordingly, the primary outcome would be assessing sleep satisfaction and the secondary outcome would be identifying sleep duration.

Study Design

Prior to developing a hypothesis we used the site Odesi to determine which potential topics we would like to investigate, and selected a database to use for the study. We selected the Canadian Student Tobacco, Alcohol and Drugs Survey. After selecting an appropriate database, we conducted additional research related to the dataset to determine potential knowledge gaps that could be investigated further. Our investigations suggested further research could be conducted investigating the relationship between marijuana usage and sleep quality among high school students.

After determining the primary and secondary outcomes that we wished to investigate, we determined the inclusion and exclusion criteria for participants. We then conducted statistical analyses on the remaining data to determine whether there is a correlation between sleep quality and marijuana usage after adjusting for covariates.

Study Participants

For the study, we used the CSTADS in 2018-2019 investigating a wide range of factors regarding mairjuana, alcohol, and drug consumption for data on our participants. Initially, 62 850 participants were included in the survey, however only 20 683 participants were included in the statistical analysis of the current study after excluding missing data sets. The study included 10 573 (51.1%) female participants and 10 110 (48.9%) male participants. Participants consisted of students from grades 9 through 12 from all 10 provinces of Canada. Of the selected participants, 74.2% lived in urban areas in comparison to 25.8% living in a rural area. Additional data was collected including whether or not participants used stimulants or sleeping pills, however this was not included in the statistical analysis.

Inclusion/Exclusion Criteria

The CSTADS collected data from Canadian students in grades 7-12. For the purposes of the study only students in grade 9 through 12 were included, so all participants in grade 7 or 8 were excluded from the dataset. The study is also primarily focused on determining the relationship between sleep quality and marijuana usage. Students were therefore excluded from the dataset if they did not state their cannabis use, sleep quality, or wake up/bedtimes. Any participants who did not answer questions regarding the use of sleeping pills or stimulants were also excluded from the data, as these are potential confounding variables that were to be measured.

Objectives/Outcomes

The overall objective of this study was to determine the relationship between marijuana usage and sleep quality in high school students. The primary objective was to determine if there is a correlation between marijuana usage and sleep quality. As previously mentioned, there have been a lot of mixed results regarding the effects of marijuana, and there has been little research on the relationship between marijuana usage and sleep quality in high school students. This study will help confirm previous research and provide insights into its effects in high school students. Our secondary outcome is whether there is a relationship between marijuana usage and sleep/wake time. There is a possibility that people who participate in recreational drug use have different sleeping patterns, which could lead to poorer sleep quality. This could imply that there is not a causal relationship between marijuana use and sleep quality, and instead a correlation due to common lifestyle traits of marijuana users. We also wanted to examine if there is a relationship between sleep/wake time and sleep quality to determine if length of sleep has an impact on sleep quality.

Statistical Analysis

We used two different statistical analyses in this study. The 2x2 Chi square is often used to measure differences between groups. We used this analytical method to determine whether there was a significant difference between cannabis and non-cannabis users in relation to sleep quality. We also used the Spearman's Rho non-parametric test to determine if there was a correlation between variables. The Spearman's Rho test was used instead of Pearson's as we were investigating nominal and ordinal variables. We examined the correlation between cannabis use and sleep quality in addition to the correlation between cannabis use and sleep/wake time. We also examined the correlation between sleep/wake time and sleep quality.

Results

The purpose of this study was to assess the relationship between cannabis use and sleep in Canadian high school students. After eliminating cases that did not meet the inclusion criteria for our study we were left with a total of 20 683 participants. These participants were then divided into cannabis users and non-cannabis users. The demographic information of both groups is summarized in **Table 1.**

Table 1: Demographic Information of Participants

Characteristic	**Non-Cannabis Users n(%) (N=11238)**	**Cannabis Users n (%) (N= 9445)**
Gender		
Female	5828 (51.9)	4745 (50.2)
Male	5410 (48.1)	4700 (49.8)
Grade		
Grade 9	3111 (27.7)	1499 (15.9)
Grade 10	3636 (32.4)	2492 (26.4)
Grade 11	2950 (26.3)	3077(32.6)
Grade 12	1541 (13.7)	2377 (25.2)
Urban or Rural School		
Urban	8496 (75.6)	6859 (72.6)
Rural	2742 (24.4)	2586 (27.4)

Note. N=20 683. All participants were high school students in Canada. “Cannabis users are defined by answering “yes” to the question “Have you ever used or tried marijuana or cannabis (a joint, pot, weed, hash, or hash oil)?”

The primary outcome assessed in this study was the quality of sleep of the participants based on their use of cannabis. A 2x2 Chi-Squared test showed that there was a significant difference between groups ($p<0.001$).

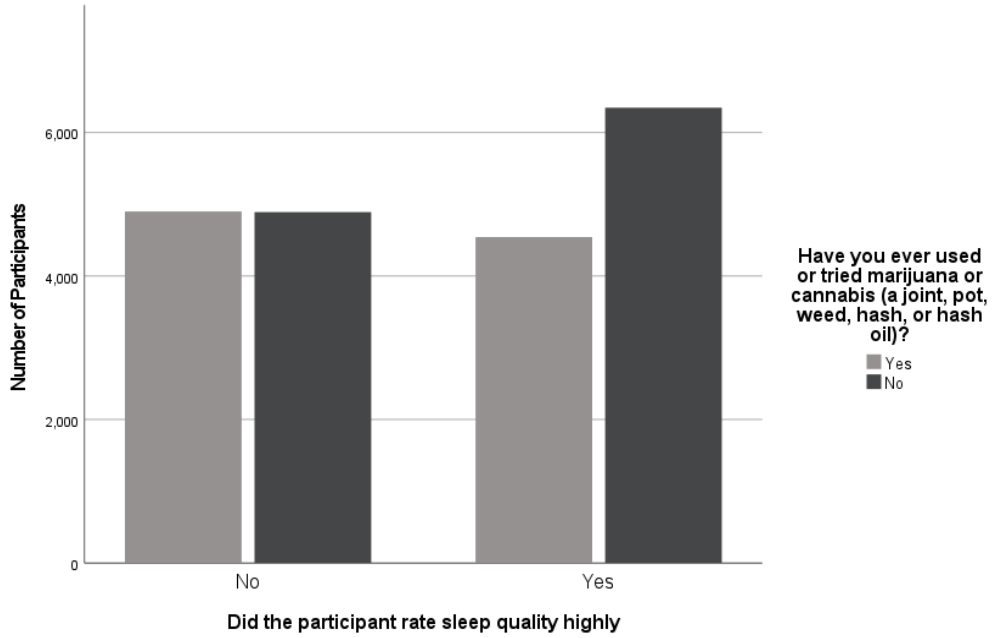

Figure 1. Observed values for 2x2 Chi-Squared test for use of cannabis and sleep quality. $\chi^2=144.145$, $p<0.001$

A Spearman’s Rho correlation was then run to assess if there was any correlation between sleep quality and being a cannabis user as well as the frequency of cannabis use in the past 12 months and 30 days. The results of this analysis showed a very weak positive correlation for

frequency of cannabis use in the past 30 days (p=0.022) and 12-months (p=0.033) as well as an extremely weak negative correlation (p<0.001) between if a user had ever used cannabis and their sleep quality (**Table 2.)**

Table 2: Correlations for Sleep Quality Vs. Cannabis Use.

Spearman's Rho		**Sleep Quality**	**Cannabis User or Not**	**Frequency of Cannabis Use- 12 Months**	**Frequency of Cannabis Use-30 days**
Sleep Quality in the last 2 weeks	**Correlation Coefficient**		-0.084**	0.033**	0.022*
	Sig. (2-tailed)		<0.001	0.003	0.036
	N		20683	9171	9215

*Correlation significant at the 0.05 level
**Correlation significant at the 0.01 level

The secondary goal of this study was to see if cannabis had any effect on the number of hours high school teens slept. To assess this relationship Spearman's Rho correlation analysis was run. The results of this analysis showed that on school nights there is a weak positive correlation (p<0.001) between whether someone has used cannabis before and the amount of sleep they got (**Table 3a)**. There was a weak negative correlation between the frequency of cannabis use in both a 12 month and 30-day period (p<0.001) and amount of sleep participants got. (**Table 3a)**

When the same analysis was run for the hours of sleep participants got on the weekend there was a weak negative correlation (p<0.001) between hours of sleep and whether the participant had used cannabis or not (**Table 3b)**. In terms of frequency of cannabis use in a 12

month and 30 day period, both factors had a weak negative correlation (p=0.019 and p=0.046) with the number of sleep participants got (**Table 3b)**.

Table 4: Correlation between hours slept and cannabis uses

a. School Nights

Spearman's Rho		Hours Slept on a school night	Cannabis User or not	Frequency of Cannabis Use- 12 Months	Frequency of Cannabis use- 30 days
Hours Slept on a school night	Correlation Coefficient		0.112**	-0.101**	-0.098**
	Sig. (2-tailed)		<0.001	<0.001	<0.001
	N		20683	9171	9215

b. Weekends

Spearman's Rho		Hours Slept on a school night	Cannabis User or not	Frequency of Cannabis Use- 12 Months	Frequency of Cannabis use- 30 days
Hours Slept on a school night	Correlation Coefficient		-0.105**	0.024*	0.021*
	Sig. (2-tailed)		<0.001	0.019	0.046
	N		20683	9171	9215

*Correlation Significant at the 0.05 level

**Correlation Significant at the 0.01 level

Finally, we wanted to see if there was any association between our 2 outcomes so we ran a spearman correlation to look for a relationship between the hours a participant slept and how they rated their sleep quality. The results of this analysis showed that there was a weak negative

correlation between sleep quality and hours slept on school nights ($p<0.001$) as well as a weak positive correlation between sleep quality and hours slept on the weekend (**Table 4).**

Table 4: Spearman's Rho Correlation For Sleep Quality and Hours Slept

		Hours of Sleep On A School Night	Hours of Sleep on A Weekend
Sleep Quality Over The Last 2 Weeks	Correlation Coefficient	-0.266	0.059
	Sig. (2-tailed)	<0.001	<0.001
	N	20 683	20 683

Discussion

The main findings of this study were split into two different groups which consisted of the primary and secondary outcomes. The presence of these two groups is based on the decision made to determine whether the use of marijuana affects sleep quality, which is represented as the primary outcome, and if its use affects sleep duration, which is represented as the secondary outcome. Additionally, we analyzed the relationship between sleep quality and duration as a secondary outcome. In a research study, it is essential to determine the primary and secondary study outcomes as the primary outcome is used when writing the stated hypothesis (Vetta & Mascha, 2017). In each group of outcomes, several different tests were used in order to analyze the correlation between sleep quality, sleep duration, and marijuana use.

The two tests that were used to analyze the data from the survey were chi-squares and a nonparametric test, specifically, a spearman's rank correlation test. The chi-square test allows for the values to be expressed in a table that compares the observed values to the values that you would expect to see if there was no relationship between the variables. When these values are

calculated, the chi-square expresses the significance of the results by producing a P-value in order to deem statistical significance. If the value is less than 0.05, then the null hypothesis is rejected and the relationship is deemed significant within a 95% confidence level. A spearman rank correlation test describes the association between two variables being expressed as a monotonic function that is either increasing or decreasing. Its significance is expressed using P-values in order to determine if the relationship is significant or by chance, however the correlation coefficient indicates the strength of the association as well as if the relationship is increasing or decreasing. Values closer to +1 or -1 are considered strongly correlated with their weak counterparts being closer to 0.

We analyzed the primary outcomes using a chi-square test as well as a nonparametric test. From this test, we determined that the relationship between the quality of sleep and the use of marijuana was significant with a p-value of <0.01 being reported. This result shows that users of marijuana and non-users of marijuana reported a statistically significant difference in their quality of sleep. Additionally, we calculated Spearman's rank correlation. The results of this test provided the information about whether the monotonic function that could be written from the two variables would be ever increasing or decreasing. Due to the P-value being less than 0.01 (0.002) for the variable indicating the frequency which participants had used marijuana over the last 12 months, the relationship between the two variables is statistically significant. We also ran the test for the variable indicating the frequency in which participants had used marijuana over the last 30 days. This variable when analyzed showed that it had a P-value of 0.036. This P-value is shown to be significant as any value under 0.05 is considered to be statistically significant showing that there is a relationship between these two variables, one that can be expressed as a monotonic function that is either ever increasing or decreasing.

We also analyzed the secondary outcomes using Spearman's rank correlation in order to determine if the relationship between variables discussing the hours slept on a weekday and on the weekend and usage of marijuana were statistically significant and could be modeled by a monotonic function. The results of the analysis determined that the relationship between marijuana use and hours slept on a weekday was statistically significant with a P-value of <0.001. However, with a correlation coefficient of -0.035, the variables are found to have a weak negative correlation. This coefficient indicates that the relationship between these two variables is negative and is considered weak as it is close to 0. Correspondingly, the relationship between the hours slept on the weekend and the use of marijuana was shown to be statistically significant as the P-value is <0.001. However, as the correlation coefficient was -0.098, this suggests that there is a very weak negative monotonic association between the two variables. The relationship between the quality of sleep and its duration was also tested using a spearman rank correlation. The results from this test indicated that there was a statistically significant relationship between the duration of sleep on weekdays and weekends and the self-reported quality of sleep in the participants, regardless of marijuana use, with p-values being reported as 0 and <0.001. However, the correlation coefficient indicated that there was a somewhat weak negative correlation between duration of sleep and its quality, whereas there was a very weak positive correlation seen between duration of sleep on weekends and its quality

The results that were taken from data analysis indicated that for the primary outcome, there is a relationship between self reported sleep quality for users and non-users of marijuana. The relationship indicated is seen as statistically significant and can be modeled using a monotonic function. The expression of this function would create a plot that showed that the increase in marijuana use would also cause an increase in the score given in the survey on

participant's quality of sleep over the last two weeks. This increase in scores indicates that the participants experience good quality sleep on an irregular basis. Therefore, it can be assumed that the hypothesis stating that there is an association between the use of marijuana and the quality of sleep is accepted and that the null hypothesis is rejected. Similarly, for the secondary outcome, there is a statistically significant relationship between the use of marijuana, and the duration of sleep on both weekdays and weekends. This relationship can also be modeled by a monotonic function, however it shows that the increase in marijuana use has a negative effect on the duration of sleep on weekdays reported by the participants in the survey. This model expresses that participants get less sleep the more that they use marijuana on a weekday, but they sleep more when they use marijuana on weekends. This model helps to accept the hypothesis that there is a correlation between the use of marijuana, and the duration of sleep in students in grades 9-12. When reviewing the results of the other secondary outcome, the monotonic functions taken from the correlation test indicate that the statistically significant relationship between sleep duration and quality possesses a weak correlation, while also being seen as negatively correlated for weekdays and positively correlated on weekends. This indicates that children experience better quality sleep when they sleep for less time during the week and better quality of sleep when they sleep longer on weekends. The model taken from these results helps to accept the hypothesis that there is an association between the duration of sleep and its quality.

When compared to other research studies about the use of marijuana and sleep quality in adults and pregnant women, the other studies found that there were no suggested differences in sleep quality in pregnant women that used marijuana (Murnan et al., 2021), however there was a difference seen in a general population study (Schierenbeck et al., 2008). When compared to the results of this study, the results suggest that there is a significant difference between sleep quality

reported in users and non-users of marijuana however, the results suggest that the association between these variables is very weak. We can therefore conclude that the results from this study are analogous to other studies conducted in this field of research.

Limitations

There are several limitations that can be found in this study. First, there is the limitation that the design of the study influenced the interpretation of the findings from our research and created a confirmation bias. Since the data taken from the survey was open for our interpretation, our interpretation was influenced by the research question and it changed the analyses that were conducted accordingly in order to provide answers to the research questions. Secondly, there is the limitation that confounding variables have the ability to influence the results of the analysis. Since the participants are all in school, there is the potential that factors unrelated to marijuana use could affect the quality and duration of sleep in the chosen participants. To solve this issue, more specific questions should be asked to help ameliorate the risk of confounding variables influencing the data taken from the survey.

Conclusion & Future Implications

Overall, the findings of this study answered the research question and showed that there was a statistically significant correlation between the use of marijuana and the quality and duration of sleep in children in grades 9-12. The results from this study can be useful for future research surrounding sleep quality and duration as well as being used for adapting drug policies surrounding safe marijuana use in teenagers. The inclusion of this research will allow for policymakers to adjust their expectations of marijuana usage for the youth population of Canada as well as changing the childrens' perspectives on the effects of marijuana**.**

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Part B

SPSS Name	What is the variable?	Coding Instructions	Measurement Scale	How will the variable be used?	Dependent or Independent?

GRADE	What grade are you in?	9= Grade 9 10 = Grade 10 11= Grade 11 12= Grade 12	Nominal/ Discrete	Divide the study participants	**Descriptive**
SEX	What was your sex assigned at birth?	1= Female 2= Male	Nominal/ Discrete	Divide the participants	**Descriptive**
URBAN	Is the respondents school in a urban or rural region?	1= Urban 2= Rural	Nominal/ Discrete	Divide the participants	**Descriptive**
SLP_030	On a typical school night, what time do you fall asleep	1= 1am 2= 2am 3=3am 4=4am 6= 6pm 7=7pm 8=8pm 9=9pm 10= 10pm 11=11pm 12= 12am 99= Not stated	Nominal/ Discrete	Used with SLP_040 to determine length of sleep (in hours) on a school night	**Dependent**
SLP_040	On a typical school morning, what time (hour) do you wake up?	1= 1pm 2= 2pm 3=3pm 4=4pm 5= 5am 6= 6am 7=7am 8=8am 9=9am 10= 10am 11=11am 12= 12pm 99= Not stated	Nominal/ Discrete	Used with SLP_ 030 to determine length of sleep in hours on a school night	**Dependent**
SLP_080	On a typical weekend, what time (hour) do you fall asleep?	1= 1am 2= 2am 3=3am 4=4am 6= 6pm 7=7pm 8=8pm 9=9pm 10= 10pm	Nominal/ Discrete	Used with SLP_090 to determine length if sleep (in hours) on a weekend	**Dependent**

		11=11pm 12= 12am 99= Not stated			
SLP_090	On a typical weekend, what time (hour) do you wake up?	1= 1pm 2= 2pm 3=3pm 4=4pm 5= 5am 6= 6am 7=7am 8=8am 9=9am 10= 10am 11=11am 12= 12pm 99= Not stated	Nominal/ Discrete	Used with SLP_080 in order to determine the length of sleep in hours on a weekend	**Dependent**
CAN_010	Have you ever used or tried marijuana or cannabis (a joint, pot, weed, hash, or hash oil)?	1= Yes 2= No 99= Not stated	Nominal/ Discrete	Divide our participants based on majaruna use	**Independent**
CAN_020	In the last 12 months, how often did you use marijuana or cannabis?	1= I have not done this in last 12 months 3= Less than once a month 4= Once a month 5= 2 or 3 times a month 6= Once a week 7= 2 or 3 times a week 8= 4 to 6 times a week 9= Every day 10= I do not know 96= Valid Skip 99= Not stated	Nominal/ Discrete	Used to determine frequency of participants marijuana usage	**Independent**
CAN_040	In the last 30 days, how	1= I have not	Nominal/	Further divide	**Independent**

	often did you use marijuana or cannabis?	done this in the last 30 days 2= Once or twice 3= Once or twice a week 4= 3 or 4 times a week 5= 5 or 6 times a week 6= Every day 7= I do not know 96= Valid skip 99= Not stated	Discrete	participants based on frequency of marijuana use	
SLP_110	In the last 2 weeks, how often have you felt satisfied with your sleep?	1= Every Day/ Night 2= Several Nights 3= Twice 4= Once 5= Never 99= Not stated	Nominal/ Discrete	Used to access sleep quality in participants who use marijuana and those who do not	**Dependent**
SLP_010	Have you ever used or tried sleeping medicine from a store (Nytol, Unisom) for non-medical reasons or to get high?	1= No, I have never used this 2=Yes, I have used this in the last 12 months 3= Yes I have used this but not in the last 12 months 99=Not stated	Nominal/ Discrete	Potential confounding variable. Used to divide the participants based on drug usage aside from marijuana to	**Descriptive**
STI_030	Have you ever used or tried stimulants (diet pills, stay awake pills, uppers, bennies) for non-medical reasons or to get high?	1= No, I have never used this 2=Yes, I have used this in the last 12 months	Nominal/ Discrete	Potentially confounding variable. Will be used to divide students based on drug use other than marjuana to	**Descriptive**

		3= Yes I have used this bunot in the last 12 months 99=Not stated		ensure we are looking at exclusively marijuana use	
SED_050	In the last 12 months, were you given a prescription by a Health Care Provider for sedatives or tranquilizers to help you sleep, calm down, or relax your muscles?	1= Yes 2= No 3= I don't know 99=Not stated	Nominal/ Discrete	Potential confounding variable. Used to divide participants based on drug usage other than marijuana to ensure we are exclusively looking at marijuana use	**Descriptive**
SED_030	Have you used sedatives or tranquilizers for non-medical reasons or to get high?	1= No, I have never used this 2=Yes, I have used this in the last 12 months 3= Yes I have used this bunot in the last 12 months 99=Not stated	Nominal/ Discrete	Potential confounding variable. Used to divide participants based on drug usage aside from marijuana	**Descriptive**
BEH_020	Is smoking cannabis allowed, or do you think is allowed, in your house?	1= Allowed inside and outside 2= Allowed inside only 3= Allowed outside only 4= Not allowed inside or outside	Nominal/ Discrete	Used to divide participants on the usage of marijuana	**Independent**
ALC_020	In the last 12 months, how often did you have a drink of alcohol that was more than just a sip	1= Didn't drink alcohol in last 12 months	Nominal/ Discrete	Potential confounding variable. Used to divide participants	**Descriptive**

		3= Less than once a month 4= Once a month 5= 2 or 3 times a month 6= Once a week 7= 2 or 3 times a week 8= 4 to 6 times a week 9= Every day 10= I don't know 96= Valid skip 99= Not stated		based on drug usage other than marijuana to ensure we are exclusively looking at marijuana use	
NRG_010	In the last 12 months, did you drink an energy drink?	1= Yes 2= No 99 = Not Stated	Nominal/ Discrete	Potential confounding variable. Used to divide participants based on drug usage other than marijuana to ensure we are exclusively looking at marijuana use	**Descriptive**
UND_010	Have you used a drug or substance to get high without knowing what it was	1= No, I have never done this 2= Yes, I have done this in the last 12 months 3= Yes, I have done this but not in the last 12 months 99= Not stated	Nominal/ Discrete	Potential confounding variable. Used to divide participants based on drug usage other than marijuana to ensure we are exclusively looking at marijuana use	**Descriptive**

Anxiety and Mental Health in Canadian Immigrant and Non-Immigrant Men Aged 25-44 as it relates to the COVID-19 pandemic and the Associated Fear of Job Loss

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INTRODUCTION

In 2019, an outbreak of pneumonia cases from an unknown origin occurred in Wuhan, Hubei Province, China. Analysis of human airway epithelial cells revealed a respiratory virus later named SARS-Cov-2 (Ciotti et al.,2020). Since the declaration of COVID-19 as a global pandemic in March 2020, it has impacted countries, their population, and their economies severely. In order to curb the COVID-19 spread, a large number of countries closed their borders regarding travel which led to further economic repercussions. During the COVID-19 pandemic, the unemployment rate in Canada rose from an annualized 5.66% to 8.9% (Statistics Canada, 2020) due to the implemented social distancing laws and mandatory shutdowns of businesses to prevent the exponential spread of COVID-19 (Larue, 2020). Furthermore, as discussed in Pacheco (2020), due to the high volume of jobs lost during the pandemic and increased media coverage of said job losses, Canadians have reported decreased job and financial security. Job security is described by Lu et al. (2016) as "an employee's expectations about the stability and longevity of his or her job in an organization". According to El-Assal (2021), Canada during the 2019 calendar year has welcomed 341,000 new immigrants. However, due to the threat of COVID-19 in 2020 which caused border restrictions and tighter criteria to travel into and outside the country, the number of immigrants who immigrated to Canada in 2020 dropped by approximately half to just 184,370 (El-Assal, 2021). However, despite the drastic decrease in immigration, it was still sufficient in order to keep growing the population. Generalized anxiety disorder or more commonly referred to as GAD is a psychological disorder that is described by Tyrer & Baldwin (2006) "as a persistent and common disorder, in which the patient has unfocused worry and anxiety that is not connected to recent stressful events, although it can be aggravated by certain situations". The development of GAD is often in conjunction with other

mental disorders and displays characteristics such as ”feelings of threat, restlessness, irritability, sleep disturbance, and tension” (Tyrer & Baldwin, 2006). GAD has no effective long-term resolution and patients with GAD often relapse into episodes of anxiety. However, short and medium term treatments that have been proven effective consist of “cognitive behavioral therapy; self-help approaches based on cognitive behavioral therapy principles; and pharmacological treatments, mainly selective serotonin reuptake inhibitors” (Tyrer & Baldwin, 2006). According to Moreno-Peral (2014), risk factors for GAD can include a variety of sociodemographic factors including age and marital status. Psychological factors such as exposure to stressful life events both in childhood and adulthood, in addition to family history of mental disorders and previous health problems. Moreover, as described by Kar & Basita (2006), adults and children who experience natural disasters such as earthquakes, hurricanes, or pandemics are at increased risk for developing GAD. Furthermore, as demonstrated by Nwachukwu et al. (2020) young adolescents aged 25 and below experience the highest level of anxiety, meanwhile adults aged 60 and above experience the least amount of stress during the COVID-19 pandemic in Canada. Meltzer et al. (2010) performed a study that revealed a correlation between job insecurity and the chance to develop both depressive disorders and GAD. As job insecurity grew, the risk of developing depression and GAD grew as well proportionally. Furthermore, workers who were employed in “less” skilled trades often reported the highest level of job insecurity and by correlation the highest risk of developing GAD from workplace factors. However, the risk of developing GAD and depression could be decreased by improving work conditions and offering more job security as demonstrated by Strazdins et al. (2011). Despite the various studies correlating job insecurity and GAD, the impact of COVID-19 on recent immigrants and the impact of COVID-19 on mental health, there exists little to no

studies that examine the relationships between generalized anxiety, job security, immigration status, and age in Canada. This gap will be studied by looking at self-reported data evaluating the mental health and psychosocial outcomes of Canadians during the 2020 COVID-19 pandemic. Thus the question evokes itself and leads to our research question: Is there a relationship between self-reported severity of generalized anxiety levels and fear of job loss in immigrant Canadian men aged 25 to 44 compared to non-immigrant Canadian men of the same age during the COVID-19 pandemic? The outcomes being assessed to answer this question are, the severity of generalized anxiety, perceived mental health and fear of upcoming job loss.

MATERIALS AND METHODS

Study Design and Database

This study is an observational cross-sectional study looking at the mental health of immigrant and non-immigrant Canadian men aged 25 to 44 as it relates to COVID-19 and the associated fear of job loss in the year 2020. Data of participants was collected through surveyed data from a self-administered online questionnaire through Statistics Canada, the Canadian Perspectives Survey Series (CPSS) retrieved from Odesi. All participants voluntarily participated through a web-only collection, known as crowdsourcing. This database, the Impacts of COVID-19 on Canadians-Mental Health, 2020, was designed to determine how Canadians are reacting to the COVID-19 pandemic and the impact it is having on their mental health which took approximately 5 minutes to complete. Participants answered questions relating to demographics, mental health, and social outcomes. The questionnaire was broadcasted through social media, government agencies, private and public organizations, and news channels with the target audience of Canadians aged 15 years and older. Data was collected from April 4th, 2020 to May 11th, 2020, and all data collected remained strictly anonymous.

Study Participants

Our analyses included only male participants of "Immigrant" and "Non-Immigrant" status, between the ages of 25 to 44 years old during the COVID-19 pandemic. With the dataset already focused on only Canadian residents specifically during the COVID-19 time period, location and time period could not be excluded. The exclusion criteria for participants included, using the variable "Gender benchmarked to sex" to exclude all female respondents. Age groups were categorized in increments of 10, while including the 25 to 34 age group, and the 35 to 44 age group, but excluding participants at any other age. Any respondents selecting "Valid skip", "Don't know" "Refusal" and "Not stated" for immigration status and the study outcomes (Severity of Generalized Anxiety, Perceived Mental Health and Fear of Upcoming Job Loss) were excluded from the analysis. A reason we chose these groups is because they had the highest percentage of cases, allowing us to have a larger sample size to analyze. We also chose men over women as it is proven that adult women have higher rates of mental illness, compared to adult men, but research on mental illness in adult men is less commonly studied (Grove & Tudor, 1973).

Study Outcomes

The primary outcomes of interest in the research question are discovering the severity of generalized anxiety and perceived mental health of both immigrant and non-immigrant men aged 25 to 44 as it relates to the COVID-19 pandemic and the associated fear of job loss. The outcomes pertaining to the severity of generalized anxiety and perceived mental health are grouped within a broad category of variables of interest labeled "Group Mental Health". In regard to perceived mental health, participants were required to choose amongst five categorical groups that best describes the overall status of their mental health during the COVID-19

pandemic. The categorical options are: “Poor”, “Fair”, “Good”, “Very good”, and “Excellent”. In regard to severity of generalized anxiety, participants were required to choose amongst five categorical groups that best determines how anxious they are symptomatically during the COVID-19 pandemic. The categorical options are: “No symptoms”, “Minimal Symptoms”, “Mild symptoms”, “Moderate symptoms”, and “Severe symptoms”. The outcome pertaining to fear of upcoming job loss is grouped within a broad category of variables of interest labeled “Group Concerns”. The categorical options are “Strongly agree”, “Agree”, “Neither agree nor disagree”, “Disagree”, “Strongly disagree”, and “Not working at a job or a business”. The inclusion of the outcomes of interest was based on their relevance to the research question. These findings are essential to consider in the midst of a pandemic in which many people are losing their jobs and dealing with something dissimilar. Statistics Canada (2020) illustrates that the unemployment rate increased by approximately 4% throughout the first few months of the COVID-19 pandemic. As a result, individuals may experience job insecurity, fearing that they will be laid off in the near future (Lu et al., 2016). This can also lead to concerns about not being able to meet financial responsibilities and needs. Job insecurity can also contribute to a rise in mental health difficulties, such as generalized anxiety disorder and depressive disorders (Meltzer et al., 2010). Considering that this study relies on self reported data, the data is reliable as it directly corresponds to how the participant is feeling with regard to the study outcome. Since this is a cross sectional study, the data collection is quick and efficient and can be used to study a multitude of outcomes pertaining to COVID-19.

Additional Data Collection

Data on age, gender with sex being the benchmark and immigration status was collected. The age group variable was used to analyze how age is associated in particular with regards to

generalized anxiety levels and fear of job loss. Intervals used for this study were “25 to 34 years old” and “35 to 44 years old” due to these groups having the highest percentage of participation in the database. The categorical data on gender benchmarked to sex was used to separate participants based on their gender, as the research question will be focusing on men. Immigrantion status was used to distinguish which individuals in the study are immigrants, non-immigrants, permanent residents; and other ambiguous choices (“Valid skip”, “Don’t know”, “Refusal”, and “Not stated”). However, our study is focused on immigrant and non-immigrant men. This will determine whether or not COVID-19 has evoked different severities of anxiety in conjunction with the risk of job loss on individuals with different immigration status.

Statistical Analysis

Our study employed 2 types of statistical tests which examined the differences and association between immigrants and non-immigrants in regards to severity of generalized anxiety, perceived mental health, and fear of upcoming job loss. Since the data was categorical, a normality test could not be conducted. In Table 1, the data of participants is organized based on their immigration status (“Immigrant” and “Non-Immigrant”) and age group (“25 to 34 years old” and “35 to 44 years old”). We used a chi-squared test to analyze the between group differences in proportion between the immigrant and non-immigrant participants for each of the study outcomes. We then collapsed our larger study outcomes to create 2x2 contingency tables and further tested these outcomes using chi-squared tests. The statistically significant findings were further analyzed using a Spearman’s Rho correlation test to determine the strength of the relationship between these variables in both immigrant and non-immigrant groups. A *p*-value of 0.05 was used to consider a statistically significant result for the chi-squared, and 0.01 for Spearman Rho. Both statistical analyzes were performed using IBM SPSS Statistics Software.

RESULTS

All participants were recruited through online services via crowdsourcing through social media, government agencies, private and public organizations, and news channels. Participants were required to complete a self-administrated online questionnaire on an anonymous portal found on Statistics Canada. The baseline data in this database included 45,989 participants, of which, 40,533 participants (88.1%) were excluded as they did not meet the male, 25 to 44 age range, and immigrant or non-immigrant status criterion. Participants with missing data who responded with either "Valid skip". "Don't Know", "Refusal", or "Not Stated" were not included. Complete data was available for 5456 (11.9%) participants as the data included 909 immigrant and 4547 non-immigrant males in the 25 to 44 age range. Of the 45,989 participants, 11 499 (25.0%) classified themselves as male. The males were then further categorized based on their age. Of the 11,499 males, 5456(47.4%) were between the ages of 25 to 44. Of these 5456 participants, 4547(83.3%) were classified as "Non-Immigrant" and 909(16.7%) were classified as "Immigrant". The percentage of immigrants and non-immigrants who reported their responses for the study outcomes of "Severity of Generalized Anxiety", "Perceived Mental Health" and "Fear of Upcoming Job Loss" can be seen in Figure 1. The frequency of respondents who identified with the immigrant status responded differently than respondents who identified with the non-immigrant status. The frequency of non-immigrant individuals who answered with "poor" and "fair" to study outcome "Perceived Mental Health" was higher than respondents of immigrant status. Frequencies of participants who responded to the study outcomes pertaining to "Severity of Generalized Anxiety" differed slightly between immigrant and non-immigrants. The frequency of immigrant respondents was higher for all categories except "Not Working a Job or Business" compared to the frequencies of respondents of non-immigrants.

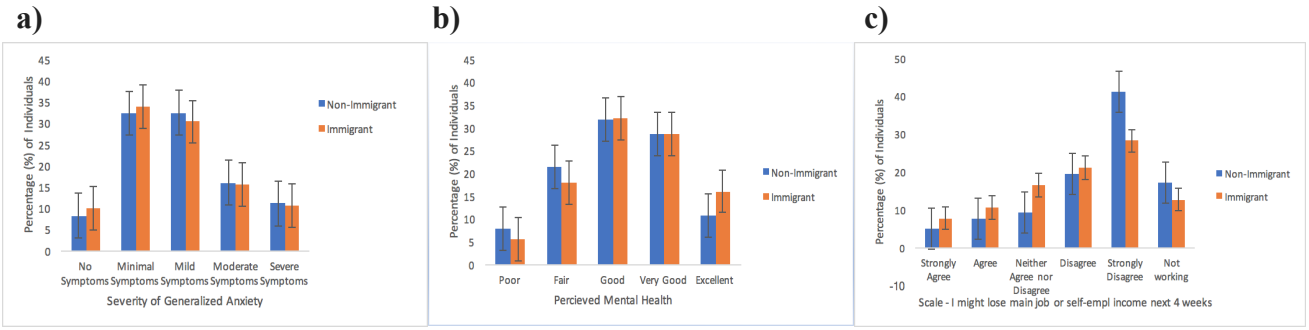

Figure 1. Clustered Bar Graph comparing the percentage (%) of Canadian non-immigrant (n=4547) and Canadian immigrant (n=909) respondents to study outcomes for a) Severity of Generalized Anxiety, b) Perceived Mental Health, and c) Fear of Upcoming Job Loss.

The chi-squared test was used to determine the statistically significant differences (Table 1) between the "Non-Immigrant" and "Immigrant" groups regarding "Severity of Generalized Anxiety" (*p*-value of 0.344), "Perceived Mental Health" (*p*-value of < 0.001) and "Fear of Upcoming Job Loss" (*p*-value of < 0.001). The proportions for "Severity of Generalized Anxiety" between the two groups were not significantly different.

Table 1: Descriptive characteristics of the impacts of COVID-19 on Canadians-mental health, 2020 study, specifically focused on participants' self-reported generalized anxiety levels of immigrant/non-immigrant Canadian men aged 25-44 [N =5456].

Variables	Non-Immigrant Men (n=4547)	Immigrant Men (n=909)	P-value
Age			
25 to 34 years old	2196(48.3)	434(47.8)	
35 to 44 years old	2351(15.7)	475(52.3)	
Severity of Generalized Anxiety			0.344
No symptoms	375(8.2)	90(9.9)	
Minimal symptoms	1463(32.2)	307(33.8)	
Mild symptoms	1475(32.4)	275(30.3)	
Moderate symptoms	729(16.0)	141(15.5)	

Severe symptoms	505(11.1)	96(10.6)	
Fear of Upcoming Job Loss			<0.001*
Strongly agree	228(5.0)	71(7.8)	
Agree	352(7.7)	96(10.6)	
Neither agree nor disagree	419(9.2)	150(16.5)	
Disagree	894(19.6)	193(21.2)	
Strongly disagree	1866(41.0)	256(28.2)	
Not working at a job or a business	788(17.3)	143(12.7)	
Perceived Mental Health			<0.001*
Poor	350(7.7)	51(5.6)	
Fair	971(21.4)	163(17.9)	
Good	1447(31.8)	291(32.0)	
Very Good	1299(28.6)	259(28.5)	
Excellent	480 (10.6)	145(16.0)	

Data values are presented as a number n(%) of patients.
*Correlation is significant at the level of 0.05 (2-tailed).

"Severity of Generalized Anxiety", "Perceived Mental Health" and "Fear of Upcoming Job Loss" was collapsed to create 2x2 chi-squared tables for additional testing amongst the two groups. "Severity of Generalized Anxiety" was collapsed into two categories (Table 2): "Experiencing Low Number of Symptoms" (consisted of "No Symptoms", "Minimal Symptoms", "Mild Symptoms") and "Experiencing High Number of Symptoms" (consisted of "Moderate Symptoms" and "Severe Symptoms"). There was no statistical difference between the two groups (*p*-value of 0.535). "Perceived Mental Health" was collapsed into two categories (Table 3): "Weak Mental Health" ("Poor", "Fair", Good") and "Strong Mental Health" ("Very

Good", "Excellent"). The proportion of "Immigrant" respondents that were categorized as "Strong Mental Health" was significantly higher than the" Non-Immigrant" respondents (*p*-value of 0.003). The proportion of "Immigrant" participants that were grouped as having "Strong Mental Health" was 44.4%, compared to the proportion of "Non-Immigrant" participants, which was 39.1%. The last outcome "Fear of Upcoming Job Loss" was collapsed into (Table 4): "Low Feeling of Fear" ("Disagree", "Strongly Disagree", "Not working at a job or business") and "High Feeling of Fear" ("Strongly Agree", "Agree" and "Neither agree nor disagree"). The proportion of "Immigrant" respondents that were grouped as "High Feeling of Fear" was significantly higher than the "Non-Immigrant" respondents. The proportion of "Immigrant" participants that were grouped as having a "High Feeling of Fear" was 34.9%, compared to the proportion of "Non-Immigrant" participants, which was 22.0%.

Table 2. Results from chi-squared test comparing severity of generalized anxiety of Canadian immigrant and non-immigrant men as it relates to COVID-19 [N =5456].

Severity of Generalized Anxiety	Non-Immigrant (n=4547)	Immigrant (n=909)	P-Value
Experiencing Low Number of Symptoms	3313(72.9)	672(73.9)	.535
Experiencing High Number of Symptoms	1234(27.1)	237(26.1)	

Data values are presented as a number n(%) of patients
*Correlation is significant at the level of 0.05 (2-tailed)

Table 3. Results from chi-squared test comparing perceived mental health of Canadian immigrant and non-immigrant men as it relates to COVID-19 [N =5456].

Perceived Mental Health	Non-Immigrant (n=4547)	Immigrant (n=909)	P-Value
Weak Mental Health	2768(60.9)	505(55.6)	.003*
Strong Mental Health	1779(39.1)	404(44.4)	

Data values are presented as a number n(%) of patients.
*Correlation is significant at the level of 0.05 (2-tailed).

Table 4. Results from chi-squared test compared fear of upcoming job loss between Canadian immigrant and non-immigrant men as it relates to COVID-19 [N =5456].

Fear of Upcoming Job Loss	Non-Immigrant (n=4547)	Immigrant (n=909)	P-Value
Low Feeling of Fear	3548(78.0)	592(65.1)	<.001*
High Feeling of Fear	999(22.0)	317(34.9)	

Data values are presented as a number n(%) of patients.
*Correlation is significant at the level of 0.05 (2-tailed).

A spearman's rho correlation test using SPSS was conducted to determine the correlation coefficient between study outcomes "Fear of Upcoming Job Loss" and "Perceived Mental Health". Results show a weak positive correlation of 0.034, and *p*-value of .310 that is not statistically significant between "Fear Upcoming Job Loss" and "Perceived Mental Health" for immigrant respondents (Table 5). Also, a weak negative correlation of -0.011, and a *p*-value of .446 that is not statistically significant between "Fear of Upcoming Job Loss" and "Perceived Mental Health" for non-immigrant respondents (Table 6).

Table 5. Spearman's Rho correlation table for immigrants analyzing association between perceived mental health and fear of upcoming job loss [N =5456].

	Perceived Mental Health	Fear of Upcoming Job Loss
Perceived Mental Health	1.000	.034
Fear of Upcoming Job Loss		1.000

*Correlation is significant at the 0.01 level (2-tailed).
Data only represents the correlation coefficient.

Table 6. Spearman's Rho correlation table for non-immigrants analyzing association between perceived mental health and fear of upcoming job loss [N =5456].

	Perceived Mental Health	Fear of Upcoming Job Loss
Perceived Mental Health	1.000	-.011
Fear of Upcoming Job Loss		1.000

* Correlation is significant at the 0.01 level (2-tailed).

Data only represents the correlation coefficient.

DISCUSSION

The purpose of the study performed was to determine if there's a difference between the anxiety experienced and mental health status of immigrants and non-immigrants during the COVID-19 pandemic. The findings of the study indicated that there are statistically significant differences between immigrant and non-immigrant Canadian males aged 25 to 44 in terms of their perceived mental health and fear of job loss. The main findings from our analysis indicated that non-immigrant males have a weaker perceived mental health than immigrant males, and immigrant males were much more fearful about losing their jobs compared to non-immigrant males. Interestingly, it appears that immigrants have a stronger sense of self-perceived mental well being, while less faith in job security compared to non-immigrant males. However no significant differences were found in the severity of generalized anxiety between immigrant and non-immigrant males, therefore, anxiety levels between these two groups do not differ. In addition, no correlation was found between fear of job loss, perceived mental health and severity of generalized anxiety during COVID-19 in both immigrant and non-immigrant men. Lack of correlation indicates that neither perceived mental health or fear of job loss have an effect on severity of generalized anxiety. Numerous other papers highlight the mental health differences between immigrants and non-immigrants in other countries. This can be used as a way to determine how the area of living has an impact on the mental health of immigrants and non-immigrants. A study conducted by Levecque et al (2009) in Belgium was focused on discovering the differences in mental health between immigrants from Turkey and Morocco in comparison to those that were born in Belgium. Contrary to our study, this study found that the mental health outcome was better for the non-immigrants than the immigrants. Our study showed

that Canadian immigrants had better perceived mental health. However, our study was focused on the time of the COVID-19 pandemic unlike the related study conducted in Belgium. In addition, our data only looked at males aged 25-44 whilst the study conducted in Belgium looked at a sample population of males and females aged 18-65. The differences in the demographics of the studied population could be the cause for the different trends observed in the studies. Levecque et al's (2009) study additionally confirmed a significant difference in the perceived depression and anxiety levels between males and females. Since our study only looked at males, we would not be able to compare results in accordance with this. This study also focuses on different factors of mental health such as depression and anxiety, whilst our study focuses on GAD and perceived mental health. Furthermore, differences in experiences of mental health could be a reflection of the support systems and education plans available to the public including immigrants and non-immigrants. Additionally, the results could also be a reflection of the different types of immigrants both countries experienced. According to Statistics Canada (2020), 48% of Canada's new immigrants are classified as economic migrants which indicate them as skilled workers or business starters. This is much higher than Belgium's percentage of skilled worker migrants at 12% (Petrovic, 2012). Skilled workers are more likely to utilize mental health resources offered to them through their workplaces compared to immigrants with employment that lack access to the same services due to their level of employment. Despite the trends observed during the study, several limitations present themselves. The first limitation to be accounted for is the sample size discrepancies between our non-immigrant and immigrant demographics. The non-immigrant population is much larger than the immigrant population which produces a bias in the magnitude of responses leading to potentially inaccurate analysis results. The second limitation to be accounted for is the location of which the data was obtained

from. Participants in self-reported studies are able to complete the assessment without any supervision or assistance. Lack of a standardized assessment to the asked questions creates the possibility of exaggeration or underreporting of outcomes. A final limitation to be considered in regards to the current study is the lack of ability to reproduce the study accurately. Since it is a self-reported survey, this study can be reproduced in terms of methodologies. However, because the variables of interest are based on a timely subject, COVID-19, the outcomes of the study may vary if it was to be performed again over a different time period. For future studies, examining the relationship in anxiety between immigrant and non-immigrant groups in different fields of work (i.e, construction, medical service, etc.) would enhance the understanding of specific workplaces in association to generalized anxiety disorder. Though our research has demonstrated that fear of job loss has little to no influence on generalized anxiety, other studies have shown workers who were employed in “less” skilled trades often reported the highest level of job insecurity and by correlation the highest risk of developing GAD from workplace factors (Meltzer et al., 2010). With further research on the impact that job insecurity has on an individual’s anxiety level, it can force policy makers to enact certain work standards or work laws to protect those that are vulnerable to sudden job losses in order to prevent the current increase of diagnosed generalized anxiety disorder among Canadian residents. (Statistics Canada, 2021). In conclusion, the findings of this study can be used to illustrate the need for developing and delivering help during the COVID-19 pandemic. Forms of relief during the COVID-19 pandemic could include medical assistance or financial assistance. It's crucial to understand how a worldwide pandemic can affect individuals' mental health in order to accurately supply needed relief.

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The Association Between Underage Drinking and Future Drinking Habits: An Observational Study

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THE ASSOCIATION BETWEEN UNDERAGE DRINKING AND FUTURE DRINKING HABITS

Introduction

Alcohol is one of the most commonly-used substances across Canada, with 78.2% of Canadians above age 15 reporting alcohol use at least once (Canadian Centre on Substance Use and Addiction, 2019). The legal age for alcohol consumption is 19 years of age for the provinces of British Columbia, New Brunswick, Newfoundland and Labrador, Northwest Territories, Nova Scotia, Nunavut, Ontario, PEI, Saskatchewan, and Yukon. For Alberta, Manitoba and Quebec, it is 18 years of age (Canadian Centre on Substance Use and Addiction, 2019). However, underage drinking is very common in Canada, especially among high school and college students (Keller, 2009). Studies have shown the effects of alcohol vary depending on factors such as gender, weight, and age (Government Services, 2021). For instance, it has been found that a lower body weight contributes to faster alcohol absorption, which is one of the reasons why younger people, who typically have a lower body mass than adults, face stronger side effects (Government Services, 2021). Alcohol consumption can lead to adverse consequences in the long term for adolescents, specifically because their brains and body are still developing. Underage drinking can have serious repercussions for individuals in the long term, such as hindered brain development. Interestingly, underage drinking can also affect an individual's vulnerability to alcohol dependence in the future (Pfefferbaum, 1998).

Alcohol dependence and binge drinking affect many Canadians. Doctors recommend that adults consume no more than two drinks per day for women and three drinks for men per day, and no more than ten drinks per week as a maximum limit, but these ideal practices are often not followed (Ontario Ministry of Health, 2021). Many Canadians engage in unhealthy drinking behaviours such as binge drinking. If a woman drinks four or more standard drinks or a man drinks five or more standard drinks on a single occasion, their consumption is considered to be

an episode of binge drinking. Findings suggest that people who consume this amount of alcohol or more have a higher likelihood of experiencing serious short-term and long-term issues related to alcohol, including violence, drunk driving, and reduced neurophysiological and neurocognitive functioning (Courtney & Polich, 2009). Alcohol may also have severe effects on people approaching old age due to increased body fat and decreased body water. Frequent drinking can put elderly people at risk of developing cardiac and neurological diseases, cancer, dementia, and other disorders (Government Services, 2021). This study aims to determine whether adults who started drinking alcohol at a younger age, particularly under the age of 19, consume more drinks per sitting than people who started drinking later on in life after they turned 19.

Knowledge Gap

The information collected over several research studies has created a very solid understanding of behaviour surrounding alcohol consumption. Information related to alcohol intake, alcoholism, and the substance, can be used as a foundation for future research to occur. However, there are many gaps in the literature about this substance pertaining to the timeline and level of consumption that should be addressed to better understand this topic.

One of the most prominent gaps in the literature includes the possible correlation between when alcohol is first consumed and the role this timing plays in influencing drinking behaviour later in life. The relationship between these variables is limited in current research and the supporting data reported is insufficient, creating a gap between people aged 35 and over and alcohol consumption levels. This research specifically looks at that underrepresented group to gain a better understanding of people in an older age group. Typically, the research investigates people under the legal drinking age or those who are under 30 years of age (Lundahl et al.,

1997). Multiple factors affect the frequency of drinking for people across Canada. One factor may include the social influence that exists within groups. Research shows that social influence may be correlated with the age at which alcohol was first consumed which could have an effect on the amount of alcohol consumed in later adulthood. A paper by Zucker et al. describes social environments as an overarching system that may impact the acceptability of alcohol consumption throughout life. This information may be useful in determining correlations between alcohol consumption in adults and the age of consuming the first alcoholic beverage. Information surrounding the age at which alcohol was first consumed and psychological developmental patterns in formative years may be beneficial when determining correlations between first alcoholic intake and behaviour around drinking alcohol later in life. Some social situations may promote a disregard for following the protocol for legal drinking ages, which could impact drinking behaviour throughout an individual's life in the form of alcoholism (Windle & Zucker, 2010). Determining if a connection between when a first alcoholic beverage is consumed before or after 19 and drinking behaviour after 35 years old can help to fill certain gaps in overall understanding in research.

Research question

Do Canadians aged 35-64 who consume their first alcoholic drink before the age of 19 consume a greater number of alcoholic beverages per sitting and drink more frequently than Canadians who had their first alcoholic drink after the age of 19?

Methods

Study Design and Database

In this observational study, our research team used data from the Canadian Alcohol and Drugs Survey, which was mainly designed to collect information on Canadian's use of alcohol

and drugs in 2019. The survey information is particularly useful for Health Canada and other organizations to monitor changes in alcohol and drug use. This self-reported survey also measured the frequency of alcohol and cannabis use, and the frequency of use of other drugs among Canadians. Data collection for this survey occurred in two waves; the first took place from June 10 to September 22, 2019, and the second was from September 23 to December 31, 2019. A letter was sent to the selected household member with instructions to complete a questionnaire. Our team obtained the dataset "CADS-5289-E-2019" from Odesi Data Portal. For the purpose of this study, our team included data on alcohol drinking habits and drinking history such as the age at which participants had their first alcoholic drink.

Study Participants

The inclusion criteria for our study were Canadians aged 35-64 who had consumed their first alcoholic beverage before the age of 19.The exclusion criteria for our study were individuals who had never drank alcohol before, those under the age of 35 and over 64 years old, and those who had missing values or skipped answering any of the questions that were being assessed.

Study outcomes

Research on post-adolescence drinking patterns based on the age first alcoholic drink was consumed is limiting, thus the study outcomes were selected to analyze the effects of underage drinking on future drinking habits. Previous studies have shown that daily alcohol intake is positively correlated with the frequency of heavy drinking, and have discovered that these variables increase the risk of alcohol dependence (Dawson & Archer, 1993). The primary outcomes in this study were the number of alcoholic beverages consumed per sitting and the frequency of drinking an alcoholic beverage. These outcomes could provide insight into how initial drinking patterns, such as the age the first alcoholic beverage consumed, influence

drinking habits in adulthood. Participants answered the following question: “During the past 12 months, how often did you drink alcoholic beverages?” to investigate the frequency of alcohol drinking among the participants. Researchers asked participants to answer the following question: “During the past 12 months, on those days when you drank alcoholic beverages, how many drinks did you usually have?” to determine the number of alcoholic beverages they consumed per sitting. The secondary outcome was the frequency of binge drinking over 12 months. Investigating the frequency of binge drinking over 12 months could provide insight into drinking behaviours on a societal level and determine whether it contributes to long-term drinking patterns. As the definition of a binge-drinking episode and the effects of alcohol differ depending on the sex of the participant, female and male respondents were asked different questions to determine how frequently they binge-drink (Government Services, 2021). Female participants were asked to report their answer to the following question: “During the past 12 months, how often have you had 4 or more drinks on one occasion?” to determine the frequency of binge drinking over 12 months. Male participants were asked: “During the past 12 months, how often have you had 5 or more drinks on one occasion?”. The analysis of these study outcomes can help improve current public health policies, particularly those on the legal drinking age required to improve population health.

Additional data

Additional data collected consisted of participants’ previous and current province of residence to investigate whether living in different provinces is associated with the age one has their first alcoholic drink and their future drinking habits. This information can provide insight into possible differences in health outcomes between individuals based on their place of residence, particularly by analyzing the effects of the legal drinking age in different provinces.

Statistical Analysis

SPSS was used for the statistical analysis of this study and results would need to have a p-value of 0.05 in order to be considered significant. The Select Cases function was used to isolate cases that satisfied our study's inclusion criteria. Our methodology also checked off the option to delete cases that were not selected. The normality of the continuous data collected about the age of having first drink was assessed with the use of the Shapiro-Wilk test. This continuous variable was then collapsed into two groups: participants who began drinking at the age of 19 or older were placed in the Of Age group and participants who began drinking alcohol before the age of 19 were placed in the Underage group. After using the Select Cases feature to temporarily eliminate the Underage cases from the dataset, the Frequencies tool was used to calculate the number and percentage of participants in the Underage group belonging to each province, age group (35-44, 45-54, and 55-64), and sex. The Underage cases were then excluded and Of Age cases were added back into the data, and the number and percentage of Of Age participants from each province, age group, and sex were calculated. The data collected on these participant characteristics are presented in Table 1. The median response of each group for the "Frequency of drinking alcohol in the past 12 months" variable was calculated using the Explore feature. The Select Cases feature was used to temporarily remove male participants from the dataset, and the median response of each group for the "Frequency of drinking 4 or more drinks in one sitting in the past 12 months" was calculated using the Explore feature. Male participants were then added back and the female participants were temporarily removed from the data in order for the Explore feature to be used to find each group's median response to the "Frequency of drinking 5 or more drinks in one sitting in the past 12 months" variable. The female participants were then added back to the data. The mean number of drinks consumed in a typical

sitting by each group was calculated using the Explore feature, and the boxplot figure comparing the two groups was edited and presented as Figure 1. To test the significance of the difference between responses collected from each group, the Independent Samples feature was used to run a Mann-Whitney U test for each of the variables described above (frequency of drinking, number of drinks in a typical sitting, frequency drank 4 or more drinks in one sitting, and frequency drank 5 or more drinks in one sitting).

Results

Assessing normality table and Table 1

Variable	**Shapiro-Wilk significance value**	**Normal or not normal**	**Measure of central tendency to be reported**
Age had first alcoholic beverage	<.001	Not normal	Median

This table demonstrates the normality of the data based on the Shapiro-Wilk test.

Of the 10293 individuals who took this survey, 3964 were included in this analysis after participants who had never drank alcohol, were not between the ages of 35-64, or had missing data in the questions being analyzed were removed, resulting in the deletion of 6329 cases from the data. The most commonly listed provinces of residence of the participants were Quebec (n= 606, 15.3% of participants) and Ontario (n= 616, 15.5% of participants).

Of the 3964 participants, 3249 had their first alcoholic drink before the age of 19 while 715 had their first alcoholic drink at the age of 19 or older. A summary of the collected data on population characteristics is featured in Table 1.

Table 1. Participant characteristics (N = 3964)

Variable	First drink before age of 19 years (n = 3249)	First drink after age of 19 years (n = 715)	P-value
Province of respondent			
· Alberta	354 (10.9)	60 (8.4)	<.001
· British Columbia	291 (9)	95 (13.3)	<.001
· Manitoba	295 (9.1)	34 (4.8)	<.001
· New Brunswick	291 (9)	45 (6.3)	<.001
· Newfoundland and Labrador	247 (7.6)	63 (8.8)	<.001
· Nova Scotia	271 (8.3)	59 (8.3)	<.001
· Ontario	453 (13.9)	163 (22.8)	<.001
· Prince Edward Island	242 (7.4)	63 (8.8)	<.001
· Quebec	514 (15.8)	92 (12.9)	<.001
· Saskatchewan	291 (9)	41 (5.7)	<.001
Respondent sex at birth			
· Male	1609 (49.5)	329 (46)	<.001
· Female	1640 (50.5)	386 (54)	<.001
Respondent age in years			
· 35 to 44	1005 (30.9)	224 (31.3)	<.001
· 45 to 54	925 (28.5)	207 (29)	<.001
· 55 to 64	1319 (40.6)	284 (39.7)	<.001

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Data are presented as the number (%) of participants unless stated otherwise.

Significant differences were found between the average responses of participants from the Of Age group and the Underage group to questions on the frequency of drinking, the number of alcoholic drinks they consume in one sitting, and the frequency of binge drinking behaviour (more than 4 drinks in one sitting for females and more than 5 drinks in one sitting for males). The results of the statistical analysis that determined the average response of each group for how frequently they drink alcohol and engage in binge drinking are highlighted in Table 2. The average number of drinks an individual typically consumes per sitting is represented in Figure 1. Individuals who began drinking alcohol when they were Of Age consumed 2 drinks per sitting on average and those who began drinking when they were Underage consumed 2.5 drinks per sitting. The difference between these medians was statistically significant, as determined by the Mann-Whitney U test (p=<.001).

Table 2. Median reported responses for participant drinking behaviour (N= 3964)

	Of Age	**Underage**	**P-value**
Frequency of drinking alcoholic beverage	Once a month	Once a week	<.001*
Frequency of drinking four or more alcoholic drinks in one sitting[c]	Never	Less than once per month	<.001*
Frequency of drinking five or more alcoholic drinks in one sitting[d]	Never	Less than once per month	<.001*

*= statistically significant result from Mann-Whitney U test. [c]= question asked to female respondents only (n= 2026). [d]= question asked to male respondents only (n=1938).

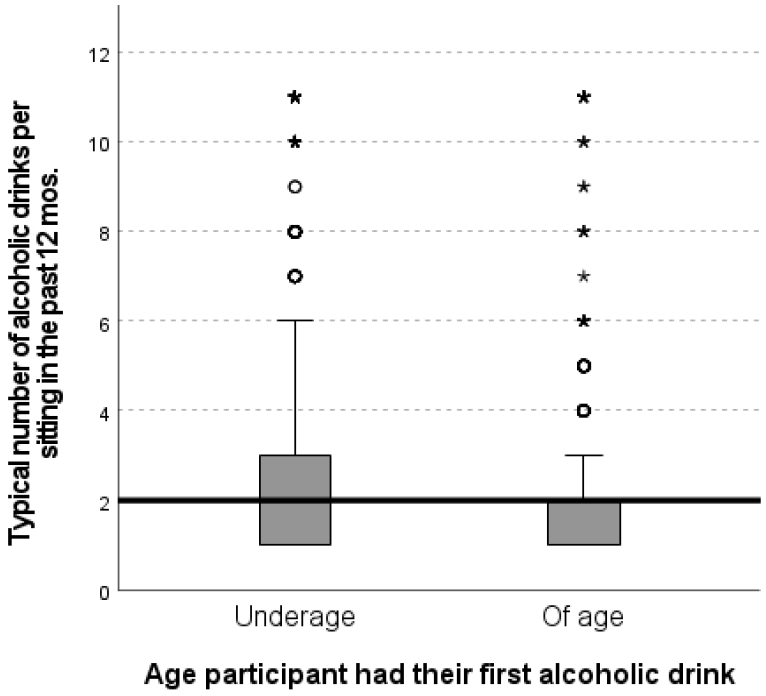

Figure 1. Median typical number of drinks consumed in one sitting for Underage group vs Of Age group.

Discussion

Main Findings

This study investigated the drinking habits, specifically the number of alcoholic drinks consumed in one sitting and the frequency of drinking for individuals between the ages of 35-64, who consumed their first drink before the age of 19. Significant differences were found between the 2 groups, the Underage group and the Of Age control group.

This study found that participants who consume their first alcoholic beverage underage drink more often in the future, supported by the fact that the Underage group drank alcohol about once a week, as compared to the Of Age group, who drank once a month. A significant association between the age someone started drinking and the number of drinks per sitting was also found; people who drank for the first time when they were underage consumed more drinks

than the people who started drinking after the appropriate age. Another significant finding of our study is that the people who drank underage were involved in binge drinking less than once a month, whereas the Of Age group did not practice binge drinking.

The p-value was found to be <0.001, which suggests a statistically significant difference between the drinking habits of the two groups. Overall, the findings suggest that a significant association exists between the consumption of alcoholic beverages before the age of 19, a higher frequency of drinking, a greater quantity of alcohol consumed in one sitting, and a higher tendency to engage in binge drinking.

Comparative Research

Since alcohol is a widely used substance, extensive research on its effects has been conducted, particularly on the varying impacts of demographic factors such as weight, age, and gender. A study by Pfefferbaum et al., (1988) revealed that underage drinking can obstruct brain development and explained the neurological effects of alcoholism; it showed that alcoholics had less brain tissue than a control group. Researchers in that study also discovered a link between underage drinking and higher alcohol dependency in the future. This finding parallels our investigation into the effects of underage drinking on future drinking habits. These results suggest that one of the consequences of underage drinking is being prone to higher alcohol consumption and a higher risk of developing neurological disorders (Pfefferbaum et al., 1988).

Another study by Buchmann and colleagues investigated the causal relationship between age at the onset of drinking and future alcohol related problems. The participants of this study included data from adolescents aged 15-19. This longitudinal study confirmed that in addition to a shared genetic and psychopathological risk for heavy alcoholics, an early onset solely was also

a significant predictor of future hazardous drinking habits (Buchmann et al., 2009). This aligns with our study where an association between underage onset of drinking and poor future drinking habits were found. However, our study does not assume the age of 19 to be underage.

The results combined from these studies can be used by other researchers to find connections between underage drinkers and their future health, such as deciding an appropriate drinking legal age. Studies can also explore the alcohol consumption patterns and association between the social components of life such as cultural influences. The unclear effects of the onset of drinking before 19 years of age up to now will be resolved for researchers looking into alcohol related studies.

Limitations

There is a possibility that the results of this study were influenced by the distribution of participants between the control and the experimental groups. With 3249 participants represented in the Underage group and only 715 participants in the Of Age group, it is possible that the lower number of participants in the control group provided a less complete view of the overall average habits of people who began drinking when they were 19 years old or older, making the comparison to the Underage group unfair.

Although 18 year-old individuals are not considered underage and can legally drink in the provinces of Alberta, Manitoba, and Quebec, our research group still referred to anyone under the age of 19 as underage throughout the study, meaning someone who began drinking alcohol at the age of 18 in these three provinces was not legally underage but would have been sorted into the Underage category in this study. Future studies may want to deem participants Underage or Of Age based on a different factor such as the medically recommended age for alcohol consumption instead of the legal drinking age for the majority of provinces.

The results also could have been affected by cases that had missing data for questions being analyzed in this study as they were deleted from the dataset. For instance, individuals who drink less alcohol may have been more likely to skip over questions relating to binge drinking as they tend to not engage in binge drinking. In this case, our results would have generally had more focus on participants who drink more and inaccurately skew results toward individuals who did not skip over such questions.

Finally, the questions that participants were asked required answers based on the past 12 months and the age at which they began drinking, which was often several years prior to their completion of the survey. Therefore, the results of this study may have been affected by recall bias as it is assumed that participants were able to accurately remember their drinking behaviour, while many could have inaccurately remembered and reflected on their drinking habits from a year prior or longer.

Next Steps

The next steps involve future research examining the relationship between family history, an individual's experience with alcohol, and their drinking habits in adulthood. This analysis could improve further research as there are potential correlations between family history of alcohol consumption and the study participant's initial experience with alcohol. Some literature suggests that positive or negative experiences with a family history of alcohol consumption could influence the participant's alcohol tendencies (Lundahl et al., 1997). This information could contribute to the reasoning for analysis results if there is significance detected.

The minimum legal drinking age rules and mandates may be researched more when analyzing drinking habits. Canada's MLDA (minimum legal drinking age) differs depending on the province, and these mandates could affect when alcohol is first consumed, whether it be for

those who are underage or of age (Yörük & Yörük, 2013). When investigating these regulations further, there may be significant data to support the connection between MLDA and an increased or decreased incidence of alcohol consumption.

Future research could incorporate a more inclusive approach including those identifying across the gender spectrum. The current definition does not allow for gender terms to describe the sex of an individual. However, upon evolving social terminology, gender is defined as the cultural, behavioural and personal traits chosen to be displayed by individuals regardless of their chromosomal and genetic makeup (Merriam-Webster, 2022). Incorporating this information into research will aid in creating more generalizable results and a more accurate representation of society. Gender expression and its associated social response could be a factor of alcohol consumption. Additional research and analysis may be required to accurately make a correlation between these two variables.

Implications

The implications of this research could highlight the relationship between when alcohol is first consumed and drinking habits later in life, paired with additional research can further paint a more complete picture. This will allow readers to gain awareness of potentially negative effects and patterns such as alcohol abuse and associated addictive behaviours seen in the results causing a change in personal behaviour regarding alcohol. This research may have the potential to spread awareness for future alcohol consumption patterns that may negatively affect family members in later generations. As research states, family history with alcohol could be correlated to alcohol consumption. If more research supporting this connection is shared, it could positively impact how people consume alcohol in order to cultivate positive family effects (Lundahl et al., 1997).

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Concern for child's mental health during the COVID-19 pandemic greater in Canadian immigrant parents ages 35-44 over non-immigrant parents: An Observational Cross-Sectional Study

LIFESCI 3LL3 – Group 16

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Introduction

The COVID-19 pandemic has changed the way society conducts daily living. With limited socialization, people experienced a loss of routine and were forced to adapt to unpredictable circumstances, which included lost wages, reduced access to services, and increased stress (Moyser, 2020). Amongst these changes, parents were especially challenged. The loss of routine and increased uncertainty has led to greater stress in parents and poor physical and mental health in children (Karki et al., 2020). Studies have identified that increased stress from the pandemic may provoke harsh parenting, putting a strain on parent-child relationships. Parental stressors magnified by the pandemic consist of a lack of both parental support and perceived control over events, as well as greater perceived stress from economic and social hardships (Brown et al., 2020). Prior to the pandemic, research suggests that peer relationships play a smaller role in predicting child mental health than compared to direct experiences with family members (McArthur et al., 2021). As family dynamics continue to change during the pandemic (Harrist et al., 2019; Eales et al., 2021), children must learn to adapt to novel and aversive situations, which can be challenging when there is a lack of access to mental health care due to the stigma projected by parents (Tulli et al., 2020).

Studies reveal that generational differences between immigrant parents and children are linked to greater mental health challenges, especially those from lower socioeconomic countries, often influenced by family relationships (Montazer, 2011). In a study done by Wang et. al., (2018) the mental health stigma among parents of school-going children was assessed, where many immigrant parents faced barriers that fell into the categories of knowledge, attitudinal, structural, and relational barriers. These parents displayed a lack of knowledge of several mental health disorders and associated mental health with negative perceptions such as shame, guilt, and

low competency. Although mental health stigma is prevalent amongst many immigrant families, this does not equate to a lack of concern for their child's wellbeing. Mental health is communicated differently amongst cultures, which can limit the resources available (Tulli et al., 2020). Many immigrant parents also reported struggling to connect and have open relationships with their children, especially those affected by acculturation (Wang et al., 2018). Children of immigrant parents are at a greater risk of depressive symptoms due to the stigma of poor mental health expressed by migrant parents (Tulli et al., 2020).

Along with the impact on mental health in children, physical health was also greatly affected by the pandemic. Due to mandates closing public spaces and playgrounds, alongside the closure of schools, children faced barriers to engaging in physical activities which resulted in a significant increase in sedentary behaviours (Moore et al., 2020). The abrupt transition to virtual schooling had caused greater stress on parents, who are anxious about COVID-19. A questionnaire conducted from April to June 2020 with 350 parents revealed that one-third of parents are extremely anxious about COVID-19 and related schooling in their children ages 5 to 11. The pandemic has brought a plethora of consequences regarding physical health in children, as many are seeing an increase in television watching, gaming, and use of screen-based devices by 75% in contrast to being physically active (McCormack et al., 2020).

Prior to the pandemic, many immigrant parents were hesitant to address mental health issues, which limits the resources available to children. There is a lack of knowledge in understanding what the implications of mental health are when living in a pandemic. While the pandemic is fluid, long-term implications have yet to be reviewed in the literature. There is insufficient research looking into parental perspectives surrounding mental health, specifically how it is perceived by immigrant parents. There is also a disconnect when understanding how

parental perspectives of mental health from immigrant parents contrast with their views on physical health concerning their children.

Given this gap in research, we aim to investigate whether the immigration status of parents is correlated with the level of concern for their child's mental health. Specifically, we are looking to examine if there is a difference in concern for a child's mental health among immigrant parents living in Canada aged 35-44 years old during the pandemic, compared to non-immigrant parents living in Canada of the same age group. To further investigate, we aim to examine if there is a difference in the level of concern for their child's physical health amongst the same population, in comparison to their level of concern for their child's mental health.

Methods

The data collected in this study are from Statistics Canada's crowd-sourcing data initiative, *Impacts of COVID-19 on Canadians: Parenting during the pandemic* (2020), obtained through the data collection database Odesi. The Crowdsourcing data series from Statistics Canada looked at data pertaining to the pandemic, assessing the quality and viability of data from a web-only collection of willing participants, as opposed to a random selection (Government of Canada, 2020). Participants were recruited by open advertising through social media, governmental agencies, private and public organizations, and media channels. Willing participants completed an anonymous, 5-minute online questionnaire from Statistics Canada's online forum, in either English or French (Government of Canada, 2020).

As an observational, cross-sectional study, the particular database "*Parenting during the pandemic"* observes Canadian families per household (Government of Canada, 2020). The database targeted Canadian adults with children aged 0 to 24 who live in the same household as the participant. Data was collected to identify the concerns and experiences of parents living in

Canada, regarding the health and social life of their children from the pandemic from March 15, 2020, to the time of data collection in June 2020 (Government of Canada, 2020).

Participants in the final database were narrowed to analyze the relationship between attitudes towards mental health and to mitigate confounding variables. Only parents who were aged 35-44 with children aged 6-14 were targeted in the study. Younger parents were selected to avoid age differences between older and middle-aged adults. Children aged 6-14 were selected as they are old enough to understand the pandemic and attended school prior to the pandemic, therefore being impacted by school closures. To relate to the Canadian population, participants had to be living in Canada, verified by their postal code. Parents must either be Canadian citizens or hold immigrant status in Canada as a landed immigrant or permanent resident.

Participants were excluded if they were not 35-44 or Canadian. Participants were also excluded if they provided incomplete or invalid answers to any of the questions provided to avoid inconsistencies in outcomes. To understand the concerns of parents, participants who answered any of the following answers, “valid skip”, “don’t know,” “refusal,” “not stated”, or “not applicable” were excluded. To avoid biases, participants who identified as Indigenous or had children with a disability were excluded. This is because Indigenous populations have unique societal factors influencing the levels of mental health in their communities. Parents with disabled children also experience differences in parenting that can impact mental health.

The primary outcome expected in this study is to see a difference between parental views on child mental health specifically between immigrant and non-immigrant groups during the COVID-19 pandemic. The specific variables looked at for this outcome were the immigration status of parents and general concern for mental health. On the questionnaire the question was phrased as “due to the COVID-19 pandemic, how concerned are you about the following for

your child or children aged 0 to 14 years". The secondary outcome in this study is to see a difference between parental views on child physical health specifically between immigrant and non-immigrant groups during the covid-19 pandemic. The question was phrased as following "Due to the COVID-19 pandemic, how concerned are you about the following for your child or children aged 0 to 14 years? - General physical health". Data was collected through the use of a psychometric scale known as the Likert scale, allowing for the measurement of parental perceptions qualitative viewpoint (Joshi, 2015). This scale provides the best method of accuracy on weighting parental perspectives by using a preexisting scale allowing for data to be replicated increasing the testing validity and replicability. The categories used to collect data were as follows: "Extremely, Very, Somewhat, Not at all, do not know, not applicable, valid skip, refusal and not stated". "Do not know, not applicable, valid skip, refusal and not stated" were removed from the data sample.

The following were additional variables that were put in the questionnaire; "Concern for child: Loneliness and isolation", "Concern for child: Opportunities to socialize with friends", "Concern for child: Amount of screen time", "Concern for child: Amount of physical Activity", "Amount of physical activity", "Amount of screen time". These variables provide further insight on parental views through the process of running statistical analysis and measuring their correlation to either parental concern for their child's mental or physical health.

SPSS Software by IBM was used to conduct statistical tests on the data collected, tabulate plots for trends, and summarize descriptive statistics to use for analyses. Due to the data being ordinal and not normally distributed, a Wilcoxon-Mann-Whitney test was conducted to observe if one experimental group had higher values than the other. Specifically, the Mann-Whitney test was used to compare the differences between immigrant and non-immigrant

parents for general concerns regarding mental health, against a series of parental concerns and measurements of child activities tested.

The nonparametric Spearman Rank Order Correlation test was used to analyze the monotonic relationship between immigrant and non-immigrant parents. Specifically, Spearman's rho was used to observe how closely related in strength and direction were parents' concerns for general physical health in comparison to general mental health. A Spearman's rho test was selected due to the categorical data being ranked and violating the assumptions for a Pearson correlation test, as the data had outliers and was non-normally distributed.

Ordinal data were outlined in Table 1 by being split into demographics and parental concerns. The distribution of responses was expressed as frequencies indicating the number of participants and as percentages of responses out of the overall sample. Measures of central tendency reported were the median and mode. To determine statistical significance, a p alpha value of 0.001 was used. The p-value was selected because of its precision since data that produces a significance of less than 0.001 is considered highly statistically significant.

Results

15,410 missing cases were found using SPSS and deleted from this analysis. The original database consisted of 32,228 participants. 3093 participants were male and 29, 135 were female. 3863 were immigrants and 28,183 were non-immigrants or non-permanent residents. The current sample size represents responses from 16818 individuals aged 35-44, 1581 of whom were male and 15,237 were female. 1982 were reported to be immigrants and 14, 836 were non-immigrants.

Table 1. Characteristics of Parent Participant Population. Data obtained from Impacts of COVID-19 on Canadians– Parenting during the pandemic by Statistics Canada. Distribution
(N = number of participants) of responses regarding parental concern for child reported. Participants with missing data were omitted from the sample. Median and mode reported. N = 16818

Table 1. Characteristics of Parent Participant Population

Demographic & Parental Concern Variables [n (%) = number of participants]		Immigrant Parents Aged 35-44 Living in Canada Group (N = 1982 people)				Non-Immigrant Parents Aged 35-44 Living in Canada Group (N = 14836 people)			
		Frequency (n)	Percent (%)	Median	Mode	Frequency	Percent (%)	Median	Mode
Gender	Male	214	10.8	2.00	2 [female]	1367	9.20	2.00	2 [female]
	Female	1768	89.2			13469	90.8		
Concern for child: General Mental health	Not at all	209	10.5	2.00	2 [somewhat]	1199	8.1	2.00	2 [somewhat]
	Somewhat	825	41.6			6484	43.7		
	Very	537	27.1			4399	29.7		
	Extremely	411	20.7			2754	18.6		
Concern for child: General Physical health	Not at all	521	26.3	2.00	2 [somewhat]	4378	29.5	2.00	2 [somewhat]
	Somewhat	855	43.1			7293	49.2		
	Very	376	19.0			2152	14.5		
	Extremely	230	11.6			1013	6.8		
Concern for child: Loneliness & isolation	Not at all	175	8.8	3.00	2 [somewhat]	987	6.7	3.00	2 [somewhat]
	Somewhat	697	35.2			5617	37.9		
	Very	597	30.1			4981	33.6		
	Extremely	513	25.9			3251	21.9		
Concern for child: Opportunities to socialize with friends	Not at all	61	3.1	3.00	4 [extremely]	349	2.4	3.00	3 [very]
	Somewhat	439	22.1			3587	24.2		
	Very	732	36.9			5860	39.5		
	Extremely	513	37.8			3251	34.0		
Concern for child: Amount of screen time	Not at all	139	7.0	3.00	4 [extremely]	1093	7.47	3.00	4 [extremely]
	Somewhat	486	24.5			4301	29.0		
	Very	585	29.5			4668	31.5		
	Extremely	772	39.0			4774	32.2		
Concern for child: Amount of physical activity	Not at all	334	16.9	2.00	2 [somewhat]	3308	22.2	2.00	2 [somewhat]
	Somewhat	730	36.8			6160	41.5		
	Very	576	29.1			3689	24.9		
	Extremely	342	17.3			1679	11.3		
Child activities: Screen time	Never	21	1.1	4.00	4 [extremely]	131	0.9	4.00	4 [extremely]
	1 to 2 times per week	81	4.1			367	2.5		
	3 to 5 times per week	135	6.8			928	6.3		
	Daily or almost every day	1745	88.0			13410	90.4		
Child activities: Physical activity	Never	24	1.2	4.00	4 [extremely]	82	0.6	4.00	4 [extremely]
	1 to 2 times per week	320	16.1			1338	9.0		
	3 to 5 times per week	527	26.6			3578	24.1		
	Daily or almost every day	1111	56.1			9838	66.3		

General Mental Health

According to Table 2, 43.7% (6484/ 14836) of non-immigrant parents responded "somewhat" when asked about their concerns for their child's general mental health, whereas the percentage was 41.6% (825/1982) for immigrant residents. The median response reported was 2.00 (Table 1), as also visualized in Figure 1. In addition, the percentage of parents who were not concerned with their child's mental health was similar for both, although this was not statistically significant as indicated by the p-value (0.695).

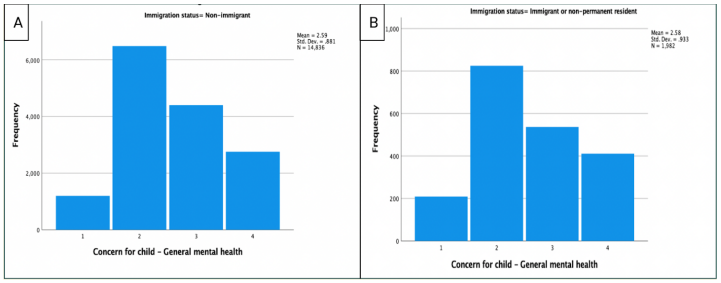

Figure 1. Concern for General mental health with reference to immigration status. Likert Scale Ratings (1-4) represent survey responses (Not at all, somewhat, very, extremely). Data is negatively skewed. Greatest distribution of responses for "2." **A-** Non-immigrant parental concern (n=14836).**B-**Immigrant/ non-permanent resident parental concern(n= 1982). Plot distribution for both groups is relatively similar.

Table 2. Distribution of responses between immigrant and non-immigrant parents regarding parental concern for general mental health. Percent (%) represents the proportion of responses. Distribution of responses is concentrated within the "somewhat" concerned category for immigrants (n= 1982) and non-immigrants (n=14836).

Concern for child - General mental health

Immigration status			Frequency	Percent	Valid Percent	Cumulative Percent
Non-immigrant	Valid	Not at all	1199	8.1	8.1	8.1
		Somewhat	6484	43.7	43.7	51.8
		Very	4399	29.7	29.7	81.4
		Extremely	2754	18.6	18.6	100.0
		Total	14836	100.0	100.0	
Immigrant or non-permanent resident	Valid	Not at all	209	10.5	10.5	10.5
		Somewhat	825	41.6	41.6	52.2
		Very	537	27.1	27.1	79.3
		Extremely	411	20.7	20.7	100.0
		Total	1982	100.0	100.0	

The median was 3.00 (Table 1) for parental concern for child's loneliness and isolation. Table 3 shows that the percentage of immigrant parents who responded "somewhat," was 37.9% (5617/14836), with 6.7% (987/14836) who were not concerned. In the non-immigrant parent group, 35.2% (698/1982) parents were somewhat concerned, with 8.8% (175/1982) who reported no concern for their child's loneliness/ isolation.

Table 3. Distribution of responses between immigrant and non-immigrant parents regarding parental concern for child's loneliness and isolation. Percent (%) represents the proportion of responses. Distribution of responses are concentrated within the "somewhat" concerned category for immigrants (n= 1982) and non-immigrants (n=14836).

Concern for child - Loneliness/isolation

Immigration status			Frequency	Percent	Valid Percent	Cumulative Percent
Non-immigrant	Valid	Not at all	987	6.7	6.7	6.7
		Somewhat	5617	37.9	37.9	44.5
		Very	4981	33.6	33.6	78.1
		Extremely	3251	21.9	21.9	100.0
		Total	14836	100.0	100.0	
Immigrant or non-permanent resident	Valid	Not at all	175	8.8	8.8	8.8
		Somewhat	697	35.2	35.2	44.0
		Very	597	30.1	30.1	74.1
		Extremely	513	25.9	25.9	100.0
		Total	1982	100.0	100.0	

Table 4. Distribution of responses between immigrant and non-immigrant parents regarding parental concern for amount of physical activity. Percent (%) represents the proportion of responses. Distribution of responses are concentrated within the "somewhat" concerned category for both groups.

Concern for child - Opportunities to socialize with friends

Immigration status			Frequency	Percent	Valid Percent	Cumulative Percent
Non-immigrant	Valid	Not at all	349	2.4	2.4	2.4
		Somewhat	3587	24.2	24.2	26.5
		Very	5860	39.5	39.5	66.0
		Extremely	5040	34.0	34.0	100.0
		Total	14836	100.0	100.0	
Immigrant or non-permanent resident	Valid	Not at all	61	3.1	3.1	3.1
		Somewhat	439	22.1	22.1	25.2
		Very	732	36.9	36.9	62.2
		Extremely	750	37.8	37.8	100.0
		Total	1982	100.0	100.0	

When parents were asked about concern for their child's socialization, results revealed that 39.5% (5860/14836) of immigrants (n=14836)were very concerned, with 2.4% (349/14836) of parents who were not concerned, shown in Table 4. Responses from immigrant parents (n= 1982) showed that 36.9% (732/1982) were very concerned, with 37.8% (750/1982) of responses that fell under "extremely" concerned. The median for both groups was 3.00 (Table 1) and the differences between groups were statistically significant (p=0.007).

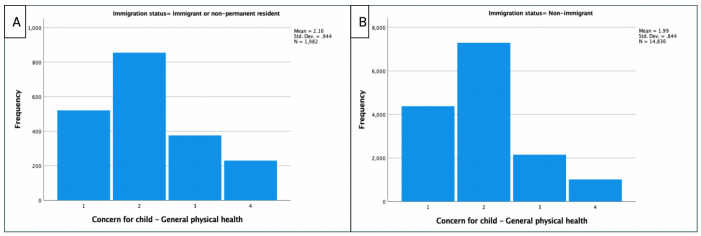

Figure 2. Concern for general physical health with reference to immigration status. Likert Scale Ratings (1-4) represent survey responses (Not at all, somewhat, very, extremely). Data is positively skewed. Greatest distribution of responses for "2." **A-** Non-immigrant parental concern (n=14836). **B-** Immigrant/ non-permanent resident parental concern (n= 1982). Plot distribution for both groups are relatively similar.

Table 5. Parental concern for amount of screen time amongst immigrants and non-immigrants. Depicted are frequency of responses rated on a Likert Scale (1-4), corresponding with level of concern.

Concern for child - Amount of screen time

Immigration status			Frequency	Percent	Valid Percent	Cumulative Percent
Non-immigrant	Valid	Not at all	1093	7.4	7.4	7.4
		Somewhat	4301	29.0	29.0	36.4
		Very	4668	31.5	31.5	67.8
		Extremely	4774	32.2	32.2	100.0
		Total	14836	100.0	100.0	
Immigrant or non-permanent resident	Valid	Not at all	139	7.0	7.0	7.0
		Somewhat	486	24.5	24.5	31.5
		Very	585	29.5	29.5	61.0
		Extremely	772	39.0	39.0	100.0
		Total	1982	100.0	100.0	

The percentage of non-immigrant parents who were extremely concerned was 32.2% (4774/14836), with 7.4% (1093/14836) who were not concerned, according to Table 5. The percentage of immigrant parents (n=14836) who were extremely concerned was 39.0% (772/ 1982), with 7.0% (139/1982) who were not concerned. The median for both groups was 3.00 (Table 1). The findings were significant (p=0.0018).

Table 6. Distribution of responses between immigrant and non-immigrant parents regarding child's screen time. Percent (%) represents the proportion of responses. Distribution of responses concentrated within the "daily or almost everyday" category for both groups.

Child activities - Screen time - frq

Immigration status			Frequency	Percent	Valid Percent	Cumulative Percent
Non-immigrant	Valid	Never	131	.9	.9	.9
		1 to 2 times per week	367	2.5	2.5	3.4
		3 to 5 times per week	928	6.3	6.3	9.6
		Daily or almost every day	13410	90.4	90.4	100.0
		Total	14836	100.0	100.0	
Immigrant or non-permanent resident	Valid	Never	21	1.1	1.1	1.1
		1 to 2 times per week	81	4.1	4.1	5.1
		3 to 5 times per week	135	6.8	6.8	12.0
		Daily or almost every day	1745	88.0	88.0	100.0
		Total	1982	100.0	100.0	

Table 7. Distribution of responses between immigrant and non-immigrant parents regarding parental concern for general physical health. Percentage (%) represents the proportion of responses. The distribution of responses is concentrated within the "somewhat" concerned category for both groups.

Concern for child - General physical health

Immigration status			Frequency	Percent	Valid Percent	Cumulative Percent
Non-immigrant	Valid	Not at all	4378	29.5	29.5	29.5
		Somewhat	7293	49.2	49.2	78.7
		Very	2152	14.5	14.5	93.2
		Extremely	1013	6.8	6.8	100.0
		Total	14836	100.0	100.0	
Immigrant or non-permanent resident	Valid	Not at all	521	26.3	26.3	26.3
		Somewhat	855	43.1	43.1	69.4
		Very	376	19.0	19.0	88.4
		Extremely	230	11.6	11.6	100.0
		Total	1982	100.0	100.0	

In Table 6, 90.4% (13410/14836) of non-immigrant parents reported their child engaging in screen time daily or close to daily. Regarding children of immigrant parents, 88.0% (1745/1982) reported their children to have engaged in screen time daily or close to daily. ($p<0.001$). The median was 4.00 for both groups (Table 1).

General Physical Health

Reported in Table 7, is the percentage of non-immigrant parents who were somewhat concerned for their child's general physical health, which was 49.2% (7293/14836). 43.1%

(855/1982) of immigrant parents responded “somewhat” concerned. Percentages for “extremely” concerned were 6.8% (1013/14836) and 11.6% (230/1982) for immigrant and non-immigrant parents respectively. 26.3% and 43.1% of immigrant parents were not concerned or somewhat concerned, respectively. The median for both groups was 2.00 (Table 1) where the distribution can be visualized in Figure 2. Results were statistically significant ($p<0.001$*).

Table 8 shows that 41.5% (6160/14836) of non-immigrant parents were somewhat concerned, with 22.3% (3308/14836) of respondents not at all concerned for their child’s physical activity. With immigrant parents, 36.9% (730/1982) responses were somewhat, with 29.1% (575/1982) answering very concerned. Percentage of immigrant parents not concerned was 16.9% (334/1982). Median was 2.00 for both groups. Results were significant, p=0.00

Table 8. Distribution of responses between immigrant and non-immigrant parents regarding parental concern for amount of physical activity. Percent (%) represents the proportion of responses. Distribution of responses are concentrated within the “somewhat” concerned category for both groups.

Concern for child - Amount of physical activity

Immigration status			Frequency	Percent	Valid Percent	Cumulative Percent
Non-immigrant	Valid	Not at all	3308	22.3	22.3	22.3
		Somewhat	6160	41.5	41.5	63.8
		Very	3689	24.9	24.9	88.7
		Extremely	1679	11.3	11.3	100.0
		Total	14836	100.0	100.0	
Immigrant or non-permanent resident	Valid	Not at all	334	16.9	16.9	16.9
		Somewhat	730	36.8	36.8	53.7
		Very	576	29.1	29.1	82.7
		Extremely	342	17.3	17.3	100.0
		Total	1982	100.0	100.0	

Table 9. Distribution of responses between immigrant and non-immigrant parents regarding parental concern for physical activities (frequency of physical activity). Percent (%) represents the proportion of responses. Distribution of responses are concentrated within the “daily or almost everyday” category for both groups.

Child activities - Physical activities - frq

Immigration status			Frequency	Percent	Valid Percent	Cumulative Percent
Non-immigrant	Valid	Never	82	.6	.6	.6
		1 to 2 times per week	1338	9.0	9.0	9.6
		3 to 5 times per week	3578	24.1	24.1	33.7
		Daily or almost every day	9838	66.3	66.3	100.0
		Total	14836	100.0	100.0	
Immigrant or non-permanent resident	Valid	Never	24	1.2	1.2	1.2
		1 to 2 times per week	320	16.1	16.1	17.4
		3 to 5 times per week	527	26.6	26.6	43.9
		Daily or almost every day	1111	56.1	56.1	100.0
		Total	1982	100.0	100.0	

Table 10. Spearman Rank Order Correlations. Highlighted values depict correlation coefficients relating concern for general physical (r=0.479) and mental health (r=0.444) Significance level was set to be 0.01. Significance is indicated by the (*) symbol.

Correlations

	Immigration status			Concern for child - General physical health	Concern for child - General mental health
Spearman's rho	Non-immigrant	Concern for child - General physical health	Correlation Coefficient	1.000	.444**
			Sig. (2-tailed)	.	.000
			N	14836	14836
		Concern for child - General mental health	Correlation Coefficient	.444**	1.000
			Sig. (2-tailed)	.000	.
			N	14836	14836
	Immigrant or non-permanent resident	Concern for child - General physical health	Correlation Coefficient	1.000	.479**
			Sig. (2-tailed)	.	<.001
			N	1982	1982
		Concern for child - General mental health	Correlation Coefficient	.479**	1.000
			Sig. (2-tailed)	<.001	.
			N	1982	1982

**. Correlation is significant at the 0.01 level (2-tailed).

According to Table 9, 66.3% (9839/14836) of non-immigrant parents reported their child to be physically active daily. 56.1% (1111/1982) of immigrant parents reported daily physical

activity engagement for their child. The median was found to be 4.00 for both groups (Table 1). Findings were significant at p=0.00.

In Table 10, data depicts a high correlation between non-immigrant parents' concerns for child mental and physical health with a correlation coefficient of 0.444 and a p-value of 0.000 and a high correlation between immigrant concern for child mental health and concern for child physical health with a correlation coefficient of 0.479 and a p-value less than 0.001.

Discussion

Concern for General Mental Health

Both immigrant and non-immigrant groups showed that over 40% of parents were somewhat concerned for their child's mental health. The results were consistent with previous research analyzing mental health stigma showing that many parents are hesitant to claim their child may be struggling with their mental health (Montazer, 2021). It is inconsistent with previous research that a larger proportion of immigrant parents expressed extreme concern for their child's mental health compared to non-immigrants, as many studies show immigrant parents unwilling to acknowledge their children struggling with mental health (Kim, 2018). The cultural stigma surrounding mental health was summarized in 4 categories, knowledge, attitudinal, relational and structural (Wang et al., 2019). The occurrence of the pandemic may have assisted in the breakdown of many barriers. For instance, the stay-at-home mandate resulted in many parents spending more time with their children, possibly reducing the relational barrier and decrease in attitudinal stigma as mental health is talked about more frequently during the pandemic (Javed et al., 2021). The meaning of “somewhat” is subjective. The Likert scale typically provides some sort of midpoint; similar to a neutral stance (Chyung et al., 2017). In the following study, participants were expected to choose between “somewhat” and “very” with no

in-between. This could explain why there is a drastic response for “somewhat”, as “very” would be implying a much more serious concern.

To better understand the reluctance observed by immigrant parents, a concern for a child’s loneliness and isolation was measured. Loneliness and isolation were reported as an extreme concern for immigrant parents than non-immigrants. Loneliness is an appropriate indicator to measure differences in attitudes towards mental health due to how closely related both variables are. Previous research has consistently proven how loneliness and isolation can negatively impact mental health, often being displayed as depressive symptomatology (Hwang et al., 2020). This is further exacerbated by the pandemic with extended quarantine periods and nationwide lockdowns that have elevated levels of loneliness to an all-time high (Smith & Lim, 2020). Children have been under longer periods of isolation due to school closures, while many parents were still able to leave for work (Meade, 2021). As it is evident how feeling lonely can worsen mental health, this monotonic relationship was not observed in the data collected. There are consistently higher levels of concern reported for loneliness than overall mental health. This could possibly be explained by immigrant parents’ avoidance to admit to concerns about the mental health of their children. As Wang et al. (2020) have outlined, there are barriers that stigmatize mental health in immigrant communities. Thus, immigrant parents have internalized cultural biases that prevent them from distinguishing poor mental health (Wang et al., 2019). When comparing distress between mental health and loneliness, immigrant parents have failed to display the same level of heightened concern for their child’s mental health.

To further understand attitudes toward mental health, concern for peer socialization was measured and it was found that immigrant parents were more worried than non-immigrants. Peer socialization is crucial for child development and helps maintain positive mental health. As

Maddox & Prinz (2003) have outlined, school bonding in children is key to preventing negative influence on developmental outcomes such as delinquency and antisocial behavior. Seen by how closely peer socialization can relate to mental health, the decline of one contributes to the worsening of the other. However, there is an absence of this coupled relationship as immigrant parents were expressing greater worry, not aligning their attitudes towards mental health with the same degree of concern. The lower levels of concern reported by both groups indicate that children's socialization had not been greatly affected by the pandemic. The amount of screen time in children is a plausible explanation as to why peer socialization has remained consistent. A majority of both groups have reported children's screen time to be increased daily. Transitions to online schooling have resulted in increased use of screen-based devices in children (O'Keeffe et al., 2011). Nationwide lockdowns have resulted in kids spending longer time gaming and on social media as a coping method for stress induced by the pandemic (King et al., 2020). Screen time in school-going children has consistently been elevated both weekdays and weekends (Ten Velde et al., 2021). The increased demand for excessive use of technology can indicate why peer socialization has not greatly been impacted and thus not greatly influential towards altering overall levels of concern for mental health (Stienwandt et al., 2020).

To revisit the relationship between physical and general mental health, the majority of parents from both groups answered "somewhat" concerned. Given the barriers mentioned, parents may be more reluctant to give definitive answers when asked about their concerns for mental health compared to physical health. While these differences were small, it is possible that there may have been a shift towards mental health during the pandemic. Work by Javed et al. (2021) examining the role of culture in mental health stigma, suggests that the pandemic has raised more awareness for mental health and highlights the comorbidity of health conditions and

mental health disorders, sharing common risk factors such as physical inactivity and poor social support. In terms of willingness to report mental and physical health symptoms, a national survey conducted by Tandon et al (2021) found that while parents did not report concern for mental health directly, they were concerned about their child's hyperactivity and conduct behaviour, which might be ways we see poor mental health take effect. Regarding our data, this can suggest why most parents were more likely to answer "somewhat" when asked about factors relating to both concerns, as there can be inconsistencies present when distinguishing whether they perceive concerns as being towards physical or mental health.

Limitations & Future Directions

Inconsistent responses contribute to the power and bias of the data analysis. Participants were limited with the responses available in the questionnaire. For example, when examining employment status through the impact of COVID-19, participants who were unemployed prior to the pandemic could not accurately state that their employment status was uninfluenced, leading to unanswered questions and missing data. The identification of ethnicity can account for the cultural impacts on concern for child mental health and physical health, which the survey did not account for. The findings of this study failed to recognize the population of participants who are non-immigrants but still experience stigma from being raised by immigrant guardians. The sample size of non-immigrant parents was drastically larger than immigrant parents, so the data represented a greater concern for the mental/physical health of children from non-immigrant parents. Future research should also consider respondents from other countries and investigation of parental concerns beyond the parental age of 35-44 for children of all ages to reduce potential covariates and provide insight on the effects of parental age on parenting style/concern, as well as whether various stages of childhood to teen influence parental concern.

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Increased Prevalence of Alcohol and E-Cigarette Usage Among Rural High School Students in Comparison to Urban High School Students

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INTRODUCTION

There are various cultural, economic, social, and educational factors that could differentiate between urban and rural areas. These elements might influence behavioral and mental health outcomes including substance use. Understanding the discrepancies in substance use behaviours between high school students in urban and rural communities can help assist public health leaders in developing different practices, policies, and prevention programs for schools as well as communities (Office of the Surgeon General (US), 2001).

The Canadian Centre on Substance Abuse observed national data from regularly occurring student surveys which had participants from grades seven to twelve. A report by McInnis and peers (2015) identifies that the median prevalence of alcohol use for students who attended urban schools was 41.2% and for students who attended rural schools it was 60.2%. Only two of the eight surveys identified that students who attended rural schools were increasingly likely to participate in daily or almost daily cannabis use. These surveys were from Manitoba and British Columbia which showed a significant odds ratio ($p<.05$) of the urban-rural environment on the outcome. However, none of the surveys showed that urban students were more likely to report any of the explored outcomes. Overall, by analyzing both national and provincial data, the study concludes that students who attend schools in rural settings are at an increased likelihood of reporting certain outcomes related to substance use (McInnis et al., 2015).

Another study reported data regarding substance use for students ages twelve to fifteen years. The participants were located in census areas classified as urban, large or small towns, and rural within Washington State (WA) in the United States and Victoria (VIC) in Australia. They identified that the rates of lifetime and current tobacco, alcohol, and cannabis use were

significantly higher in rural compared to urban students in both states, presenting an odds ratio for current substance use as 1.31. Overall, this study infers that early adolescent rural students use substances more frequently than their urban equivalent (Coomber et al., 2011).

Another group of researchers focused solely on substance use with regards to the rural end of the urban-rural spectrum. In this study, the researchers define the rural group as a population of individuals between 2,500 and 19,999, while the very rural group represents a rural population of less than 2,500. The results indicate that the drug users from the very rural group were significantly less likely to report using marijuana, since 61% of rural participants compared to only 46% of very rural participants reported usage. Although there were no statistically significant differences between the two groups in the use of alcohol, alcohol usage was marginally higher in very rural areas, with 81% of rural participants reporting usage compared to 86% of very rural participants reporting usage. As these two results contradict each other, it is difficult to conclude that substance use is generally more or less prevalent in either demographic region (Schoeneberger et al., 2006).

A study conducted by Warren and peers (2017) examines rural-urban differences in the prevalence of substance usage including alcohol, smoking tobacco, chewing tobacco, and marijuana within each grade level, from the sixth to the twelfth to gain a more comprehensive understanding of the rural-urban differences in recent use. Through a survey, the researchers found that a greater percentage of rural students across grades 9 to 11 reported using alcohol in the past 30 days when compared to their urban peers, presenting odds ratios of 1.22 for 9th-grade students, 1.17 for 10th-grade students and 1.10 for 11th-grade students. However, for 12th graders, the odds ratio presented as 0.82, indicating a greater percentage of urban students who reported endorsing alcohol use in the past 30 days. A significant difference emerged for high

school students in terms of marijuana usage, with a greater percentage of urban students endorsing use in the past 30 days, presenting an odds ratio of 0.65. The results of this study appear to be less conclusive than those noted previously and ultimately shows that the use of substances varies between rural and urban students. (Warren et al., 2017).

Currently, there is finite research on the relationship between rurality and what substances are used by adolescent users. There has been research done on the types of substances used by adolescents in rural and urban areas but results differ among studies (Coomber et al., 2011; McInnis et al., 2015; Schoeneberger et al., 2006; Warren et al., 2017). This has created a knowledge gap since the prevalence of substance use amongst certain populations has not yet been identified. The issue of electronic cigarette (e-cigarettes) usage is becoming more popular and therefore an increasing concern in recent years. The 2018 National Youth Tobacco Survey (NYTS) report stated that 3.6 million adolescents in the United States were currently using e-cigarettes. They also reported that e-cigarette use has drastically increased from 11.70% to 20.70% of adolescents between the years 2017 and 2018 (Sapre et al., 2020). This recent spike in popularity creates a knowledge gap that may be filled through further research on the topic of e-cigarettes. Therefore, the following study will aim to investigate if there is a correlation between substance use, specifically e-cigarettes, alcohol and marijuana, in Canadian adolescents between grades 9 to 12 residing in rural locations compared to Canadian adolescents between grades 9 to 12 residing in urban locations.

METHODS

Study Design and Database

The current study is a retrospective observational cross-sectional study. The data was drawn from the 2018-2019 Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS)

database. CSTADS is an ongoing national biennial school-based survey conducted by the Propel Centre for Population Health Impacts to collect data on youth substance use. The survey utilized a stratified single-stage cluster sampling procedure and a paper questionnaire as a structured research instrument. In the 2018-19 CSTADS, information on tobacco use, alcohol and drug use were collected on students in grades 7 to 12 (secondary I through V in Quebec) in 10 Canadian provinces. The survey was implemented in schools between October 2018 and June 2019. Overall, a total of 62,850 participants from 442 schools are included in the database. The database was accessed through the Odesi portal.

Study Participants

The current study includes participants who were in grades 9 to 12 from schools in 10 Canadian provinces. From the study population, there was listwise data exclusion of participants in grades 7 and 8. These cases were excluded because the prevalence of alcohol and drug usage among grade 7 and 8 students are very low; whereas, by Grade 12, consumption has surged (Young, 2012). Participants that responded “I do not know” to survey the questions were excluded from the study because of inconclusive data. We excluded data pairwise for our primary outcomes, therefore individuals were excluded if they did not provide definitive answers to outcome questions or did not answer the question (missing data). The experimental group consisted of participants that answered “Rural” to the rurality question, “Is the respondent's school in an urban or rural region?”, while the control group consisted of participants that answered with “Urban” to the same question.

Study Outcomes

The primary outcome of the study is to examine the differences in alcohol use, cannabis use and e-cigarette use in rural high school students and urban high school students. The

independent variable of the study is the rurality status of high school students. For alcohol, e-cigarette and cannabis use questions, participants selected a category on a nominal scale on the frequency of usage in the last 30 days. The secondary outcome of the study is to compare the use of cigarettes and e-cigarettes in the experimental and control group. The participants answered the question about the average number of cigarettes smoked per week along with their rurality status. This outcome was studied because alternatives to cigarettes are increasingly popular in youth (Lutfiyya *et al.*, 2008). The tertiary outcome of the study is to compare the socioeconomic status of high school students in rural and urban communities. The participants answered the question about median household income along with their rurality status. This outcome was included because adolescent substance use could be a result of their socioeconomic status (Das *et al.*, 2016). Understanding how rurality status influences substance use in high school students is of great clinical importance. Investigation regarding the relationship between rurality status and adolescent substance use will provide schools, healthcare providers, and parents with more evidence on environmental influences that impact substance use (Das *et al.*, 2016). Additionally, the data of the survey is reproducible as it used a large-scale generalized population.

Additional Data Collection

Our study included additional participant characteristics such as grade, median household income, and average number of cigarettes smoked per day in the past week. We included the grade variable to better understand the age of study populations in both rural and urban communities. The median household income variable was included to assess the difference in socioeconomic status between the rural and urban populations. Lastly, the variable, average number of cigarettes smoked, was included to compare with one of the primary variables, e-cigarette use, and examine for a difference in substance usage in students.

Statistical Analysis

Shapiro-Wilk normality tests were run on continuous variables such as “average number of cigarettes smoked” and “median household income”. For analysis of the primary research question, continuous data were reported as median and interquartile range (IQR) and categorical data are reported as frequency (%). Each response category for each of the primary outcome questions was assessed separately between the two groups, the rural and urban populations, using Bonferroni corrected z-score tests. Additionally, the variables regarding e-cigarette, marijuana or alcohol usage within the last 30 days, were transformed to assess two options (“has tried” or “never tried”) and chi-square tests were run with rurality status to produce a Yates’ correction for continuity value. The variables were collapsed to produce a more accurate and generalizable p-value. Whereas, running the chi-square tests for the individual analysis of each category was to evaluate the specific differences between the experiential and control group. The chi-square test is appropriate for the research question as it is designed to test for a statistically significant relationship between nominal variables such as rurality and substance (alcohol, cannabis, and e-cigarette) use. The results determine if there is a correlation between the variables or are they independent of one another. A biserial correlation analysis test was run between the dichotomous variable “rurality” and either the continuous variable of “median household income” or “average number of cigarettes smoked” to determine the correlation coefficient and statistical significance. All statistical analyses were run using IBM SPSS Statistics Version 28. A p-value less than (<) 0.05 was considered statistically significant.

RESULTS

Our primary objective of this study was to further understand the relationship between rurality and substance use. In particular, we focused on e-cigarette, alcohol, and marijuana usage

in the last 30 days. The participants included in the study were high school students from grades 9 to 12, as students from grades 7 to 8 were excluded. Due to these inclusion and exclusion criteria, our sample population for this study was 38,229 participants as 24,621 participants did not meet the criteria. As seen in Table 1, the sample population's descriptive characteristics are displayed. Furthermore, Table 1 provides insight into the participants' substance use behaviors.

Table 1. Descriptive characteristics of study population [N=38,229]. Participants were divided by whether they attended a high school in an urban community or a rural community.

Characteristics	Students Attending High School In An Urban Community [N=28964]	Students Attending High School In A Rural Community [N=9265]
Highschool Grade Level		
Grade 9	9030 (31.2)	2724 (29.4)
Grade 10	8769 (30.3)	2493 (26.9)
Grade 11	7346 (25.4)	2149 (23.2)
Grade 12	3819 (13.2)	1899 (20.5)
Average Median Household Income (Dollars) (median (IQR))	65000 (20000)	60000 (15000)
Average Number of Whole Cigarettes Smoked Per Day in The Past Week (median (IQR))	1.3 (1)	1.9 (1)
E-cigarette Usage in The Last 30 Days		
Daily or Almost Daily	3010 (10.6)	1090 (12.1)
< Daily, but at least once a week	1810 (6.4)	754 (8.4)
< Weekly, but at least once in last 30 days	2366 (8.4)	957 (10.7)
Tried, but not in the last 30 days	3783 (13.4)	1418 (15.8)
Never Tried	17326 (61.2)	4762 (53.0)
5 or More Drinks of Alcohol on One Occasion in The Last 30 Days		
I Have Not Done This in the Last 30 Days	4753 (44.8)	1739 (40.1)
Once or Twice	4532 (42.7)	1904 (43.9)
Once or Twice a Week	967 (9.1)	497 (11.5)
3 or 4 Times a Week	207 (1.9)	110 (2.5)
5 or 6 Times a Week	58 (0.5)	32 (0.7)
Everyday	100 (0.9)	54 (1.2)

Marijuana or Cannabis Usage in The Last 30 Days		
I Have Not Done This in the Last 30 Days	3979 (45.9)	1453 (44.6)
Once or Twice	2462 (28.4)	869 (26.6)
Once or Twice a Week	705 (8.1)	291 (8.9)
3 or 4 Times a Week	452 (5.2)	181 (5.6)
5 or 6 Times a Week	329 (3.8)	140 (4.3)
Everyday	744 (8.6)	327 (10.0)

Note. Values are reported as number (%) of students unless otherwise stated. Only students that participated were included.

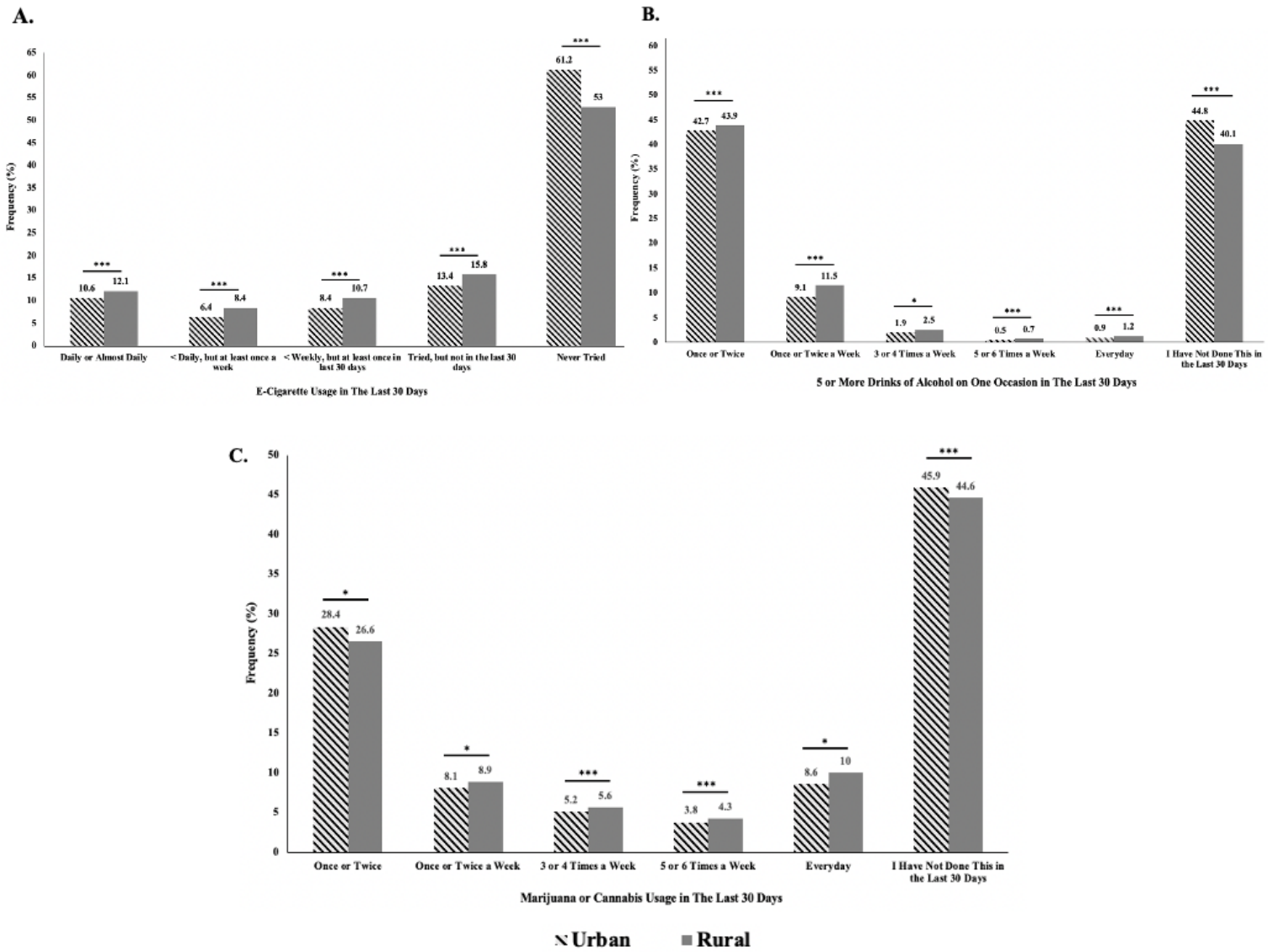

Figure 1. Relationship Between Substance Use (E-cigarette, Alcohol and Marijuana) and the Rurality Status of High School Students From Grades 9 to 12. **(A)** E-cigarette usage in the last 30 days. From left to right: [*** = p = <0.001],[*** = p = <0.001], [*** = p = <0.001],[*** = p = <0.001], [*** = p = <0.001], missing = 954. **(B)** 5 or more drinks of alcohol on one occasion in the last 30 days. From left to right: [***

= p = <0.001],[*** = p = <0.001], [* = p = 0.015],[*** = p = <0.001], [*** = p = <0.001],[*** = p = <0.001], missing = 23.276 **(C)** Marijuana or Cannabis Usage in The Last 30 Days. From left to right: [* = p = 0.047],[* = p = 0.025], [*** = p = <0.001],[*** = p = <0.001], [* = p = 0.046], [*** = p = <0.001], missing = 26,297

To assess our primary objective and to better visualize the data from Table 1, Figure 1 was created. Pearson's chi-squared tests along with Bonferroni corrected z-tests were run between groups for each categorial-type response within each substance use outcome of e-cigarettes, alcohol and marijuana usage. From Figure 1, it can be seen that each between-group showed statistical significance as all p-values were below 0.05. Moreover, it can be seen that almost every category shows a higher rural frequency than urban frequency. The only exceptions include the "never tried" category for e-cigarette usage, the "I have not done this in the last 30 days" for alcohol usage and both the "once or twice category" and "I have not done this in the last 30 days" for marijuana or cannabis usage.

Table 2. Pearson's chi-squared test analysis to determine the significance and relationship between the rurality status of high school students from grades 9 to 12 and substance use behaviors. Participants were divided by whether they attended a high school in an urban community or a rural community.

Characteristics	**Students Attending High School In An Urban Community** [N=28964]	**Students Attending High School In A Rural Community** [N=9265]	**Yates' Correction for Continuity**
E-cigarette Usage in The Last 30 Days			
Has Tried	46922 (12.1)	5030 (36.1)	< 0.001*
Never Tried	338837 (87.9)	8924 (63.9)	
5 or More Drinks of Alcohol on One Occasion in The Last 30 Days			
Has Tried	6468 (54.4)	2845 (58.7)	< 0.001*
Never Tried	5426 (45.6)	2001 (41.3)	

Marijuana or Cannabis Usage in The Last 30 Days			
Has Tried	5237 (53.7)	2025 (54.9)	0.227
Never Tried	4519 (46.3)	1666 (45.1)	

Note. Values are reported as number (%) of students with an exception for the Yates' correction for continuity value. Only students that participated were included. * = $p < 0.05$

To further address the primary outcome, a Pearson's chi-squared test was run for each collapsed substance use category. The yates correction continuity for both e-cigarette and alcohol were <0.001 showing that both variables are statistically significant (Table 2). For marijuana or cannabis usage, the value was 0.227 showing that it is not statistically significant (Table 2).

Table 3. Biserial correlation analysis to determine the significance and relationship of the rurality status of high school students from grades 9 to 12 on either the average number of whole cigarettes smoked per day in the past week or the average median household income. Participants were divided by whether they attended a high school in an urban community or a rural community.

Characteristics	**Students Attending High School In An Urban Community** [N=28964]	**Students Attending High School In A Rural Community** [N=9265]	**P-value**	**Pearson Correlation Value (r_b)**
Average Number of Whole Cigarettes Smoked Per Day in The Past Week	1.3 (1)[a]	1.9 (1)[b]	0.113	0.063
Average Median Household Income (Dollars)	65000 (20000)[c]	60000 (15000)[d]	< 0.001*	-0.178

Note. Values are reported as median (IQR) with the exception of p-value and biserial Pearson correlation value (r_b). Only students that participated were included. [a]N=3118, [b]N=1554, [c]N=28964, [d]N=9265. * = $p < 0.05$

To assess the secondary objective, a Biserial correlation analysis was run between the rurality status of high school students and the average number of whole cigarettes smoked per day in the past week (Table 3). The results indicated that there was a small positive correlation between the two groups but the results were not statistically significant ($r_b = 0.130$, $p = 0.113$).

Similarly, to assess our tertiary objective, a Biserial correlation analysis was run between the rurality status of high school students and the average median household income (Table 3). Since the Shapiro-Wilk normality test indicated non-normal distribution, the values for the median household income variable are reported as median and interquartile range. The results indicated that there was a small negative correlation between the two groups and the results were statistically significant ($r_b = -0.178$, $p = < 0.001$).

DISCUSSION

The main findings suggest that urban high school students (grades 9-12) are more likely to have never tried e-cigarettes compared to rural high school students (grades 9-12) (Table 2). The results also indicate that urban high school students are more likely to have never tried alcohol compared to rural high school students (Table 2). While the results show that a greater percentage of urban high school students never tried marijuana or cannabis compared to rural high school students, the difference between these results is not found to be statistically significant (Table 2).

Our finding that e-cigarette use is significantly different between rural high school students and urban high school students aligns with existing literature. A cross-sectional study conducted by Lutfiyya et al. similarly examined the correlation between rural residency and tobacco usage by analyzing a merged dataset of adolescents ages 12 to 18 years. Their analyses

reveal that adolescents who lived either in urban (OR=.33, CI=.31, .35) or suburban (OR=.34, CI=.32, .36) regions are ultimately less likely to become daily smokers than adolescents who resided in rural regions. The researchers explain that greater accessibility and availability of tobacco products for rural youth could justify their results. Their study also highlights that there may be fewer regulatory restrictions on smoking in public places in rural regions (Lutfiyya et al., 2008). While these explanations support our results for e-cigarette use (Table 2), they do not explain the results for cigarette use (Table 3). Thus, these findings may further indicate that the use of different types of tobacco products, including cigarettes, may not be consistent with the prevalence of e-cigarette usage in rural or urban communities.

Another study conducted by Lambert et al. analyzed a pooled dataset that observed 3 years of data (2002-2004). Similar to our results regarding alcohol use (Table 2), they indicate that rural youth (ages 12-17 years) have higher alcohol use than urban youth (ages 12-17 years). The study also identifies that the highest rates of youth binge (15.0%, $P < .001$) and heavy drinking (4.1%, $P < .001$) were found in the most rural areas. One explanation outlined in their study is fewer alternatives for recreation and more causes of stress exist for youth in rural areas (Lambert et al., 2008). Our findings on alcohol consumption are further supported by a study by Chan et al. which examined data from the National Drug Strategy Household Survey 2013. The study shows for participants aged 12-17 years, drinking alcohol during the past 12 months was predicted by living in rural areas (OR = 2.26, $P = .003$) but not by living in inner regional areas (OR = 1.32, $P = .218$). The study also shows that parents in rural areas are more likely to use alcohol in ways that encourage adolescent drinking (Chan et al., 2016). Social factors such as parental pressures could potentially explain our results for alcohol consumption as well.

A study by the Canadian Centre on Substance Abuse (CCSA) evaluated cannabis use in students from grades 7-12. The study concludes that there are mixed findings regarding this topic and the researchers show that neither urban or rural settings are a risk for cannabis use among students. Their results support our findings that there is no statistically significant difference in marijuana or cannabis use between rural and urban high school students. This may be explained by both urban and rural populations holding similar negative perceptions and stigma toward cannabis use by youth.

One of the limitations of this study was that the analysis of data regarding e-cigarette and cigarette use does not represent all types of nicotine products. We chose to evaluate the discrepancy in e-cigarette between rural and urban populations since e-cigarette usage is gaining popularity among Canadian adolescents. The 2018-2019 Canadian Student Tobacco, Alcohol and Drugs Survey reported that 34% of students in grades 7-12 had ever tried an e-cigarette in the survey and 20% used them within the last 30 days (Government of Canada, 2022). While the survey data indicates the popularity of e-cigarettes, it does not account for the usage of other nicotine products among teenagers. Since there was no statistically significant difference found in cigarette usage between rural and urban high school students (Table 3), it would be advisable to research the prevalence of other tobacco products in rural and urban settings. It is necessary to acknowledge that the use of other substances containing nicotine may be prevalent among both rural and urban demographics. Another limitation of this study is that the data was collected through self-reporting methods. Due to the stigma surrounding substance use, there might have been an overall underreport of data. One way that this was mediated was by using a data set that derived from individually reported data rather than household reported data. Household data has a major drawback of inaccurate information being provided by the respondent. Further

methodological limitations within this data set include the fact that confounding variables such as history of family addiction, ethnicity, and additional socioeconomic factors were not analyzed.

The implications of this research are that rurality may be a risk factor associated with alcohol and e-cigarette usage. However, the results regarding the relationship between cannabis usage and rurality are inconclusive, requiring further research on this specific correlation. While this study only observed alcohol, e-cigarette and cannabis usage over the course of 30 days, it would be beneficial to gather data regarding lifetime usage of these substances. Obtaining this information would better define lifetime patterns of substance use. This could help inform future research to implement substance use prevention programs. Furthermore, it is possible that the COVID-19 pandemic might have increased the incidents of substance use by exacerbating mental health issues. Therefore, it would be prudent for further research to address and observe substance use during this time period, possibly through conducting a longitudinal study by relaunching the survey. Since First Nation Reserve schools were excluded from the database of this study, it would be informative to address the discrepancies in sociodemographic factors, such as socioeconomic status and ethnicity, that may lead to differences in substance use.

There are currently not many Canadian research articles published discussing the discrepancies between rural and urban substance use amongst adolescents as most available studies only examine American or international populations. However, this study solely focuses on the Canadian population, allowing for a better understanding of the relationship between geographic location and substance use behaviors in Canada. Ultimately, this study contributes to the scope of literature regarding the use of substances by high school students in both rural and urban settings. Regardless, it is necessary for further research to be executed regarding this topic in order to address greater populations within Canada.

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Association of Online and In-Person Therapy with Alcoholic Behaviour

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Introduction

There are various differences between online and in-person treatments involving drug and alcohol addiction. Online therapy involves the use of technology and data analytics to understand and give personalized rehab for those addicted to different substances (Bhavani et al., 2016; Dallery et al., 2015). Online treatment is fairly accessible around the world as over 5 billion people have access to mobile phone services (Silver, 2019). There are multiple types of online treatments that can cater to different substance-use disorders. Digital therapeutics are self-directed, interactive applications that are easily accessible, available 24/7, and are of high quality (Hixon, 2015). More specifically, digital therapeutics educate individuals about effective, scientific skills to alter unhealthy thoughts and actions (such as constant alcohol consumption). Telehealth involves giving long-distance care using telecommunication technology (Lin et al., 2019). There are also other mental health services online such as web-based therapy, e-therapy, cybertherapy, email therapy, e-interventions, computer-mediated interventions, and internet-based therapy (Amichai-Hamburger et al., 2014). These treatments can be done one-on-one or as a group on zoom and similar applications.

In-person addiction treatment involves in-person interactions that aid substance use disorders (SUD's). These rehab treatments include detox, inpatient rehab, outpatient rehab, and medication that mitigates addiction (Juergens, 2022). Inpatient rehab is when patients live in the hospital while getting treatment. Outpatient rehab is when individuals get rehabilitation such as cognitive behavior therapy without staying in a hospital.

Individuals are more likely to become addicted to drugs during adolescence and young adulthood. The brain during adolescence is comparable to a car with a working gas pedal (reward system), and broken brakes (prefrontal cortex). This makes teenagers more likely to stray away from pain while chasing pleasurable rewards. Their decision-making and analytical skills are poorly developed as well. This causes them to have issues with properly weighing the pros and cons of a

situation which leads them to partake in risk-taking activities such as consuming a lot of drugs and alcohol (National Institute on Drug Abuse, 2014). This age group has been studied thoroughly regarding rehabilitation outcomes.

Multiple barriers exist involving online and in-person treatments. Online cognitive behavioral treatment has been known to not appeal to those with financial concerns, poor access to technological resources (e.g. those in third world countries), computer anxiety, life chaos, and preference for autonomy (Moskalenko et al., 2020). Online treatment is not entirely accessible and is hard for certain people to use. In-person treatment barriers include the time it takes to travel, the inability to travel, in-person anxiety, language or cultural differences, and the risk of spreading viruses such as COVID-19. It is hard and risky for many to go to in-person treatment.

While there are many developing studies determining the use and effectiveness of internet-based interventions (IBIs), when comparing the results of these studies it's noticeable that they mainly compare subject use of one IBI to another or in cases subject use of various IBI's to a control group of participants who don't use any. We have yet to have a study that objectively compares the use of IBI interventions, face-to-face interventions, or a combination of both to a control group that doesn't have access to either. For example, a study conducted by Blanker et al. in 2011 compared the use of various IBI's from self-assessment to individual therapy to a control group "waiting list" who didn't receive any form of treatment. It was found that internet-based therapy and self help were effective interventions in reducing problematic alcohol use, internet based therapy being more effective in treatment. But there was little to no mention of these results being compared to actual face-to-face interaction. This also seen in other studies, a study conducted by Cunningham et al. 2009 utilized Check Your Drinking, a "screener, an internet based self-help intervention for non-treatment-seeking problem drinkers in the general population". It was shown in their results that participants who were able to access this service displayed a "six to seven drinks per week reduction in drinking compared to controls (a 30% reduction in typical weekly drinking)"

(Cunningham, 2009). Also mentioning that "The size of this reduction is of the same magnitude as has been observed in face-to-face brief interventions for problem drinking in primary health care settings". However, the study itself had not looked at face-to-face interaction and is just referencing results from a different study.

Overall, when studies are determining the effectiveness of IBI's in drug or alcohol abuse treatment, they are done without the comparison of an experimental group which involves face-to-face or any form of in-person treatment. Furthermore, we have yet to see if a combination of IBI and face-to-face intervention has proven to be more effective compared to IBI or face-to-face intervention exclusively. We know from previous research that IBI's have proven to be as effective as in-person treatment and there are in fact limitations to both in-person and IBI intervention, whether it be cost or transportation to lack of good internet or lack of accessibility to a computer. But we have yet to see a study that compares these types of interventions at the same time, in conjunction with one another or if possible experimental groups gaining access to one intervention type, then switching over to another and seeing the results over an extended period of time. As well as a study that outlines the methodological pitfalls and limitations of each intervention method when conducted around the same time frame.

Based on past studies, and the knowledge gap found, an important research question to ask regarding these types of treatments is, there a greater association with 12-month online therapy in improved alcoholic behavior (e.g. reduction in alcohol consumption, sobriety, and relapse) in Canadian male and female adults aged 18-44 compared to 12-month in-person therapy with the same demographics and age-group?

Methods

Study Design and Database

As a means to understand the scope of substance use across Canada, this database was created as a way to gather information regarding Canadian use of drugs and alcohol, such as the types of

substances that would be used and the frequency at which they would be used. This would allow health organizations to monitor which specific substances are being taken more frequently and to understand the negative effects using these substances can have. This study follows an observational- cross-sectional design, where households were randomly selected, and a member of the household was then chosen to complete an electronic questionnaire. The questionnaire contained questions beyond looking at types of substances and their use. There were questions which looked at if the individual had close friends or family who engaged in substance use and if the individual attempted to seek help for substance abuse at any point in their life. As well as asked questions regarding the individual's education level and livelihood.

Study Participants

In our final variation of the database, after considering which group of participants would be the most ideal to observe we came to the decision that we would be focusing on participants between the ages of 18 to 44. This is because when considering the prevalence of substance consumption and exposure, it is at this specific age range where drug and alcohol abuse is most prevalent. Furthermore, we decided to exclude participants older than 44 because while some of these participants may suffer from substance abuse, the younger group of individuals tend to partake in using more recreational and illegal substances.

Study Outcomes

The main outcome that was focused on in our research was regarding participants engaging in treatment for substance abuse. In doing so the questionnaire included a variety of questions asking participants if they had received professional help for substance abuse and how effective did they feel the treatment had been. To properly gauge participant engagement in seeking professional help, questions were set up in a categorical format where other than answering yes or no to specific questions, participants were able to pick from a range of answers. Questions were formatted in a

way that asked participants within the past 12 months, had the participant considered seeking professional help for alcohol or drug abuse and if so, was the treatment targeted for alcohol abuse, drug abuse or both. Participants were also asked for the number of times they had received professional help and to rate how helpful the treatment had been for them.

Having these questions included in the questionnaire allowed for the understanding of if there is any benefit when seeking professional help when the individual feels it is needed compared to seeking professional help without this need. As well as it allows for the understanding of how frequently professional help needs to be sought out to be effective.

Additional Data Collection

Beyond looking at participants' engagement with treatment, we also collected data regarding various factors/obstacles that could occur in an individual's life which may have prevented the participant from engaging in treatment. These variables are important to consider as it gives insight and allows for an understanding as to why an individual had answered a particular way on the questionnaire. It can help explain that a person answered no to receiving professional help because they were unable to due to treatment not being covered by insurance or due to transportation costs or another obstacle that is mentioned in the questionnaire. We utilized these variables to see if any one of these obstacles is correlated with the participant answers on the questionnaire and to see if any of these obstacles had an effect on ratings of treatment.

Statistical Analysis

To compute our statistical analysis, we used a program called SPSS, Statistical Package for the Social Sciences. With all of these variables being categorical testing for normality was not possible. Logistic regression and Pearson r correlation values were calculated and a correlation coefficient value was computed, we utilized a cutoff point of 0.05 for our p values.

Results

Data codebook

SPSS name	What is the variable?	Coding instructions	Measurement scale	How will the variable be used?	Independent or dependent
TT_05	Felt needed professional help for alcohol or drug use - ever	1 - Yes 2 - No 6 - Valid skip 7 - Don't know 8 - Refusal 9 - Not stated	Nominal	Establish/highlight how prevalent substance abuse is within the population	Independent
TT_10A	Sought professional help for alcohol or drug use - ever	1 - Yes 2 - No 6 - Valid skip 7 - Don't know 8 - Refusal 9 - Not stated	Nominal	Establish/highlight how prevalent substance abuse is within the population	Independent
TT_20	Offered professional help for alcohol or drug use - ever	1 - Yes 2 - No 6 - Valid skip 7 - Don't know 8 - Refusal	Nominal	Highlight/contrast how well the system offered support to	Dependent

		9 - Not stated		those in need	
TT_25A	=	1 - Yes 2 - No 6 - Valid skip 7 - Don't know 8 - Refusal 9 - Not stated	Nominal	Highlight/contrast how many people who felt they needed/sought out treatment compared to how many received it	Independent
TT_25BP	No. of times received professional help for alcohol or drug use - ever	1 - 1 time 2 - 2 times 3 - 3 times 4 - 4 times 5 - 5 times 6 - 6 times 7 - 7 times or more 96 - Valid skip 97 - Don't know 98 - Refusal 99 - Not	Ordinal	Highlight/identify how often people return to professional help for substance abuse	Descriptive

		stated			
TT_35	Issue for which received professional help - 12 mo	1 - For an alcohol issue only 2 - For a drug issue only 3 - For both alcohol and drug issues 6 - Valid skip 7 - Don't know 8 - Refusal 9 - Not stated	Nominal	Identify/separate groups based on type of reported substance abuse between alcohol, drugs, or both	Independent
TT_40	Type of issue - inpatient/outpatient/both - 12 mo	1 - An inpatient 2 - An outpatient 3 - Both 6 - Valid skip 7 - Don't know 8 - Refusal 9 - Not stated	Nominal	Establish/highlight the different situations an individual can receive treatment within/separate groups based on type of patient	Descriptive

TT_45P	**Time waited to begin treatment**	**1 - 0 days to less than 1 month** **2 - 1 month or more** **6 - Valid skip** **7 - Don't know** **8 - Refusal** **9 - Not stated**	**Nominal**	**To be compared to time waited to begin treatment for online treatment**	**Dependent**
TT_50	**Helpfulness of treatment received - 12 mo**	**1 - Very helpful** **2 - Somewhat helpful** **3 - Somewhat unhelpful** **4 - Not at all helpful** **6 - Valid skip** **7 - Don't know** **8 - Refusal** **9 - Not stated**	**Ordinal**	**To be compared to helpfulness of treatment received for online treatment - 12 mo**	**Dependent**
TT_60A	**Obstacle to receiving help - Waiting**	**1 - Strongly agree** **2 - Agree**	**Ordinal**	**Highlight/emphasize how another form**	**Dependent**

	list too long	3 - Neither agree nor disagree 4 - Disagree 5 - Strongly disagree 6 - Valid skip 7 - Don't know 8 - Refusal 9 - Not stated		of treatment might overcome this obstacle	
TT_60B	Obstacle to receiving help - Treatment type desired not available	1 - Strongly agree 2 - Agree 3 - Neither agree nor disagree 4 - Disagree 5 - Strongly disagree 6 - Valid skip 7 - Don't know 8 - Refusal 9 - Not stated	Ordinal	Highlight/emphasize how another form of treatment might overcome this obstacle	Dependent
TT_60C	Obstacle to	1 - Strongly	Ordinal	Highlight/em	Dependent

	receiving help - Treatment not covered by insurance	agree 2 - Agree 3 - Neither agree nor disagree 4 - Disagree 5 - Strongly disagree 6 - Valid skip 7 - Don't know 8 - Refusal 9 - Not stated		phasize how another form of treatment might overcome this obstacle	
TT_60D	Obstacle to receiving help - Transportation difficult	1 - Strongly agree 2 - Agree 3 - Neither agree nor disagree 4 - Disagree 5 - Strongly disagree 6 - Valid skip 7 - Don't know 8 - Refusal	Ordinal	Highlight/emphasize how another form of treatment might overcome this obstacle	Dependent

		9 - Not stated			
TT_60E	Obstacle to receiving help - Personal/family responsibilities	1 - Strongly agree 2 - Agree 3 - Neither agree nor disagree 4 - Disagree 5 - Strongly disagree 6 - Valid skip 7 - Don't know 8 - Refusal 9 - Not stated	Ordinal	Highlight/emphasize how another form of treatment might overcome this obstacle	Dependent
TT_60F	Obstacle to receiving help - Too busy	1 - Strongly agree 2 - Agree 3 - Neither agree nor disagree 4 - Disagree 5 - Strongly disagree 6 - Valid skip 7 - Don't	Ordinal	Highlight/emphasize how another form of treatment might overcome this obstacle	Dependent

		know **8 - Refusal** **9 - Not stated**			
TT_60H	**Obstacle to receiving help - Language or cultural difficulties**	**1 - Strongly agree** **2 - Agree** **3 - Neither agree nor disagree** **4 - Disagree** **5 - Strongly disagree** **6 - Valid skip** **7 - Don't know** **8 - Refusal** **9 - Not stated**	**Ordinal**	**Highlight/emphasize how another form of treatment might overcome this obstacle**	**Dependent**

Normality table

Our dataset did not contain any continuous variables. We were therefore unable to test for normality.

Table 1. Survey responses to study on alcohol or abuse and treatment, including obstacles to receiving treatment.

Variable	Frequency (%)
No. of times received professional help for alcohol or drug use - ever	
1 time	26 (38.8)
2 times	11 (16.4)
3 times	8 (11.9)
4 times	3 (4.5)
5 times	3 (4.5)
6 times	2 (3.0)
7 or more times	14 (20.9)
Total	67
Valid Skip	3339
Received professional help for alcohol or drug use - ever	
Yes	67 (2.1)
No	3003 (92.4)
Total	3070
Valid Skip	180
Helpfulness of treatment received - 12 mo	
Very helpful	9 (52.9)
Somewhat helpful	8 (47.1)
Somewhat unhelpful	0
Not at all helpful	0

Total	17
Valid Skip	3389
Obstacle to receiving help - Waiting list too long	
Strongly agree	4 (6.6)
Agree	10 (16.4)
Neither agree nor disagree	27 (44.3)
Disagree	11 (18.0)
Strongly disagree	9 (14.8)
Total	61
Valid Skip	3345
Obstacle to receiving help - Treatment type desired not available	
Strongly agree	3 (4.9)
Agree	7 (11.5)
Neither agree nor disagree	30 (49.2)
Disagree	14 (23.0
Strongly disagree	7 (11.5)
Total	61
Valid Skip	3345
Obstacle to receiving help - Treatment not covered by insurance	
Strongly agree	3 (5.1)
Agree	16 (27.1)
Neither agree nor disagree	25 (42.4)
Disagree	10 (16.9)

Strongly disagree	5 (8.5)
Total	59
Valid Skip	3347

Obstacle to receiving help - Transportation difficult

Strongly agree	2 (3.3)
Agree	6 (10.0)
Neither agree nor disagree	25 (41.7)
Disagree	16 (26.7)
Strongly disagree	11 (18.3)
Total	60

Obstacle to receiving help - Personal/family responsibilities

Strongly agree	8 (13.1)
Agree	11 (18.0)
Neither agree nor disagree	25 (41.0)
Disagree	11 (18.0)
Strongly disagree	6 (9.8)
Total	61
Valid Skip	3345

Obstacle to receiving help - Too busy

Strongly agree	9 (15.0)
Agree	20 (33.3)
Neither agree nor disagree	15 (25.0)
Disagree	12 (20.0)
Strongly disagree	4 (6.7)
Total	60

Obstacle to receiving help - Language or cultural difficulties	
Strongly agree	0
Agree	0
Neither agree nor disagree	16 (27.1)
Disagree	20 (33.9)
Strongly disagree	23 (39.0)
Total	59
Valid Skip	3347

Data are presented as number (%) of responses from survey participants.

Spearman's Rho

			Obstacle to receiving help - Waiting list too long	Obstacle to receiving help - Transportation difficult
Spearman's rho	Obstacle to receiving help - Waiting list too long	Correlation Coefficient	1.000	.500**
		Sig. (2-tailed)	.	<.001
		N	61	60
	Obstacle to receiving help - Transportation difficult	Correlation Coefficient	.500**	1.000
		Sig. (2-tailed)	<.001	.
		N	60	60
**. Correlation is significant at the 0.01 level (2-tailed).				

	Obstacle to receiving help - Transportation difficult	Obstacle to receiving help - Treatment not covered by insurance		
Spearman's rho	Obstacle to receiving help - Transportation difficult	Correlation Coefficient	1.000	.264*
		Sig. (2-tailed)	.	.043
		N	60	59
	Obstacle to receiving help - Treatment not covered by insurance	Correlation Coefficient	.264*	1.000
		Sig. (2-tailed)	.043	.
		N	59	59
*. Correlation is significant at the 0.05 level (2-tailed).				

	Obstacle to receiving help - Personal/family responsibilities	Obstacle to receiving help - Too busy		
Spearman's rho	Obstacle to receiving help - Personal/family responsibilities	Correlation Coefficient	1.000	.651**
		Sig. (2-tailed)	.	<.001
		N	60	59
	Obstacle to receiving help - Too busy	Correlation Coefficient	.651**	1.000
		Sig. (2-tailed)	<.001	.
		N	59	59
**. Correlation is significant at the 0.01 level (2-tailed).				

Results

We analysed data from Canadian participants aged 18-44 years regarding their alcohol and substance abuse. The data was collected through surveys with the target population being all Canadians over the age of 15 with the exception of those residing in the Territories, Native Reserves, or institutions. The total dataset had N = 3,406 study participants. Due to valid skips and exclusions based on age group, the variables we studied contained up to 67 participants.

Of the Canadians surveyed, 67 responded that they had received treatment for drug and alcohol-related issues at least once in their life. Of those who responded, 38.8% received treatment only once and 20.9% were in treatment 7 or more times. 17 responses were recorded regarding the helpfulness of treatment received in the past 12 months. Nobody indicated that treatment was somewhat or completely unhelpful. About half (52.9%) indicated treatment was very helpful and 47.1% said it was only somewhat helpful. It is interesting to note the decrease in responses seen in this variable compared to all others analysed, around 60 to 17.

The other variables we looked at were obstacles to receiving treatment. We analysed the answers to the questions and how they correlate to each other. We wanted to check the obstacles' correlation to each other to determine if there are some that exacerbate each other. Spearman's rho analysis showed a strong correlation between those who responded to having personal/family problems and being too busy as obstacles. Another relationship found was a moderate correlation between the waiting list being too long and having transportation issues. Interestingly, there was no relationship between transportation issues and not having insurance.

Discussion

The database utilised in this study, the Canadian Alcohol and Drug Survey (CADS), collected information about alcohol and drug use from a total of 3,406 individuals across Canada;

since the study conducted was concerned only with those who had received treatment for alcohol or drug use, the sample size analysed only ever reached a maximum of 67 participants, as 67 reported receiving help ever and the vast majority of the population, 92.4%, reported having never received professional help for substance abuse in their life.

Helpfulness of treatment received

The variable "Helpfulness of treatment received" reported only 17 responses; this is a considerable drop in participation compared to the other questions in the dataset, which on average involve around 60 participants. One possible explanation for this is that this is the only variable that is constricted by time; all other questions are set up in an infinite time frame as opposed to the last 12 months. It is interesting to note that all of the participants who responded to this question found treatment to be at least somewhat helpful, with 52.9% reporting very helpful and 47.1% reporting somewhat.

Obstacles to receiving help:

Waiting list too long

Professional services such as addiction therapy can be very high in demand, and as such cause patients to wait long amounts of time before receiving an appointment. Lack of availability is a common issue found in many medical, mental health and other professional services; in theory, converting these services to online mediums would make access to them easier, potentially allowing professionals to better maintain schedules and maybe maximizing how much help each patient receives, but it would not have a significant impact on appointment wait times as it does not affect the issue of lack of availability. Additionally, the recorded frequency implies that the majority of the subject group did not feel that the long waiting list was an obstacle to treatment (44% said do not care, 32.8 said they at least somewhat disagreed).

Treatment type desired not available

Matters concerning alcohol and drug use can often be very personal and emotionally intensive; therefore, some individuals tend to be more particular in what they are comfortable partaking in. Online services might appeal more to some people who, for instance, would feel more comfortable participating in treatment from the comfort of their own home. Naturally, this could work in the opposite direction for those with different preferences. In the dataset, the majority of subjects neither agreed nor disagreed (49.2%), meaning they found no such issue with their treatment.

Treatment not covered by insurance

The idea of converting to online treatment services, in practicum, would not play a significant role in this variable, as insurance policies would not likely change or differ between online and in-person treatments. Additionally, the majority of the population, (42.4%) reported that they neither agreed nor disagreed with insurance being an obstacle to treatment. However, more (32.2%) of participants agreed or strongly agreed that insurance did in fact play a role in them receiving treatment, while 24.4% disagreed or strongly disagreed, bringing attention to the separate issue of how powerful insurance can be in respect to whether or not a person is able to receive or continue treatment.

Transportation difficult

Addiction services provided through treatment facilities such as rehab centres can be difficult to access due to geographical availability; addiction treatment centres are very expensive to set up and run, and often cannot reach everywhere they are needed. This is an issue that would be readily solved by converting to online services, as professionals can reach out virtually to almost anyone who has a working internet connection, which is quite often more easily accessed than a form of transportation. The majority of the participant group, 45%, disagreed or strongly disagreed that this was an obstacle to them receiving help. However, 13.3% agreed or strongly agreed, meaning that there is an existing demographic that would benefit from online services.

Personal/family responsibilities

In theory, online services being much more easily accessible from any location allows appointments to take up less time in a patients day, allowing them more freedom to manage their personal and family responsibilities. The results of the dataset were rather evenly distributed, with 31.1% of participants agreeing or strongly agreeing, 27.9% disagreeing, and 41% reporting neither.

Too busy

Similarly to the obstacle of personal/family responsibilities, the process of online treatment requires much less effort to maintain appointments than physically going into a treatment centre. Treatment can be accessed virtually anywhere, better allowing people to make it work into their schedules. 48.3% of people agreed that being too busy interfered with them receiving treatment, while only 26.7 disagreed. The Spearman Rho test conducted on the personal/family responsibilities and too busy obstacle variables confirms that the two are correlated.

Language/cultural difficulties

For many people in Canada, connecting to people who speak their language is an obstacle they constantly face in many everyday scenarios. In the case of treatment services, which can already be difficult to come by, adding the extra hurdle of language barriers can make seeking treatment almost impossible. Because virtual treatment can connect any professional with any patient, anywhere, the language barrier in particular can be much more easily overcome, as patients can more easily find professionals who speak their language. In the utilized dataset, no participants found an issue with language or cultural difficulties in seeking treatment.

Many of the obvious benefits to online therapy focus primarily on the difference in accessibility, as this is without a doubt the most prominent advantage to virtual services over in-person variations and has proven very beneficial during the COVID-19 pandemic, which has lead to an increase in the development and distribution of online mental health and other wellness services. A review published by Lattie et al. in 2022 discussed different forms of online therapy,

mainly cognitive behavioural therapy, acceptance and commitment therapy, and psychodynamic therapy. They compare different services and formats of delivery, as well as how each would best benefit various demographics and age groups to maximise effectiveness, outreach and engagement of online-based treatments. The most valuable finding within their review is that since the beginning of the pandemic, more people are opting for online-based or blended services as opposed to strictly in-person treatments, meaning that these differences in accessibility do indeed have value to patients and provide a genuine advantage in maintaining treatment (Lattie et al, 2022).

In conclusion, online-based treatment services pose many objective advantages over in-person therapy, most notably with respect to accessibility and convenience, that do appeal to many patients especially since the beginning of the COVID-19 pandemic. While some patients still prefer in-person treatment for valid reasons such as valuing face-to-face interaction, participation in virtual services is on the rise as professionals work to further improve the efficiency of their programs. In the future, it would be very beneficial to conduct a research study that directly involves patients who have participated in online, in-person, and blended approaches to treatment to achieve a more clear outlook on the patients individual experience with each form of treatment, and which they believe to be the most effective.

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Perceived Life Stress of Female Nurses and Allied Healthcare Workers aged 35-44, working full-time in Ontario determined by one's occupation, Correlates to one's Mental Health Compared to Before the COVID-19 Pandemic: A Cross-sectional Cohort Study

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INTRODUCTION

Poor mental health is known to have a detrimental effect on humans and their livelihood (Schönfeld et al., 2017). The COVID-19 pandemic exacerbated many issues in healthcare settings (He et al., 2022). A variety of factors that contribute to perceived life stress and burnout include the number of working hours, gender, workplace autonomy, schedule flexibility, age, and personality (Maunder et al., 2021). This increase in perceived life stress in the workplace is known to be a determinant for decreased mental health (Bovier et al., 2004). As a result, the mental health of many healthcare workers began declining leading to workplace burnout. Indefinitely, healthcare workers could possibly face increased psychological pressures (Vizheh et al., 2020). Thus, creating a serious concern for the healthcare system as burnout often leads to higher workplace turnover, which ultimately affects the entire healthcare system and quality of patient care (Maunder et al., 2021).

In 2019, prior to the COVID-19 pandemic, the Ontario (ON) government passed Bill 124, which implemented a wage-suppression for nurses, and other healthcare professionals. Bill 124 limits any wage increases to a maximum of 1% total compensation for three years ("About the Bill 124 and Actions - ONA", 2021). Ontario Nurses have recognized this bill as a contributing factor towards the increasing burnout rate seen within the healthcare system. The effects of the bill and burnout contributed to the growing problem of shortages of essential healthcare workers, leading to reduced quality of patient care (Maunder et al., 2021).

Most research currently focuses on evaluating the mental health effects of primary nurses and physicians. Current literature lacks information regarding other professionals, such as allied healthcare workers. Additionally, literature fails to report the effects of mental health during the pandemic between groups of different healthcare professions. The purpose of this

study is to fill these gaps in knowledge by comparing nurses and allied healthcare workers to understand how experiences of stress before and after the pandemic (determined by one's profession) can impact their perceived mental health and life stress.

A recent survey conducted by Statistics Canada interviewed over 18,000 healthcare workers, showing that 70% of healthcare workers reported declining mental health because of the burden experienced from working during the COVID-19 pandemic (Moyser, 2020). It was found that 37% of nurses stated they currently have poor mental health, compared to 27% of physicians (De Hert, 2020). A large portion of available data focuses on disparities between physicians and nurses and often dismisses other healthcare professionals (Dzau et al., 2018). Moreover, men and women represented in medicine are slightly skewed. Within physicians, the division in gender is approaching an even split, however, there are comparably more female nurses than other identifiable genders (Moyser, 2020). Specifically, during the pandemic, women were more likely to report a decline in their mental health (Moyser, 2020). In 2018, the Registered Nurses Association of Ontario reported that the average age of registered nurses was 40.8 years of age, while the average age of physicians in Ontario was 50.0 years of age in 2018 (RN/NP Workforce Backgrounder, 2018). The average allied healthcare professional is comparable to the average nurse in terms of age, gender and work setting (Rubin et al., 2021).

For this study, Ontario guidelines and labelled variables provided by ODESI for allied healthcare workers were cross-referenced in Ontario to compile a list of professions under these occupations. This includes audiologists, dieticians, social workers, occupational therapists, physiotherapists, respiratory therapists, speech-language pathologists, and other healthcare professionals who do not involve nurses, doctors, pharmacists, ophthalmologists, laboratory workers, and dentists. Comparatively, what differs between nurses and allied healthcare workers

besides their occupation, is their number of working hours**.** Nurses tend to work more odd hours, including weekends and night shifts, thus hours worked are crucial to controlling this data set to draw reliable conclusions.

Other variables need to be controlled for when comparing these two groups. The largest groups within the dataset are females, aged between 35-44, who live in Ontario, and work full-time. Thus, it is possible to obtain a more robust data set and obtain a higher degree of significance when drawing conclusions about perceived life stress and mental health compared to before the pandemic. The data set consisted of all categorical nominal data and lacked scales of value. However, this is not without merit as the physiological objective data, while useful, is only surrogate to the understanding of the subjective self-reported factors that directly influence perceived life stress and mental health. Self-reported data in psychological health yields valuable data that is free from confounding variables that are often seen in surrogate data. Self-reports can also be made in private and anonymous which promotes truthful responses. The research question for this study is to investigate if there is a difference in perceived life stress (PLS) and its effect on self-reported perceived mental health between female nurses aged 35-44 in Ontario, working full time compared to female allied health workers (i.e audiologist, social workers, OT, PT, dietician, SLP, respiratory therapist) workers in Ontario of the same age group, working full-time? The secondary outcome of this study aims to assess the association between PLS and mental health compared to before the pandemic (MHCBP). This study aims to bridge the gap in knowledge of the mental health status of allied healthcare professionals during the COVID-19 pandemic as there is a current gap in knowledge. It also seeks to bring recognition and set policies that mandate better conditions for all healthcare workers, including allied professionals, for the benefit of their mental health, and ultimately to increase patient care quality.

METHODS

Study Database **|** Data for this study was taken from "The Impacts of COVID-19 on Health Care Workers: Infection Prevention and Control" on ODESI, which is an electronic questionnaire crowdsource initiative that collects information relating to job setting and type, personal health, demographics, questions regarding personal protective equipment (PPE) and prevention and control protocols, in Canada. This cross-sectional study included participants who provide health care services directly, those who provide technical support to medical staff, or those who provide support services in health care. Crowdsourcing in this context refers to collecting information based on an online questionnaire (Hargrave, 2021). The purpose of collecting this data was to understand the impacts of COVID-19 on health care workers in Canada, with a key focus on access to PPE and infection prevention and control protocols in the workplace. Data was collected using a non-probabilistic approach as no random selection of participants was done (Statistics Canada, 2021). The sampling procedure for this database was a snowball, in which existing participants give referrals to recruit other participants needed for this study (*Snowball Sampling: Definition, Advantages and Disadvantages*, 2021). This crowdsource conducted an electronic questionnaire, available through a link found on the Statistics Canada website, to collect necessary data without any assistance from interviewers. It is important to note that this dataset was not found to be utilized in any other published research study.

Study Participants **|** The downloaded database consisted of 18139 participants. The participants selected were female, aged 35-44 years, resided in Ontario, primary job location in Ontario and working full-time as these were the majority of nurses and allied health care worker population surveyed leading to a final study population of 993. Those with invalid responses and those not in the cohort described were excluded from the study. Females were also chosen as they were

more likely to report a decline in their mental health (Moyser, 2020). Our study aimed to examine the differences between nurses and allied healthcare workers, thus participants with either of these two occupations were included in the dataset. For the two outcome variables that were evaluated during our study, Mental Health Compared to Before Pandemic (MHCBP) and Perceived Life Stress (PLS), the participants who skipped their response as "did not know", "refused", or "not stated", were excluded from the study due to missing data.

Study Outcomes & Additional Information **|** The primary outcome considered whether nurses and allied healthcare professionals experienced a change in PLS and MHCBP. The secondary outcome of this study shows a positive correlation between PLS and MHCBP. This was chosen as there was a gap in knowledge on the effects of PLS and MHCBP in allied healthcare workers in general, and compared to nurses. This is illustrated by studies such as Havaei et al. (2021) and Galbraith et al. (2021) examining similar declines in the mental health of distinct occupational groups nurses and doctors, without a comparison between groups. If studies did compare groups, most compared the general population, isolated individuals, and healthcare workers, with healthcare workers also seeing the greatest decline in mental health (He et al., 2022; Martín et al., 2021). Occupation and PLS were used to determine the effects of mental health compared to before the pandemic. These variables are both categorical and nominal. PLS and MHCBP were compared to show the positive correlation between the two categorical variables. To perform the analysis, age, job location, sex, and working status were controlled to include only females, aged 35-44, working full time in ON. This data collection involved self-reported data as it was an online questionnaire. The variable PLS asked participants, "Thinking about the amount of stress in your life, how would you describe most of your days?" with the options of "1-not at all stressful", "2-not very stressful", "3-a bit stressful", "4-quite a bit stressful", "5-extremely

stressful", "6-don't know", "7-refusal" and "8-skip". The variable MHCBP asked participants, "Compared to before the COVID-19 pandemic, how would you say your mental health is now?" with the options of "1-much better", "2-somewhat better", "3-about the same", "4-somewhat worse", "5-much worse", "6-don't know", "7-refusal" and "8-skip". The use of self-reported data used in this study is anonymous, randomized and free from the effects of confounding variables that are often seen in surrogate data. This has a high degree of validity as the variables measure what they are intended to measure along with the ability to state they "did not know", "refused", or "skip". Self-reported measures have proven to be less influenced by confounding variables, thus increasing their validity, allowing for an accurate analysis of the data to answer the research question, thereby increasing the reproducibility of the study (Crawford et al., 2006). We also included additional descriptive variables such as immigration status and group identity to further describe our population in order to obtain a more holistic picture of our study population.

Statistical Tests **|** SPSS statistical analysis software was used to determine statistical significance of this study. The p-value for significance used was at the 0.05 level, to determine that there is a less than 5% chance of seeing these results by chance. Between-group differences were analyzed through a 2x2 Chi-squared test with two comparable groups by comparing the two selected occupations. The first test included one comparable group called "better" consisting of categories 1, 2, and 3 in MHCBP and another comparable group called "worse" included categories 4 and 5 in MHCBP. The second test included one comparable group called "better", consisting of categories 1, 2, and 3 in PLS and another comparable group called "worse", including categories 4 and 5 in PLS. A Spearman Rho test was run to measure the strength of association between the variables MHCBP and PLS for nurses and allied healthcare workers together, by examining the correlation coefficient (*rho*) and significance using a p-value at 0.05 level (95% CI).

RESULTS

Descriptive Statistics **|** Table 1 indicated that 339 (86.9%) and 542 (89.9%) nurses and allied healthcare workers respectively was non-immigrant participants. 46 (11.7%) and 60 (10%) nurses and allied healthcare workers respectively was immigrants. 524 (86.9%) allied healthcare workers and 338 (86.7%) nurses were not visible minorities. Frequencies and corresponding percents for each category of MHCBP and PLS was reported. P-value of <0.001 was obtained for the correlation between occupation groups and MHCBP or PLS using a 2x2 Chi-squared test.

Table 1. Descriptive characteristics of the 2020 Canada Impacts of COVID-19 on Healthcare Workers: Infection Prevention and Control database participants [N = 993].

Variable	Nurse (n=390)	Allied Healthcare Worker (n=603)	*p*-value
Immigration Status			
Non-immigrant	339(86.9)	542(89.9)	
Immigrant or non-permanent resident	46(11.7)	60(10.0)	
Not stated	5(1.2)	1(0.2)	
Group Identity			
Visible minority	45(11.5)	73(12.1)	
Not a minority	338(86.7)	524(86.9)	
Not stated	7(1.8)	6(1.0)	
Mental Health Compared to Before the Pandemic			
Much better now	0(0.0)	8(1.3)	
Somewhat better now	9(2.3)	26(4.3)	
About the same	45(11.5)	147(24.4)	<0.001*
Somewhat worse now	214(54.9)	317(52.6)	
Much worse now	122(31.3)	105(17.4)	
Perceived Life Stress			
Not at all stressful	0(0.0)	6(1.0)	
Not very stressful	10(2.6)	38(6.3)	
A bit stressful	93(23.8)	238(39.5)	
Quite a bit stressful	197(50.5)	260(43.1)	<0.001*
Extremely stressful	89(22.8)	59(9.8)	
Not stated	1(0.3)	2(3.3)	

Data are presented as numbers (%) of patients unless otherwise stated. Chi-square test omitted "Much better now" and "Not at all" categories due to missing data.

Distribution of Study Participants | Figure 1 displayed the distribution in responses between nurses and allied healthcare workers for MHCBP. A greater number of nurses and allied healthcare workers reported having a "somewhat worse now" mental health rating compared to before the pandemic. In both occupation groups, very few to no participants reported having "much better now" mental health.

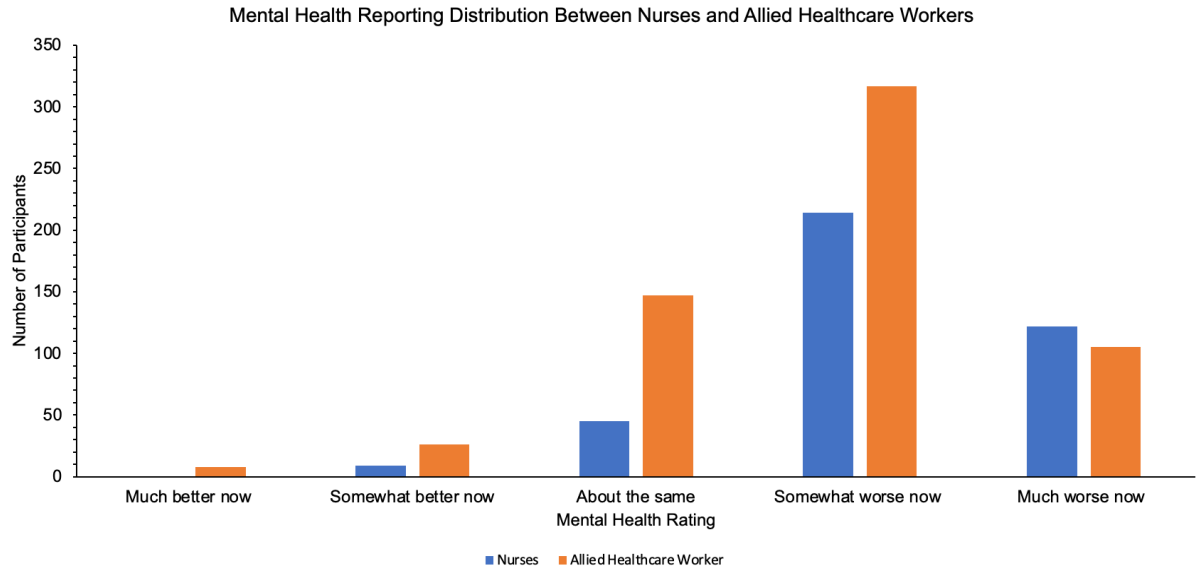

Figure 1. Double bar graph comparing mental health ratings between occupations. Mental Health Before the Pandemic responses of study participants comparing nurses and allied healthcare workers. [N = 993].

Spearman Rho Correlation | The Spearman Rho's test obtained the correlation between the variables MHCBP and PLS for both nurses and allied healthcare workers. Tables 2 and 3 showed the Spearman correlation analysis between MHCBP and PLS in each of the occupation groups. In Table 2, the Spearman Rho correlation coefficient for allied healthcare workers was $r = 0.330$, with a significance of $p < 0.001$ for $n = 603$. In Table 3, nurses were only examined and the Spearman rho correlation coefficient value was $r = 0.123$, with a significance value of $p = 0.015$.

Table 2. Spearman Correlation between MHCBP and PLS in Allied Healthcare Workers (n=603). The Spearman rho's correlation coefficient between MHCP and PLS in Allied Healthcare Workers is r = 0.330, with a significance of p<0.001 at the 0.05 level (95% CI).

		PLS	MHCBP
Perceived Life Stress (PLS)			
	Correlation Coefficient	1.000	0.330
	Significance (2-tailed)		<0.001*
	N	603	603
Mental Health Compared to Before the Pandemic (MHCBP)			
	Correlation Coefficient	0.330	1.000
	Significance (2-tailed)	<0.001*	
	N	603	603

Table 3. Spearman Correlation between Mental Health Before the Pandemic (MHCBP) and Perceived Life Stress (PLS) in Nurses (n = 390). The Spearman rho's correlation coefficient between MHCP and PLS in Nurses is r = 0.123, with a significance of p = 0.015 at the 0.05 level (95% CI).

		PLS	MHCBP
Perceived Life Stress (PLS)			
	Correlation Coefficient	1.000	0.123
	Significance (2-tailed)		0.015*
	N	390	390
Mental Health Compared to Before the Pandemic (MHCBP)			
	Correlation Coefficient	0.123	1.000
	Significance (2-tailed)	0.015*	
	N	390	390

Chi-squared Analysis **|** A 2x2 table chi-squared test was run between two variables, MHCBP and PLS for the whole study population [N=990]. A p-value of <0.001 was reported for the continuity correction.

Table 4. 2x2 Chi-squared test results between groups “better” or “worse” Perceived Life Stress and “better” or “worse” Mental Health Compared to Before the Pandemic. [N = 990]. “Not stated category” for PLS was omitted for this test due to missing data (n = 3).

	Value	**Asymptomatic Significance (2-sided)**
Continuity Correction		<0.001*
N of Valid Cases	990	

DISCUSSION

Summary of Research Study | The purpose of this study was to determine the effects of perceived life stress on mental health compared to before the COVID-19 pandemic between two different occupations in the healthcare field, nurses and allied healthcare workers, in an attempt to bridge the gap in knowledge for the mental health of allied healthcare workers. We hypothesized that an increased or stressful perceived life stress, dependent on one's occupation as either a nurse or an allied healthcare professional, influences the participant's mental health status to be worse compared to before the pandemic. We also hypothesized that there is an association between PLS and MHCBP.

Summary of Main Findings | It can be concluded that MHCBP and PLS are significantly weakly correlated to the occupation of nurses, in contrast, they are significantly moderately correlated in allied healthcare workers. The results suggest that nurses experience worse outcomes related to MHCBP and PLS compared to allied healthcare workers ages 35-44, working full time, and working in Ontario. The results also suggest that PLS has a significant correlation to MHCBP.

***Chi-squared & Spearman-Rho Analysis Interpretation*|** A Chi-squared test was run between occupation, PLS, and MHCBP to understand any between-group differences. It can be concluded that there was a significance of $p<0.001$ between occupations, for both of their reported MHCBP and PLS as seen in Table 1, indicating that the variables tested are associated with one another. Similarly, according to Table 4, the whole study population was used to determine if there is an association between MHCBP and PLS. The p-value of <0.001 indicates a statistically significant, indicating that the variables tested are associated with one another. Other studies performed by CAMH (n.d) show that when stress becomes overwhelming and prolonged, there are increased risks for mental health problems, especially in the long term. This coincides with the significant

result reported in the Chi-squared analysis between PLS and MHCPB, which indicated that these variables are significantly associated. The Spearman *Rho* statistical test was conducted for nurses and allied healthcare workers separately to see if the ratings of PLS and MHCBP were correlated within each occupation group. According to Table 2, the allied healthcare workers had a significant moderate correlation between PLS and MHCBP ($r = 0.330$, $p < 0.001$). However, it is important to note that according to Table 3, the correlation coefficient for nurses and their association between PLS and MHCBP was significantly weak ($r = 0.123$, $p = 0.015$). It was predicted that a stronger association between these two variables should result, however, there was no strong association to analyze the results upon. Other studies support the idea that there is a strong negative correlation between perceived occupational stress and psychological well-being (Suleman, 2018). This contrasts with the predictions of this study as there is only a significantly moderate ($r = 0.330$, $p < 0.001$ in allied healthcare workers) or significantly weak ($r = 0.123$ $p = 0.015$ in nurses) correlation.

Comparison between studies | This study relates to other published findings similarly discussing COVID-19 and the mental health impacts suffered. However, most studies focus solely on nurses. For example, Havaei et al. examined the impact of the pandemic on the mental health of nurses in British Columbia using three different points in time to observe a decline in mental health as the pandemic progressed, similar to what this study's results suggest (2021). Usually, if a study focuses on a different occupation other than nurses, the focus is on doctors such as the study conducted by Galbraith et al. examining the mental health of doctors during the pandemic where they also saw a decline in mental health status (2021). Many other studies focus on comparing the general population, isolated individuals, and healthcare workers such as studies done by He et al. in 2022 and Martín et al. in 2021, both of which reported a greater decline in

the mental health of healthcare workers, similar to this study's results according to Figure 1. Each of these studies focuses on one specific profession or groups of multiple professions. This places limitations on the analysis of the presence of a correlation between occupation and mental health scores. Many of these studies also take place in broad areas such as China, but by focusing on Ontario, there can be an increased and easier implementation of policy and practices in Ontario.

Limitations **|** Previous literature using this data bank was not found. This could be due to publication bias and publishers only wanting to publish positive findings. The lack of published studies could also be due to a lack of funding and interest in these areas. The mental health data collected from the database was self-reported. In a study conducted by Kim et al., measures for stress were obtained through biomarkers such as heart rate and blood hormone levels. However, these results are surrogate to self-reported data, thus they do not always accurately measure the levels of stress, and are subject to confounding variables (Crawford et al., 2006). Moreover, another limitation that arises due to survey-based research is the aspect of social desirability, where participants may wish to present themselves in a favourable light. When implementing a self-report assessment to assess personality and attitudes, participants may give answers to appear favourable to either themselves or the interviewer (Rosenman et al., 2011). Furthermore, due to the length of the questionnaire, some respondents may report feeling survey fatigue in which they fail to give full attention to questions due to attention deficits, or non-compliance (Porter et al., 2004). Additionally, there were disparities between the population sizes of the two occupation groups surveyed, as there were significantly more allied healthcare workers (n = 603) than nurses (n = 390). This could have led to skewed analysis, results, and findings. The data collected for MHCBP and PLS were solely categorical (nominal), limiting the number of

statistical tests that can be performed in statistical softwares, such as SPSS, compared to continuous data.

Future Directions and Implications **|** Healthcare workers who experience high levels of stress can produce worsened health outcomes for the patients they are responsible for (Maunder et al., 2021). Interventions to attend to nurses and allied healthcare workers mental health should be implemented. Further studies should assess what methods of treatment are best for healthcare workers to alleviate the burden they face. This could include psychiatric intervention, paid time off, a decrease in amount of work, or other alternatives. As the pandemic begins to tail off, further questionnaires can be put in place to determine how healthcare workers' perceived life stress and mental health have altered. As this study specifically focuses on nurses and allied healthcare workers, policies that aid in reducing the life stress of these occupations can ultimately lead to a better state of mental health. Figure 1 indicated that most nurses and allied healthcare workers experienced worsening mental health compared to before the pandemic. For this reason, the abolishment of Bill 124, which caps wages of nurses, could be a potential solution to reducing the number of nurses that perceive a more stressful life and worsened mental health compared to before the pandemic.

Conclusion **|** To conclude, this study aimed to understand the association of PLS, determined by one's occupation, and its impact on MHCBP. It also aims to understand the relationship between PLS and MHCBP. It was determined that both MHCBP and PLS are related to each other and also dependent on one's occupation. Nurses reported worse MHCBP and a significantly weak association between PLS and MHCBP. In comparison, allied healthcare workers have a significantly moderate correlation between PLS and MHCBP.

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Exploring the Association Between E-Cigarette Use and the Sleep Quality of Canadian Adolescents: A Cross-Sectional Study

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Introduction

An e-cigarette, also known as a “vape” or “vape pen”, is an electronic device that simulates cigarette smoking (Centers for Disease Control and Prevention [CDC], 2021a). It heats a liquid containing nicotine, flavourings and other chemicals to produce an inhalable aerosol (CDC, 2021a). Recently, e-cigarette use has become very prevalent in Canada, particularly among adolescents (CDC, 2021a). In 2020, 14% of adolescents between the ages of 15 and 19 self-reported that they “vaped” in the past 30 days, representing the highest percentage of e-cigarette use across all age groups (Statistics Canada, 2021). This rise in vaping can be attributed to increased accessibility due to recent laws permitting retail centers such as convenience stores to sell e-cigarettes (Tobore, 2019). Advertisements have increasingly promoted e-cigarette products as a “healthier alternative” to traditional cigarette smoking, which has created a sense of appeal among teenagers (Tobore, 2019). To deter youth from vaping, the Government of Canada introduced the “New Nicotine Concentration in Vaping Products Regulations” which serves to limit nicotine concentration levels to 20 mg/ml along with a proposed flavour ban to eliminate an aspect of e-cigarettes that was particularly appealing to adolescents (Health Canada, 2021).

Although limited, studies have focused on the physical effects associated with e-cigarette usage. Inhaling the vapours of e-cigarettes and the accompanying chemicals from flavouring and metallic coils may create a state of oxidative stress within the body (Tobore, 2019). Oxidative stress occurs when the production of reactive species accumulated via smoking exceeds the body’s ability to detoxify them, creating an imbalance (Pizzino et al., 2017). Oxidative stress is particularly harmful to the brain and may contribute to a myriad of associated issues including attention deficits, aggressive behaviour, memory impairment, and sleep problems (Tobore,

2019). Adolescents are particularly vulnerable and susceptible to these cognitive impacts due to their ongoing brain development, which does not cease until adulthood (Tobore, 2019). Our knowledge of how smoking the specific chemicals in e-cigarettes affects the body is an actively growing area of research. Nicotine is contained within the vapour of a vast majority of e-cigarettes sold in North America (CDC, 2021b). Copious amounts of research have demonstrated a correlation between nicotine use and adverse health effects, and have even provided biological mechanisms in some cases (Al-Bashaireh et al., 2018; Arany et al., 2018; Oakes et al., 2016; Jaehne et al., 2009). Nicotine can negatively affect the kidneys, the lungs, the musculoskeletal system, and neurotransmitter systems, which affect sleep and mood (CDC, 2021b; Al-Bashaireh et al., 2018; Arany et al., 2018; Oakes et al., 2016; Jaehne et al., 2009).

This paper will focus specifically on sleep quality. Sleep quality may be defined by metrics such as sleep satisfaction, daytime sleepiness, trouble falling asleep, and inability to stay awake (Heart and Stroke, 2018). Sleep deprivation is extremely detrimental to health and development, with increasing complexities and morbidities among youth (Brand & Kirov, 2011). Consequently, research regarding substances that specifically impact the quality of adolescent sleep should be prioritised to improve policies and prevent poor health outcomes. Given the long history of traditional cigarette smoking, much research has been conducted investigating their effect on sleep quality (Purani et al., 2019; Kang & Bae, 2021). In contrast, e-cigarettes are a relatively newer product, having been invented in 2004 and legalised in 2018 in Canada (Heart and Stroke, 2018). The paucity of research concerning e-cigarettes and their effect on sleep quality is owed to its infancy.

Some studies have explored sleeping issues among dual-users - using e-cigarettes and conventional tobacco cigarettes - and have found these users to have lower sleep quality in

comparison to single-users, suggesting that increased nicotine levels is the main driver of decreased sleep quality (Boddu et al., 2019). The literature has also suggested that the combination of nicotine with the various chemicals found in e-cigarette vapour can induce negative effects on the quality of one's health, especially in the more vulnerable adolescent population (Tobore, 2019; CDC 2021b). This area of research is rapidly growing and constitutes a topic to prioritise due to the increase in adolescent e-cigarette use. Still, there are no known studies that employ self-reported questionnaire data from Canadian adolescents to explore an association between e-cigarette use and sleep quality.

To address the gap in the literature, this study intends to investigate if being an e-cigarette user (daily, weekly, or monthly use) is associated with sleep quality (assessed by a self-reported questionnaire) in Canadian adolescents ages 12 to 17 years old compared to Canadian adolescents of the same age who are non-users (less than monthly use or no use at all). It is hypothesised that e-cigarette usage will be inversely related to sleep quality. That is to say that as e-cigarette usage increases, sleep quality will decrease among Canadian adolescents.

Methods

Canadian Student Tobacco, Alcohol and Drugs Survey

This study analysed the results from the 2018-19 Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS), which is conducted by Health Canada. CSTADS is an observational, cross-sectional survey that invites students from grades 7-12 from all ten Canadian provinces to share information primarily about their substance use, but data regarding demographics, quality of life, and mental health is also collected. The survey questions from the CSTADS that we obtained from Odesi and were used in the statistical analyses of this study are shown in the codebook below.

SPSS name	What is the variable? (Similar to Label in SPSS)	Coding instructions
E_cigarette_usage	On how many of the last 30 days did you use an e-cigarette (vape, vape pen, tank & mod, e-juice)?	1 = Daily or almost daily 2 = Less than daily, but at least once a week 3 = Less than weekly, but at least once a week 4 = Less than monthly 5 = Not at all 6 = I do not know 99 = Not Stated
Grade	What grade are you in?	7 = Grade 7 8 = Grade 8 9 = Grade 9 10 = Grade 10 11 = Grade 11 12 = Grade 12
Sex	What was your sex at birth?	1 = Female 2 = Male
Satisfied	In the last 2 weeks, how often have you felt satisfied with your sleep?	1 = Every day/night 2 = Several times 3 = Twice 4 = Once 5 = Never 99 = Not Stated
Tired	In the last 2 weeks, how often have you felt tired/dragged out/sleepy during the day?	1 = Every day/night 2 = Several times 3 = Twice 4 = Once 5 = Never 99 = Not Stated
Falling_asleep	In the last 2 weeks, how often have you had extremely hard time falling asleep?	1 = Every day/night 2 = Several times 3 = Twice 4 = Once 5 = Never 99 = Not Stated

Missing Data

Survey participants who did not provide an answer or have missing data for any of the survey questions mentioned in the above codebook were removed from the data set entirely. Thus, the remaining respondents in the data set had an answer provided for each of the questions outlined in the above codebook. This was done so that participants who did not provide responses for certain questions would not be part of some analyses and excluded from others. From a total of 62 850 respondents, 8236 respondents had missing data in at least one of the survey questions of interest and were subsequently removed from the data set. This left 54614 respondents used in the analyses explained in upcoming sections.

Study Groups

The study respondents were split into two groups for the independent variable, smoking status. The responses *"daily or almost daily"*, *"less than daily, but at least once a week",* or *"less than weekly, but at least once a month"* to the question *"On how many of the last 30 days did you use an e-cigarette (vape, vape pen, tank & mod, e-juice)?"* were collapsed into a single, new category named "User". For the same question, the responses *"less than monthly"* and *"not at all"* were collapsed into a single, new category named "Non-user". The variable was collapsed in a manner that separated the responses based on where we believe a threshold exists for observable negative health effects as a result of smoking.

For assessing the dependent variable of sleep quality, the three survey questions were used: *"In the last 2 weeks, how often have you felt satisfied with your sleep?", "In the last 2 weeks, how often have you felt tired/dragged out/sleepy during the day?",* and *"In the last 2 weeks, have you had an extremely hard time falling asleep?"*. The possible responses for all three questions were identical: *"every day/night"*, *"several times"*, *"twice"*, *"once"*, and *"never"*. For the first survey question (*"In the last 2 weeks, how often have you felt satisfied with your*

sleep?"), the responses *"every day/night"* and *"several times"* were collapsed into a single, new category named "Satisfied". The remaining responses (*"twice"*, *"once"*, and *"never"*) were collapsed into a single, new category named "Not satisfied". The two remaining survey questions had their respective responses collapsed in the same manner, however, the new categories were named "Yes" and "No", respectively, to indicate whether or not the respondents experienced the sleep disturbance explained in the question. These variables were collapsed in a manner that assumes the responses *"twice"*, *"once"*, and *"never"* are negligible frequencies and the responses *"every day/night"* and *"several times"* are notable frequencies.

Statistical Analysis

The data analysis was conducted utilising SPSS Statistical Tool developed by IBM and the significance level was set to $P < 0.05$.

A chi-squared test was used to determine if a statistically significant difference exists between the expected and observed proportions of the responses for the dependent variables based on their smoking status. This test was appropriate as all data was categorical and the categories could be set up in a 2x2 contingency table as shown below. A chi-squared test was conducted for the proportions of each of the three dependent variables (*"In the last 2 weeks, how often have you felt satisfied with your sleep?", "In the last 2 weeks, how often have you felt tired/dragged out/sleepy during the day?",* and *"In the last 2 weeks, have you had an extremely hard time falling asleep?")* based on smoking status (User/Non-user).

A binary logistic regression was used to determine the degree to which smoking status impacts the likelihood of one experiencing the outcomes outlined in the dependent variable survey questions. A binary logistic regression was used because the dependent variable was categorical with two categories. The test was appropriate as the assumptions of a logistic

regression were not violated: the sample size was large enough (N=62850), there were no outliers as the data was categorical, and only one predictor was used, so correlation between predictor variables did not need to be checked. Three binary logistic regressions were run, one for each of the dependent variables, all with the predictor variable of smoking status.

Results

The original sample size of the database was 62,850. A final number of 54,614 participants were included in the analyses upon precluding 8,236 participants from the final analysis due to missing data responses with respect to the study's dependent variable.

For our primary analysis, a chi-square test was performed between the independent variable (e-cigarette usage) and our study demographics, as seen in Table 1. This was conducted to find statistically significant differences in proportions of people who fall into groups by sex, grade and our dependant variable sleep. There was ultimately a statistically significant difference between several descriptive variables and all 3 dependent variables measuring sleep quality.

Table 1

Characteristics of Youth E-Cigarette Usage Study with Effect on Sleep in Participants from Grade 7-12. *Descriptive Characteristics of Study Population [N = 54614].*

Characteristics	**Total**	**E-Cigarette Non-Users**	**E-Cigarette Users**	**P-Value**	**$\chi 2$**
Grade					
7	10,728	10,216 (95.3)	512 (4.7)		
8	10,349	9,246 (89.3)	1,103 (10.7)		
9	10,165	8,287 (81.5)	1,878 (18.5)		
10	9,884	7,252 (73.4)	2,632 (26.6)		
11	8,413	5,813 (69.1)	2,602 (30.9)		

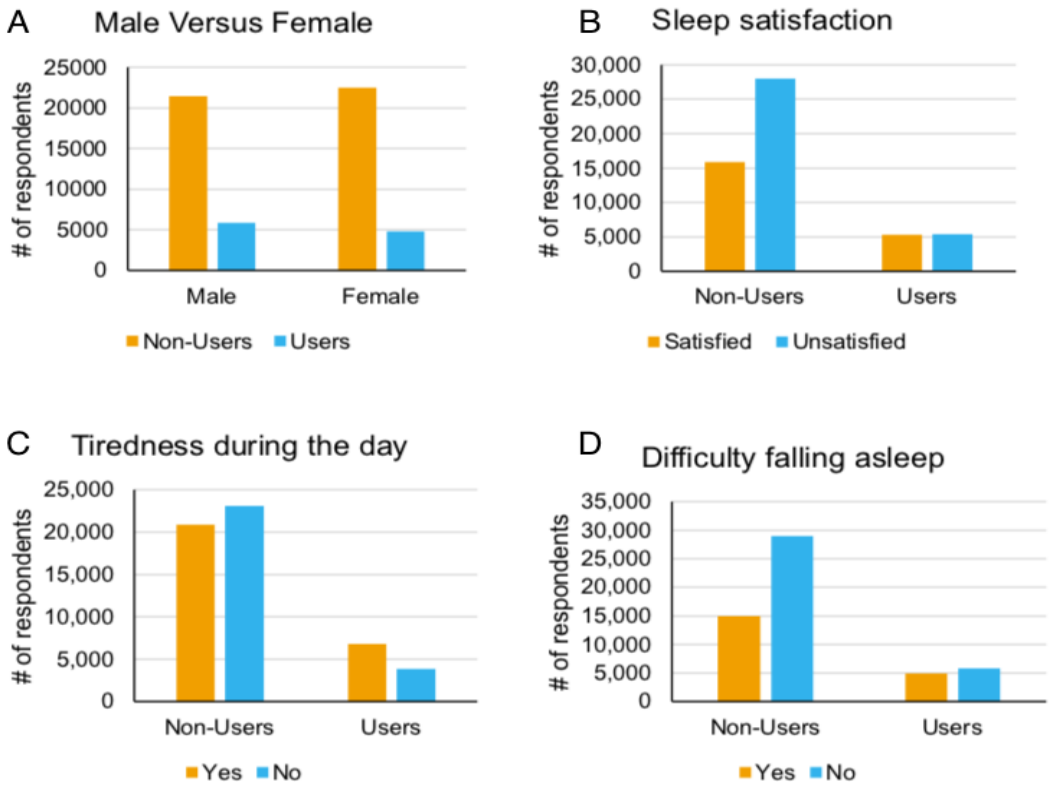
12	5,075	3,129 (61.7)	1,946 (38.3)		
Total	54,614	43,941(80.5)	10,673 (19.5)	< .001*	4165.7
Sex					136.3
Male	27,310	21,432 (78.5)	5,878 (21.5)	< .001*	
Female	27,304	22,509 (82.4)	4,795 (17.6)	< .001*	
Have you been satisfied with your sleep in the last 2 weeks?					661.3
Yes - Satisfied	21,203	15,898 (75.0)	5,305 (25.0)	< .001*	
No - Unsatisfied	33,411	28,043 (84.0)	5,368 (16.0)	< .001*	
Have you felt tired during the day in the last 2 weeks?					932.2
Yes	27,660	20,840 (75.3)	6,820 (24.7)	< .001*	
No	26,954	23,101(85.7)	3,853(14.3)	< .001*	
Have you had an extremely hard time falling asleep in the last 2 weeks?					531.1
Yes	19,822	14,969 (75.5)	4,913 (24.5)	< .001*	
No	34,732	28,972 (83.4)	5,760 (16.6)	< .001*	

Values presented in Table 1 are shown as frequency and percent. The data in table one was obtained using a chi-square test. Proportions of e-cigarette users between males and females and between grades were statistically significant, $P < .001$*. Sleep satisfaction significantly differed between groups, $P < .001$*. Proportions of Users and Non-Users having an extremely hard time falling asleep and feeling tired during the day were both statistically significant between groups with $P < .001$*. The largest difference between expected and observed data for the dependant variable was for feeling tired during the day, as shown with the $\chi 2$ value of 932.2.

The number of respondents that fall into either category for each dependent variable and for males and females are shown in Figure 1. More males were found to use E-Cigarettes than females. A higher proportion of non-users were found to be more unsatisfied than satisfied with

their sleep. A higher proportion of users than non-users reported having difficulty falling asleep. A higher proportion of users than non-users also reported feeling tired during the day.

Figure 1. The proportions of E-cigarette users and non-users on sleep quality and between the sexes.



Each graph compares the number of respondents who fall into the user and non-user groups and their association with the sleep quality. Panel A shows the difference in E-Cigarette usage between males and females. Panel B shows the proportions of users and non-users that reported being satisfied with their sleep. Panel C shows whether users or non-users reported feeling tired during the day. Panel D shows the difference in difficulty falling asleep between users and non-users.

For our secondary analysis, a binary logistic regression was conducted to identify relationships and the direction of those relationships between sleep quality and e-cigarette use as seen in table 2. This was done to determine any significant differences in sleep quality and the

magnitude of the effect of e-cigarette use. We ultimately found significant differences and an increase in the accuracy of one of our models given the predictor variable.

Table 2. Effect of e-cigarette usage on sleep quality as shown through binary logistic regression.

Dependent Variable	Block 0 Percentage	Omnibus Test Significance	Block 1 Percentage (PAC)	Overall Significance	Exp(B)
Felt tired during the day in the last 2 weeks	50.6	P < .001* $\chi 2 = 943.0$	54.8	P < .001*	.510
Satisfaction with sleep in the last 2 weeks	61.2	P < .001* $\chi 2 = 649.2$	61.2	P < .001*	1.743
Extremely hard time falling asleep in the last 2 weeks	63.6	P < .001* $\chi 2 = 519.4$	63.6	P < .001*	.606

Omnibus goodness of fit test was significant for each dependent variable output. Overall test significance was significant for each variable. Only feeling tired during the day had an increase in accuracy from block 0 to 1. Sleep satisfaction had a positive relationship with our predictor variable EXP(B) > 1 while the other two variables had a negative relationship EXP(B) < 1.

Discussion

Demographics

E-cigarette use in Canadian adolescents has substantially increased due to recent laws permitting retail centers to sell e-cigarettes (Tobore, 2019). Previous research has demonstrated that cigarette smoking negatively impacts health and sleep quality due to its nicotine content (Brook et al., 2015). Since nicotine is also a key compound in e-cigarettes, the effects of e-cigarette use on sleep quality is a growing area of study. We sought to expand on this research and explore whether there is an association between e-cigarette usage and sleep quality in Canadian adolescents. We did this by assessing the publicly available results from the 2018-19 CSTADS conducted by Health Canada.

We found that the vast majority (80.5%) of survey respondents did not identify as e-cigarette users (Table 1). In line with our observations, Cullen et al. (2018) found that approximately 79.2% of American highschool students had not used an e-cigarette in the past 30 days. We also observed that a higher proportion of male respondents self-identified as e-cigarette users than female respondents (Figure 1A). Indeed, it is reported that men are more likely to use substances compared with women (Kooshabi et al., 2010; McElrath et al., 2016). Drug use tends to be higher in male adolescents, as they are more likely to engage in risky behaviour compared to female adolescents (Becker et al., 2017). Male adolescents are also more likely to consume substances for stress management and as a way to fit in with their peers (Kooshabi et al., 2010).

We also found that e-cigarette use increased with age group (Table 1). For instance, 10.7% of grade 8 respondents self-identified as users, while almost twice this proportion of grade 12 respondents (19.5%) self-identified as users (Table 1). This observation is in line with previous research that has noted that older teens in highschool have increased availability to substances, are more likely to engage in high risk behaviours, and try new things (Volkow, 2010). There are also more social activities in highschool that involve substances as compared with middle school (Volkow, 2010).

E-cigarette use and sleep health outcomes

Notably, more than half of all respondents (users and non-users) reported dissatisfaction with their sleep (Table 1; Table 2; Figure 1B). This is not surprising as students tend to report poor sleep quality compared with most age groups (Liu et al., 2020). One study found that highschool students experienced the most prevalence of shorter sleep duration (70.8%), day dysfunction (84.7%), and poor sleep quality (17.2%) compared with elementary school students and college students (Liu et al., 2020).

The results from our Chi-squared analysis indicated that there was a statistically significant difference between users and non-users for the three dependent variables. The results from the binary logistic regression indicated the directional nature of those differences. The Exp(B) values indicate that the odds of not feeling tired during the day are 0.510 times lower among users, the odds of being satisfied with sleep are 1.743 times higher among users, and the odds of not having an extremely hard time falling asleep are 0.606 times lower among users. The sleep satisfaction result contradicts our hypothesis and what the current literature suggests, however, it is the only contradictory result. Thus, we are led to believe that other confounding variables must have impacted those responses. These findings, with the exception of the satisfactory sleep results, align with prior research. Brett et al. (2020) found that e-cigarette users experience worse sleep health than non-users in American college students (n=1664). Another longitudinal study by Riehm et al. (2020) followed American adolescents (n=9,588) from 2013 to 2015 and assessed their sleep-related complaints, such as falling asleep during the day, restlessness, and bad dreams. They found that e-cigarette use significantly increased their odds for sleep-related complaints (Riehm et al., 2020). A cross-sectional study by Wiener et al. (2020) also noted that e-cigarette use was associated with less sleep in young American adults (n=2889). It is clear that prior research has begun to establish an association between e-cigarette use and poor sleep quality. Our study findings expand on these findings and provide evidence that this association also applies to Canadian adolescents.

Although we did not explore gender differences with respect to sleep health, previous research has found that e-cigarette use is associated with worse sleep quality and sleep latency in women (Boddu et al., 2019; Malhotra et al., 2021).

Limitations, implications, and future directions,

The findings of this study are subject to limitations. For instance, we did not capture known risk factors of poor sleep health in our analysis. Specifically, adolescent respondents may have consumed other substances such as cigarettes, alcohol, and/or illicit drugs that are conducive to unhealthy sleep habits (Wetter & Young, 1994; Steinn & Friedmann, 2005). Poor mental health, a sedentary lifestyle, and regular electronic-screen use are additional factors with known consequences to sleep health in adolescents and were also not captured in our analysis (Waiberg et al., 2021; Yang et al., 2017; Hale et al., 2018). Additionally, due to the nature of our data collection methods, our findings may be affected by survey response biases. Adolescents, especially compared with other age groups, are more likely to misrepresent responses to appear more socially desirable (Althubaiti, 2016; Latkin et al., 2017). This particularly applies to questions that gauge their substance use habits (Althubaiti, 2016; Latkin et al., 2017). Specifically, some individuals may have over-reported or under-reported their e-cigarette use, depending on their perception of 'socially desirable' behaviour (Latkin et al., 2017). There may also be recall bias because the survey questions requested the survey respondents to recall their behaviour and events from the past two weeks (Althubaiti, 2016). Finally, as a result of collapsing the survey responses into dichotomous categorical variables, we effectively decreased the specificity of how the variables were originally stratified. Consequently, our results do not consider a wide range of possible degrees.

It has been well studied that chronic sleep insufficiency is associated with a myriad of adverse health outcomes in adolescents (Bush et al., 2021). For example, it increases their likelihood of poor self-esteem, depression, and anxiety (Woods & Scott, 2016). It can also reduce cognitive ability, focus, concentration and school performance (Bruce et al., 2017). As such, these findings have public health implications. For example, educational programs have success

in preventing and deterring substance use (Melendez-Torres et al., 2017). With respect to deterring e-cigarette use, a federally-initiated educational program that teaches younger children and adolescents of the social, psychological, and physical health consequences of e-cigarette use is one such solution (Melendez-Torres et al., 2017). Many adolescents also use e-cigarettes to self-medicate for stress (Jha & Kraguljac, 2021). Educating young children and adolescents appropriate and healthy stress-management mechanisms is another such solution (Back et al., 2007). A recent amendment in federal policy has restricted the sale of flavoured e-cigarettes to adult-only vendors (Canada, 2021). Perhaps further restriction on vendors may help to further limit availability to adolescents (O'Conner et al., 2019).

Further research is required to understand whether other factors can explain the poor sleep quality that are associated with e-cigarette use in Canadian adolescents and whether these factors have a synergistic effect. Longitudinal surveys that follow the same sample group for a long period of time can help improve our understanding of whether this association remains true over time. Additional surveys can gather student perceptions wherein respondents can self-identify factors that may contribute to their sleep health.

In this study, we expand on and replicate the findings of previous research with a focus on Canadian adolescents, and thus, add to the growing literature on the relationship between e-cigarette use and sleep quality. E-cigarette use is indeed associated with poor sleep quality in Canadian adolescents, with higher e-cigarette use seen in male and older adolescents. Future research can expand on these findings and explore whether additional factors contribute to poor sleep health.

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Impacts of COVID-19 on Mental Health of 15-24 Year Old Canadians, Residing in Rural and Urban Areas

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Abstract

The COVID-19 pandemic has impacted the mental well-being of individuals all around the world. Although it has been a well known topic of conversation, there are still gaps in determining COVID-19 effects on young individuals, ages 15-24, residing in Canadian rural and urban communities. Our team collected data through the Odesi database and investigated the perceived/self-reported mental health and GAD scores of 2267 young Canadian individuals, living in rural and urban areas. Logistic regression was used to perform statistical analysis between the two groups (urban and rural) and a chi-squared test was used to determine any significant differences between them. We determined that there were no significant differences regarding the mental health of young people, ages 15-24 years old, residing in Canadian rural vs urban areas and no significant differences between perceived mental health and GAD scores, between urban vs. rural populations. However, there was a statistically significant difference between the perceived/self-reported mental health vs GAD scores within/inside each urban population and rural communities. Future studies may continue to investigate the differences in mental health between rural and urban areas with additional variables (such as gender, ethnicity etc.) to determine if these variables contribute to their mental well-being.

Introduction

The rise of the COVID-19 pandemic has tremendously impacted individuals worldwide. According to the United Nations (2020), a steep decline in the mental wellbeing of individuals globally, has been reported. This can be accredited to a multitude of factors including social isolation, widespread misinformation, financial issues, and general loss (ex: loss of family members) (United Nations, 2020). As a response to this widespread mental health crisis, an increasing number of studies concerning the mental health impact of COVID-19 have been

published (Chen et al., 2021). A recent study by Gloster et al. (2020) surveyed over 10,000 individuals worldwide and found high levels of stress and depression as caused by the pandemic. They also found certain predictor variables related to lower mental health, such as social support or encouragement, access to basic necessities, and level of education (Gloster et al., 2020). Furthermore, mental health concerns have also been increasingly prevalent among youths and young adults, during the COVID-19 pandemic. It was discovered by Akkaya-Kalayci et al. (2020), that young individuals who reside in Turkey and Austria and who are between the ages of 15-25 years old, appeared to have worsening mental health conditions during the pandemic. Their psychological being and mental state declined significantly, while anxiety and depression increased remarkably (Akkaya-Kalayci et al., 2020). Generally, past literature indicates that youth and adolescents tend to have lower mental health status. This is supported by Nair et al. (2017), who conducted a study on young individuals between the ages of 13-17 years old, studying in Indian rural vs urban schools. The study indicates that among the 690 participants, girls and boys showed emotional and mental health concerns, respectively. Thus, it can be revealed from past research that mental health issues have been on the rise among young people, in various areas of the world and COVID-19 has clearly exacerbated these symptoms.

Although mental health during the COVID-19 pandemic has been an on-going topic of interest within the field of health research and is a subject that has come to light; stigma towards it is still very much prevalent in today's society (Pedersen & Paves, 2014). This, in turn, results in individuals refusing to disclose their mental state, being less likely to seek treatment, and can result in an increase in the severity of mental illness symptoms (Gaddis et al., 2018). When individuals refuse to seek assistance, it further cultivates an environment where undiagnosed mental illness may prevail, resulting in an endless cycle. Further symptoms of mental illness may

also be exacerbated, such as additional increase of anxiety, depression and other related disorders. Due to the stigma surrounding mental health disorders, this has also led to individuals under-reporting their mental health state (Bharadwaj, 2017). According to CAMH (n.d.), only 50% of Canadians would willingly reveal to their coworkers or colleagues that a loved one has a mental illness, compared to 72 percent who would reveal a cancer diagnosis, and 68 percent who would share a family member's diabetes. On the other hand, 39% of Ontario employees declared that they would not inform their superiors if they were undergoing mental health issues (CAMH, n.d.). The stigma is unfortunately no exception to those living in rural and urban areas.

According to a study by Stewart et al. (2015), older people who reside in rural areas have alarming levels of untreated mental illnesses. Stigma plays a critical role as to why older individuals avoid seeking help, resulting in untreated mental issues and concerns. It is further determined by Stewart et al. (2015), that these older individuals, who are 60 years old or above, are reported to have more public and self-stigma, as compared to those who live in urban areas. However, in contrast to rural areas displaying lower mental health, several other studies have shown that urbanization in regions highly impacts the mental health of individuals. The factors that play a critical role to this may include socio-economic status or social class, discriminiation from others and their surrounding conditions (Gruebner et al., 2017). These findings suggest that mental health issues are very much prevalent in different geographical areas and are not limited towards specific age groups, as those who live in rural and urban areas, although not equally, both display mental health concerns. Despite the abundance of existing research regarding COVID-19, stigma, reporting or under reporting of mental health among young people and older individuals, and mental health similarities/differences in rural and urban areas, there is still a gap in determining whether there are discrepancies between self-reported mental health vs measured

GAD scores and differences in mental health, specifically among young people who are between the ages of 15-24 years old, in Canadian urban areas and rural areas, during the COVID-19 pandemic.

Our team is particularly interested in investigating the age group of 15-24 years old, due to existing research regarding the prevalence of mental health disorders among young people and the limited data towards the difference of mental health between young people residing in rural vs urban areas, specifically in Canada. We are also interested in investigating discrepancies between perceived/self-reported (excellent, very good, good, fair and poor) mental health vs measured GAD score (met cut off point of having anxiety) because of past literature, which states that older individuals do not properly report their mental health status (Stewart et al., 2015). Therefore we want to investigate whether the stigma related to mental health disorders is not only confined to older individuals but also remains relevant to the younger population (for the purpose of this study, we have defined young people, individuals and youth- used interchangeably, as those between the ages of 15-24 years old). Our team ultimately aims to fill in these gaps through 2 research questions: (1) Are there differences in the mental health of young individuals, aged 15-24 in Canada, residing in urban areas vs rural areas, during the COVID-19 pandemic? (2) Are there discrepancies in self-reported perceived vs GAD cut-off scores among young individuals, aged 15-24 in Canada, between urban vs rural areas, during the COVID-19 pandemic?

Methods

Study Design (and Database)

This observational, cross-sectional, national study was undertaken from the Odesi database- impacts of COVID-19 on the mental health of Canadians. Information was collected

from individual participants through an anonymous, voluntary, self-administered online questionnaire. Participants were crowdsourced through social media, as well as through outside organizations such as news channels, public and private entities, and government agencies to reduce potential probabilistic responses, as well as to offer increased representation and generalization towards the greater population. The questionnaire was offered through an anonymous portal on Statistics Canada, and available in both English and French, with an estimated completion time of five minutes. The questionnaire obeyed standard practices and design, akin to a computer-assisted interview condition, to increase ease of access, and was tested extensively before application for potential errors or biases in wording, as well as maintenance of a logical consistency and flow between questions.

Sampling and Population (Study participants)

Data for the study came from Statistics Canada, which surveyed 45, 989 individuals 15 years of age and older, from March 24th to April 11th of 2022. For our study, the inclusion criteria was as follows: residents of Canada; 15 to 24 years of age; living in urban areas, where populations are greater than 10, 000, or rural areas, where populations are less than 10, 000. Of the individuals who participated in the survey, 45,383 provided an answer to a question asking if they lived in a rural or urban area. From this population, 43,669 were excluded as they were above the age of 24, leaving n=2287 individuals left for analysis. All data were collected anonymously.

Study Outcomes

The main outcomes we predict from this study would be a significant difference in the mental health of Canadian young people in rural and urban settings. Other outcomes include any other trends in the data that we uncover, such as discrepancies in perceived mental health vs

GAD scores in rural and urban areas. We are expecting that by looking at all potentially confounding variables that were not accounted for, we would be able to identify the reasons for the results we received. In the study, individuals were questioned about their perceived mental health twice, each time with categorical answers ranging from 1 for excellent mental health to 5 for poor mental health. The categories were flipped the second time the question was presented with 1 to 5, representing poor and excellent mental health, respectively. This was done to compare the responses before and after the survey to ensure that perceptions of mental health remained consistent. Studies in the past have used ordinal scales, to serve as an option for participants to rank their state of mental well being. For the validity, reproducibility, specificity of this study, the participants' mental well being was measured categorically, through a scale, from poor to excellent. According to Lee (2020), a 5-item scale to evaluate and screen the anxiety levels of adults during the COVID-19 pandemic was implemented. This scale showed a promising result in screening the mental health of the participants and illustrated concrete validity and reliability. This scale, also known as the Coronavirus anxiety scale, greatly identifies the difference between those with anxiety vs without anxiety through a cut score of ≥ 9, with 90% sensitivity and 85% sensitivity (Lee, 2020). The same strategy was conducted for this study, such that participants also ranked their mental health categorically, through the use of a scale, ranking their perceived mental health as being poor to excellent. This allows for great measurement and use in clinical research settings and practices.

General Anxiety Disorder Test

A Generalized Anxiety Disorder (GAD) test was administered to survey participants in order to assess their mental health. People suffering with GAD may be unduly anxious about money, health, and other difficulties. Individuals suffering from GAD have a tough time

controlling their anxiety. The GAD test's reliability and validity as a general population anxiety measure is supported by Zhong et al. (2015), stating that GAD-7 is reliable and contains factorial and concurrent validity. The normative data also supplied in this study used to test its reliability and validity, can be used to compare a subject's GAD test score to those determined from a broad population reference group.

Demographics

Additional data aside from outcome variables was collected from participants to collect demographic information. This includes gender, province of residence, and immigrant status. Additionally, data concerning visible minority status and indiginous identity was also collected.

Statistical Analyses:

Number and percent were used in table 1, as we had all categorical data. The software SPSS was used for all statistical analyses, and a p-value less than 0.05 was considered significant. Statistical regression was used to determine if urban vs. rural was a strong predictor of GAD scores. Other predictor variables were also run through the analysis such as immigrant status, and indigenous status. Lastly, to determine whether there was a difference between self-reported mental health and meeting GAD cut-off scores, the Chi^2 test was employed. To do this, we first further divided self-reported mental health variables into good/poor mental health. To run an efficient 2X2 analyses, we first created a new variable that accounted for whether an individual's self-reported mental health aligned or not with their GAD score results. Once this dichotomous variable was created, we ran a chi-squared test with this new variable and urban/rural populations.

Results

Table I: Demographic information of the sample of Canadian individuals surveyed aged 15-24 [N=2287(%)]

	Rural n (%)	Urban n (%)
Gender		
Male	40 (20%)	606 (29%)
Female	164 (80%)	1477 (71%)
Missing	0 (0%)	0 (0%)
Immigrant Status		
Immigrant	8 (4%)	305 (15%)
Non-immigrant	196 (96%)	1776 (85%)
Missing	0 (0%)	2 (<1%)
Visible Minority		
Yes	8 (4%)	550 (26%)
No	195 (96%)	1518 (73%)
Missing	1 (<1%)	15 (<1%)
Canadian Region of Residence		
Atlantic Region	53 (26%)	181 (9%)
Prairie Provinces	41 (20%)	286 (14%)
Central Canada	86 (42%)	1362 (65%)
West Coast	24 (12%)	254 (12%)
Missing	0 (0%)	0 (0%)
Indigenous identity flag		
Yes	18 (8.8%)	62 (3%)
No	185 (30.4%)	2011 (90.4%)
Missing	1 (<1%)	10 (<1%)
Total	204	2083

Demographic information was collected from participants n=2287(%) living in rural or urban areas in various regions of Canada. The online survey was administered by Statistics Canada from April 24th to May 11th of 2020. Urban areas were categorized by municipalities with populations of 10, 000 or above, and rural areas were categorized by populations below 10, 000.

Table I depicts demographic information collected from the sample population (n=2287). In rural areas, the majority of participants were women, non-immigrant, not a visible minority

and lived in central Canada. In urban areas, the majority of the participants were women, non-immigrant, not a visible minority, and lived in central Canada.

Table 2. Variable in the equation of Logistic regression for GAD cutoff point.

Variable in the equation		B	S.E.	Wald	df	sig	Exp(B)
Step 1	Mental health cutoff	-2.485	0.191	168.429	1	<0.001	0.83
	Rural/urban indicator	-0.027	0.160	0.029	1	0.866	0.973
	Visible minority	-0.329	0.107	9.315	1	0.002	0.721
	Constant	2.084	0.189	121.659	1	<0.001	8.037

The data was collected from individuals aged 15-24 (n=2267) who completed an online self-administered survey through Statistics Canada. The wald scores significance and exp(B) of 3 predictor variables which include a rural and urban indicator , visible minority indicator and perceived mental health cutoff are shown in the variable of equation chart.

According to the Omnibus Tests of Model Coefficients depicted in table 2, the full model containing all 3 predictors was statistically significant (Chi-squared=273.535, p=<0.001), suggesting that the model was able to predict cases who had, versus did not have a mental health condition. The model correctly classified 65.1% of cases. Only 1 predictor variable made a unique, significant contribution to the model. The most important predictor of reporting their GAD was whatever they rated their perceived mental health. The odds of having a GAD were 12.04 (95% CI 0.057-0.121) times lower for respondents who had good perceived mental health. Rural and urban indicators were not significant with a p=0.866. Visible minority was also an

indicator but with a lower wald score of 9.31. The odds of having a GAD were 1.37 (95% CI 0.057-0.121) times lower for respondents who had identified as a visible minority.

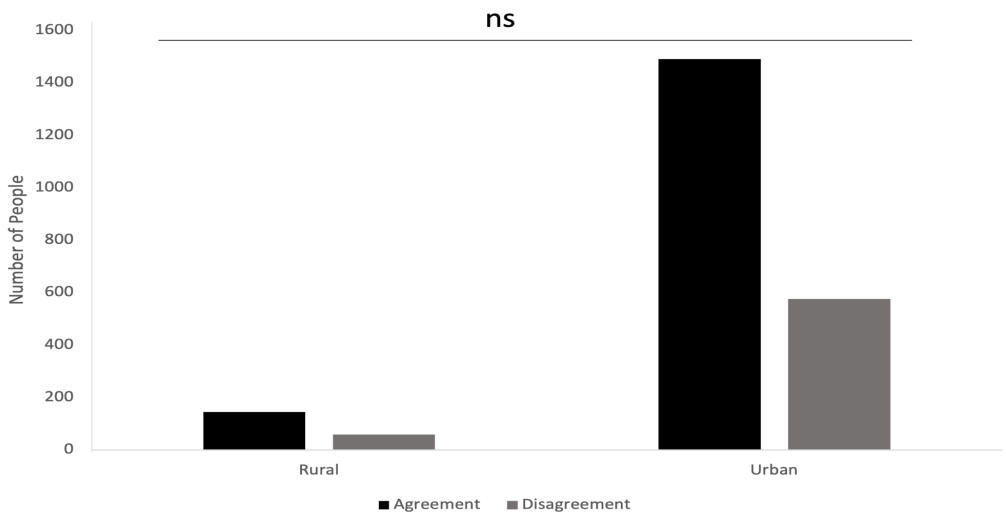

Figure 1. Difference between urban and rural population's GAD and self-reported alignment. The data was collected from individuals aged 15-25 (n=2267) who completed an online self-administered survey through Statistics Canada. The figure depicts urban and rural populations in regards to their GAD scores and self-reported mental health aligning (agreement) or opposing one another (disagreement). A Chi squared analysis was run to test for significance between populations. The Chi squared value was 0.069, with a significance value of 0.793.

For our second research question, we investigated whether there is a statistically significant difference between the self-reported perceived vs GAD score cut-off variable, of those in rural areas compared to urban areas, as depicted in Figure 1. In rural populations, 71.29% (n=202) of individuals had their GAD scores and perceived mental health aligned with one another, whereas 28.71% (n= 58) did not align. For urban populations (n=2065), 72.15% (n=1490) and 27.85% (n=575) had alignment and non-alignment, respectively. When comparing between populations, a chi-squared value of 0.069 and a significance value of 0.793.

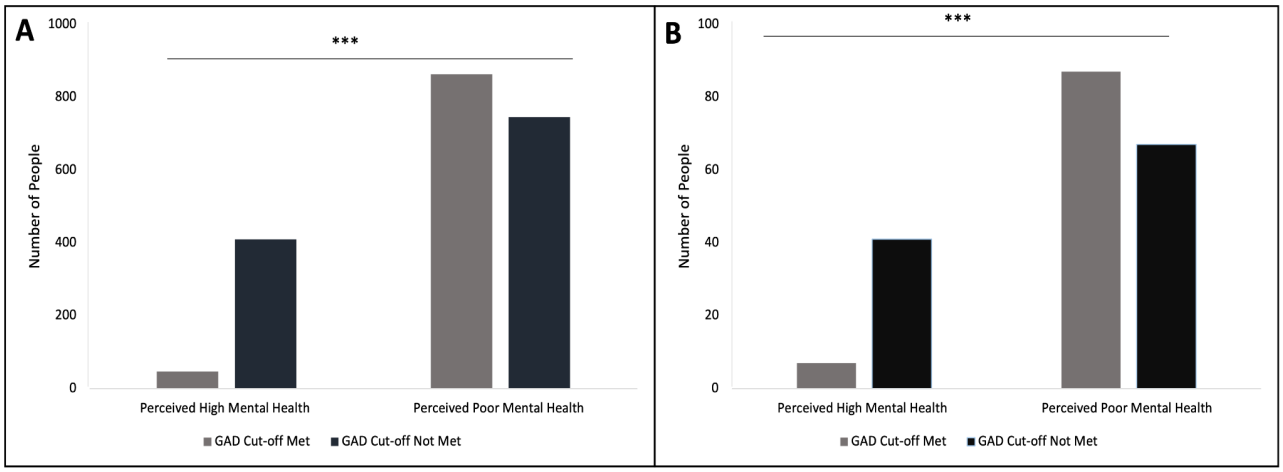

Figure 2. Difference within urban and rural population's GAD and perceived mental health. The data was collected from individuals aged 15-24 (n=2267) who completed an online self-administered survey through Statistics Canada. Both panels depict the number of people who self-reported high and low mental health and whether based on that, they met the GAD cut-off score. Panel A (urban) had a value of <0.001. Panel B (rural) had a value of <0.001.

To further investigate self-reported mental health compared to GAD scores, we looked at the difference in these variables inside each urban and rural populations. The results are depicted in figure 2. Individuals who self-reported high mental health in the urban population (n=467), 10.28% (n=47) met the GAD cut-off score, whereas 89.7% did not. Individuals who self-reported low mental health in the urban population (n=1608), 53.67% (n=863) had GAD scores that met the cut-off, however 46.33% (n=745) did not. The same is shown in rural populations, where groups that reported high mental health (n=48), 14.58% (n=7) had GAD scores that met the cut-off, and 85.41% (n=41) had GAD scores that did not meet the cut off, and within the group who reported poor mental health (n=154),56.49% (n= 87) had GAD scores that met the cut-off, and 43.50% (n=67) had GAD scores that did not meet the cut-off.

Discussion

Through the analysis of perceived mental health and GAD scores of the participants in the study, our team discovered that there were no significant differences regarding the mental health of young people, ages 15-24 years old, residing in Canadian rural vs urban areas and no significant difference between perceived mental health and GAD scores between these areas. However, there was a statistically significant difference between the perceived/self-reported mental health vs GAD scores within/inside each area (rural and urban).

In relation to our first research question, the logistical regression findings in table 2, revealed that neither urban nor rural variables were significant in predicting generalized anxiety or poor perceived mental health in young adults, drawing to the conclusion that there isn't any difference between young adults' mental health in rural or urban communities. In relation to our second research question, we discovered that there is no significant difference between whether the participants met or did not meet the GAD cut-off point for having anxiety disorder, between groups who have high perceived and low perceived mental health. Our results are in contrast to a study done by Paykel et al. (2000), stating that there are differences in the mental health of those living in rural vs urban areas. Results indicate that those living in urban areas are more socially deprived and carry more life stressors, while rural individuals have less depressive episodes (Paykel et al., 2000, Wang, 2004). Factors including: age, immigration status, socioeconomic, occupation and marital status may play a role (Wang, 2004). The same is stated by Zhang et al. (2021), that urban individuals, during the COVID-19 pandemic, had a higher GAD score, compared to rural. In contrast, people residing in rural and northern locations had elevated levels of self-reported depression than the provincial average (CMHA, 2010). Finally, the mental health

of young males in rural communities in Canada are also found to be stigmatized, potentially preventing them from seeking support (CMHA, 2010).

We believe that the difference in our findings compared to past literature is due to the rural population being underrepresented, evident by the small rural sample size in our database. Other variables, like ethnicity, may also have played a more significant role in their mental health, potentially seen in our logistic regression analysis (Table 1), which revealed a minimal correlation between visible minorities having GAD. Further research in these communities should be done in order to investigate this phenomenon, to see whether it is a real effect or just caused by the underrepresentation of this group.

In addition to the findings to our second research question, because our team found no discrepancies between rural and urban areas, we were then curious if there are discrepancies in the alignment of self-reported mental health and GAD scores, inside each area- shown in figure 2. We found a significant difference between whether the participants met or did not meet the GAD cut-off point for having anxiety disorder between groups who have high perceived and low perceived mental health (figure 2). However, it is important to note that the study we conducted only looked at GAD scores for clinically relevant mental health disorders. Other mental health disorders like depression were not measured in this survey and therefore individuals may have met the GAD cut-off score based on how they ranked their perceived mental health (poor, excellent, etc.) due to other mental disorders that they are currently experiencing, aside from anxiety. According to past literature, young individuals who have depression also appear to have anxiety, providing evidence that the two are comorbid with one another (Cummings et al., 2013).

While all possible avenues of control were taken with data collection and study design, some confounding aspects are inherent within the methods taken. Participants were

crowdsourced to this study through advertisement on various online portals.While this may prove efficacious for collecting data from participants in urban communities, where exposure to these avenues of information is more bountiful, this may prove difficult for recruitment and accessibility from more rural communities. This may provide evidence for the large discrepancy between case numbers in the rural and urban group and may point towards the results of the research question not being representative of the rural Canadian population. In the case of this study, participants must have reliable internet access to participate, and this may lead to exclusion of many prospective participants or populations of people living in rural communities, especially in the northern provinces/territories where reliable internet access is scarce. In fact, a 2019 report provided by the Canadian Radio-television and Telecommunications Commission (CRTC), showed that while 87.4% of Canadian households had access to broadband internet connection, only 45.6% of Canadian households within rural communities did. Furthermore, 75% of respondents were hailed from only 3 provinces, which may present as sampling bias within the data, skewing the results in such a way that it may not be representative of how mental health is perceived in the various rural and urban communities across Canada. In order to improve upon a future study like this, gathering more individuals from rural areas, perhaps through the use of landlines and phone calls, opens up the survey to many more people living in rural communities who might not have internet access.

Some limitations in past research studies that we have investigated also involve their research being conducted in other countries, and thus unable for it to be generalized towards the Canadian population. Our research findings may then serve as a baseline for future research to further investigate whether there are differences in the mental health between younger individuals who reside in Canadian rural vs urban areas and the extent of these differences.

Perhaps, future studies may add additional variables, such as ethnicity, to determine if other factors contribute to their mental well-being. Future studies may also continue to investigate whether stigma affects how younger people would report their mental health. This will lay the foundation on how to better encourage individuals to confidently report their mental health status and continue to find ways to demolish the stigma surrounding mental illnesses.

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Between Gender Differences in the Adult (18+) Canadian Female Indigenous Population on the Association Between Alcohol Consumption Frequency and Mental Health Status: A Cross-Sectional Study

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Introduction

Alcohol, Gender, and Mental Health

Alcohol consumption has been a societal past-time since the beginning of recorded history (Room et al., 2005). Twenty-two million Canadians (80% of the Canadian population) reported consuming alcohol in the past year (Statistics Canada, 2013). While alcohol can have mild health benefits when consumed safely and responsibly, its use in excess can have detrimental health effects on the body (World Health Organization, 2009a). The effects of alcohol are not limited to physical symptoms such as strain in the heart, liver, muscles, and the brain; but have a measured impact on mental health as well (Paton, 2005). Mental and behavioural disorders attributed to the use of alcohol include: withdrawal state with delirium, alcohol related psychotic disorder, and alcohol related neuropsychiatric disease (World Health Organization, 2009b). Males have traditionally reported more frequent alcohol use at higher volumes of consumption, but the drinking prevalence gap between men and women is shrinking (Fama et al., 2020).

Alcohol use and misuse is increasing disproportionately among women compared to their male counterparts, with an 84% increase and 35% increase respectively (Grant et al., 2017). Much of the data available on the effects of alcohol in women is outdated and neglects mental-health outcomes, although existing data suggests that women are more susceptible to the effects of alcohol and experience a higher number of alcohol-related medical problems (Ashley et al., 1977). The majority of the current research between brain and body examines the physical basis of cognition and metabolism in relation to women and alcohol consumption. There is room for significant research to be conducted to determine a potential association between alcohol consumption and the mental health status of women.

Alcohol & Indigenous Populations

Indigenous peoples are an underrepresented group in the field of alcohol research. Much of the limited research that has been conducted on alcohol and Indigenous groups has been conducted outside of Canada. A systematic review conducted in 2020 found a need for more unbiased data on the prevalence of alcohol dependence in Indigenous communities in New Zealand, Canada, and the USA (Weatherall et al., 2020).

Studies report the implementation of known effective interventions in other populations on Indigenous groups, with the lack of cross-cultural research neglecting cultural differences in Indigenous family life, structure, obligations, and drinking contexts (Gray et al., 2004; Kelly & Kowalyszyn, 2003). Poorer treatment outcomes for alcohol-related problems have been seen in Indigenous populations, leading to high levels of comorbidities, higher health related costs for Indigenous communities, and greater impairment and disability (Gray et al., 2010; Hall et al., 2001).

Alcohol & Adult Aged Indigenous Women

Much of the information on alcohol and adult aged (18+) Indigenous women has been sourced outside of Canada. According to Gibson S. et al (2020), the National Maternity Data Development Project conducted individual interviews and group discussions with Indigenous Australian and non-Indigenous pregnant women of 18 years or older regarding their views on alcohol consumption during pregnancy. Both groups of women demonstrated comprehension of alcohol as harmful to the development of babies (Gibson et al., 2020).

Previous research found Indigenous women less likely to drink while pregnant than non-Indigenous women, however, with those that do consuming risky amounts (Australian Institute of Health and Welfare, 2016; Fitzpatrick et al., 2015). Indigenous Australian women in

particular, mainly attributed inability to abstain from alcohol consumption during pregnancy to the influence of social environment; mental health issues, addiction, and domestic violence (Gibson et al., 2020). The potential association between mental health issues and alcohol consumption among Indigenous women lacks formal research, especially within Canada.

Knowledge Gap & Research Question

There is a clear gap in the literature when it comes to measured effects of alcohol on mental health in relation to Indigenous female populations in Canada. This paper aims to answer the following research question: Is there a disproportionate association between alcohol consumption frequency and mental health status (on an informal scale with options: poor, fair, good, very good, and excellent) between adult (18+) Canadian Indigenous females and adult (18+) Canadian Indigenous males over a 12 month period? The primary outcome measure is the mental health status of participants, on an informal scale of categorical options ranging from poor to excellent. Secondary outcomes we will address span the same 12 month period; being the frequency alcohol use affects ability to do expected tasks, and the frequency of feelings of guilt or remorse following drinking. A tertiary outcome we will be looking at is whether an individual has ever had a relative, friend, or doctor express concern regarding their alcohol use over a 12 month period.

Methods

Survey Design

We employed a retrospective cross-sectional study design using the databank titled "Canadian Alcohol and Drugs Survey, 2019" that we accessed through the Ontario Data Documentation, Extraction Service and Infrastructure (ODESI). As outlined by ODESI, the Canadian Alcohol and Drugs Survey (CADS) is conducted biannually by the governmental

organization Health Canada. Data in the 2019 iteration was collected between June 10th to December 31st, 2019. A collection method of random digit dialing and interview questioning through landline and cellular telephone numbers was employed. The sample was restricted to Canadian residents 15+ years in age (n = 10,293), answering on a voluntary basis. Excluded from selection were Canadians who were phoneless; institutionalized; unable to speak English; residents on First Nations reserves; or residents of the Yukon and Northwest Territories or Nunavut (Statistics Canada, 2019). Questions asked served to cover the topics of the attitudes around, frequencies of, and potential harmful effects of alcohol use, cannabis use, and the use of other drugs.

Study Participants

For the purposes of this study, CADS 2019 respondents were included on the basis of the following inclusion criteria: adults ≥18 years, sex at birth being male or female; and Canadian Indigenous identification as First Nations (North American Indian), Métis or Inuk (Inuit). The age cutoff was selected in accordance with the legal definition for the adult population.

The exclusion criteria included participants who used or tried cocaine or crack, ecstasy, heroin, amphetamines or methamphetamine, kratom, mephedrone, or any other injectable drug in the 12 months leading up to the data collection point. A co-morbidity has been established between alcohol use disorder and other drug use disorders, where the presence of one increases the likelihood of the other (Falk et al., 2008). The exclusion of these variables served to isolate the correlation between alcohol and the behaviours of interest, while controlling for potential influence from other substances. Missing data entered as a “refusal” or “not stated” for the variables of alcohol consumption frequency and mental health status were also excluded, as they are crucial to the study’s primary question.

Study Outcomes

The primary outcome assessed in this study was mental health status, where participants were asked the question, “In general, how is your mental health?”. A single-item measure of self-rated mental health (SRMH) included the answer options: poor, fair, good, very good, excellent. It is important to note that this form of measurement is not a formal diagnostic tool for mental health status. However, the SRMH subjective self-reflection on mental health status has been found to be a significant predictor for depression related mental disorders, and even comorbid physical disorders (Hoff et al., 1997).

Two secondary outcome variables were considered. The first was the frequency of feelings of guilt or remorse after drinking, where participants were asked, “During the past 12 months, how often have you had a feeling of guilt or remorse of drinking?” The other secondary outcome variable considered was how frequently alcohol use affected one’s ability to do expected tasks, where participants were asked, “During the past 12 months, how often have you failed to do what was normally expected from you because of drinking?”. Both variables had responses in the five ordinal categories typical of quantity-frequency (QF) form: never, less than monthly, monthly, weekly, and daily or almost daily. Feelings of guilt or remorse was selected as a variable of interest, as guilt specifically has been found to have a strong relationship with depressive disorders (Tilghman-Osbourne et al., 2014). We were also interested to see if failure to do expected tasks was correlated with mental health status, as incapacitation in our adult study population can lead to problems such as absenteeism from work (Buist-Bouwman et al., 2005).

The tertiary response considered in this study was whether a relative, friend, or doctor had expressed concern about the participants alcohol use, where participants were asked, “Has a relative, friend, doctor, or another health worker been concerned about your drinking or

suggested you cut down your alcohol intake? Was it in the past year?". The responses were the dichotomous, normal categories of yes and no. We thought this variable would be an indicator of obvious, observable dysfunction with alcohol, and potentially with mental distress as well.

Additional Data Collection

Additional variables to consider were drinks per occasion (among drinkers), and frequency of being unable to stop drinking once started. These drinking attitudes allow for a better visualization of a potential alcohol use disorder. Although not a part of the statistical analyses, these variables are worth analyzing in the case of results strongly disagreeing with the existing research in the field.

Statistical analysis

All data was analyzed using Statistical Packages for the Social Sciences (SPSS). The p-value for significance used was 0.05.

A Chi-Squared Test between the categorical variables of alcohol consumption frequency and mental health status, with sex at birth layered to determine a potential difference in their associated by sex.

To determine the predictive strength of the secondary and tertiary outcome variables on mental health status, a binary logistic regression was performed with the following predictor variables: sex at birth; frequency of alcohol consumption; frequency alcohol affected ability to do expected tasks; frequency of feelings of guilt or remorse following drinking; and a relative, friend, or doctor expressing concern over alcohol use.

Results

Demographics and Sample Characteristics

Table 1 Sample Characteristis for the Full Sample and Divided up by Sex

Measure	Total (*n* = 298)		Male (*n* = 128)		Female (*n* = 170)	
	n	%	*n*	%	*n*	%
Sex						
Male	128	42.95				
Female	170	57.05				
Age group						
18-24 yr	8	2.68	3	2.34	5	3.0
25-34 yr	49	16.44	16	12.5	33	19.4
35-44 yr	44	14.77	21	16.41	23	13.5
45-54 yr	71	23.83	31	24.22	40	23.5
55-64 yr	68	22.82	25	19.53	43	25.3
≥ 65 yr	58	19.46	31	24.22	26	15.3
Alcohol consumption measures						
Frequency of drinking						
Never	61	21.4	25	21.6	35	21.7
Once a month or less	80	28.07	25	20.0	55	34.2
2-3 times per month	59	20.7	19	15.2	40	24.8
1-3 times per week	53	18.6	36	28.8	17	10.6
4-5 times per week	16	5.61	10	8.0	6	3.7
Daily or almost daily	16	5.61	8	6.4	8	5.0
Drinks per occasion (among drinkers)						
1-2 drinks	143	61.9	59	60.8	84	62.7
3-4 drinks	59	25.6	21	21.7	38	28.4
5-6 drinks	17	7.4	6	6.2	11	8.2
7-8 drinks	4	1.7	4	4.1	0	0
9-10 drinks	4	1.7	3	3.1	1	0.7
≥ 10 drinks	4	1.7	4	4.1	0	0
Drinking Attitudes						
Frequency unable to stop drinking once started						
Never	219	94.4	93	96.9	126	92.7
Less than monthly	8	3.5	1	1.0	7	5.1
Monthly	4	1.7	2	2.1	2	1.5
Daily or almost daily	1	0.4	0	0	1	0.7
Frequency feeling guilt and remorse after drinking						
Never	201	85.9	89	90.8	112	82.4
Less than monthly	29	12.4	7	7.1	22	16.2
Monthly	3	1.3	2	2.1	1	0.7
Weekly	1	0.4	0	0	1	
Mental health status						
Poor	8	2.6	4	3.1	4	2.3
Fair	25	8.2	9	7.0	16	9.0
Good	77	25.2	28	21.9	49	27.7
Very good	116	38.0	42	32.8	74	41.8
Excellent	79	25.9	45	35.2	34	19.2

Data are presented as number of participants and corresponding percentage value (%), unless otherwise stated.

Table 1 displays the responses gathered by the Government of Canada for CADS 2019. The total sample size for this survey was 10,293. In keeping with the inclusion and exclusion criteria the sample size was reduced to 298, 57.05% of which were female and 42.95% of which were male.

Alcohol Consumption

Overall, almost all participants (n = 224, 75%) reported consuming alcohol within the last twelve months (Table 1). Of those who consumed alcohol, more than half reported having an alcoholic drink more than once a month (n = 144, 50.5%). When participants were asked how many alcoholic drinks they had on a typical day of drinking, nearly half reported 3 or more drinks (n = 88, 38.1%).

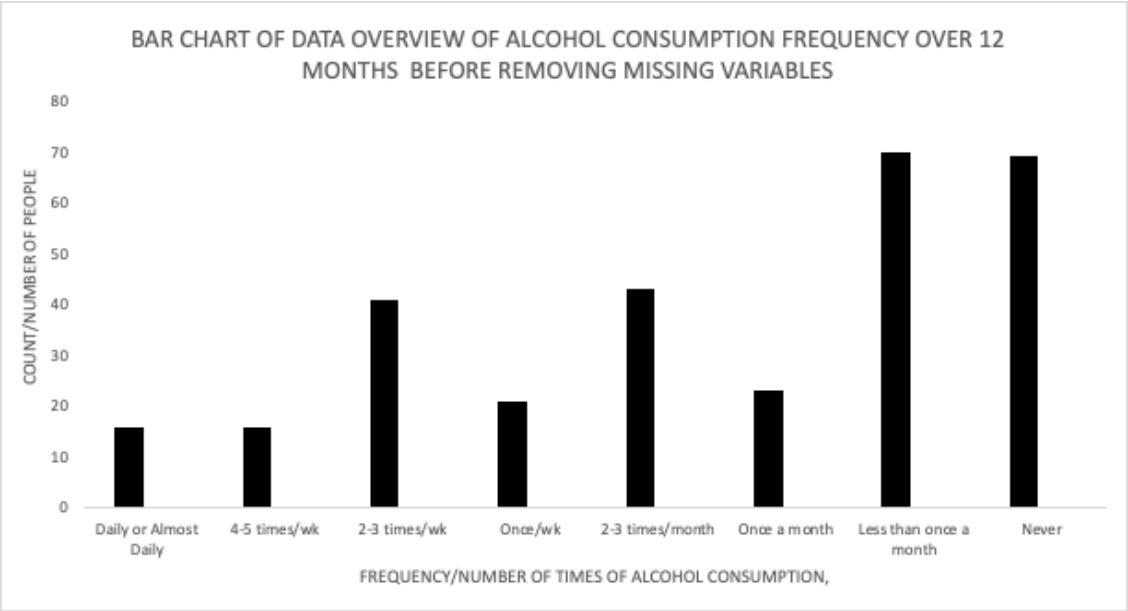

Figure 1. Bar chart of the data overview of total alcohol consumption frequency before the missing variables were removed

Figure 1 displays a bar chart of the data overview of the total frequency of alcohol consumption for a duration of 12 months before the missing variables were removed (n=299). The most common alcohol consumption frequency habits were less than once a month- with seventy people (23.4%), and never- with sixty-nine individuals (23.1%).

Table 2 Chi-Square Test of Respondent's Sex at Birth and Mental Health Status

Respondent's sex at birth		Value	df	Asymptotic Significance (2-sided)
Male	Pearson Chi-Square	.525[b]	3	.913
	Likelihood Ratio	.533	3	.912
	Linear-by-Linear Association	.097	1	.755
	N of Valid Cases	128		
Female	Pearson Chi-Square	.832[c]	3	.842
	Likelihood Ratio	.844	3	.839
	Linear-by-Linear Association	.000	1	.990
	N of Valid Cases	170		

To address the primary outcome of the study, a chi-squared test for association between alcohol consumption frequency and mental health status based on sex at birth was done with 128 males and 170 female participants (n = 298). The test yielded a chi-squared statistic that was lower for males ($\chi 2$=0.525, p=0.913) than females ($\chi 2$=0.832, p=0.842), however this result was not significant.

The potential effects of our secondary and tertiary outcome variables were taken into consideration with the binary logistic regression. The accuracy of expected values for a model with no predictor variables is outlined in Table 3. SPSS predicted cases where mental health status would be poor or fair correctly 88.9% of the time. This is in comparison to the five factor predictor variable model shown in Table 4, where the predictor variables model guessed poor or fair mental health status cases with 88.6% accuracy. These models were not significantly different as detailed in the Omnibus Test of Model Coefficients in Table 5 ($\chi 2$=5.919, p=314). Thus, the five predictor variable model is not a significantly better predictor of mental health status than the model where no predictors were included.

Table 3 Efficacy of beginning block model predictor on mental health status

	Observed		Predicted Mental health status: Poor or Fair	Predicted Mental health status: Better than Fair	Percentage Correct
Step 0	Mental health status	Poor or Fair	0	33	.0
		Better than Fair	0	264	100.0
	Overall Percentage				88.9

Table 4 Efficacy of five predictor variable model on mental health status

	Observed		Predicted Mental health status: Poor or Fair	Predicted Mental health status: Better than Fair	Percentage Correct
Step 1	Mental health status	Poor or Fair	0	33	.0
		Better than Fair	1	263	99.6
	Overall Percentage				88.6

Table 5 Omnibus Test of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	5.919	5	.314
	Block	5.919	5	.314
	Model	5.919	5	.314

The binary logistic regression also yielded the strength of associations between individual predictor variables and the primary outcome of mental health status, as seen in Table 6. The only variable of significance was the frequency one had feelings of guilt or remorse after drinking (B=-2.284, Exp(B)=0.102, p=0.38). Frequency of feelings of guilt or remorse after drinking was inversely correlated with mental health. As the frequency of feelings of guilt or remorse after drinking increase, the odds of having a good mental health status decrease by 10.2%.

Table 6 Contribution of individual predictor variables to model

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Frequency of Alcohol Consumption	.449	.506	.786	1	.375	1.566
	Frequency alcohol use affects ability to do expected tasks	-.622	.522	1.420	1	.233	.537
	Frequency had feeling of guilt or remorse after drinking	-2.284	1.103	4.290	1	.038	.102
	Relative/friend/doctor concerned about alcohol use	-.335	.871	.148	1	.700	.715
	Respondent's sex at birth	-.037	.391	.009	1	.925	.964
	Constant	2.606	.771	11.416	1	<.001	13.542

Discussion

Summary of Results and Comparison to Existing Literature

The results of this research find the sex at birth differences between frequency of alcohol consumption and mental health in Canadian Indigenous adults to be inconclusive. This may be due to the small sample size of this study. However, while the between sex differences regarding this association remains unstudied in Indigenous populations, existing literature on the general population demonstrates similar mixed, and ultimately inconclusive results.

One retrospective cross-sectional study surveying US participants aged 16-84 assessed alcohol use through the Alcohol Use Disorders Identification Test (AUDIT), and mental health using the Hospital Anxiety and Depression Scale (HADS) (Alati et al., 2004). A non-linear, U-shaped relationship was found between alcohol consumption and mental health for males, Alcohol consumption and depression were related linearly for females. Another prospective cohort study following women of Brisbane through pregnancy assessed alcohol consumption frequencies through six informal categories detailing number of drinks, and mental health through the Malaise Inventory (Alati et al., 2005). Contrastingly, the study suggested a non-linear, J-shaped relationship for females. A third Australia wide retrospective cross-sectional

study on those aged 18-80 assessed alcohol intake using AUDIT, while mental health was measured through four depression and anxiety scales (Rodgers et al., 2000). A non-linear, U-shaped relationship for both males and females was observed.

The disagreement in results may stem from a variety of factors, including lack of standardization in study demographic, duration, and design; and metric for alcohol use and mental health status.

This study also found that the regression model including predictor variables of sex at birth; frequency of alcohol consumption; frequency alcohol use affects ability to do expected tasks; frequency of feelings of guilt or remorse following drinking; and having a relative, friend, or doctor express concern regarding participant's alcohol use, was a poor predictor for mental health status. Assessing the model's individual predictor variables, greater frequency of feelings of guilt or remorse following drinking were associated with poorer mental health status. This inverse relationship between guilt and mental health is consistent with decades of research. One study among college students by Jones and Kugler (1993) found a correlation between higher levels of guilt- measured through the Guilt Inventory, and higher levels of depression- assessed using the Beck Depression Inventory (BDI). Participants also self-responded to adjectives they identified with. They observed that those more prone to situationally triggered guilt described feeling lonely, depressed, miserable, and sad, all characteristic of poor mental health. While the study by Jones and Kugler did not attribute this form of guilt to a specified origin, alcohol consumption can cause situational guilt as focused on in this study. Another study by Treeby & Bruno (2012) corroborated these findings, demonstrating an association between shame prone individuals and negative affective states- a crucial influence in mental health status (Gross et al., 2019).

Limitations

As with all studies, our study comes with its limitations. The sample size of this study is relatively small, with only 298 respondents. While this is enough respondents to allow us to perform statistical analysis, we cannot say for sure that the results represent the entire Indigenous population of Canada. A larger sample size would not only increase the accuracy of our statistical findings but would also provide a more complete picture of the status of alcohol and mental health in Indigenous Canadians. The cross-sectional nature of this study should also be interpreted as a snapshot in time and may not reflect trends over time. The results that we found were applicable to alcohol and mental health of Canadian Indigenous individuals in 2019 but may not necessarily reflect trends today. To see how this correlation between alcohol and mental health changes over time, longitudinal studies are necessary. Another limitation arises from the method of data collection. Respondents answered questions in relation to alcohol consumption and mental health via telephone interview, and some people may not wish to disclose this information. We were able to control for participants who did not respond to these questions, but we were unable to control for participants who may have provided dishonest answers to these questions. This is a potential source of bias and could have skewed our findings. The lack of standardized measurement for a few metrics of this study were also a limitation to our study. A formal mode of measurement distinguishing between acceptable and problematic alcohol use, such as the AUDIT questionnaire, was not employed. Our study also lacked a formal diagnostic measure of mental health status, such as the BDI. Formally measuring our study variables would increase our accuracy and validity.

Implications and Future Directions

The correlation found between feelings of guilt or remorse following alcohol

consumption and poorer mental health status highlights the need for mental health support in Canadian Indigenous populations. Our results indicate that there is a need for support programs to help this population cope with and manage feelings of guilt and remorse related to alcohol consumption. This correlation signifies that traditional therapies and rehabilitation programs in Canada may not be reflective of the needs of Indigenous Canadians. The small respondent pool also highlights the need for more research to be done on Canadian Indigenous populations.

Future studies should aim to include longitudinal data and larger sample sizes. This will make the results more generalizable to the whole Indigenous population of Canada, as well as increase the accuracy of statistical testing. Researchers should also look at why the respondent pool was so small to see if there is a better avenue for data collection, such as surveys online or by mail. Inclusion of data regarding hospitalization and rehabilitation in relation to alcohol consumption may also help reduce some of the biases that can be introduced by self-report questionnaires. While this study focused only on alcohol consumption, future studies should look at drug use as a whole and how this relates to mental health in Indigenous populations. Statistical analysis can also be performed in the future to determine if the results found in Indigenous populations differ from results found in other populations of people. Research should also focus on the most effective ways to provide help to Indigenous communities, as this may differ from the traditional rehabilitation and therapy programs offered to other Canadians.

To conclude, this study aims to better understand mental health within Indigenous groups in Canada, particularly Indigenous women, as these demographics have been historically underrepresented in science research. Understanding Canada's Indigenous groups is a hopeful conduit to better understanding and meeting their needs.

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